Lot 42 Wellesley Road North, Kemerton
Offset Site Study Report

Prepared for GHD on behalf of Albemarle
June 2018

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Executive Summary

On behalf of their client, Albemarle, GHD engaged Ecoedge in June 2018 to prepare an Offset Site Study Report for Lot 42 in Kemerton, near Bunbury, Western Australia

GHD are coordinating the environmental impact assessment and approvals process for Albemarle's proposed development of a Lithium Processing Plant within the Kemerton Strategic Industrial Area (KSIA) (the 'Albemarle Kemerton Plant').

The proposed development area, located within the KSIA (referred to herein as the 'Proposal Area'), contains vegetation that comprises the 'Banksia Woodlands of the Swan Coastal Plain' Threatened ecological community (TEC), which is listed as Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This vegetation was mapped by ELA (2017) as Gibson *et al*. (1994) Floristic Community Type 21c 'Low lying *Banksia attenuata* woodlands and shrublands', which is a Priority ecological community. The Proposal Area also contains remnants of a former pine plantation that comprises foraging habitat for two of the three species of EPBC Act-listed Black Cockatoo.

A proposed offset site has been identified in Lot 42, Kemerton ('Lot 42'), which is predominantly located within the KSIA Buffer[1], approximately 5.7 km north east of the Proposal Area. The type of offset proposed is a land acquisition offset.

Lot 42 is located approximately 20.5 kilometres north-east of Bunbury, in the south west of Western Australia. It totals 153.3 ha of which approximately 142 ha is remnant native vegetation. The remaining 11.3 ha comprises scattered trees over pasture.

Significant impacts to flora, vegetation and habitat within the Proposal Area that will result from the Proposal, and for which Lot 42 is being considered as an environmental offset, are listed below (GHD, 2018b).

Direct loss of:

- Approximately 6.37 ha of native vegetation mostly in Good condition that is associated with both the 'Banksia Woodlands of the Swan Coastal Plain' Threatened ecological community and 'Low lying *Banksia attenuata* woodlands or shrublands' Priority ecological community;
- 118 plants of a Priority 4-listed species (*Acacia semitrullata*);
- 14.99 ha of vegetation associated with 'Multiple Use' wetlands areas with little to no ecological value;
- Beard (1979) (vegetation association 1000) and Heddle *et al.* (1980) (Bassendean complex – central and south) vegetation extents by less than 0.2% of the vegetation extent at the local scale (Shire of Harvey) and 0.06 % at the regional scale (SCP).

[1] A portion of Lot 42 is within the Kemerton core area.

- 45.73 ha of suitable foraging habitat and 14.45 ha of potential breeding habitat for threatened Black Cockatoo species; and
- One potential breeding tree (Jarrah) which is > 500 mm DBH, with no observed hollows.

Key results

The key results from the survey of the proposed offset site at Lot 42 are as follows.

Flora

One hundred and one flora taxa were identified of which eighty eight were native flora. A spring survey would very likely result in the number of flora increasing by at least 50%, particularly with regard to herbaceous species.

Threatened Flora

No flora taxa listed as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Wildlife Conservation Act 1950* were found.

Priority flora

Two Priority flora taxa were found during the survey, *Acacia semitrullata* (P4) and *Eucalyptus rudis* subsp. *cratyantha* (P4). *Acacia semitrullata* (P4) is fairly common throughout the EmCcBaAfW vegetation unit and likely to be so in similar vegetation in the Kemerton area. *Eucalyptus rudis* subsp. *cratyantha* is the dominant species in the ErMrW vegetation unit. It is very likely that a spring survey over vegetation on Lot 42 would find other conservation significant flora.

Within the Proposal Area, 118 *Acacia semitrullata* (P4) plants will be lost as a result of the development of the Albemarle Lithium Processing Plant.

Conservation Significant Flora

Of the 35 Threatened or Priority taxa known to occur within approximately 10 km of Lot 42, two were very highly likely to occur onsite, one was highly likely to occur and a further 22 were moderately likely to be present. Ten had a low likelihood of occurring. A spring survey would be required to confirm the presence of other conservation significant flora.

Introduced Flora

Two of the introduced flora taxa recorded within the Lot 42 (*Gomphocarpus fruticosus* and *Zantedeschia aethiopica*) are declared as pest plants under the *Biosecurity and Agriculture Management Act 2007*. *G. fruticosus* (Narrow-leaf Cottonbush) is in the C3 (management) category. *Z. aethiopica* (Arum Lily) is in the Exemption (for keeping) category.

Vegetation Units

Six vegetation units were identified within the Lot 42 during the preliminary and Reconnaissance flora surveys. Of these, three meet the criteria for the Federally-listed Banksia

Woodlands of the Swan Coastal Plain Threatened ecological community (TEC) (EmCcBaAfW, EgEmAfBaW and CcBaAfOF). The EgEmAfBaW vegetation unit comprises the Priority 3 listed ecological community 'Southern Swan Coastal Plain *Eucalyptus gomphocephala* - *Agonis flexuosa*'.

Vegetation Condition

Lot 42 contains 142 ha of intact remnant native vegetation. Most (39.1%) was classed as Excellent condition. A further 19.2% was classed as Very Good and 31.5% as Good.

Black Cockatoo potential breeding habitat

The results of the tree quadrat survey suggest that the main woodland/forest areas within the subject site, which cover about 135 ha, contain about 2,783 trees that can be regarded as representing potential black cockatoo breeding habitat using DotEE criteria.

Eighty five trees containing possible large hollows potentially suitable for black cockatoos to use for breeding were observed opportunistically within the Lot 42 during the survey period. A small number of these trees showed some inconclusive evidence of possible use by cockatoos (i.e. minor chew marks).

Black Cockatoo foraging habitat

The extent of quality foraging habitat within the subject site (Lot 42) can be regarded as those areas containing marri, jarrah and banksia. This area totals about 113.3 ha. Areas dominated by flooded gum can be regarded as being of low value as foraging habitat as this tree species is not a favoured food source.

It should also be noted that the degraded "pasture" areas also contain a scattering of trees some of which are represented by marri and jarrah and therefore also contribute to the overall forging resource available.

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoo habitat

The *Banksia*-dominated vegetation on Lot 42 represents a good example of upland Banksia Woodlands that is not (currently) subject to degradation by *Phytophthora* Dieback. It also has the advantage of being adjacent to large areas of Banksia Woodlands to the south and to the east which increases its conservation value and long-term viability. It has been logged in the past but otherwise a large part of it is in Excellent or Very Good condition.

To offset impacts to Banksia Woodlands TEC and Black Cockatoo habitat associated with the Proposal, based on inputs to the *EPBC Act Offsets Assessment Guide* (DSEWPaC 2012a) calculated areas of 18 ha of Banksia Woodlands TEC and 105 ha of Black Cockatoo habitat must be provided in the proposed offset area. Lot 42 contains 135 ha of potential Black Cockatoo breeding habitat, with 113.3 ha of this habitat comprising quality Black Cockatoo

foraging habitat. The 113.3 ha of vegetation which is quality Black Cockatoo foraging habitat also meets the criteria for the Banksia Woodlands TEC. The Banksia Woodlands vegetation comprises FCT21a, which has similarities with FCT21c which is present on the Proposal Area.

The 113.3 ha of Black Cockatoo foraging habitat on Lot 42 achieves 108.6% offset of the loss of Black Cockatoo habitat that will result from the Proposal.

The 113.3 ha of Banksia Woodland vegetation on Lot 42 achieves 650.51% offset of the loss of 6.37 ha of Banksia Woodlands TEC.

Floristic Community Types

The FCT that comprises the Banksia Woodlands TEC on the Proposal Area, and that will be lost as a result of the Proposal, is SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands'. This community is listed as a PEC (P3). Vegetation that comprises the Banksia Woodlands TEC on Lot 42 is SWAFCT21a 'Central *Banksia attenuata-Eucalyptus marginata* woodlands', which is not a Priority or Threatened community at the State level; and SWAFCT 25 'Southern Swan Coastal Plain *Eucalyptus gomphocephala* - *Agonis flexuosa*' which is a Priority 3 ecological community[2].

FCTs 21a and 21c are part of the same 'Supergroup' (Supergroup 3) as defined by Gibson *et al.,* (1994), being 'community types centred on the Bassendean system'. Both are situated on sandy soils of the Swan Coastal Plain and are dominated by *Banksia* species in the mid-storey. It is the floristic differences that resulted in their division into separate community types (Gibson *et al.,* 1994).

Wetlands

Lot 42 contains approximately 24.1 ha of wetland vegetation, of which approximately 20.9 ha is mapped as either Resource Enhancement or Conservation category wetlands. Both Resource Enhancement wetlands would be more appropriately classified as Conservation category due to their condition. Russell Smith, who carried out the field survey, stated that he has not seen wetlands of their like before in such good condition (Russell Smith, pers. comm. 28 June 2018).

This is compared to 14.99 ha of Multiple Use wetland areas with little to no ecological value in the Proposal Area.

Environmentally Sensitive Areas

One ESA is mapped on Lot 42, designated around the Conservation category wetland. No ESAs are mapped within the Proposal Area.

Regional Ecological Linkages

[2] A proposal to list 'Tuart Woodlands of the Swan Coastal Plain' as a TEC under the EPBC Act is currently being assessed by DotEE. The decision is expected by 31 July 2018.

Vegetation on Lot 42 directly forms part of a mapped regional ecological linkage, as it is crossed by a linkage axis line. Two thirds of the site vegetation has been assigned a proximity rating of “1a” which is the highest rating with the remainder rated as “1b”, the second highest rating.

Vegetation within the Proposal Area does not directly form part of a linkage. It was assigned a proximity rating of “2a”, indicating it has an edge touching vegetation that is, or is itself, <500 m from a linkage axis.

Summary of Inputs into the Offsets Calculator

The EPBC Act Offsets Assessment Guide has been used to determine the required offsets for impacts to the Banksia Woodlands TEC and Black Cockatoo habitat associated with the Proposal. Consideration has also been given to the Western Australian Offsets Policy and Guidelines.

A summary of the inputs into the Offsets Calculator section of the EPBC Act Offsets Assessment Guide for the proposed offset site (Lot 42) is provided in the table below.

The outcomes account for greater than 100% direct offset for the impacts stated above.

Offset Calculator Attribute	Input Value
Proposed offset	Lot 42 Area: ~142 ha of remnant native vegetation and ~11.3 ha of modified vegetation (or parkland cleared area)
Time horizon (years)	
Time over which loss is averted	20 years
Time until ecological benefit	1 year
Start area (ha)	113.3 ha of Banksia Woodlands TEC and Black Cockatoo foraging and potential breeding habitat
Start quality (scale of 1-10)	7
Future area and quality with and without offset (%)	
Risk of loss (%) without offset	30%
Future quality without offset (scale 1-10)	Black Cockatoo habitat = 5, Banksia Woodlands TEC = 6
Risk of loss (%) with offset	5%
Future quality with offset (scale 1-10)	7
Confidence in result (%)	
Averted loss component input	90%
Change in habitat quality component input	85%
Output	
Net present value (adjusted hectares)	
Black Cockatoo foraging and breeding habitat	27.38 ha
Banksia Woodlands TEC	20.72 ha

The 113.3 ha of Black Cockatoo foraging and potential breeding habitat on Lot 42 achieves 108.6% offset of the loss of Black Cockatoo habitat that would result from the Proposal.

The 113.3 ha of Banksia Woodland vegetation on Lot 42 achieves 650.51% offset of the loss of 6.37 ha of Banksia Woodlands TEC.

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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.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and for no other party. Ecoedge assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of Ecoedge or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

1 Background

On behalf of their client, Albemarle, GHD engaged Ecoedge in June 2018 to prepare an Offset Site Study Report for Lot 42 Wellesley Road North in Kemerton, near Bunbury, Western Australia (**Figure 1**).

GHD are coordinating the environmental impact assessment and approvals process for Albemarle's proposed development of a Lithium Processing Plant within the Kemerton Strategic Industrial Area (KSIA) (the 'Albemarle Kemerton Plant').

The proposed development area, located within the KSIA (referred to herein as the 'Proposal Area'), contains vegetation that comprises the 'Banksia Woodlands of the Swan Coastal Plain' Threatened ecological community (TEC), which is listed as Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This vegetation was mapped by ELA (2017) as Gibson *et al*. (1994) Floristic Community Type 21c 'Low lying *Banksia attenuata* woodlands and shrublands', which is a Priority ecological community. The Proposal Area also contains remnants of a former pine plantation that comprises foraging habitat for two of the three species of EPBC Act-listed Black Cockatoo[3].

GHD have prepared an Offsets Assessment Guide (GHD, 2018a; 2018b) which indicates the quantum of impact to native vegetation, including the Banksia Woodlands of the Swan Coastal Plain TEC, and Black Cockatoo habitat, and the offset required to compensate for the loss of these values from the Proposal Area.

A proposed offset site has been identified in Lot 42 Wellesley Road North in Kemerton ('Lot 42'), which is located within the KSIA Buffer, approximately 5.7 km northeast of the Proposal Area. The type of offset proposed is a land acquisition offset.

In preparation of initial impact assessment documentation and this assessment, the following field studies have been undertaken within Lot 42:

- Lot 42 Preliminary Assessment Memorandum_240518 (Ecoedge, 2018)
- Reconnaissance flora and vegetation assessment (out of season)
- Black Cockatoo habitat survey

The results of the Reconnaissance flora and vegetation assessment and Black Cockatoo habitat survey were incorporated into this report.

[3] For the purposes of this report the term Black Cockatoo is in reference to all three species i.e. Baudin's black-cockatoo *Calyptorhynchus baudinii*, Carnaby's black-cockatoo *Calyptorhynchus latirostris* and the forest red-tailed black-cockatoo *Calyptorhynchus banksii naso,* unless stated otherwise.

1.1 Purpose of this report

The purpose of the assessment was to delineate key flora, vegetation and fauna habitat values within Lot 42. The outcomes of the assessment will be used to determine its suitability as an offset for the development of the proposed Albemarle Kemerton Plant.

1.2 Scope and Objectives

The scope of the assessment was to undertake a desktop assessment and reconnaissance flora and vegetation survey, and a targeted Black Cockatoo habitat assessment of Lot 42. The following actions were undertaken:

- Complete a desktop assessment of the study area prior to the field survey work to identify biological features and constraints which may be in or nearby Lot 42;
- Identify and review any existing and relevant environmental reports;
- Identify significant flora, vegetation/ecological communities and fauna habitat;
- Identify broad pre-European vegetation type(s) using Beard (various);
- Conduct a reconnaissance flora and vegetation field survey to verify/ground truth the desktop assessment findings, including an assessment of threats to the flora, vegetation and fauna habitat values;
- Undertake vegetation condition mapping using an appropriate condition scale for the bioregion (as per Environmental Protection Agency (EPA), 2016);
- Undertake ecological community mapping to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) structure and floristics;
- Undertake targeted Black Cockatoo habitat assessment and mapping; and
- Undertake relevant environmental constraints mapping using GIS mapping software.

The biological survey aspects that relate to flora were undertaken having regard to the EPA 2016) Technical Guidance and those aspects that relate to fauna were undertaken having regard to EPA Guidance Statement No.56 (EPA 2004) and the subsequent Technical Guide (EPA and Department of Environment and Conservation (DEC) 2010).

1.3 Location and Site Description

Lot 42 is located approximately 20 kilometres north-east of Bunbury, in the south west of Western Australia (**Figure 1**). It totals 153.3 ha of which approximately 142 ha is remnant native vegetation[4] (**Figure 2**).

[4] The remainder of Lot 42 consists of pasture and or pasture with scattered trees. In regards to Black Cockatoo habitat, the portions that include scattered trees over pasture are included in calculations, but in regards to calculations of remnant vegetation, these areas are excluded.

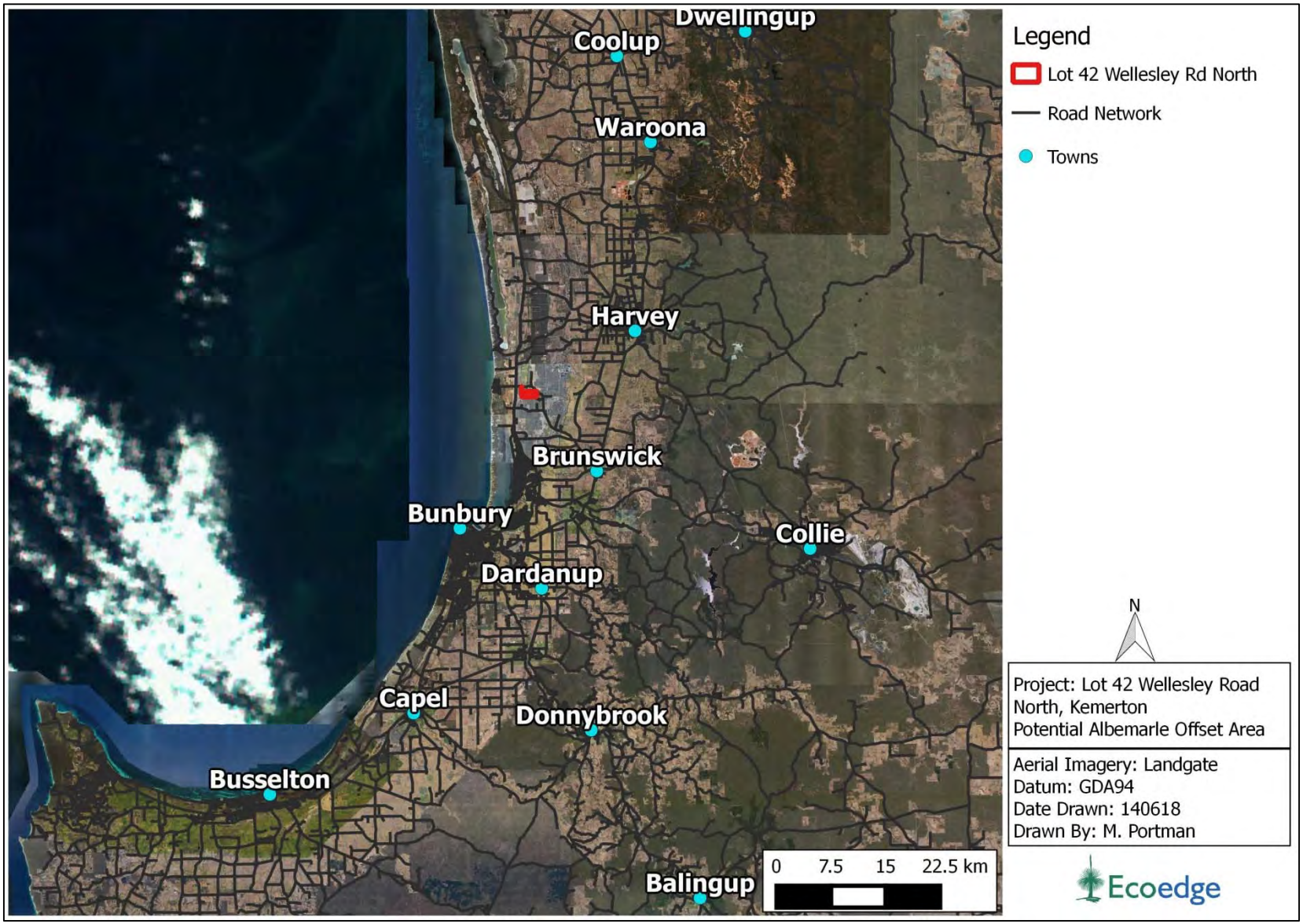

Figure 1. Lot 42 is shown in red.

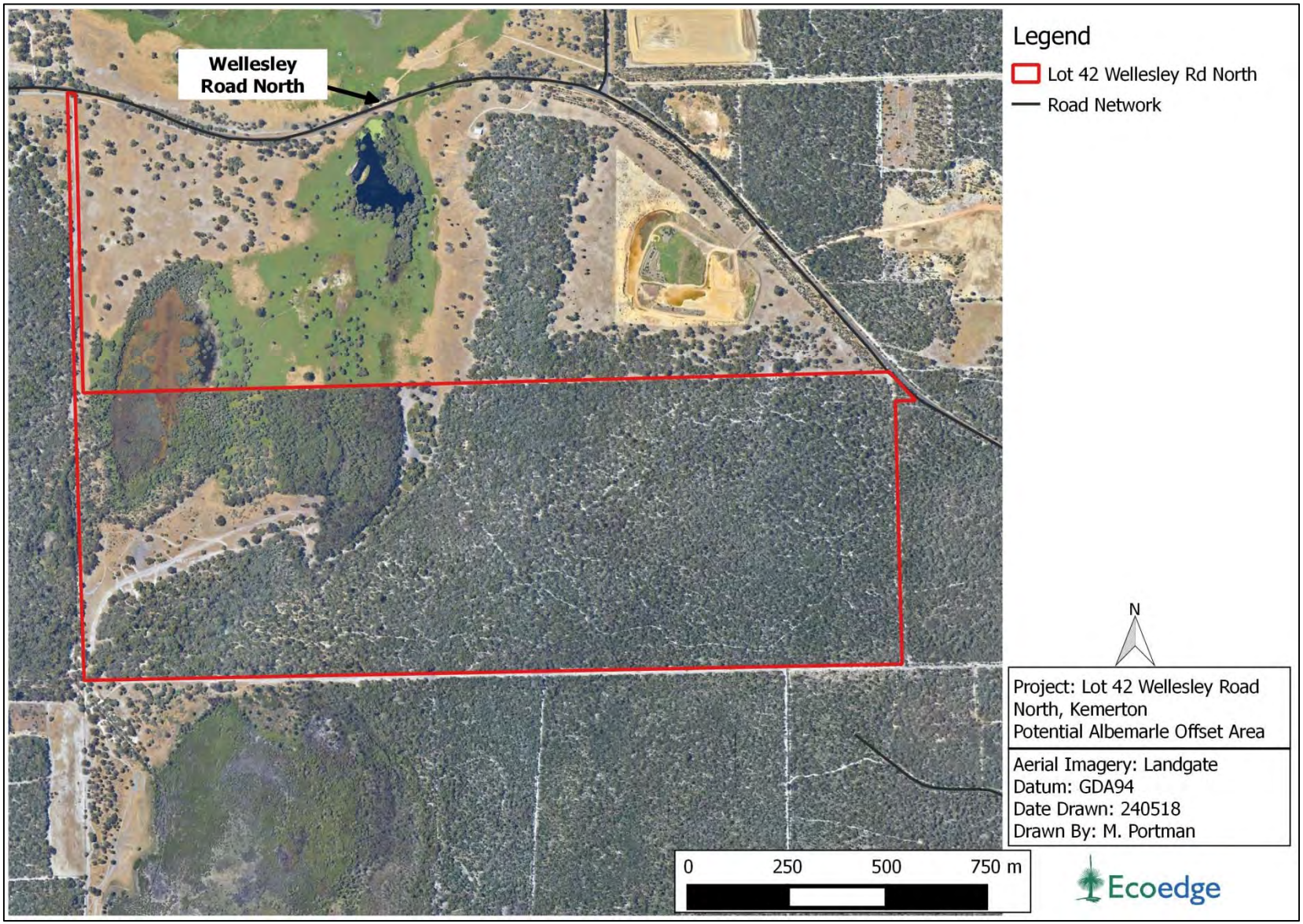

Figure 2. Aerial photograph of Lot 42.

2 Proposal Area

Significant impacts to flora, vegetation and habitat within the Proposal Area that will result from the proposed Albemarle Kemerton Plant, and for which Lot 42 is being considered as an environmental offset, are listed below (GHD, 2018b).

Direct loss of:

- Approximately 6.37 ha of native vegetation mostly in Good condition that is associated with both the 'Banksia Woodlands of the Swan Coastal Plain' Threatened ecological community and 'Low lying *Banksia attenuata* woodlands or shrublands' Priority ecological community;
- 118 plants of a Priority 4-listed species (*Acacia semitrullata*);
- 14.99 ha of vegetation associated with 'Multiple Use' wetlands areas with little to no ecological value;
- Beard (1979) (vegetation association 1000) and Heddle *et al.* (1980) (Bassendean complex – central and south) vegetation extents by less than 0.2% of the vegetation extent at the local scale (Shire of Harvey) and 0.06 % at the regional scale (SCP).
- 45.73 ha of suitable foraging habitat and 14.45 ha of potential breeding habitat for threatened Black Cockatoo species; and
- One potential breeding tree (Jarrah) which is > 500 mm DBH, with no observed hollows.

The residual impact associated with the vegetation, flora and fauna habitat loss will remain an impact through the 25 years or more, life of the Plant.

3 Likely Quantum of Impact of Proposal

Using the *EPBC Act Offsets Assessment Guide* (DSEWPaC 2012a) Impact Calculator, quantum of impact values were calculated for Black Cockatoo foraging habitat and Banksia Woodlands TEC (GHD, 2018a). The results of these calculations are:

- The total quantum of impact associated with the removal of low value Black Cockatoo foraging habitat is 9.07 ha
- The total quantum of impact associated with the removal of moderate to high value Black Cockatoo foraging habitat is 16.14 ha.
    - An area of 105 ha of suitable Black Cockatoo foraging habitat can potentially offset 100% of this impact (dependent upon the characteristics of the proposed offset site).
- The total quantum of impact associated with the removal of 6.37 ha of Banksia Woodland TEC is 3.19 ha.

- An area of 18 ha of Banksia woodland TEC/PEC in Good condition or better can potentially offset 100% of this impact (dependent upon the characteristics of the proposed offset site).

It is against these offset requirements that Lot 42 is being assessed in this Report.

4 Methodology

4.1 Desktop Assessment

4.1.1 Flora and vegetation survey

A "desktop assessment" was carried out by downloading from the Threatened and Priority flora (TPFL) and W.A. Herbarium databases an extract of records occurring within approximately 10 km[5] of Lot 42 (DBCA, 2018a). A NatureMap report was generated, listing of all flora (including Threatened flora) occurring within approximately 10 km of Lot 42 (DBCA, 2017b) (**Appendix 1**). A Protected Matters Search report was generated to provide information regarding Matters of National Environmental Significance (MNES) known or potentially occurring within approximately 10 km of Lot 42 (DotEE, 2018a) (**Appendix 1**). 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.

4.1.2 Black Cockatoo habitat survey

A desktop assessment component of this survey was not required.

An estimate of the amount of Black Cockatoo habitat within 15 km of Lot 42 is provided based on available mapping data (**see Section 9.4.3**).

4.2 Field Survey

4.2.1 Flora and Vegetation Survey

A Reconnaissance single season vegetation and flora assessment of Lot 42 was conducted by botanist Russell Smith (SL flora permit SL012218) over two visits that occurred on 22 May and 12 June 2018. The field survey was undertaken to identify and describe the dominant vegetation units where possible, assess vegetation condition and identify and record vascular flora taxa present at the time of survey. Searches for conservation significant ecological communities and flora taxa were also undertaken.

The survey methodology employed was undertaken with reference to the *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment. Perth, Western Australia* (Environmental Protection Authority (EPA), 2016).

[5] The database extract, NatureMap and Protected Matters Search reports were generated for an alternative potential offset area, Lot 509 in Kemerton, which is located approximately 3 km east of Lot 42.

Field survey methods involved traversing Lot 42 by foot to sample all the apparent vegetation units. Information on dominant or common flora species, vegetation structure, vegetation condition and soil unit and colour was collected at 54 survey points. A waypoint was taken at each survey point using a GPS unit, and at most survey points a photograph was taken. Plant species not able to be reliably identified in the field were photographed for later identification. Where conservation significant flora was identified in the field their location was recorded using a GPS and approximate number of plants was estimated for that location.

Vegetation units were identified, and boundaries delineated, using information from a combination of field observations and assessment of topographical features and aerial photography. Vegetation units were described based on structure, dominant taxa and cover characteristics as defined by field observations. Vegetation unit descriptions were based on structural classes based on EPA (2016), as adapted from Keighery (1994).

Vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA, 2016). The scale recognises the intactness of vegetation and consists of six rating levels as outlined in **Appendix 2**.

Taxonomy and conservation status were checked against DBCA (2017c).

4.2.2 Black Cockatoo Habitat Survey

The Black Cockatoo habitat survey was carried out by Russell Smith and Greg Harewood on 22 June, and 1 and 2 July 2018. The following methods were employed during the assessment to comply with the defined scope of works and are based on guidelines published by the DotEE (Commonwealth of Australia 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 (Commonwealth of Australia 2012) these being:

- Breeding Habitat;

- Foraging Habitat; and
- Night Roosting Habitat.

So as to comply with the requested scope of works and in line with the published guidelines the following surveys were carried out.

Breeding Habitat survey
DotEE (Commonwealth of Australia 2012) have defined Black Cockatoo breeding habitat as any suitable tree species tree with a Diameter at Breast Height (DBH) of over 50cm. Due to the total size of Lot 42, and the likely large number of trees involved it was deemed impractical to record all trees present that have a DBH ≥50cm.

Therefore, to estimate the number of trees with a DBH of ≥50cm present, 21 30 m by 30 m quadrats (0.09 ha each) were established across Lot 42 in suitable habitat (as mapped during the Reconnaissance flora and vegetation survey) and the number of trees with a DBH ≥50cm within each counted (

Figure 3). These figures were then used to estimate the total number of trees with a DBH ≥50cm present in the total area. The DBH of each tree within each quadrat was estimated using a pre-made 50 cm "caliper".

Target tree species included marri, jarrah, tuart and Flooded Gum or any other *Corymbia/Eucalyptus* species of a suitable size that may have been 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.

Any trees containing what appeared to be large hollows possibly suitable for use by black cockatoos as nest hollows were also recorded opportunistically (i.e. not all areas surveyed) across the entire subject site.

For the purposes of this assessment a tree containing a potential cockatoo nest hollow was 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 cockatoo 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, was 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). If considered warranted, trees with possible nest hollows were also scratched and raked with a large stick in attempt to flush any sitting birds from hollows and calls of

chicks were also listened for (note: assessment may have been completed outside of the main breeding season of one or more black cockatoo species).

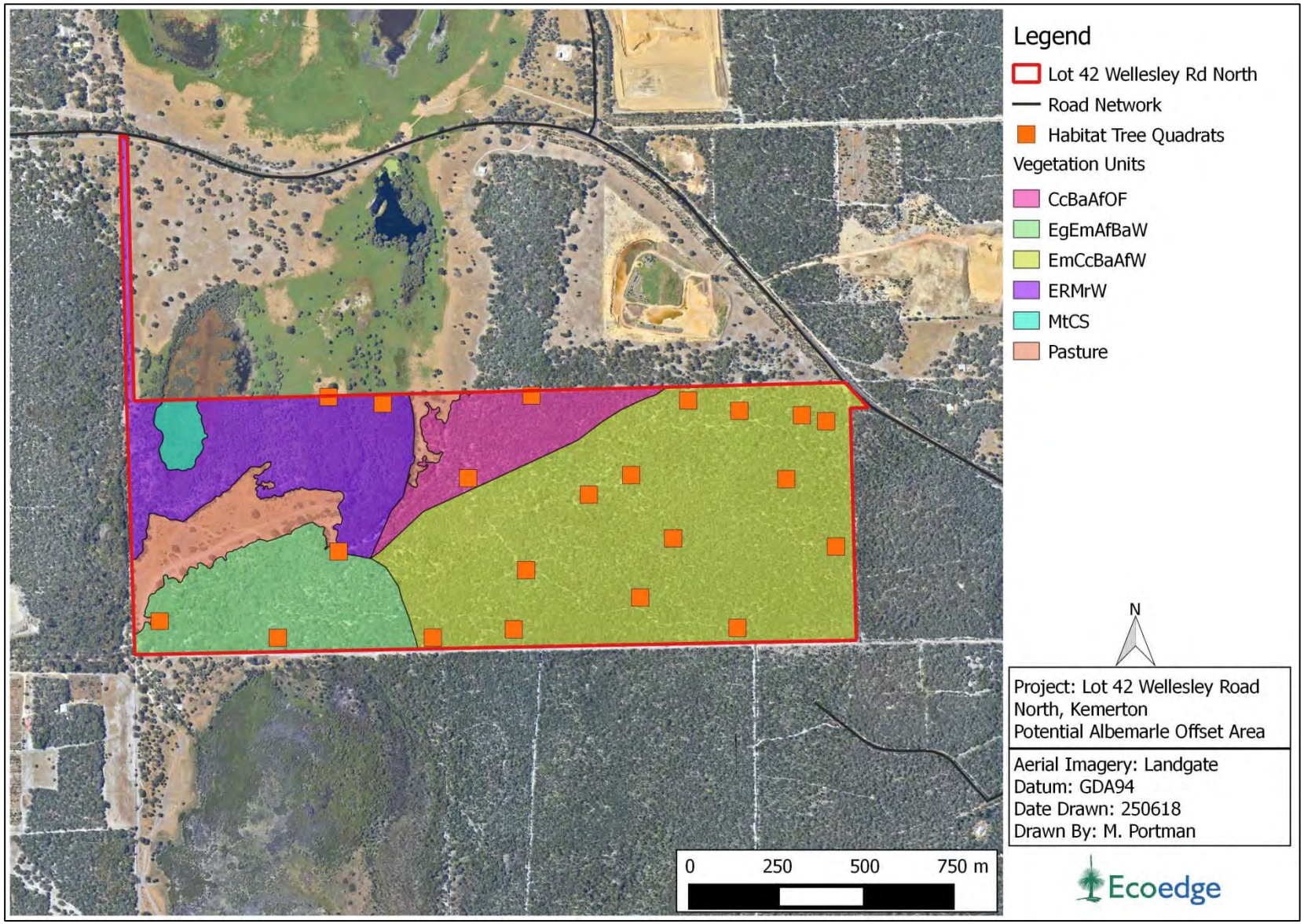

Figure 3. Location of tree quadrats used for the Black Cockatoo habitat assessment.

Foraging Habitat assessment

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 (based on vegetation unit mapping) was also documented irrespective of the presence of any actual foraging evidence.

Night 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).

Regional Habitat Extent

An estimate of the amount of black cockatoo habitat within 15 km of the subject set is provided based on available mapping data.

4.3 Survey Limitations

4.3.1 Flora and Vegetation Survey

Potential limitations with regard to the Reconnaissance flora survey are addressed in **Table 1**.

Table 1. Limitations with regard to reconnaissance flora survey 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	Moderate	Many annual or annually-regenerating species were not visible or not identifiable because of the time of survey.
Climatic and seasonal effects	Moderate	Out of season survey with most species not flowering.
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 off the Survey Area was accessible, and all vegetation communities were sampled.
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.

4.3.2 Black Cockatoo Habitat Survey

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 black cockatoo habitat assessment 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 three to five metres, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

5 Existing Environment and Desktop Assessment

5.1 Biogeographic Region, Location and Description

Lot 42 is situated within Swan Coastal Plain Perth (SWA02) sub-region of the Swan Coastal Plain biogeographic region, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia, 2016). It is located in Kemerton in the Shire of Harvey, between the Forrest Highway in the west and Wellesley Road North in the east. It is bounded in the west and north by freehold rural land, in the south by land vested in the Conservation and Parks Commission and in the east by Landcorp land (**Figure 4**).

Lot 42 covers approximately 153.3 ha of which approximately 142 ha is remnant native vegetation. Topographically, it rises from 4 m above sea level (ASL) in the west (wetlands) to a height of 34 m ASL on the east (uplands), and predominantly consists of upland vegetation (above 8 m ASL) (**Figure 4**).

5.2 Geology

The Swan Coastal Plain is comprised of a series of three successive coastal dune systems representing the geological history of shoreline movement and aeolian deposition of marine particles. The dominant dune systems, from west to east, are the Quindalup, Spearwood and Bassendean Dunes. East of the Bassendean Dunes lies the alluvial Pinjarra Plain system. Within the Swan Coastal Plain, Lot 42 is situated on soils of the Spearwood soil-landscape system as defined by Barnesby and Proulx-Nixon (2000).

The Spearwood Dunes are of aeolian origin and are characterised by a series of limestone-capped peaks. They also feature low dunes and swales of shallow pale grey sands over yellow sands (Government of Western Australia, 2000).

Barnesby and Proulx-Nixon (2000) mapped six soil phases or mapping units as occurring on Lot 42, these are described in **Table 2** and shown in **Figure 5**.

Table 2. Soil phases occurring within Lot 42 (Barnesby and Proulx-Nixon, 2000).

Soil Mapping Unit	Description
211Sp_S1b	Dune ridges with deep siliceous yellow brown sands or pale sands with yellow-brown subsoil and slopes up to 15%.
211Sp_S2a	Lower slopes (1-5%) of dune ridge with moderately deep to deep siliceous yellow-brown sands or pale sands with yellow-brown subsoils and minor limestone outcrop.
211Sp_S2c	Lower slopes (1-5%) of dune ridge with bleached or pale sands with a yellow-brown or pale brown subsoil (like S1c). Usually occurs on the eastern edge of the Spearwood Dunes.
211Sp_S4a	Flat to gently undulating sandplain with deep, pale and sometimes bleached, sands with yellow-brown subsoils.
211Sp_S4c	Flat to gently undulating sandplain with deep, yellow-brown or dark brown siliceous sands that are seasonally inundated.
211SpW_SWAMP	Swamp. Sand over limestone. Wet soils, water. Melaleucas, flooded gum, sedges and reeds.

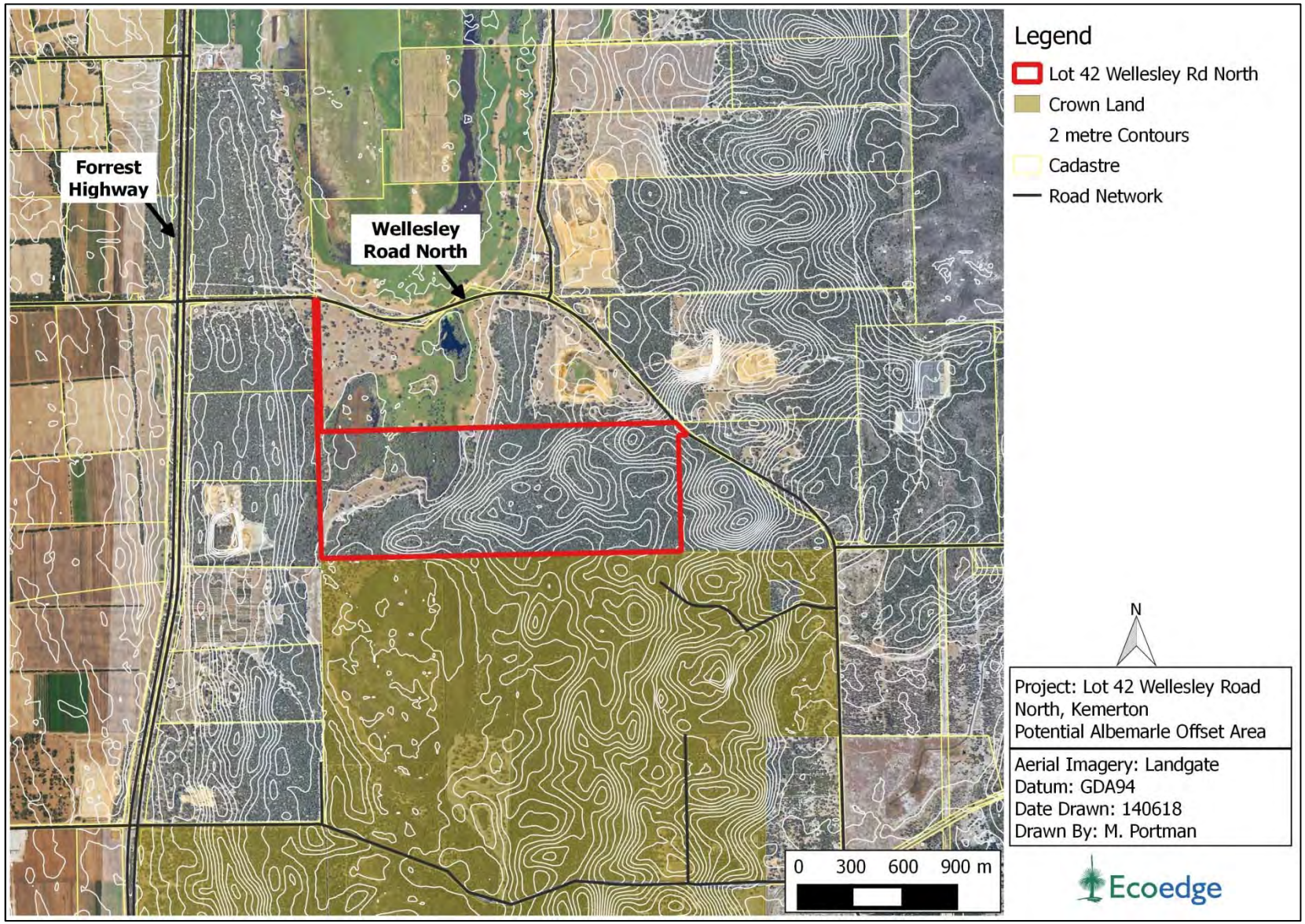

Figure 4. Lot 42 in relation to the road network, surrounding land uses and Crown Land.

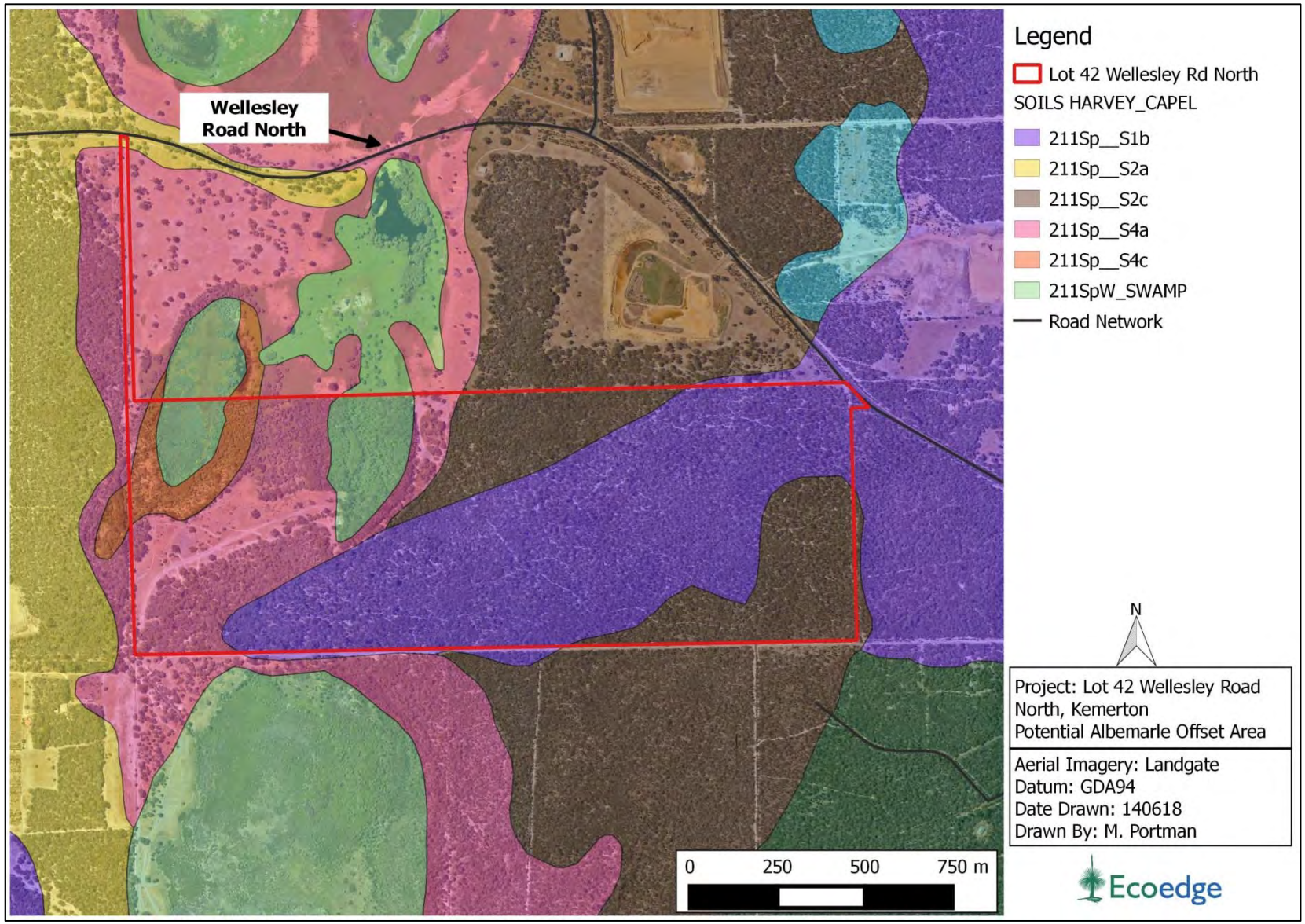

Figure 5. The soil phases mapped for Lot 42 (Barnesby and Proulx-Nixon, 2000).

5.3 Vegetation according to pre-European Mapping Datasets

5.3.1 Vegetation Associations

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)[6]. Approximately two thirds of the remnant vegetation on Lot 42 was mapped as Beard vegetation association 998, which is described as "Medium woodland; tuart". The remainder was mapped as association 6, "Medium woodland; tuart & jarrah".

5.3.2 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 1:250,000 Mapping of Vegetation Complexes in the Swan Coastal Plain of Western Australia (Heddle *et al.,* 1980) as updated by Webb *et al*. (2016), remnant vegetation within Lot 42 was mapped as the Yoongarillup Complex and the Karrakatta Complex - Central and South, which are described as follows:

Yoongarillup Complex: "Woodland to tall woodland of *Eucalyptus gomphocephala* (Tuart) with *Agonis flexuosa* in the second storey. Less consistently an open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). South of Bunbury is characterised by *Eucalyptus rudis* (Flooded Gum)-*Melaleuca* species open forests."

Karrakatta Complex - Central and South: "Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River."

[6] Beard's vegetation mapping units are referred to as 'associations' however these do not correspond to the NVIS Level 5 'Associations'. The NVIS system was developed long after Beard's work was completed, and while both classification systems use the same term, NVIS 'Associations' describe vegetation in more detail than do Beard's.

5.3.3 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).

In its report on the Statewide Vegetation Statistics incorporating the CAR Reserve Analysis, the Government of Western Australia provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the Comprehensive, Adequate and Representative (CAR) reserve system for WA (Government of Western Australia, 2018). This system is also based on the National retention targets of 30% overall. Only reserves managed by DBCA under the *Conservation and Land Management Act 1984* are considered for inclusion in the "CAR Reserve Analysis".

Table 3 lists the percentage remaining of the Yoongarillup Complex and the Karrakatta Complex - Central and South, and indicates whether the Commonwealth 30% retention target is met. An assessment of Beard vegetation associations 998 and 6 against the *Statewide Vegetation Statistics* for the State is presented in **Table 4**.

Table 3. Lot 42 vegetation complexes with regard to the Commonwealth retention target (Government of Western Australia, 2018).

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	% current extent in DBCA Managed Lands*
Yoongarillup Complex	35.55%	Yes	18.34%
Karrakatta Complex - Central and South	23.48%	No	8.06%

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

Table 4. Beard vegetation associations 998 and 6 assessed against the Statewide Vegetation Statistics (Government of Western Australia, 2018).

Beard Vegetation Association	% Remaining of pre-European extent (total)	% of pre-European extent in all DBCA managed land (total)
998 "Medium woodland; tuart"	36.2% (all within the SWA02 IBRA subregion)	20.8% (all within the SWA02 IBRA subregion)
6 "Medium woodland; tuart & jarrah"	23.61 % (all within the SWA02 IBRA subregion)	21.9% (all within the SWA02 IBRA subregion)

* Excludes Crown Freehold Department Interest Lands that are managed under Section 8(a) of the CALM Act.

5.4 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 (Western Australia) may list communities that are considered to be at threat as either Threatened or Priority Ecological Communities. The current listing of Threatened and Priority Ecological Communities is specified in DPaW (2016) and DBCA (2017a).

Threatened Ecological Communities can also be listed under the Commonwealth EPBC Act (Department of the Environment and Energy (DotEE), 2018b; Department of Environment, Water, Heritage and the Arts (DEWHA), 1999). The categories of TEC under the EPBC Act are defined in **Appendix 3**.

A Protected Matters Search Tool report was generated to provide information regarding MNES known or potentially occurring within approximately 10 km of Lot 42 (DotEE, 2018a, **Appendix 1**), and the current DPaW and DBCA TEC and PEC listings were consulted (DPaW, 2016; DBCA 2017a). TECs and PECs known to occur within approximately 10 km of Lot 42 are listed in **Table 5**.

Table 5. TECs and PECs occurring within approximately 10 km of Lot 42 (Gibson *et al*., 1994; DPaW, 2016; DBCA, 2017a; DotEE, 2018a).

Community Name	Community Description	Status (WA)	Status (EPBC Act)
'Claypans of the Swan Coastal Plain' – a federally listed TEC consisting of the following four State-listed communities: 1. SWAFCT07: Herb rich saline shrublands in clay pans (TEC) 2. SWAFCT08: Herb rich shrublands in clay pans (TEC) 3. SWAFCT09: Dense shrublands on clay flats (TEC) 4. SWAFCT10a: Shrublands on dry clay flats (TEC) 5. Clay pans with shrubs over herbs (PEC)		1. VU 2. VU 3. VU 4. EN 5. P1	CR
'Banksia Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed and non-listed communities		Various	EN
SWAFCT3c – *Corymbia calophylla – Xanthorrhoea preissii* woodlands and	*Corymbia calophylla – Xanthorrhoea preissii woodlands and shrublands.* Eucalyptus wandoo	TEC (CR)	EN

Community Name	Community Description	Status (WA)	Status (EPBC Act)
shrublands of the Swan Coastal Plain	is an occasional dominant. This community occurs on heavy soils.		
SWAFCT20a - *Banksia attenuata* woodland over species rich dense shrublands	Found on sandy soils and is reported to be the richest group of any of the *Banksia* communities recorded (with an average species richness of 67.4 species per site), low weed frequency, a distinctive diverse shrub layer, and the occurrence of *Mesomelaena pseudostygia, Alexgeorgea nitens, Daviesia nudiflora, Synaphea spinulosa, Hibbertia racemosa* and *Stylidium calcaratum.*	TEC (EN)	EN
SWAFCT21b - Southern *Banksia attenuata* woodlands	Structurally, this community type is normally *Banksia attenuata* or *Eucalyptus marginata – B. attenuata* woodland. Common taxa include *Acacia extensa, Jacksonia* sp. *Busselton, Laxmannia sessiliflora, Lysinema ciliatum* and *Johnsonia acaulis.* A component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC.	PEC P3	EN
SWAFCT21c - Low lying *Banksia attenuata* woodlands or shrublands	Occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. Tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana, Banksia attenuata*, *B. menziesii, Regelia ciliata, Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be either a woodland or occasionally shrubland A component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC.	PEC P3	EN
SWAFCT25 - Southern Swan Coastal Plain *Eucalyptus gomphocephala* -	Woodlands of *Eucalyptus gomphocephala* - *Agonis flexuosa* south of Woodman Point. Recorded from the Karrakatta, Cottesloe and Vasse units. Dominants other than tuart were occasionally recorded, including *Corymbia calophylla* at Paganoni block and *Eucalyptus*	PEC P3	EN

Community Name	Community Description	Status (WA)	Status (EPBC Act)
Agonis flexuosa woodlands	*decipiens* at Kemerton. Occasionally dominants other than tuarts were recorded (*Corymbia calophylla* and *Eucalyptus decipiens*) however tuarts are emergent nearby. *Banksias* found in this community include *Banksia attenuata, B. grandis* and *B. littoralis*.Tuart formed the overstorey nearby however. Can form a component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC listed TEC or the Tuart Woodlands of the Swan Coastal Plain PEC.[7]		

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

5.5 Threatened and Priority Flora

Threatened flora species are gazetted under Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* (WC Act)[8] 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 "Threatened flora", dependent on more information.

Appendix 4 presents the categories of Threatened and Priority Flora as defined by the WC Act (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 5** (DotEE, 2018c).

Threatened or Priority flora occurring within approximately 10 km of Lot 42 generated from an extract from the DBCA databases (DBCA, 2018a) and a NatureMap search (DBCA, 2018b), including a Likelihood of Occurrence assessment is provided in **Appendix 6**. Taxa listed under the EPBC Act (based on results of the Protected Matters Search Tool query (DotEE, 2018a)) are noted. The results of the DBCA database search are mapped in **Figure 6**. There are currently no Threatened or Priority flora records for Lot 42 in the DBCA database (most likely because no targeted searches for such have been undertaken).

The abovementioned desktop searches recorded:

- 13 taxa listed as Threatened under either the EPBC Act and/or WC Act
- 2 Priority 1 taxa

[7] A proposal to list 'Tuart Woodlands of the Swan Coastal Plain' as a TEC under the EPBC Act is currently being assessed by DotEE. The decision is expected by 31 July 2018.

[8] Transition to the *Biodiversity Conservation Act 2016* will commence in the near future. At the time of preparing this report, the WC Act 1950 was current in regards to the conservation of Threatened and Priority flora.

- 1 Priority 2 taxa
- 13 Priority 3 taxa
- 6 Priority 4 taxa

The following listed taxa are known to occur within 500 m of Lot 42:

- *Drakaea elastica* ('Critically endangered' Threatened flora, also listed as 'Endangered' under the EPBC Act)
- *Boronia juncea* subsp. *juncea* (Priority 1)
- *Lasiopetalum membranaceum* (Priority 3)
- *Acacia semitrullata* (Priority 4)

5.6 Regional Ecological Linkages

Molloy *et al*. (2009) identified a series of regional ecological linkages in their report on the South West Regional Ecological Linkages (SWREL) Project. The SWREL project was a collaboration between the Western Australian Local Government Association's *South West Biodiversity Project* and the then Department of Environment and Conservation's *Swan Bioplan*. Ecological linkages are defined by Molloy *et al*. (2009) 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*."

While there is no statutory basis for regional ecological linkages, their importance has been recognised as an environmental policy consideration in both EPA and planning policy over the last decade (EPA, 2009 and references therein).

In addition to mapping linkage axes, 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 linkage axis line.

A linkage axis line crosses through the southeast of Lot 42. Two thirds of vegetation onsite has been assigned a proximity rating of "1a" which is the highest rating, and one third is "1b", the second highest rating (**Figure 7**). Vegetation on Lot 42 directly forms part of a regional ecological linkage.

5.7 Geomorphic Wetlands

Wetlands on the Swan Coastal Plain have been classified into types using the geomorphic wetland classification system of Semeniuk & Semeniuk (1995), which is based on the characteristics of landform and water permanence, for example, lake, sumpland and dampland. The Swan Coastal Plain wetlands have also been evaluated and assigned an appropriate management category and corresponding category objective, providing guidance

on the nature of the management and protection the wetland should be afforded. These categories are described in **Table 6**.

Table 6. Wetland management categories (Essential Environmental Services, 2005).

Management Category	Definition	Category Objective
Conservation	Wetlands with high conservation value for both natural or human use	To preserve wetland (natural) attributes and functions
Resource Enhancement	Wetlands with moderate natural and human use attributes that can be restored or enhanced	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use	Wetlands that score poorly on both natural and human use attributes	To use, develop and manage wetlands in the context of water, town and environmental planning

According to the current database (DEC, 2008), one Conservation category wetland is mapped on Lot 42 on the western boundary. Most of this wetland is mapped outside of Lot 42 (**Figure 8**). Lot 42 also contains two Resource Enhancement wetlands. Another extensive Conservation category wetland is mapped adjacent to the southern boundary of Lot 42, on DBCA Freehold land. In total, Lot 42 contains approximately 24.1 ha of wetland vegetation, of which approximately 20.9 ha is mapped as either Resource Enhancement or Conservation category wetlands.

5.8 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).

The Department of Water and Environment Regulation (DER) provides a dataset of ESAs, the most current version of which is dated 2016. Their Clearing Permit System online mapping tool provides information about the criteria that triggered each individual ESA's designation. One ESA is mapped on Lot 42 near the western boundary (**Figure 9**) (DWER, 2016), associated with the Conservation category wetland.

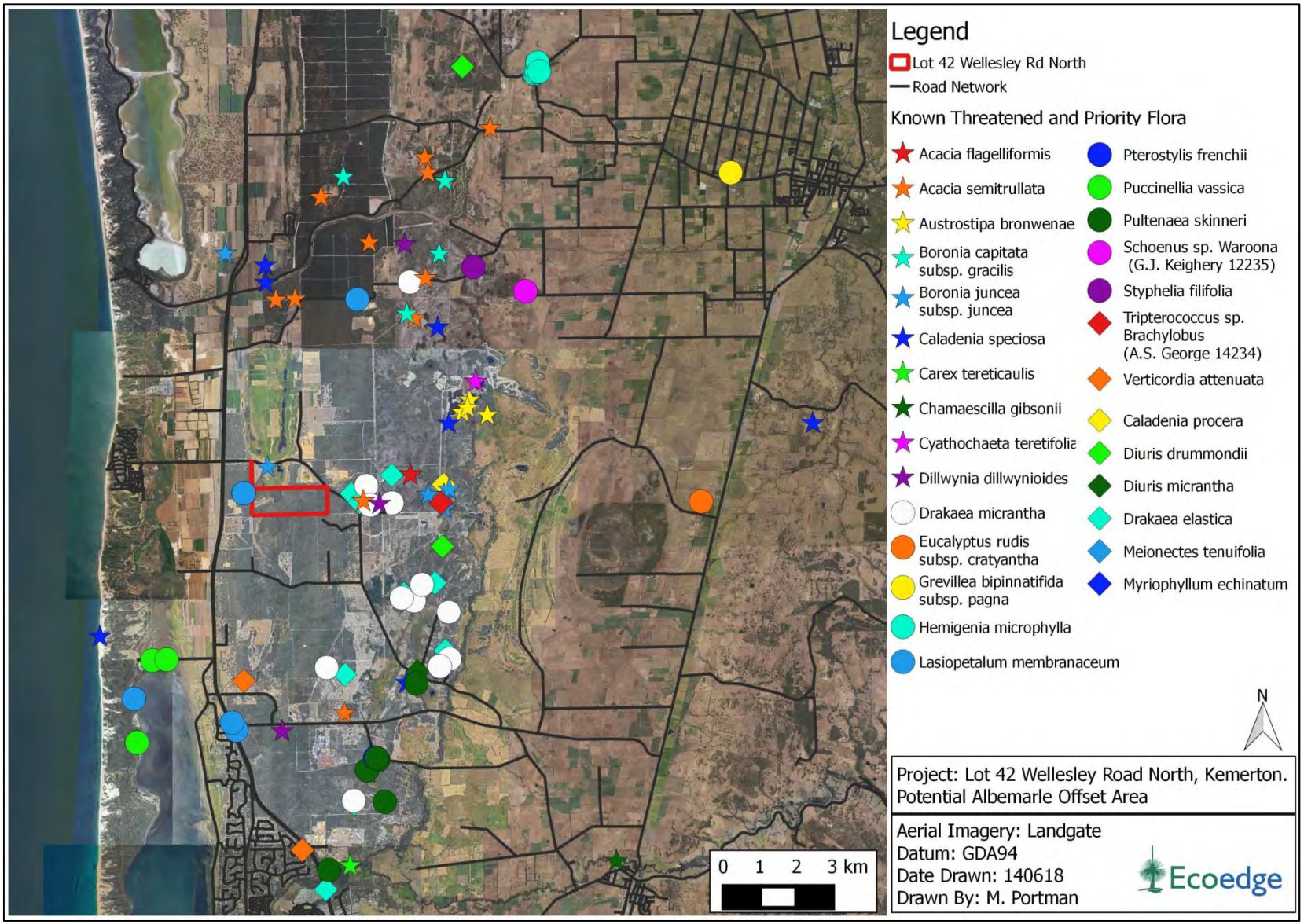

Figure 6. Known occurrences of Threatened and Priority flora around Lot 42 (DBCA, 2018a).

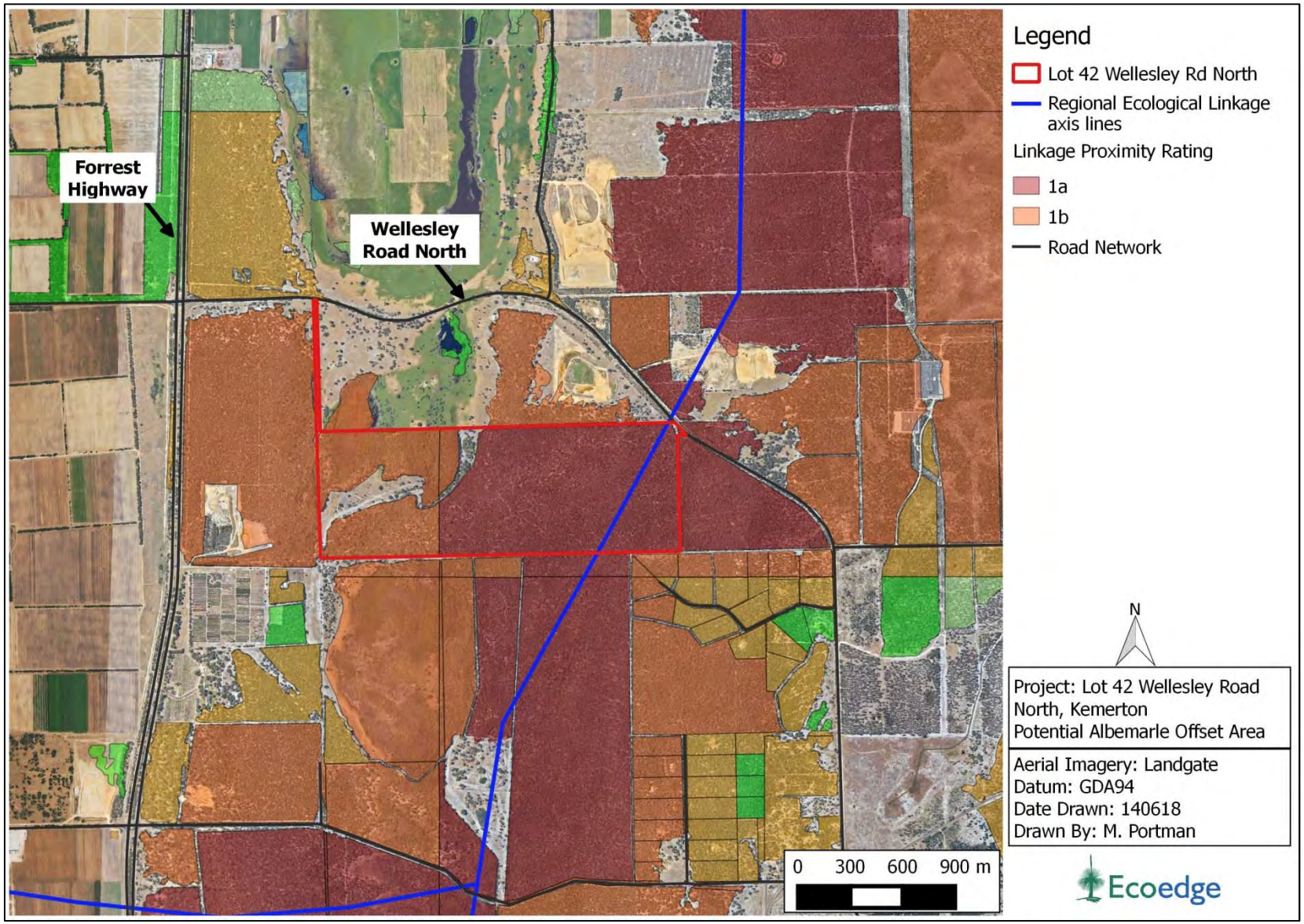

Figure 7. Lot 42 in relation to Regional Ecological Linkages (Molloy *et al*., 2009).

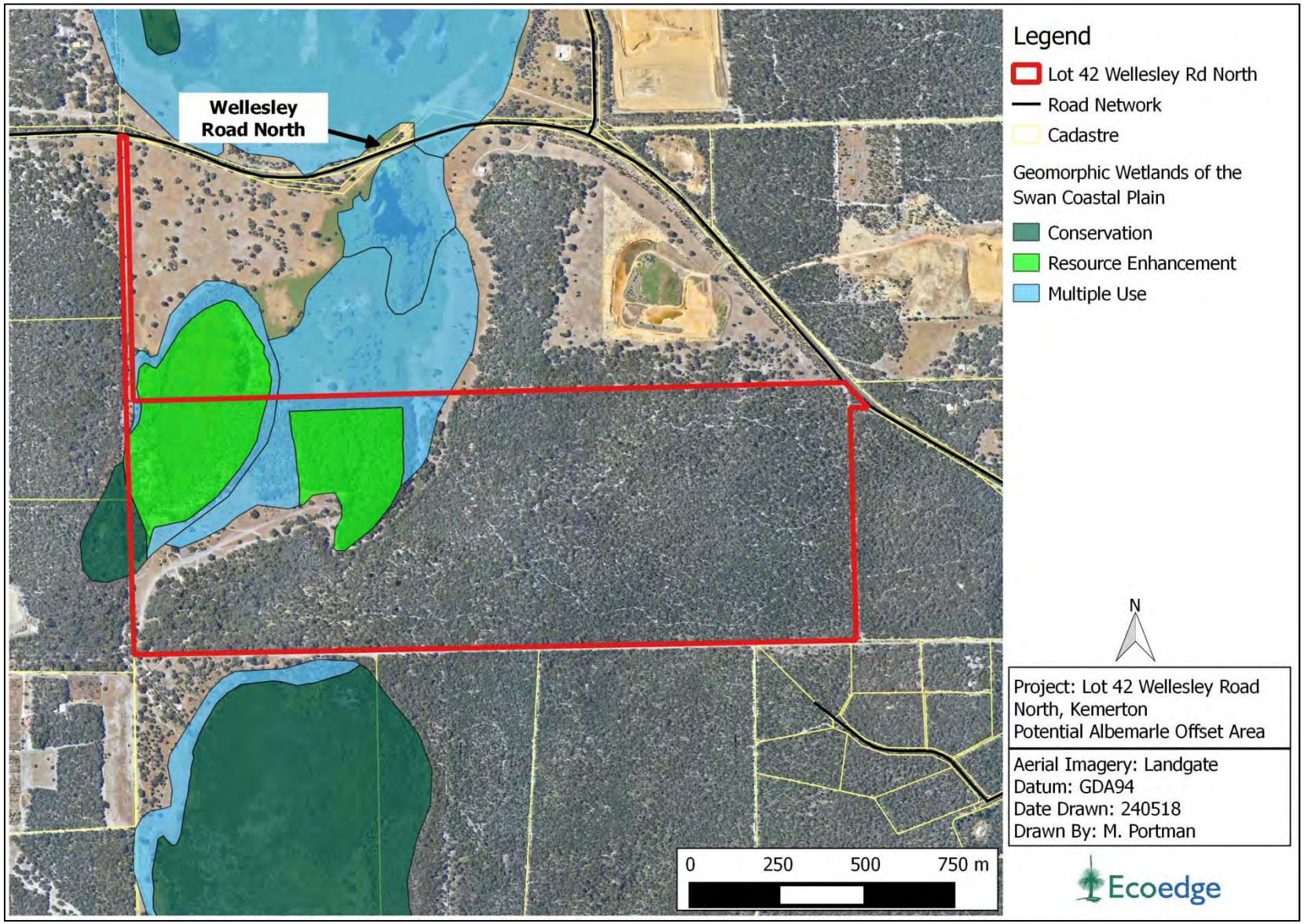

Figure 8. Lot 42 in relation to Geomorphic wetlands (DEC, 2008).

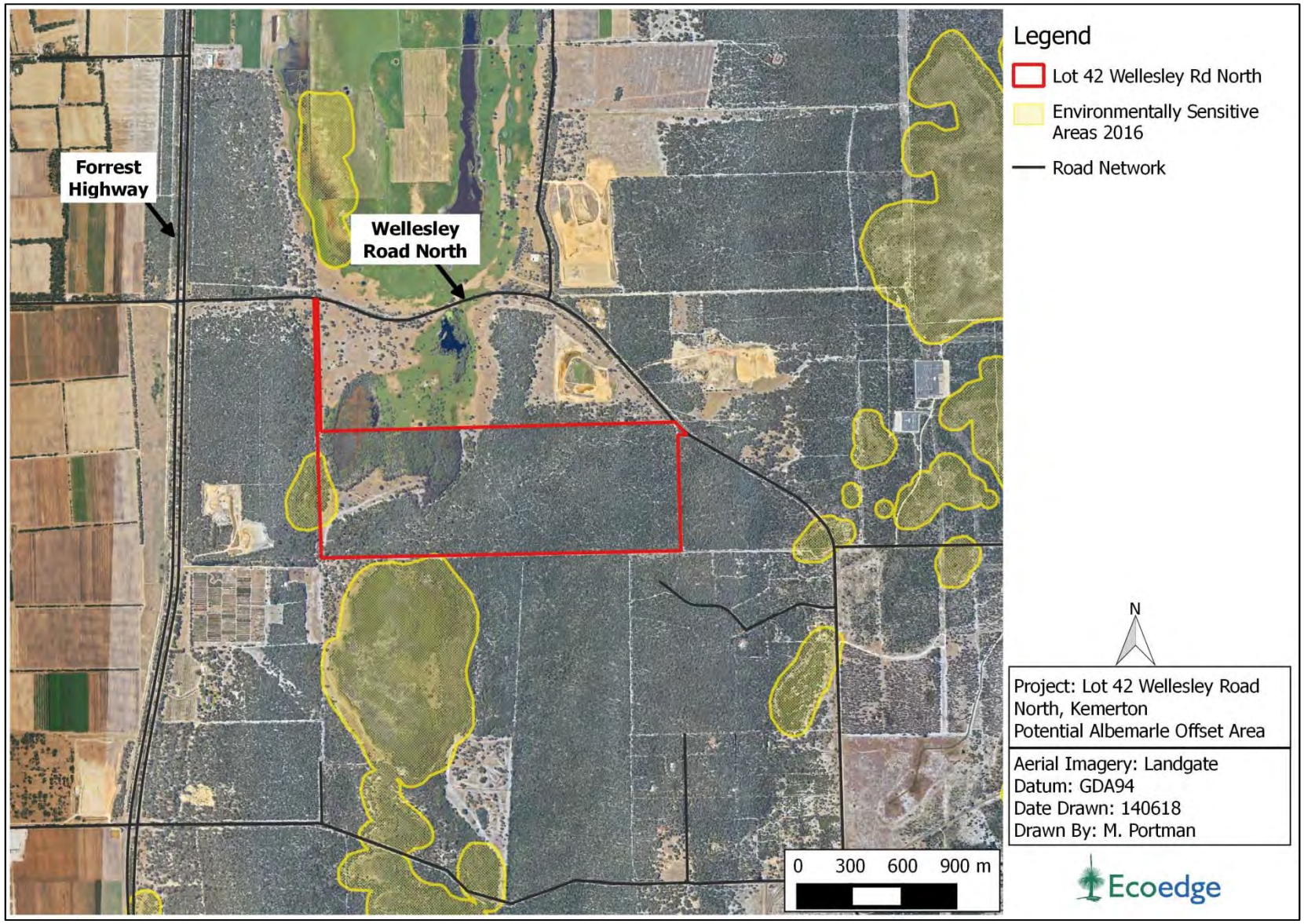

Figure 9. Lot 42 in relation to Environmentally Sensitive Areas (DER, 2016).

6 Field Survey Results

6.1 Flora

One hundred and one flora taxa were identified during the survey (**Appendix 7**), of which eighty eight were native flora. Because the survey was done outside of spring, this represents an underestimate of the total number of flora within Lot 42. A spring survey would very likely result in the number of flora increasing by at least 50%, particularly with regard to herbaceous species.

No Threatened flora taxa were identified during the field survey.

6.1.1 Introduced Flora

Thirteen species of introduced plants were found within Lot 42. Two of them (*Gomphocarpus fruticosus* and *Zantedeschia aethiopica*) are declared as pest plants under the *Biosecurity and Agriculture Management Act 2007*. *G. fruticosus* (Narrow-leaf Cottonbush) is in the C3 (management) category. *Z. aethiopica* (Arum Lily) is in the Exemption (for keeping) category.

The other introduced species are common weeds of remnant vegetation in SW Western Australia and are most prevalent in the areas of bushland adjacent to the cleared farmland, and where livestock have entered the bushland to graze.

6.1.2 Priority Flora

Two Priority flora taxa were found during the survey, *Acacia semitrullata* (P4) and *Eucalyptus rudis* subsp. *cratyantha* (P4). A photograph of *Acacia semitrullata* (P4) is shown in **Figure 10**

Figure 10. The location of the *Acacia semitrullata* plant is shown in **Figure 11**.

Acacia semitrullata (P4) is fairly common throughout the EmCcBaAfW vegetation unit and likely to be so in similar vegetation in the Kemerton area (Eco Logical Australia, 2013), however only one plant was recorded as being present within a releve (383390.5 E, 6330803.1 N.

Eucalyptus rudis subsp. *cratyantha* is the dominant species in the ErMrW vegetation unit. *Eucalyptus rudis* subsp. *cratyantha* (P4) is mainly confined to alluvial soils along waterways on the Swan Coastal Plain between Rockingham and Dunsborough, with outliers near Collie and along the Leeuwin-Naturaliste Ridge south to Gracetown. Much of its original habitat has been cleared for agriculture.

It is very likely that a spring survey over vegetation on Lot 42 would find other conservation significant flora.

Figure 10. *Acacia semitrullata*.

6.1.3 Other significant flora

No other significant flora as defined by the EPA (2016) was identified within Lot 42 during the field survey.

Of the 35 Threatened or Priority taxa known to occur with approximately 10 km of Lot 42, the Likelihood of Occurrence assessment post-field survey (refer **Appendix 6**) concluded that 2 conservation significant flora taxa (*Acacia semitrullata* and *Eucalyptus rudis* subsp. *cratyantha*) were very highly likely to occur onsite, one (*Caladenia speciosa*) was highly likely to occur and a further 22 were moderately likely to be present. 10 had a low likelihood of occurring. A spring survey would be required to confirm the presence of other conservation significant flora onsite.

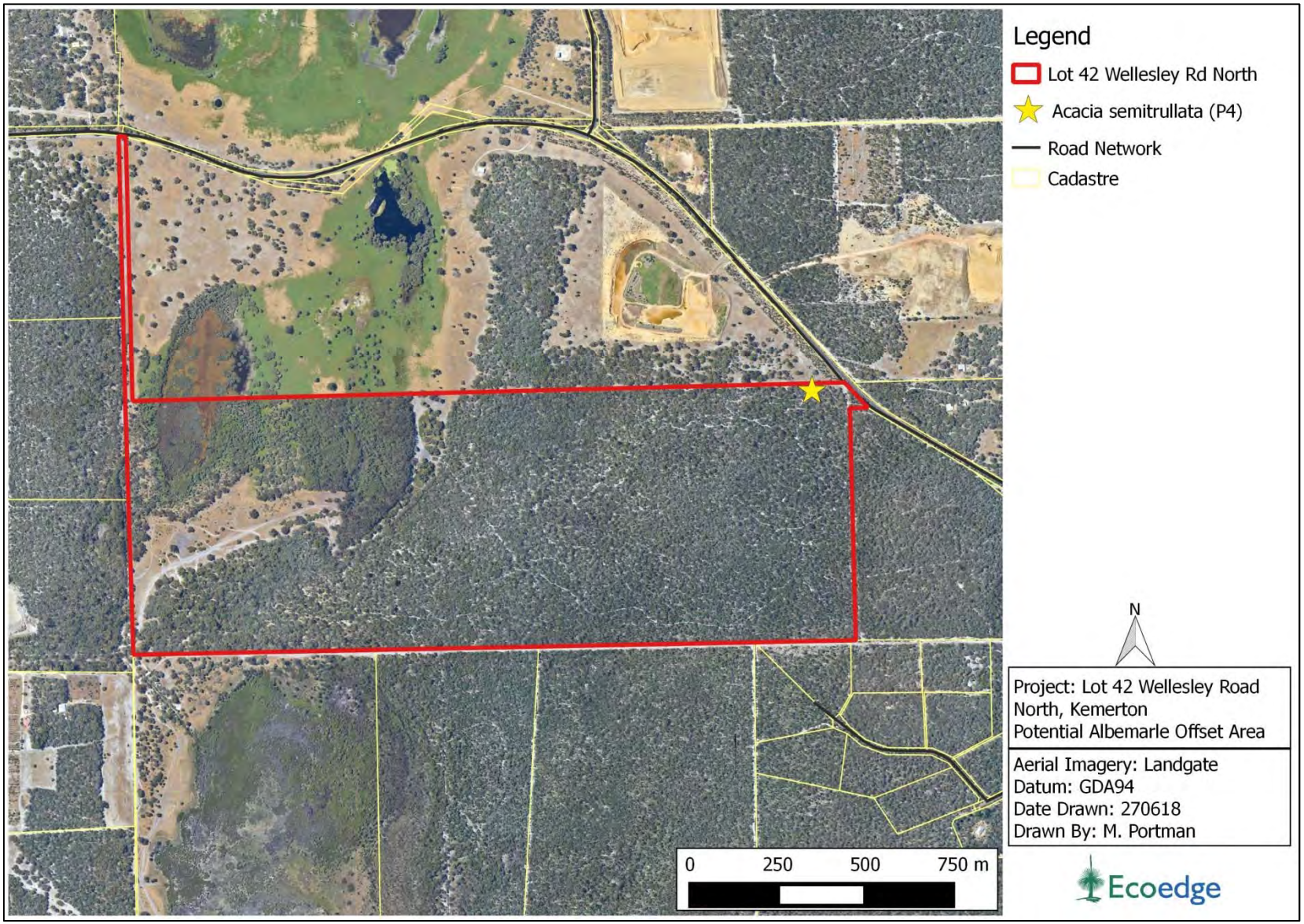

Figure 11. Location of the *Acacia semitrullata* plant (P4).

6.2 Vegetation

6.2.1 Vegetation Units

Six vegetation units were identified within the Lot 42 (**Figure 12**). The extent and proportion of each vegetation unit within Lot 42 is shown in **Table 7**. They are described and photographs of each of them are presented in **Table 8**.

The vegetation groups were separated by species composition, structure, landscape position and soil. The main influence on the separation of vegetation in the Survey Area into units is landscape position. The EmCcBaAfW vegetation unit is confined to the Spearwood S1b and S2c soil-landscape phases (Dune ridges and lower slopes of dune ridges), while the CcBaAfOF vegetation unit is confined to the Spearwood S2c phase (Lower slopes of dune ridges) (refer to **Figure 5** for the distribution of these soil phases within Lot 42).

The EgEmAfBaW vegetation unit with its sparse Tuart over-storey is situated on both the Spearwood S2c phase and Spearwood S4a (Flat to gently undulating sandplain) phases. The Flooded Gum-*Melaleuca rhaphiophylla* woodland (ErMrW) is confined to the Spearwood S4a phase while the MtCS unit is confined to the Spearwood Swamp phase.

Table 7. Extent and proportion of each of the vegetation units within Lot 42.

Vegetation Unit	Description	Area (ha)	%
CcBaAfOF	Marri-*Banksia attenuata*-Peppermint open forest	11.7	7.6
EmCcBaAfW	Jarrah-Marri-*Banksia attenuata*-Peppermint woodland	80.8	52.7
EgEmAfBaW	Tuart-Jarrah-Peppermint-*Banksia attenuata* open forest	20.8	13.5
ErMrW	Flooded gum-*Melaleuca rhaphiophylla* woodland	21.8	14.2
MtCS	*Melaleuca teretifolia* closed scrub	2.3	1.5
Pasture	Scattered Flooded Gum over bracken and pasture	15.9	10.4
Total		153.3	100.0

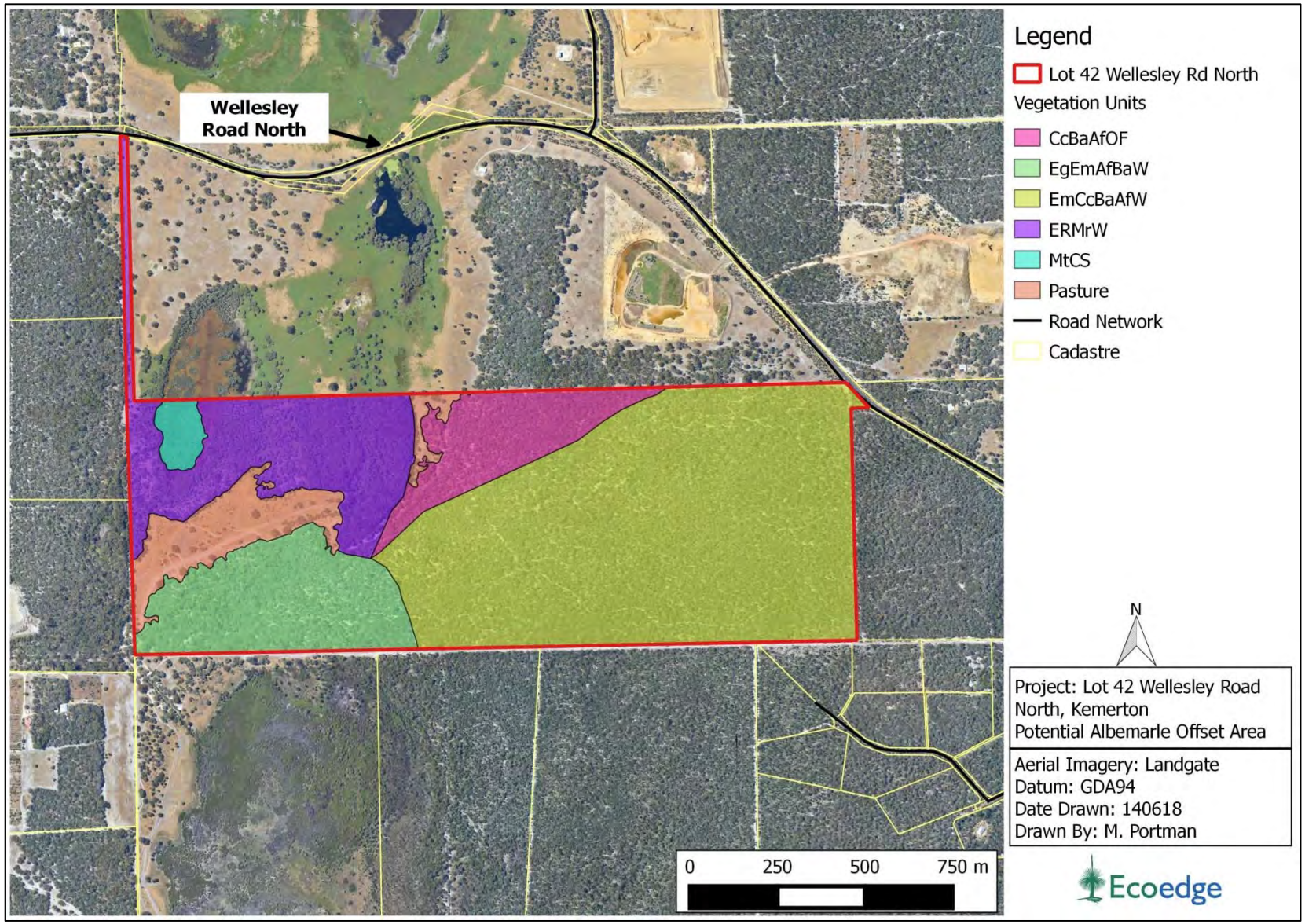

Figure 12. Vegetation units mapped for Lot 42.

Table 8. Vegetation units mapped for Lot 42.

Vegetation Unit	Description	Area (ha)	Representative photograph
EmCcBaAfW	Woodland of *Eucalyptus marginata*, *Banksia attenuata* and *Agonis flexuosa* and occasional *Banksia ilicifolia* and *Nuytsia floribunda*, with emergent *Corymbia calophylla* over a diverse shrubland on grey sand	80.8	
EgEmAfBaW	Tall woodland of Eucalyptus gomphocephala over Eucalyptus marginata, Agonis flexuosa and Banksia attenuata, with occasional Corymbia calophylla and Melaleuca preissiana on lower slopes on yellow-grey sand	20.8	
CcBaAfOF	Open forest or Woodland of *Corymbia calophylla* over *Banksia attenuata*, *B. ilicifolia* and *Agonis flexuosa* over low shrubland and introduced grasses on grey loamy sands on lower slopes	11.7	

Vegetation Unit	Description	Area (ha)	Representative photograph
ErMrW	Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over *Melaleuca teretifolia* shrubland over *Baumea arthrophylla*, *Lepidosperma longitudinale* and *Juncus pallidus* over *Centella asiatica* herbs on grey-brown loam (there are some disturbed areas with a more open understorey)	21.8	
MtCS	Closed shrubland to shrubland of *Melaleuca teretifolia* with *Cassytha racemosa* twiners over scattered herbs and sedges including *Centella asiatica* and *Lepidosperma longitudinale*.	2.3	
Pasture (with scattered *Eucalyptus rudis* and *Pteridium esculentum*)	Pasture (with scattered *Eucalyptus rudis* and *Pteridium esculentum*)	15.9	

6.2.2 Vegetation Condition

Over half of the vegetation on Lot 42 (58.3%) was categorised as Excellent or Very Good condition (**Figure 13**, **Table 9**). Another 31% was classed as Good condition. The areas rated as Degraded or Completely Degraded had been cleared or partially cleared in the past for grazing. There is evidence of past logging, particularly in the vegetation dominated by marri and jarrah.

In regards to the wetlands on Lot 42, after the field survey, botanist Russell Smith stated that he has not seen wetlands of their like before in such good condition (Russell Smith, pers. comm. 28 June 2018).

Table 9. Extent of vegetation on Lot 42 in each condition class.

Condition	Area (ha)	%
Excellent	60.0	39.1
Very Good	29.4	19.2
Good	48.3	31.5
Degraded	4.3	2.8
Completely Degraded	11.3	7.4
	153.3	100.0

Threats to the vegetation are discussed in **Section 7**.

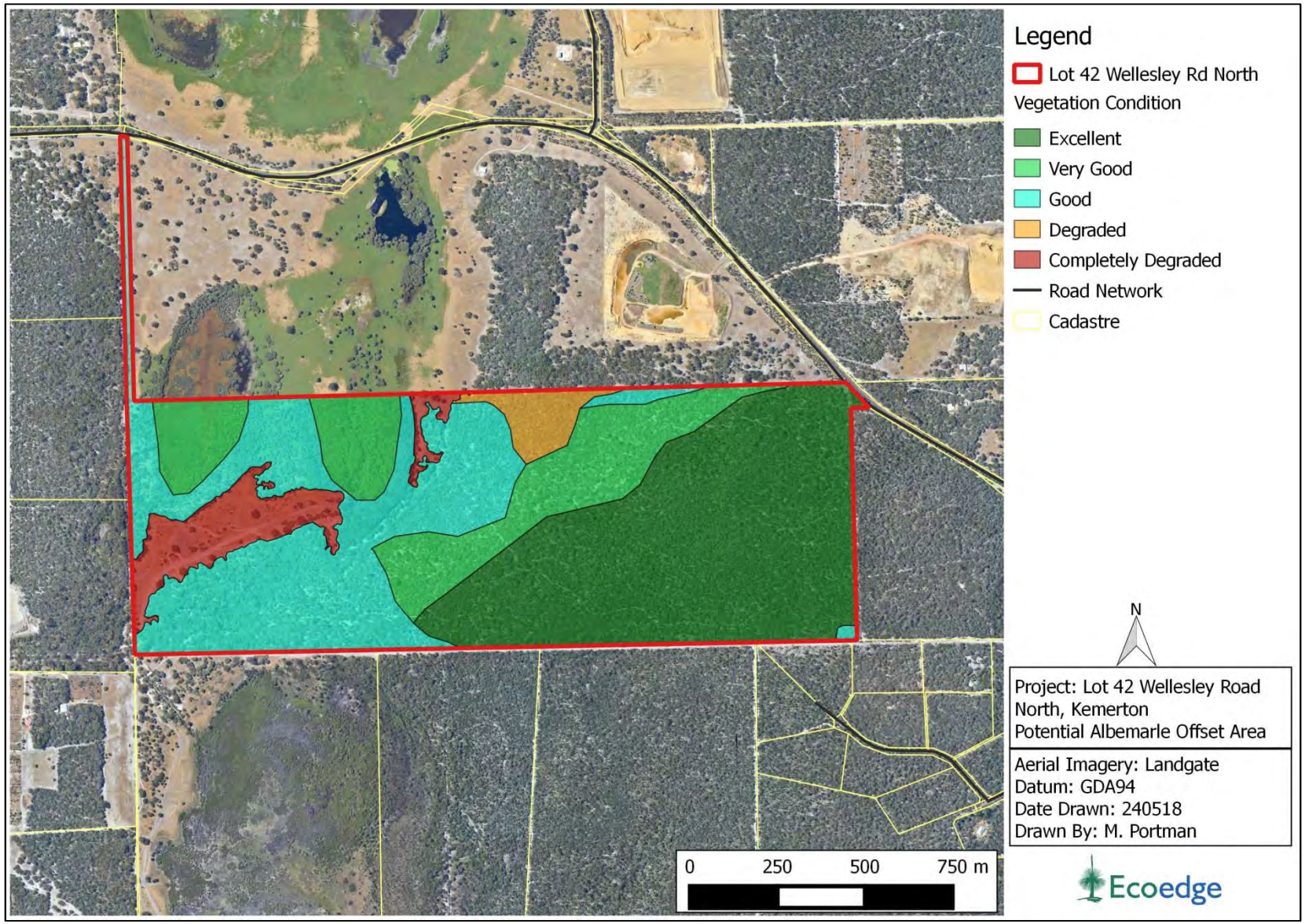

Figure 13. Condition of vegetation on Lot 42.

6.2.3 Conservation Significance of the Vegetation

The equivalent Floristic Community Type (FCT) for each vegetation unit (if one could be found) as defined by Gibson *et al*. (1994) is shown in **Table 10**.

Table 10. Vegetation unit nearest corresponding FCT and status.

Vegetation Unit	Description	Floristic Community Type (SWAFCT[9])
EmCcBaAfW	Jarrah-Marri-*Banksia attenuata*-Peppermint woodland	SWAFCT21a (Central *Banksia attenuata-Eucalyptus marginata* woodlands). Forms part of the Federally-listed "*Banksia* Woodlands of the Swan Coastal Plain" TEC
EgEmAfBaW	Tuart-Jarrah-Peppermint-*Banksia attenuata* open forest	SWAFCT 25 (Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa*). Can form a component of the Federally-listed "*Banksia* Woodlands of the Swan Coastal Plain" TEC or the Tuart Woodlands of the Swan Coastal Plain PEC.
CcBaAfOF	Marri-*Banksia attenuata*-Peppermint open forest	SWAFCT21a (Central *Banksia attenuata-Eucalyptus marginata* woodlands). Forms part of the Federally-listed "*Banksia* Woodlands of the Swan Coastal Plain" TEC
ErMrW	Flooded gum-*Melaleuca rhaphiophylla* woodland	SWAFCT 14? (Deeper wetlands on sandy soils) Not TEC or PEC (status stated as 'insufficiently known' by Gibson *et al*.)
MtCS	*Melaleuca teretifolia* closed scrub	No equivalent
Pasture	Scattered Flooded Gum over bracken and pasture	NA (too degraded to determine equivalent)

The most widespread vegetation unit (EmCcBaAfW) is inferred to be SWAFCT 21a (Central *Banksia attenuata-Eucalyptus marginata* woodlands; Gibson *et al*., 1994) which is part of the Federally-listed TEC "*Banksia* Woodlands of the Swan Coastal Plain" (*Endangered* category). Vegetation unit CcBaAfOF is also inferred to belong to SWAFCT 21a. The Tuart-dominated vegetation unit EgEmAfBaW on Lot 42 (inferred to be SWAFCT 25, Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands) is also part of the "*Banksia* Woodlands of the Swan Coastal Plain" TEC (DotEE, 2016).

Vegetation unit ErMrW possibly belongs to SWAFCT 14 (Deeper wetlands on sandy soils), however it is not a good fit. Neither are any of the other potential floristic community types described by Gibson *et al*. (1994). This is also true of the *Melaleuca teretifolia* closed scrub

[9] SWAFCT- refers to the Swan Coastal Plain "floristic community type" as defined in Gibson *et al*. (1994).

(MtCS), which has no match. It is generally acknowledged that the diversity of wetlands on the Swan Coastal Plain is not represented by the work of Gibson *et al*. (1994).

6.2.4 Wetlands

Due to their intactness and 'Very Good' condition, both the Resource Enhancement category wetlands on Lot 42 would be more appropriately classified as Conservation category wetlands. The botanist who carried out the field survey stated that he has not seen wetlands of their like before in such good condition (Russell Smith, pers. comm. 28 June 2018).

6.2.5 Banksia Woodlands of the Swan Coastal Plain TEC

Based on the data collected, a total of 113.3 ha of vegetation on Lot 42 meets the criteria for the Banksia Woodlands of the Swan Coastal Plain TEC ('Banksia Woodlands TEC'). This is comprised of the vegetation units EmCcBaAfW, CcBaAfOF and EgEmAfBaW. Vegetation representing the TEC is mapped in **Figure 14**.

The *Banksia*-dominated vegetation on Lot 42 represents a good example of upland Banksia Woodlands, that is not subject (currently) to degradation by *Phytophthora* Dieback. It also has the advantage of being adjacent to large areas of Banksia Woodlands to the south and to the east which increases its conservation value and long-term viability. It has been logged in the past but otherwise a large part of it is in Excellent or Very Good condition.

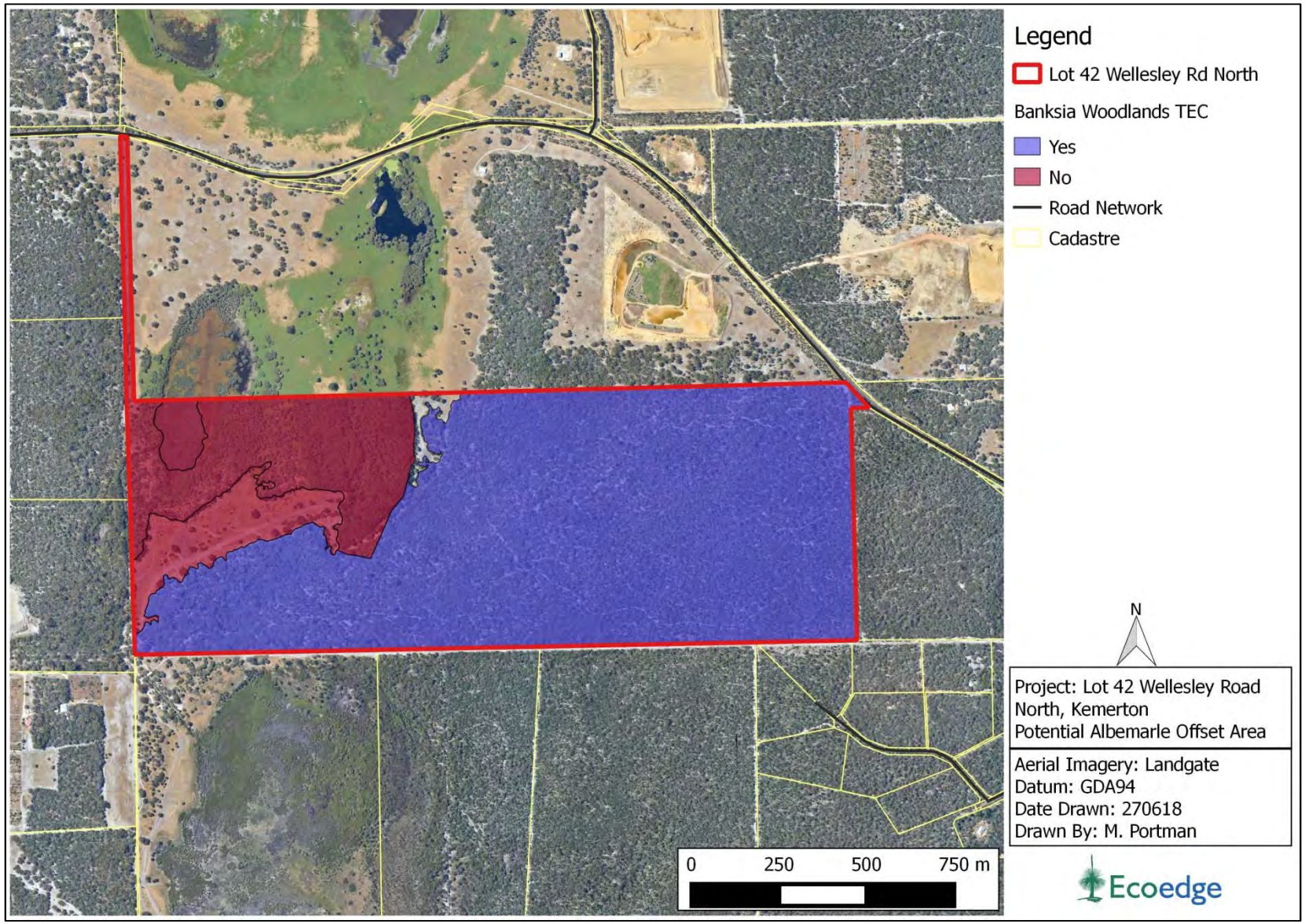

Figure 14. Vegetation mapped as the Banksia Woodlands TEC is shown in blue.

6.3 Black Cockatoo Habitat

6.3.1 Breeding Habitat

Trees considered potentially suitable for Black Cockatoos to use as nesting habitat (subject to a suitable hollow being present or forming and a range of other factors) which were found within Lot 42 comprised the following species:

- Marri – *Corymbia calophylla*
- Jarrah - *Eucalyptus marginata*
- Flooded Gum – *Eucalyptus rudis*
- Tuart – *Eucalyptus gomphocephala*

The main woodland/forest areas containing these tree species make up approximately 135 ha of Lot 42 and this figure has been used in potential breeding habitat tree calculations[10].

The results of the tree quadrat survey carried out to estimate the number of trees with a DBH ≥50cm within Lot 42 are provided in Table 11 below.

The results of the tree quadrat survey suggest that the main woodland/forest areas within the subject site which cover about 135 ha contain about 2,783 trees that can be regarded as representing potential black cockatoo breeding habitat using DotEE criteria (i.e. suitable species with a DBH >50cm irrespective of the presence of adequate hollows). It should be noted that the area mapped as pasture (15.9 ha) also contains a scattering of trees, some of which would also fit the criteria for being "potential breeding habitat".

Eighty five trees containing possible large hollows potentially suitable for black cockatoos to use for nesting were observed opportunistically within the Lot 42 during the survey period (**Figure 15**). A small number of these trees showed some inconclusive evidence of possible use by cockatoos (i.e. minor chew marks).

The results obtained during this survey are consistent with ELA's assessment of the area in 2013 (ELA, 2013) where they rated all of the upland vegetation within Lot 42 as being of High value as Black Cockatoo breeding habitat, and low-lying areas as Moderate, due to the presence of vegetation containing potential breeding trees at estimated densities (for the main vegetation types present) ranging from 5.2 to 12 trees per hectare.

[10] In regards to Black Cockatoo habitat, the portions of site vegetation that include scattered trees over pasture are included in calculations, but in regards to calculations of remnant vegetation, these areas are excluded.

Table 11. Tree Survey Results and Calculations.

Quadrat No.	Northing	Easting	TREES > 50 cm	*Eucalyptus marginata*	*Corymbia calophylla*	*Eucalyptus rudis*	*Eucalyptus gomphocephala*	Dead	Estimate of Total Number of Trees with DBH>50cm per ha (Avg./0.09)	Estimate of Total Number of Trees with DBH>50cm (Trees per ha x Total 135 ha)
1	6330748.01	383182.86	3		2			1	33.3	5028.3
2	6330776.97	383036.36	0						0	0
3	6330563.89	382873.54	0						0	0
4	6330507.77	382752.58	1		1				11.1	1676.1
5	6330359.42	383459.12	0						0	0
6	6330124.74	383177.45	1	1					11.1	1676.1
7	6330213.57	382899.28	2	2					22.2	3352.2
8	6330120.73	382537.77	2	1	1				22.2	3352.2
9	6330097.09	382306.10	4	1	3				44.4	6704.4
10	6330096.29	381863.18	4	2			2		44.4	6704.4
11	6330144.98	381525.05	3				3		33.3	5028.3
12	6330345.13	382037.01	1				1		11.1	1676.1
13	6330554.85	382407.47	1	1					11.1	1676.1
14	6330292.15	382573.11	1		1				11.1	1676.1
15	6330552.12	383317.10	0						0	0
16	6330734.95	383361.64	1	1					11.1	1676.1
17	6330383.14	382993.60	3	1	2				33.3	5028.3
18	6330791.34	382588.38	2	1	1				22.2	3352.2
19	6330768.70	382163.13	4			4			44.4	6704.4
20	6330787.22	382007.79	4			4			44.4	6704.4
21	6330720.10	383430.28	2	1	1				22.2	3352.2
Total			**39**	**12**	**12**	**8**	**6**	**1**	**20.6**	**2,782.9**

6.3.2 Foraging Habitat

The following represents a list of plant species recorded within Lot 42 during the Reconnaissance flora and vegetation survey known (or highly likely) to be used by one or more of the Black Cockatoo species as a food source (i.e. foraging habitat).

- Jarrah – *Eucalyptus marginata* – seeds.
- Marri – *Corymbia calophylla* - flowers, seeds, nectar.
- Tuart - *Eucalyptus gomphocephala* - flowers, seeds, nectar.
- Flooded Gum - *Eucalyptus rudis* - flowers, nectar.
- Banksia – *B. attenuata, B. grandis, B. ilicifolia, B. littoralis* - flowers, seeds.
- Grey Stinkwood - *Jacksonia furcellata* – seeds.
- Peppermint - *Agonis flexuosa* – bark, grubs.
- Orange Wattle - *Acacia saligna* – fresh bark.
- Grass Tree – *Xanthorrhoea gracillis, X. brunonis* – seeds

It should be noted that the degree to which the various plant species are utilised varies considerably. For example, marri is documented as being the primary food source for all three species, though jarrah and *banksia* make up a high proportion of some black cockatoo species food source in other areas where they proliferate. Plants such as tuart, flooded gum, grey stinkwood and peppermint (for example) are only foraged upon rarely.

Evidence of black cockatoos foraging was observed during the field survey in the form of chewed marri fruits and banksias cones. This evidence was attributed to the forest red-tailed black-cockatoo in the case of the marri fruits and Carnaby's black-cockatoo in the case of the *banksia* (**Table 12**).

The extent of quality foraging habitat within the subject site can be regarded as those areas containing marri, jarrah and banksia. This area totals about 113.3 ha. Areas dominated by flooded gum can be regarded as being of low value as foraging habitat as this tree species is not a favoured food source.

It should also be noted that the degraded "pasture" areas also contain a scattering of trees some of which are represented by marri and jarrah and therefore also contribute to the overall forging resource available within Lot 42.

The observations made during this survey are consistent with ELA's assessment of the area in 2013 (ELA, 2013) where they rated the majority (over two thirds) of the remnant vegetation within Lot 42 as being of a High value as Black Cockatoo forging habitat. The remaining approximately one third was rated as being of a Moderate value.

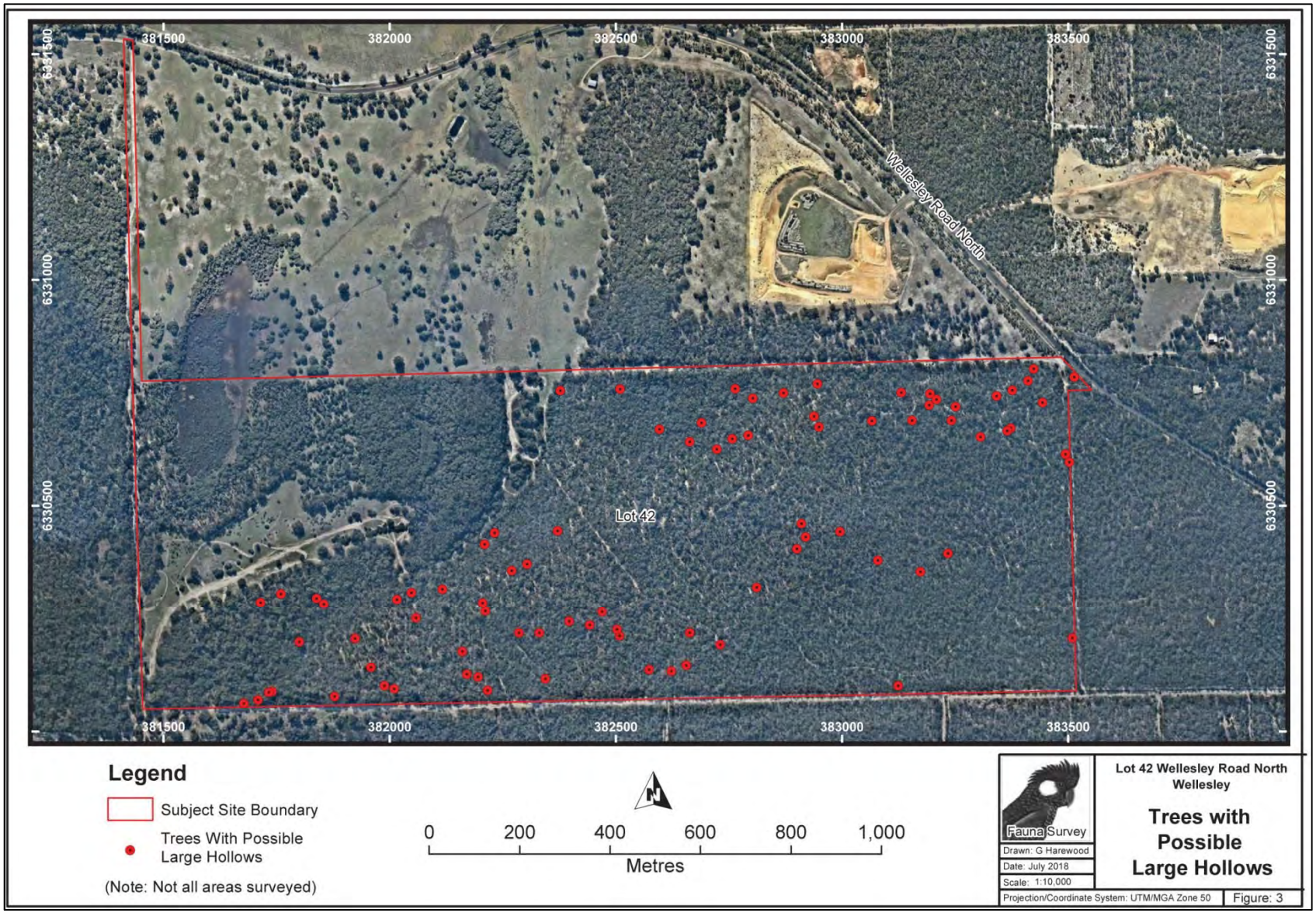

Figure 15. Trees with hollows that may potentially be used by Black Cockatoos are marked in red.

Table 12. Foraging evidence examples.

Foraging Evidence Description	Example Image
Marri Fruits – foraging activity attributed to the forest red-tailed black-cockatoo.	
Banksia Cones – foraging activity attributed to Carnaby's black-cockatoo	

6.3.3 Night Roosting Habitat

No evidence of trees being used for overnight roosting by black cockatoos was observed. However, given the known use of the general area by black cockatoos, the presence of large trees/groves of trees there is potential for the site to be utilised for this purpose despite no actual evidence being found.

Forest red-tailed black-cockatoos were heard calling and a small flock of Carnaby's black cockatoo were observed within the subject site during the survey period suggesting roost sites may exist nearby.

A review of the 2017 Great Cocky Count database shows no documented roost sites within the subject site, the closest active roost (2017) being about 5.5 km north east. This site was in use by 123 white tailed black cockatoos (most probably Carnaby's) during the 2017 Great Cocky Count. Another six documented roost sites (but not necessarily in current use) occur with 15 km of the subject site.

7 Threats to the Vegetation

7.1 *Phytophthora* Dieback Disease

Phytophthora Dieback Disease

The vegetation on Lot 42 that contains *Phytophthora* susceptible species (units CcBaAfOF, EmCcBaAfW and EgEmAfBaW) appears to be free of the disease, except for some small potential infestations along the external boundary track. The most prominent of these is that on the southern boundary track, approximately 250 m from the SE corner (**Figure 1716**). Two photos of this potential dieback infestation are shown below (**Figure 1617, Figure 18**).

Once present in *Banksia attenuata* woodland, *Phytophthora* disease kills close to 100% of that species and also *Banksia grandis* within 15 years (Shearer *et al*, 2006). Within Lot 42 the other *Banksia* present, *B. ilicifolia* appears to be somewhat less susceptible than *B. attenuata* and *B. grandis*, or, at least is able to re-establish temporarily from its seed bank. Nevertheless, eventually all three *Banksia* species disappear, along with many other species.

Figure 16. Dead and dying *Banksia attenuata* trees on the southern boundary of Lot 42.

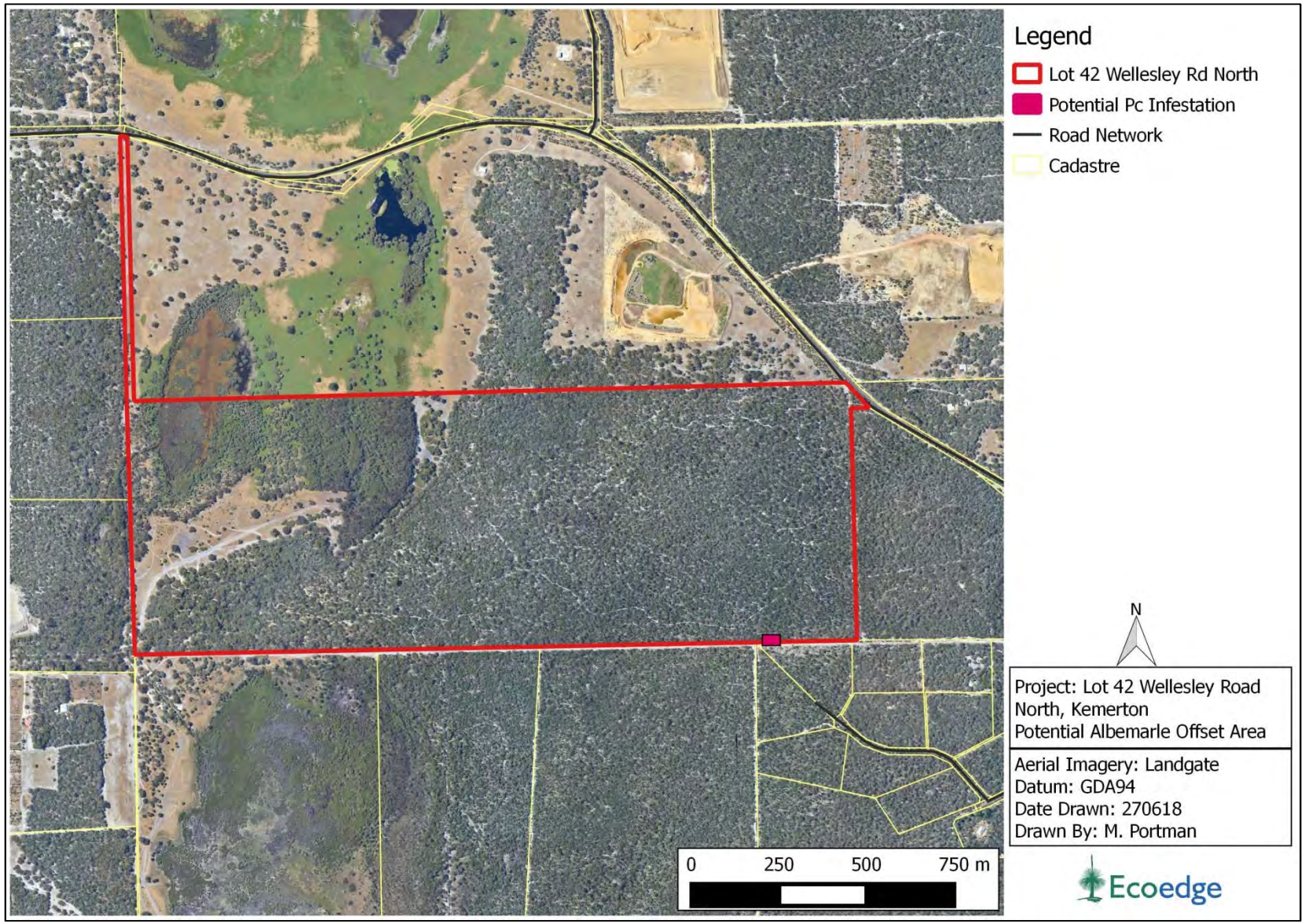

Figure 17. The location of the suspected *Phytophthora* Dieback infestation is shown in dark pink.

Figure 18. Another view of a potential *Phytophthora cinnamomi* infestation on the southern boundary of Lot 42.

7.2 Other Causes of Vegetation Degradation

Weeds

Of the thirteen weed species recorded during the field survey, two (*Gomphocarpus fruticosus* and *Zantedeschia aethiopica*) are declared as pest plants under the *Biosecurity and Agriculture Management Act 2007*. *G. fruticosus* (Narrow-leaf Cottonbush) is in the C3 (management) category, while *Z. aethiopica* (Arum Lily) is in the Exemption (for keeping) category.

The other introduced species are common weeds of remnant vegetation in southwest Western Australia and are most prevalent in the areas of bushland adjacent to the cleared farmland, and where livestock have entered the bushland to graze.

Grazing

Lot 42 has been subject to livestock grazing in the past, but this appears to no longer be occurring. Because of the grazing many of the native understorey species in the western parts (adjacent to pasture) have been removed or suppressed.

Whilst kangaroos are present and having some impact on vegetation through grazing pressure, this does not appear to be a significant threat to the vegetation.

Rubbish Dumping

Lot 42 is open to access by the public and this has led to the dumping of domestic and industrial refuse in the northern part of the site.

Motor Vehicle Access

Off-road motor vehicles have access to and are accessing Lot 42. Disturbance caused by these vehicles is particularly evident in the southern part of the Survey Area, particularly in the former pasture areas and parts of the wetlands. These parts of Lot 42 are currently being used as 'mud pits' for 4WD and other off-road recreational vehicles. These vehicles are also a potential cause of *Phytophthora* disease introduction into and spread within Lot 42.

Timber Cutting

The south west part of Lot 42 is open to access by members of the public and there has been some recent timber cutting in this area. Timber cutting within this area is likely to continue whilst access remains unrestricted.

8 Possible Actions to Address Threats

Suggested actions to address threats to the vegetation and habitat values on Lot 42 are presented in **Table 13**.

Table 13. Possible actions to address threats to vegetation and habitat values.

Threat	Impact	Possible Action	Likely Outcome	Specific and Measurable Success Criteria
Phytophthora Dieback	- Loss of flora diversity, cover and abundance - Opening up of canopy - Future loss of Black Cockatoo habitat through recruitment failure	- Restriction of access - Education of contractors carrying out firebreak and fencing maintenance - Application of Phosphite to affected vegetation (or other methods in consultation with DBCA)	- Slowing of the rate of spread and removing the risk of introduction/spread through human-activity - Possible recovery of impacted individuals	- No new infestations - Regeneration and persistence of native vegetation in impacted areas measured annually or bi-annually through the use of targeted survey and photopoint monitoring.
Weeds	- Loss of flora diversity, cover and abundance	Targeted control of Arum Lily and Cotton Bush and other high impact species that may establish	- Control of infestations - Recovery of native vegetation	- Eradication of target species from Lot 42 within 2 years - No new infestations of these or other high impact weed species are established
Macropod grazing	- Loss of flora diversity, cover and abundance - Future loss of Black Cockatoo habitat through grazing of germinants and juvenile plants	- only monitoring of impact currently required; action required should impact increase	- Ability to implement control program before significant impacts occur to the vegetation	- Bi-annual monitoring of macropod grazing impacts (after establishment of baseline) - Control program implemented should grazing pressure increase beyond current levels
Unrestricted access	- Destruction of vegetation - Potential Spreading of *Phytophthora* Dieback	- Installation of a fence around the vegetation to restrict all off-road vehicle (including bike) access	- Reduction of likelihood of introduction and or spread of *Phytophthora* Dieback - Recovery of floristic diversity and vegetation cover in impacted areas	Fence installed and access controlled within a maximum of 3 months of land acquisition[11]
Timber cutting and rubbish dumping	- Destruction of vegetation - Potential Spreading of *Phytophthora* Dieback	- Installation of a fence around the vegetation to restrict all off-road vehicle (including bike) access	- Reduction of likelihood of introduction and or spread of *Phytophthora* Dieback - Recovery of floristic diversity and vegetation cover in impacted areas	Fence installed and access controlled within a maximum of 3 months of land acquisition

[11] It is very unusual for a large area of Banksia-dominated vegetation such as that on Lot 42 to still remain largely free of *Phytophthora* Dieback. It is critical that access is restricted as soon as possible to ensure the Dieback-free status is maintained.

9 Offset Assessment Guide Inputs

The *EPBC Act Offsets Assessment Guide* (DSEWPaC 2012a) was used to assess the quantum of residual impact associated with the Proposal and quantify offset requirements (GHD, 2018a; 2018b).

The Guide is designed to accompany the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012b), which is used to support application of the policy for a proposed environmental offset. The guide is a tool to assist in determining the suitability of offset proposals. The guide includes four parts, including:

- Matter of National Environmental Significance assessment box
- *Impact Calculator*
- *Offset Calculator*
- Summary box

The guide was used to determine the required offsets for impacts to both Banksia Woodlands TEC and Black Cockatoo habitat resulting from the Proposed Albemarle Kemerton Plant.

The inputs into the *Impact Calculator* section include:

- Black Cockatoo habitat –
    - 23.05 ha of moderate to high value habitat (Quality of 7)
    - 22.68 ha of low value habitat (Quality of 4)
- 6.37 ha of Banksia Woodlands TEC (Quality of 5).

The calculated total quantum of impact based on these inputs to the Impact Calculator is 3.19 ha of Banksia Woodlands TEC and 25.11 ha of Black Cockatoo habitat. This section provides an outline and a justification of the inputs into the *Offsets Calculator* for Lot 42, the proposed offset site.

9.1 The offset

Lot 42 covers 153.3 ha of which approximately 142 ha is intact remnant native vegetation. 135 ha of the Lot is considered to be potential breeding habitat with 113.3 ha within this area comprising quality Black Cockatoo foraging habitat. The 113.3 ha of vegetation which is quality Black Cockatoo foraging habitat also meets the criteria for the Banksia Woodlands TEC. Approximately 92.5 ha of this is SWAFCT21a which has similarities with the SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC that will be lost under the Proposal.

Input values for the *Offset calculator* are based on the following:

- Approximately 113.3 ha of the offset area is Banksia Woodlands of the Swan Coastal Plain TEC

- Approximately 135 ha of the offset area is potential Black Cockatoo breeding habitat of which 113.3 ha is also quality Black Cockatoo foraging habitat.
- The land is proposed to be a conservation estate vested in the Conservation and Parks Commission of Western Australia and managed by DBCA.

9.2 Time horizon

9.2.1 Time over which loss is averted

Input: 20 years

The *time over which loss is averted* is the foreseeable timeframe (in years) over which changes in the level of risk to a proposed offset site can be considered and quantified. That is, it is the time that any measures for securing a site for conservation purposes, such as conservation covenants on title, are intended to last. Longer time frames are valued more highly than shorter time frames.

The proposed offset area will be protected in perpetuity (20 years) once the area has been vested with the DBCA for conservation purposes (or a conservation covenant placed).

9.2.2 Time until ecological benefit

Input: 1

The *time until ecological benefit* is the estimated time (in years) that it will take for the habitat quality improvement of the proposed offset to be realised.

Vegetation within Lot 42 is in significantly better condition than that within the Proposal Area (majority in Excellent or Very Good condition on Lot 42 as opposed to Good condition in the Proposal Area), achieving an immediate conservation benefit once it has been acquired. A timeframe of one year has been allowed for the time it is anticipated to take to purchase and apply protection to the offset area.

9.3 Start area

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoos

Lot 42 is 153.3 ha, of which approximately 142 ha is remnant native vegetation.

135 ha of the Lot is considered to be potential breeding habitat with 113.3 ha within this area comprising quality Black Cockatoo foraging habitat. The lower area of 113.3 ha will be used in calculations as this area covers the minimum foraging and potential breeding habitat available.

The 113.3 ha of vegetation which is quality Black Cockatoo foraging habitat also meets the criteria for the Banksia Woodlands TEC.

Approximately 92.5 ha of the vegetation meeting the criteria for Banksia Woodlands TEC is SWAFCT21a which has similarities with the SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC that will be lost under the Proposal.

9.4 Start quality

There are three components that contribute to the calculation of habitat quality: site condition, site context, and species stocking rates (DSEWPaC 2012b). These three components are defined as follows:

> **Site condition:** Condition of a site in relation to the ecological requirements of a threatened species. This includes considerations such as vegetation condition and structure, the diversity of habitat species present, and the number of relevant habitat features
>
> **Site context:** The relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species. This includes considerations such as movement patterns of the species, the proximity of the site in relation to other areas of suitable habitat, and the role of the site in relation to the overall population or extent of a species.
>
> **Species stocking rate:** The usage and/or density of a species at a particular site. The principle acknowledges that a particular site may have a high value for a particular threatened species, despite appearing to have poor condition and/or context. It includes considerations such as survey data for a site in regards to a particular species population. It also includes consideration of the role of the site population in regards to the overall species population viability.

When determining the suitability of a proposed offset using the guide, the minimum requirement is that the quality score of the offset site must at least reach the same value as the quality score of the Proposal Area.

9.4.1 Start quality input value

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoo habitat

Input: 7

The current potential offset site is Lot 42. Lot 42 is approximately 153.3 ha of which 113.3 ha has been assessed as being representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC (**Figure 14**). None comprises the SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC however 92.5 ha is SWAFCT 21a, which has similarities with SWAFCT21c. See below for a discussion of FCTs 21a and 21c.

The 113.3 ha of Banksia Woodlands TEC also constitutes Black Cockatoo foraging habitat and potential breeding habitat (the total area of breeding habitat is slightly large at 135 ha and includes remnant trees remaining within the pasture area).

9.4.2 Site condition

Vegetation condition

The majority (39.1%) of the 142 ha of remnant native vegetation on Lot 42 has been assessed as Excellent condition with a further 19.2% assessed as Very Good and 31.5% as Good. A total of 10.2% is Degraded or Completely Degraded (**Section 6.2.2**). In comparison, just over 90% of the vegetation in the Proposal Area is either Degraded or Completely Degraded. 9% is in Good condition and only 0.3% is in Excellent condition. As such, the use of Lot 42 as an offset will achieve an immediate conservation benefit.

Banksia Woodlands TEC and SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC (P3).

The 113.3 ha of Banksia Woodland TEC within Lot 42 has been assessed as mostly Excellent or Very Good condition, with a further one third in Good condition. By comparison Banksia Woodland TEC within the Proposal area is in predominantly Good condition.

The Banksia Woodlands vegetation on Lot 42 appears to be largely free of *Phytophthora* Dieback, with only a small potential infestation observed on the southern boundary (**Figure 1716**). It also appears not have been subject to the same level of clearing and grazing impacts as that on the Proposal Area, and unusually, grazing pressure from kangaroos is not currently posing a significant threat. The Lot 42 Banksia Woodlands have the advantage of being adjacent to large areas of Banksia Woodlands to the south and to the east which increases its conservation value and long-term viability.

As a result of the above, the Banksia Woodlands vegetation on Lot 42 is considered to have high conservation value.

Floristic Community Types

The FCT of Gibson *et al*., (1994) that comprises the Banksia Woodlands TEC on the Proposal Area, and that will be lost under the current Proposal, is SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands'. This community is listed as a PEC (P3).

The vegetation on Lot 42 comprises the following FCTs:

- SWAFCT 25 (20.8 ha) (Southern Swan Coastal Plain *Eucalyptus gomphocephala* - *Agonis flexuosa* woodlands) Priority Ecological Community (P3) and component of the Banksia Woodlands TEC;
- SWAFCT 21a (92.5 ha) (Central *Banksia attenuata-Eucalyptus marginata* woodlands). Component of the Banksia Woodlands TEC; and

- SWAFCT 14 (closest fit) (21.8 ha) (Deeper wetlands on sandy soils). Not a Threatened or Priority ecological community.

SWAFCT 21c is not represented on Lot 42. SWAFCT 21a and 21c are part of the same 'Supergroup' (Supergroup 3) as defined by Gibson *et al.,* (1994), being 'community types centred on the Bassendean system'. Over 50% of the sites in this group (from the 1994 study) occur on soils of the Bassendean system, 20% on the Spearwood Dunes and 18% on the Pinjarra Plain. SWAFCT 21a and 21c share similarities in their distribution, landscape positions and floristics, although it is the differences in their floristics that resulted in their separation into separate community types (Gibson *et al.,* 1994).

Whilst not the same FCT as that which will be lost under the Proposal, because of the large extent of Banksia dominated vegetation on Lot 42, its contiguousness with adjacent conservation lands, high quality, and current low level of threat and disturbance, it is recommended to be a suitable offset for the loss of 6.37 ha of SWAFCT21c.

Black Cockatoo habitat

Lot 42 contains 135 ha of potential breeding habitat of which 113.3 ha is also foraging habitat. The majority of this is in Excellent or Very Good condition, with the remainder in Good condition. Some areas (~10% of the site vegetation) are in Degraded or Completely Degraded condition in regards to their floristic diversity however retain relatively intact canopy layers which provide both foraging and potential breeding habitat for Black Cockatoos (**Section 6.2.2**).

Both canopy and mid storey density and diversity are greater within the offset area than the Proposal Area. The Proposal Area canopy consists predominantly of the introduced *Pinus spp.* which provides foraging habitat for FRTBC but does not provide potential breeding habitat. The canopy on Lot 42 is varied, containing marri, jarrah, *Eucalyptus gomphocephala* (tuart) and *Eucalyptus rudis* (Flooded Gum), all of which are both foraging and potential breeding habitat. The midstorey is absent from the Proposal Area vegetation. On Lot 42, it is comprised of *Banksia attenuata, B. grandis* and *B. ilicifolia*, all known foraging habitat for all three species of Black Cockatoo. As it is the canopy and midstorey strata that contain species utilised by Black Cockatoos for foraging and potential breeding habitat, vegetation in Lot 42 is considered to have the higher habitat value of the two sites.

Priority Flora

During the preliminary and Reconnaissance field surveys, which were both carried out in autumn to early winter 2018, one individual of the Priority 4 species *Acacia semitrullata* was observed on Lot 42, as well as individuals *Eucalyptus rudis* subsp. *cratyantha* (Flooded Gum) (P4).

Acacia semitrullata is fairly common throughout the EmCcBaAfW vegetation unit, however only one plant was recorded as being present within a releve (**Figure 11**). Flooded Gum forms

the canopy in the ErMrW (Flooded gum-*Melaleuca rhaphiophylla* woodland) vegetation unit, of which 21.8 ha was mapped within Lot 42 (**Figure 12**).

The Proposal Area contains 118 individuals of *Acacia semitrullata* that will be lost under the Proposal.

It is very likely that a spring survey of vegetation on Lot 42 would find other conservation significant flora.

Wetlands

Lot 42 contains approximately 24.1 ha of wetland vegetation, of which approximately 20.9 ha is mapped as either Resource Enhancement or Conservation category wetlands (**Figure 8**). About half the wetland vegetation is in Very Good condition, with the remainder assessed as Good. Russell Smith, who carried out the field survey, stated that he has not seen wetlands of their like before in such good condition (Russell Smith, pers. comm. 28 June 2018).

Both resource Enhancement category wetlands would be more appropriately classified as Conservation category wetlands. This is compared to 14.99 ha of Multiple Use wetland areas in the Proposal Area that have little to no ecological value.

Environmentally Sensitive Areas

One ESA is mapped on Lot 42 (**Figure 9**), designated around the Conservation category wetland. No ESAs are mapped within the Proposal Area.

Regional Ecological Linkages

Vegetation on Lot 42 directly forms part of a mapped regional ecological linkage, as it is crossed by a linkage axis line (**Figure 7**). Two thirds of the site vegetation has been assigned a proximity rating of "1a" which is the highest rating with the remainder rated as "1b", the second highest rating.

Vegetation within the Proposal Area does not directly form part of a linkage. It was assigned a proximity rating of "2a", indicating it has an edge touching vegetation that is, or is itself, <500 m from a linkage axis.

9.4.3 Site context

Proximity to other known or likely occurrences of Banksia Woodlands TEC

The Banksia Woodlands ecological community only occurs on or adjacent to the Swan Coastal Plain of Western Australia, which stretches to the north and south of Perth. The broader region—Southwest Australia—is recognised as one of only two global biodiversity hotspots in Australia. Since the 19th century, the region has been heavily cleared for agriculture, housing and associated infrastructure. In total, about 50-60% of the original extent of the ecological community has been cleared (Commonwealth of Australia, 2016). The estimated extent remaining in 2015 was about 336,000 to 337,000 hectares (DotEE, 2016).

Patch size distribution indicates the ecological community now has a highly fragmented geographic distribution with most patches (about 82%) under ten hectares in size and facing demonstrable threats. The median patch size has reduced from an estimated pre-European value of 146 ha to a current size of only 1.6 ha. The 142 ha remnant on Lot 42 is clearly significant for its patch size as well as for its other values, particularly as it is contiguous with large areas of remnant vegetation to the west and south.

Based on a survey by Eco Logical (2013), the 7,600 ha KSIA, which extends almost 10 km to the south and south-west of Lot 42, contains approximately 3,244 ha of vegetation that meets the criteria of Banksia Woodlands of the Swan Coastal Plain TEC (3,081 ha FCT21a, 163 ha of FCT21c). Of this about 1,466 ha of *Banksia* woodland is on Crown Land (1,365 ha of FCT21a and 101 ha of FCT21c). Extending the mapping by Eco Logical (2013) 8 km north to Myalup Road adds another approx. 3,400 ha of Swan Coastal Plain Banksia woodland to the total mapped by Eco Logical (2013), however, much of this is on private land (R. Smith, unpublished).

If added to the reserve system, the 113.3 ha of Banksia Woodlands TEC on Lot 42 would make a useful addition to the extent of this community protected within the Bunbury region. Although it represents only about 1.7% of the Swan Coastal Plain Banksia Woodlands TEC in the Kemerton-Myalup area it has the advantages of being in large part in Very Good or Excellent condition and being adjacent to large areas of similar vegetation to the south and west.

Proximity to known Black Cockatoo breeding sites and larger areas of foraging vegetation
The area of native remnant native vegetation remaining with the regional area is detailed in **Table 14**, and mapped in **Figure 19**.

Table 14. Extent of remnant vegetation in the regional area.

Buffer Distance	Estimated Area of Remnant Native Vegetation
5 km	6,072 ha
10 km	11,527 ha
15 km	15,667 ha

The remnant native vegetation within the subject site (~142 ha) makes up ~1.2% of area of native vegetation within a 10 km range. It is not possible to determine exactly how much of this represents black cockatoo habitat as only broad scale vegetation complex mapping is available for the entire area, but a high percentage is likely to contain breeding, foraging and/or roosting habitat.

Proximity to Important Bird Areas (IBAs)
Thirteen of Western Australia's Bird IBA's have been identified as significant to Carnaby's Black Cockatoo (Dutson *et al.,* 2009). The criteria used for the designation of IBAs for

Carnaby's Black Cockatoo are sites supporting at least 20 breeding pairs, or 1% of the population regularly utilising an area in the non-breeding part of the range. There are no IBAs within close proximity to Lot 42.

9.4.4 Species stocking rate (Black Cockatoos)

No evidence of breeding activity was observed during the field survey of Lot 42.

Evidence of Black Cockatoos foraging was observed during the field survey in the form of chewed marri fruits and banksias cones. This evidence was attributed to the forest red-tailed black-cockatoo in the case of the marri fruits and Carnaby's black-cockatoo in the case of the *banksia.*

No evidence of trees being used for overnight roosting by Black Cockatoos was observed. However, given the known use of the general area by Black Cockatoos, the presence of large trees/groves of trees there is potential for Lot 42 to be utilised for this purpose despite no actual evidence being found.

Forest red-tailed black-cockatoos were heard calling and a small flock of Carnaby's Black Cockatoo were observed within Lot 42 during the survey period suggesting roost sites may exist nearby.

There are seven documented roosting sites (GCC 2017) within 15 km of Lot 42.

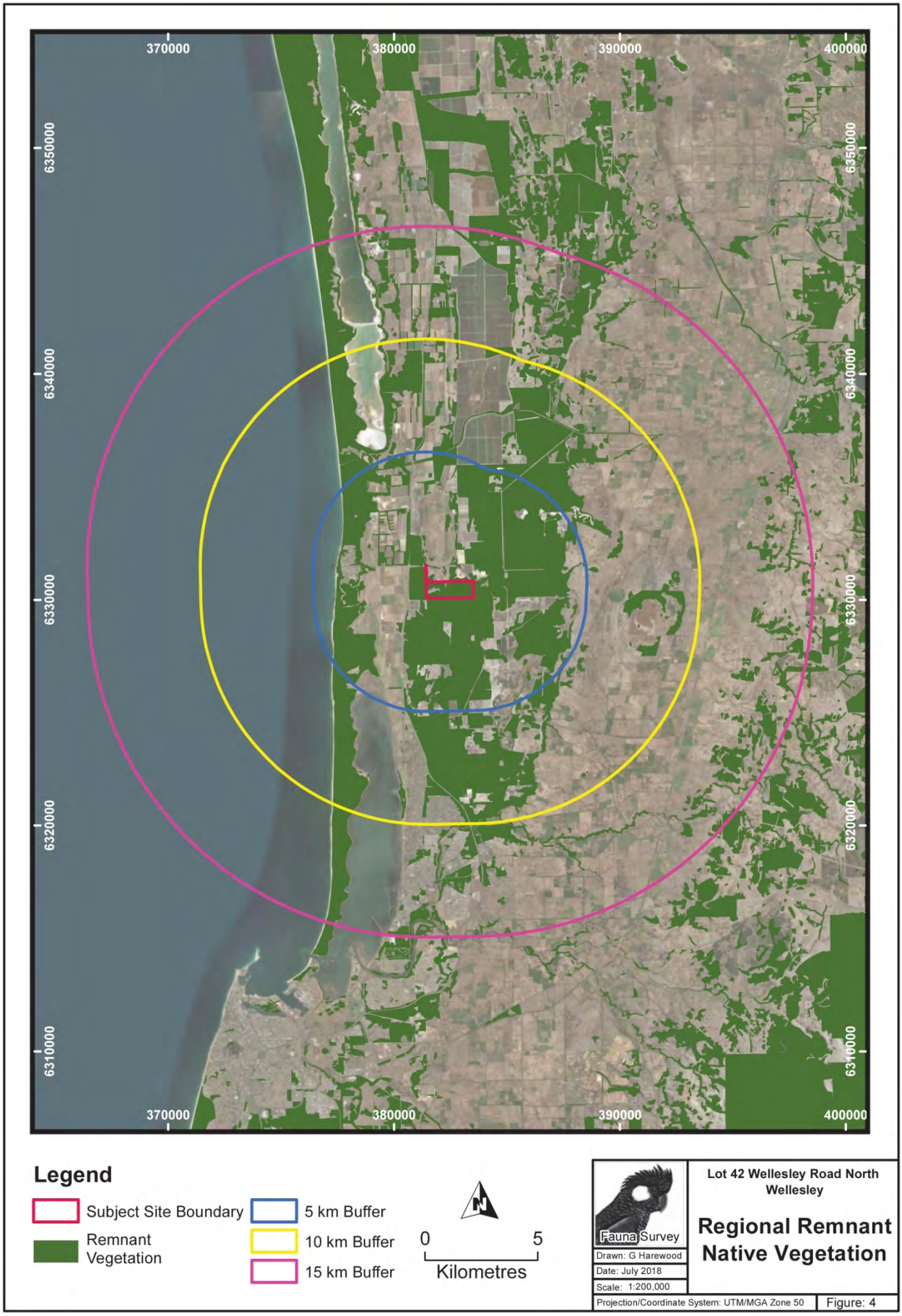

Figure 19. Remnant vegetation within 15 km of Lot 42.

9.5 Future area and quality with and without offset

9.5.1 Risk of loss (%) without offset

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoos

Input: 30%

The University of Queensland 'Guidance for deriving Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act' (2017) lists the average background vegetation loss for Harvey of ~10%. This has been increased by an additional 20% as the proposed offset location (within the KSIA buffer on freehold land) is not currently included in the conservation estate, and can potentially be developed for non-sensitive private uses or industry, subject to Development Approval. There are no known current Development Approval applications for Lot 42 or within the broader KSIA buffer area.

9.5.2 Future quality without offset (scale 1-10)

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and

Input: 6

Black Cockatoos

Input: 5

Without an offset, vegetation on Lot 42 is expected to degrade over time.

The site is open to access by the public and is being used for off-road vehicle recreation. This poses a serious and daily risk for the introduction and or spread of *Phytophthora* Dieback. Rubbish dumping and timber cutting also appear to be relatively frequently occurring.

Two declared pest plants are present, one of which, Arum Lily (*Zantedeschia aethiopica*), poses a potentially significant threat to the currently intact and high-quality wetland vegetation. *Phytophthora* Dieback appears to be present in at least one location along the southern boundary, and is beginning to impact the vegetation.

9.5.3 Future Quality with offset (scale 0-10)

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoos

Input: 7

An improvement in quality may occur over time if the site is fenced and through other management measures, however this is not yet known therefore it has been the conservative assumption to remain at the current baseline quality of 7 has been made.

9.5.4 Risk of loss (%) with offset

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoos

Input: 5%

Minimal risk as it is intended that the offset area is vested with DBCA for inclusion in the conservation estate to avert the risk of loss in perpetuity (or a conservation covenant will be placed on the site). There is still a slight chance of loss as a result of the potential for natural disaster impacts (bushfire, severe storm damage) within the area.

9.6 Confidence in result (%)

Confidence that the offset site can be delivered

Input: 90%

Albemarle has a high degree of confidence that the proposed offset site can be acquired and protected through vesting with the DBCA or through a conservation covenant. Albemarle has commenced consultation with the landowner, Landcorp who has indicated their support for the Proposal. Albemarle has also commenced consultation with the DBCA in regards to vesting an offset site in the conservation estate.

Confidence that the quality of the offset site can be maintained (or improved)

Input: 85%

Albemarle has a high degree of confidence that the proposed offset area can be sufficiently protected through management to at least maintain, if not improve, the current quality of vegetation and habitat within the offset area. Simple management measures such as fencing to restrict access, and Arum Lily control, will have substantial benefit.

Management measures that could be implemented to protect the offset area from further degradation will be outlined in Albemarle's Offset Strategy.

9.7 Net present value (adjusted hectares)

Prior to calculating the net present value of the Black Cockatoo habitat on Lot 42, a total quantum of impact score for the Proposal was calculated, being the combined total for both the low and moderate habitat areas (22.68 ha with a quality of 4 (quantum of impact of 16.14) and 23.05 ha with a quality of 7 (quantum of impact of 9.07)). The total quantum of impact value is 25.21 ha.

While there is approximately 135 ha of potential breeding habitat on Lot 42, the lower figure of 113.3 ha of foraging habitat has been used in the net present value calculation. The net present value of the 113.3 ha of Black Cockatoo foraging and potential breeding habitat on Lot 42 is 27.38 ha.

Outcome: 113.3 ha of Black Cockatoo foraging and potential breeding habitat on Lot 42 achieves 108.6% offset of the loss of Black Cockatoo habitat that will result from the Proposal.

Banksia Woodlands TEC

The quantum of impact for Banksia Woodland TEC is calculated as 3.19 ha. The net present value of the 113.3 ha of Banksia Woodland vegetation on Lot 42 is 20.72 ha.

Outcome: The 113.3 ha of Banksia Woodland vegetation on Lot 42 achieves 650.51% offset of the loss of 6.37 ha of Banksia Woodlands TEC.

While Lot 42 does not contain any vegetation corresponding to SWAFCT 21c vegetation that would be lost under the proposal, it provides a substantially greater offset for the loss of the Banksia Woodlands TEC than is required.

9.8 Summary of inputs

A summary of the inputs into the *Offsets Calculator* for Lot 42 is provided in **Table 15**. The *Offsets Calculator* is presented in **Appendix 8**.

Table 15. Summary of inputs into Offset Calculator.

Offset Calculator Attribute	Input Value
Proposed offset	Lot 42 Area: ~142 ha of remnant native vegetation and ~11.3 ha of modified vegetation (or parkland cleared area)
Time horizon (years)	
Time over which loss is averted	20 years
Time until ecological benefit	1 year
Start area (ha)	113.3 ha of Banksia Woodlands TEC and Black Cockatoo foraging and potential breeding habitat
Start quality (scale of 1-10)	7
Future area and quality with and without offset (%)	
Risk of loss (%) without offset	30%
Future quality without offset (scale 1-10)	Black Cockatoo habitat = 5, Banksia Woodlands TEC = 6
Risk of loss (%) with offset	5%
Future quality with offset (scale 1-10)	7
Confidence in result (%)	
Averted loss component input	90%
Change in habitat quality component input	85%
Output	
Net present value (adjusted hectares)	
Black Cockatoo foraging and breeding habitat	27.38 ha
Banksia Woodlands TEC	20.72 ha

10 Additional Information for Offset Strategy development

10.1 Relevant Plans and Policies

The use of Lot 42 as an offset for the Proposal is aligned with the following plans and policies:

- Banksia Woodlands of the Swan Coastal Plain Conservation Advice (DotEE, 2016)

which states the Conservation Objective is to 'protect occurrences of the ecological community using the EPBC Act'.

The three Priority Protection and Restoration Actions listed in the Advice are:

1. Protect the ecological community to prevent further loss of extent and condition;
2. Restore the ecological community within its original range by active abatement of threats, re-vegetation and other conservation initiatives;

3. Communicate with and support researchers, land use planners, landholders, land managers, community members, including the Indigenous community, and others to increase understanding of the value and function of the ecological community and encourage their efforts in its protection and recovery.

The addition of 113.3 ha of Banksia Woodlands to the conservation estate through its vesting in DBCA is aligned with the Conservation Objective (as the EPBC Act Offsets Policy and Guide is the mechanism through which Lot 42 would be utilised as an offset), and meets the first and second Priority Protection and Restoration Actions. There is the potential, through stakeholder consultation and engagement that the third may also be met as a result of the offset.

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan

Which states the Recovery Objective 'To stop further decline in the distribution and abundance of Carnaby's cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases.'

The six Recovery Actions listed in the Recovery Plan are:

1. Protect and Manage Important Habitat
2. Undertake Regular Monitoring
3. Conduct Research to Inform Management
4. Manage Other Impacts
5. Engage with the Broader Community
6. Undertake Information and Communication Activities

Lot 42 contains 135 ha of Carnaby's Cockatoo potential breeding habitat which includes 113.3 ha of foraging habitat. It is located within the species' known breeding and foraging ranges. The addition of Lot 42 to the conservation estate is aligned therefore with both the Recovery Objective and the first Recovery Action as stated in the Recovery Plan.

- Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan

Which states the Recovery Objective to 'To stop further decline in the breeding populations of Baudin's Cockatoo and the Forest red-tailed Black Cockatoo and to ensure their persistence throughout their current range in the south-west of Western Australia.'

Twelve Recovery Actions are listed in the species' Recovery Plan. None of these relate directly to the retention or protection of the species habitat, focussing instead on funding, research and reduction of other threats. Conservation of the species' habitat within the known breeding and foraging ranges is intrinsic to the species' recovery. Lot 42 contains 135 ha of Baudin's and Forest red-Tailed Black Cockatoo potential breeding habitat which includes

113.3 ha of foraging habitat (areas containing marri, jarrah, tuart and or banksia). It is located within the known foraging range and potential breeding range of both species.

11 Principles for the use of Environmental Offsets

In Western Australia, government decision making processes in relation to the use of environmental offsets are underpinned by six principles. These are set out in the Environmental Offsets Policy (Government of Western Australia (GoWA), 2011). An assessment of the proposal against each of these is included below.

The offset proposed is a land acquisition offset.

11.1 Principle 1. Environmental offsets will only be considered after avoidance and mitigation options have been pursued

- The entire proposed development area for the Albermarle Kemerton Plant (the 'Proposal Area') is required to be cleared of vegetation (comprising 54.31 ha of native vegetation and 33.39 of remnant pine plantation) in order to develop the Proposal. Direct impacts to vegetation are therefore unavoidable within the Proposal Area.
- Conservation significant flora and vegetation have been avoided within the initial 257 ha lease option boundary. This included the exclusion of 12 ha of Very Good condition vegetation representative of the Banksia Woodlands TEC/PEC from the development area.
- To avoid fragmentation of vegetation within the KSIA, a site which is predominantly regrowth and disturbed areas was chosen in preference to an alternate location comprising largely remnant vegetation with only a small area of regrowth.
- The extent of native vegetation clearing required was minimised through the site selection process, which resulted in the selection of a site that has largely been previously cleared for pine plantation and agriculture/grazing.

11.2 Principle 2. Environmental offsets are not appropriate for all projects

It is acknowledged that offsets are not appropriate for all projects. As the Proposal will result in significant residual impacts due to impact on threatened/protected fauna species and vegetation, an offset is considered to be appropriate.

11.3 Principle 3. Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted

The retention and conservation of existing remnant vegetation is significantly more cost-effective that the re-establishment of vegetation or the recreation of habitat, and in most cases will also result in greater environmental benefit. This is due in part to the time lag to benefits of revegetated areas, and the substantial resources (time, money, expertise) that are required to make revegetation success a probability. Therefore the acquisition of existing

intact vegetation on Lot 42 as an offset for the Proposal is considered to be a cost effective proposition.

The Proposal Area is located within the KSIA and Lot 42 is predominantly within the KSIA Buffer. Lot 42 is located approximately 5.7 km northeast of the Proposal Area.

Vegetation on Lot 42 provides correlating vegetation (TEC) and Black Cockatoo habitat values to those that will be lost under the current Proposal, and these are present in greater quantities and in better condition on Lot 42 than within the Proposal Area.

Under the Proposal, 6.37 ha of Banksia Woodlands TEC will be lost. Lot 42 contains 113.3 ha of vegetation that meets the criteria for the Banksia Woodlands TEC.

Under the Proposal, 22.68 ha of low quality and 23.05 ha of moderate to high quality Black Cockatoo foraging habitat will be lost. Lot 42 contains 113.3 ha of quality Black Cockatoo foraging habitat.

One potential nesting tree is present within the Proposal Area. Lot 42 contains 135 ha of potential breeding habitat, and is estimated to contain about 2,783 potential Black Cockatoo breeding habitat trees (DBH >50cm). Eighty five trees examined during the assessment appeared to possibly contain hollows of a size suitable for black cockatoos to use for breeding, although no actual evidence of breeding was seen.

While the FCTs present on Lot 42 (SWAFCT 21a, SWAFCT 25 and SWAFCT 14 (closest fit)) differ from that within the Proposal Area (SWAFCT 21c) these are very similar community types, and are classed within the same Supergroup of Gibson *et al.* (1994) of 'community types centred on the Bassendean system'. Both are characterised by their situation on sandy soils of the Swan Coastal Plain and by the presence of Banksia species as dominants or co-dominants in the mid or canopy layer. In the Bunbury area (including Kemerton), SWAFCT 21c generally presents as *Banksia attenuata-B. ilicifolia-Agonis flexuosa* or *Corymbia calophylla-B. attenuata-B. ilicifolia*, while SWAFCT 21a is *Eucalyptus marginata-B. attenuata* woodlands, *E. marginata-Corymbia calophylla-B. attenuata* woodlands or *B. attenuata* woodlands.

118 individuals of the Priority 4-listed taxa *Acacia semitrullata* will be lost under the current Proposal. Only one individual of the taxa was recorded in a relevé during the Reconnaissance field survey, howeverd it was noted as being fairly common throughout the EmCcBaAfW vegetation unit and as such it is likely that more would be located during a targeted survey.

Vegetation on Lot 42 directly forms part of a regional ecological linkage, and adjoins land vested in the Conservation and Parks Commission to the south.

Under the current proposal, a direct offset would be implemented through acquisition of Lot 42, which will be vested with the DBCA conservation estate. Threats currently impacting on vegetation and habitat values would be addressed through the design and implementation of

management measures that will form part of the overall Offset Strategy (of which this report forms part).

The use of Lot 42 as an offset for the Proposal is considered to be relevant and proportionate to the significance of the environmental value being impacted.

11.4 Principle 4. Environmental offsets will be based on sound environmental information and knowledge

The proposed use of Lot 42 as an offset is aligned with the Recovery Plans for all three Black Cockatoo species and the Conservation Advice for the Banksia Woodlands TEC.

The addition of vegetation within Lot 42 to the conservation estate will ensure its future protection from development, and that it is managed for its natural values.

As discussed in **Section 9.4.3**, the average patch size for Banksia Woodlands is now 1.6 ha, down from an estimated pre-European value of 146 ha. Lot 42 contains 113.3 ha of contiguous Banksia Woodlands vegetation and has the advantage of being contiguous with adjacent large areas of similar vegetation. To the south this vegetation is vested in the Conservation and Parks Commission. This substantial patch size and proximity to adjacent vegetation adds to the conservation value of the vegetation, beyond its apparent values as an occurrence of the TEC or as Black Cockatoo habitat.

11.5 Principle 5. Environmental offsets will be applied within a framework of adaptive management

The proposed use of Lot 42 as an offset and its future addition to the conservation estate provides significant opportunities within the framework of adaptive management. It can potentially be used as a trial or pilot site for new approaches to threat reduction, and being under the management of DBCA will be consistently subject to new, more effective management techniques as these become best practice.

11.6 Principle 6. Environmental offsets will be focused on longer term strategic outcomes

Vegetation within the Kemerton area is recognised for its intactness, floristic diversity, wetlands and wetland diversity, provision of habitat for threatened flora and fauna and other values. The proposed addition of Lot 42 to the conservation estate provides a solid strategic outcome.

12 Suitability of Lot 42 as an Offset for the Proposal and Conclusion

12.1 Summary

Banksia Woodlands TEC, SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands' PEC and Black Cockatoo Habitat

To offset impacts to Banksia Woodlands TEC and Black Cockatoo habitat associated with the Proposal, based on inputs to the *EPBC Act Offsets Assessment Guide* (DSEWPaC 2012a) calculated areas of 18 ha of Banksia Woodlands TEC and 105 ha of Black Cockatoo habitat must be provided in the proposed offset area. Lot 42 contains 135 ha of potential breeding habitat of which 113.3 ha is also suitable as Black Cockatoo foraging habitat. The 113.3 ha of suitable Black Cockatoo foraging habitat is also vegetation representative of the Banksia Woodlands TEC.

The results of the tree quadrat survey suggest that the main woodland/forest areas within the subject site which cover about 135 ha contain about 2,783 trees that can be regarded as representing potential black cockatoo breeding habitat using DotEE criteria.

Eighty five trees containing possible large hollows potentially suitable for black cockatoos to use for nesting were observed opportunistically within the Lot 42 during the survey period. A small number of these trees showed some inconclusive evidence of possible use by cockatoos (i.e. minor chew marks).

The 113.3 ha of Black Cockatoo foraging and potential breeding habitat on Lot 42 achieves 108.6% offset of the loss of Black Cockatoo habitat that would result from the Proposal.

The 113.3 ha of Banksia Woodland vegetation on Lot 42 achieves 650.51% offset of the loss of 6.37 ha of Banksia Woodlands TEC.

Floristic Community Types

The FCT that comprises the Banksia Woodlands TEC on the Proposal Area, and that will be lost under the current Proposal, is SWAFCT21c 'Low lying *Banksia attenuata* woodlands and shrublands'. This community is listed as a PEC (P3). Vegetation that comprises the Banksia Woodlands TEC on Lot 42 is SWAFCT21a 'Central *Banksia attenuata-Eucalyptus marginata* woodlands', which is not a Priority or Threatened community at the State level; and SWAFCT 25 'Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa*' which is a Priority 3 ecological community[12].

These FCTs are part of the same 'Supergroup' (Supergroup 3) as defined by Gibson *et al.,* (1994), being 'community types centred on the Bassendean system'. Both are situated on sandy soils of the Swan Coastal Plain and are dominated by *Banksia* species in the mid-storey.

[12] A proposal to list 'Tuart Woodlands of the Swan Coastal Plain' as a TEC under the EPBC Act is currently being assessed by DotEE. The decision is expected by 31 July 2018.

It is the floristic differences that resulted in their division into separate community types (Gibson *et al.,* 1994).

Priority flora

Under the current proposal, 118 *Acacia semitrullata* (P4) plants on the Proposal area will be lost. Two Priority flora taxa were found on Lot 42 during the survey, these being *Acacia semitrullata* (P4) and *Eucalyptus rudis* subsp. *cratyantha* (P4). It is likely that more individuals of *Acacia semitrullata* and other conservation significant flora taxa would be located in a targeted spring survey.

Wetlands

Lot 42 contains approximately 24.1 ha of wetland vegetation, of which approximately 20.9 ha is mapped as either Resource Enhancement or Conservation category wetlands. Both Resource Enhancement wetlands would be more appropriately classified as Conservation category due to their condition. Russell Smith, who carried out the field survey, stated that he has not seen wetlands of their like before in such good condition (Russell Smith, pers. comm. 28 June 2018).

This is compared to 14.99 ha of Multiple Use wetland areas with little to no ecological value in the Proposal Area.

Environmentally Sensitive Areas

One ESA is mapped on Lot 42, designated around the Conservation category wetland. No ESAs are mapped within the Proposal Area.

Regional Ecological Linkages

Vegetation on Lot 42 directly forms part of a mapped regional ecological linkage, as it is crossed by a linkage axis line. Two thirds of the site vegetation has been assigned a proximity rating of "1a" which is the highest rating with the remainder rated as "1b", the second highest rating.

Vegetation within the Proposal Area does not directly form part of a linkage. It was assigned a proximity rating of "2a", indicating it has an edge touching vegetation that is, or is itself, <500 m from a linkage axis.

12.2 Conclusion

A summary of the values that would be lost under the current proposal (the impact) against the values that would be protected through the use of Lot 509 as the offset is presented in **Table 16**.

Table 16. Lot 42 Offset Area and Proposal Area comparison.

Parameter	Proposal Area (Loss)	Offset Area (Conservation)
Banksia Woodlands TEC	6.37 ha in Good condition	113.3 ha, 39% in Excellent condition, 19% in Very Good and 31% in Good condition.
Black Cockatoo quality foraging habitat	45.73 ha of which 22.68 ha is low quality and 23.05 ha is moderate to high quality	113.3 ha, 39% in Excellent condition, 19% in Very Good and 31% in Good condition.
Black Cockatoo potential breeding habitat	One tree with hollows, potential breeding habitat of 14.45 ha	135 ha, majority in Excellent, Very Good or Good condition, 10% Degraded or Completely Degraded . 85 trees with hollows suitable for use by Black Cockatoos (some with possible signs of use)
Priority flora (*Acacia semitrullata*)	118 plants	One plant with more likely to be found in a targeted survey
Wetlands	14.99 ha of Multiple Use wetland	24.1 ha of wetland vegetation of which approximately 20.9 ha is either Resource Enhancement or Conservation category wetlands. About 50% in Very Good and 50% in Good condition.
Regional Ecological Linkages	Not directly part of a linkage, vegetation assessed as “2a”	Directly part of a linkage, majority of vegetation assessed as “1a”, the highest score
ESAs	No ESAs	1 ESA

Based on field assessments and the information collated for this report, it is concluded that the vegetation and habitat on Lot 42 is an appropriate offset for the impacts that would result from Albemarle’s current proposal to develop their Kemerton Plant.

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Appendix 1. Protected Matters Search Tool and NatureMap reports.

Appendix 2. Vegetation Condition Scale (EPA, 2016).

Appendix 3. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2017a).

Appendix 4. Definitions of Threatened and Priority List flora (DBCA, 2017b).

Appendix 5. Categories of Threatened Species under the EPBC Act (DotEE, 2017c).

Appendix 6. Threatened or Priority flora occurring within 10 km of Lot 42.

Appendix 7. List of Vascular Flora found within Lot 42.

Appendix 8. EPBC Act Offsets Assessment Guide – Offset Calculator

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

Lot 509 NatureMap Species Report

Created By Guest user on 10/05/2018

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 47' 43" E,33° 08' 22" S
Buffer 10km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	3339	*Acacia flagelliformis*		P4	
2.	3537	*Acacia semitrullata*		P4	
3.	38480	*Austrostipa bronwenae*		T	
4.	11612	*Boronia capitata subsp. gracilis*		P3	
5.	16633	*Boronia juncea subsp. juncea*		P1	
6.	18038	*Caladenia procera*		T	
7.	13862	*Caladenia speciosa*		P4	
8.	16245	*Cyathochaeta teretifolia*		P3	
9.	3863	*Dillwynia dillwynioides*		P3	
10.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
11.	12938	*Diuris micrantha*		T	
12.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
13.	13635	*Drakaea micrantha*		T	
14.	13512	*Eucalyptus rudis subsp. cratyantha*		P4	
15.	19630	*Grevillea bipinnatifida subsp. pagna*		P1	
16.	6859	*Hemigenia microphylla*		P3	
17.	5038	*Lasiopetalum membranaceum*		P3	
18.	33638	*Meionectes tenuifolia*		P3	
19.	6193	*Myriophyllum echinatum*		P3	
20.	31731	*Pterostylis frenchii*		P2	
21.	4183	*Pultenaea skinneri (Skinner's Pea)*		P4	
22.	17731	*Schoenus sp. Waroona (G.J. Keighery 12235)*		P3	
23.	48297	*Styphelia filifolia*		P3	
24.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
25.	12392	*Verticordia attenuata*		P3	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

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.

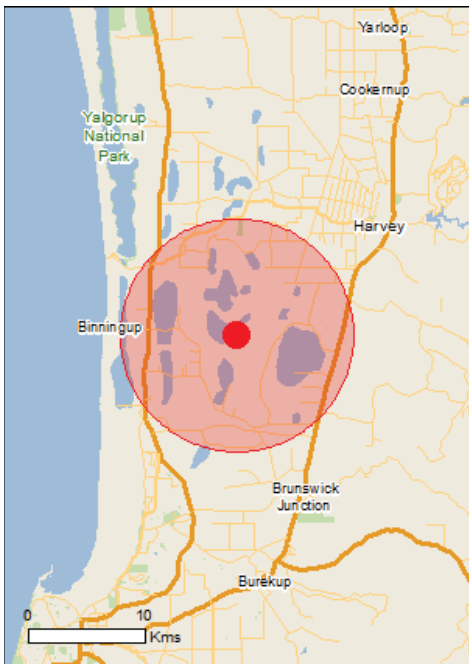
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 10/05/18 14:19:06

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



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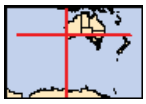

Summary

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:	3
Listed Threatened Species:	29
Listed Migratory Species:	12

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:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	19
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:	4
Regional Forest Agreements:	1
Invasive Species:	29
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Peel-yalgorup system	Within 10km of Ramsar

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
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	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 known to 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 known to 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]	Endangered	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
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat known to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat likely to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Austrostipa bronwenae [87808]	Endangered	Species or species habitat known 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 procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	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
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		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 likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to 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 known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to 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

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

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 likely to 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]		Breeding known 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 known to 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 known to 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
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
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 known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat known to 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
Benger Swamp	WA
Byrd Swamp	WA
NTWA Bushland covenant (0004)	WA
NTWA Bushland covenant (0095)	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
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
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		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		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
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to 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
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Benger Swamp	WA

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

-33.15259 115.7879

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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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 3. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2018b).

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 4. Definitions of Threatened and Priority List flora under the WC Act (DBCA, 2017b).

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 5. 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 6. Threatened and Priority flora occurring within 10 km of Lot 509, and Likelihood of Occurrence.

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
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.	Low
Andersonia gracilis	T (EN)	Sep-Nov	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Low
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
Diuris purdiei	T (EN)	Sep-Oct	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow. Grey-black sand, moist. Winter-wet swamps.	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
Synaphea stenoloba	T (EN)	Aug-Oct	Caespitose shrub, 0.3–0.45 m high. Fl. Yellow. Sandy or sandy clay soils. Winter-wet flats, granite. Shrublands and woodlands on loamy soils.	Low
Diuris drummondii	T (VU)	Nov-Jan	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow. Low-lying depressions, swamps.	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
Eleocharis keigheryi	T (VU)	Aug-Nov	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green. Clay, sandy loam. Emergent in freshwater: creeks, claypans	Moderate
Austrostipa bronwenae	T	Sep-Oct	Perennial grass, 0.6 m high x 0.3 m wide. Flowers green. Reproductive method: seeds, caespitose.	Moderate
Synaphea sp. Fairbridge Farm (D.	T	Oct	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. Yellow.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
Papenfus 696)			Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	
Synaphea sp. Serpentine	T	Sep-Oct	Shrublands and woodlands on loamy soils	Low
Boronia juncea subsp. *juncea*	P1	Apr	Slender or straggly shrub, pedicels and sepals glabrous. Fl. pink. Sand. Low scrub.	Moderate
Grevillea bipinnatifida subsp. *pagna*	P1	Aug or Oct-Nov	Prostrate, lignotuberous shrub, 0.2-0.7 m high. Fl. red & orange & yellow. Grey sandy clay and loam, ironstone. Seasonal wetlands, swamps, roadsides.	Low
Pterostylis frenchii	P2	Nov-Dec	Tuberous, herb, to 0.35 m high, with rosette leaves. Fl. white. Calcareous sand with limestone, laterite. Flatlands and gentle slopes.	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,	Moderate
Carex tereticaulis	P3	Sep-Oct	Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown. Black peaty sand.	Moderate
Chamaescilla gibsonii	P3	Sep	Clumped tuberous, herb. Fl. blue. Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Moderate
Cyathochaeta teretifolia	P3	Oct-Jan	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	Moderate
Dillwynia dillwynioides	P3	Aug-Dec	Decumbent or erect, slender shrub, 0.3–1.2 m high. Fl. red, yellow, orange,. Sandy soils. Winter-wet depressions.	Moderate
Grevillea prominens	P3	Sep-Oct	Spreading shrub, 0.5–1.7 m high, 0.3-1 m wide. Fl. cream, white. Gravelly loam. Along creeklines	Low
Hemigenia microphylla	P3	Sep-Dec	Slender shrub, 0.4-1.8 m high. Fl. blue-purple. Sandy clay, peaty clay, granite. Winter-wet depressions.	Low
Lasiopetalum membranaceum	P3	Sep-Dec	Multi-stemmed shrub, 0.2-1 m high. Fl. pink, blue, purple. Sand over limestone.	Moderate

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
Meionectes tenuifolia	P3			Moderate
Myriophyllum echinatum	P3	Nov	Erect annual, herb, 0.02-0.03 m high. Fl. red. Clay. Winter-wet flats.	Moderate
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	Oct-Nov	Tufted annual, grass-like or herb (sedge), 0.02-0.06 m high. Fl. brown-red-green. Clay or sandy clay. Winter-wet flats.	Moderate
Styphelia filifolia	P3			Moderate
Verticordia attenuata	P3	Dec-May	Shrub, 0.4–1 m high. Fl. pink. White or grey sand. Winter-wet depressions	Moderate
Acacia flagelliformis	P4	May-Sep	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow. Sandy soils. Winter-wet areas.	Moderate
Acacia semitrullata	P4	May-Oct	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream, white. White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Very High
Caladenia speciosa	P4	Sep-Oct	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white, pink. White, grey or black sand.	High
Eucalyptus rudis subsp. *cratyantha*	P4	Jul-Sep	Tree, 5-20 m high, bark rough, box-type. Fl. white. Loam. Flats, hillsides.	Very High
Pultenaea skinneri	P4	Jul-Sep	Slender shrub, 1-2 m high. Fl. yellow, orange, red. Sandy or clayey soils. Winter-wet depressions.	Low
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	Nov-Dec or Feb	Perennial, herb, to 1 m high. Fl. yellow/yellow-green. Grey sand, red clay, laterite, often moist. Low-lying flats.	Moderate

Appendix 7. List of Vascular Flora found within Lot 42.

FAMILY NAME	LATIN NAME	NATURALISED	CONSV CODE
Anarthriaceae	*Lyginia imberbis*		
Apiaceae	*Centella asiatica*		
Apiaceae	*Platysace filiformis*		
Apiaceae	*Platysace tenuissima*		
Apocynaceae	*Gomphocarpus fruticosus*	*	
Araceae	*Zantedeschia aethiopica*	*	
Asparagaceae	*Chamaescilla corymbosa*		
Asparagaceae	*Lomandra integra*		
Asparagaceae	*Lomandra sericea*		
Asparagaceae	*Thysanotus dichotomus*		
Asparagaceae	*Thysanotus manglesianus*		
Asphodelaceae	*Trachyandra divaricata*	*	
Asteraceae	*Arctotheca calendula*	*	
Asteraceae	*Hypochaeris glabra*	*	
Asteraceae	*Lagenophora huegelii*		
Asteraceae	*Senecio minimus*		
Asteraceae	*Trichocline spathulata*		
Asteraceae	*Ursinia anthemoides*	*	
Chenopodiaceae	*Atriplex prostrata*	*	
Chenopodiaceae	*Rhagodia baccata*		
Cyperaceae	*Baumea articulata*		
Cyperaceae	*Baumea juncea*		
Cyperaceae	*Ficinia nodosa*		
Cyperaceae	*Lepidosperma gladiatum*		
Cyperaceae	*Lepidosperma leptostachyum*		
Cyperaceae	*Lepidosperma longitudinale*		
Cyperaceae	*Lepidosperma squamatum*		
Cyperaceae	*Tetraria capillaris*		
Dasypogonaceae	*Dasypogon bromeliifolius*		
Dennstaedtiaceae	*Pteridium esculentum*		
Dilleniaceae	*Hibbertia cuneiformis*		
Dilleniaceae	*Hibbertia hypericoides*		
Dilleniaceae	*Hibbertia racemosa*		
Droseraceae	*Drosera pallida*		
Ericaceae	*Astroloma pallidum*		
Ericaceae	*Brachyloma preissii*		
Ericaceae	*Conostephium pendulum*		
Ericaceae	*Leucopogon propinquus*		
Fabaceae	*Acacia applanata*		
Fabaceae	*Acacia huegelii*		
Fabaceae	*Acacia longifolia*	*	
Fabaceae	*Acacia pulchella*		
Fabaceae	*Acacia saligna*		
Fabaceae	*Acacia semitrullata*		P4

FAMILY NAME	LATIN NAME	NATURALISED	CONSV CODE
Fabaceae	*Bossiaea eriocarpa*		
Fabaceae	*Daviesia divaricata*		
Fabaceae	*Daviesia physodes*		
Fabaceae	*Gompholobium tomentosum*		
Fabaceae	*Hovea trisperma*		
Fabaceae	*Jacksonia furcellata*		
Fabaceae	*Jacksonia sparsa*		
Fabaceae	*Kennedia prostrata*		
Geraniaceae	*Geranium retrorsum*		
Haemodoraceae	*Conostylis aculeata*		
Haemodoraceae	*Phlebocarya ciliata*		
Iridaceae	*Watsonia meriana*	*	
Juncaceae	*Juncus pallidus*		
Lamiaceae	*Hemiandra pungens*		
Lauraceae	*Cassytha racemosa*		
Loranthaceae	*Nuytsia floribunda*		
Marasmiaceae	*Rytidosperma setaceum*		
Myrtaceae	*Agonis flexuosa*		
Myrtaceae	*Calytrix leschenaultii*		
Myrtaceae	*Corymbia calophylla*		
Myrtaceae	*Eucalyptus gomphocephala*		
Myrtaceae	*Eucalyptus marginata*		
Myrtaceae	*Eucalyptus rudis*		
Myrtaceae	*Kunzea glabrescens*		
Myrtaceae	*Melaleuca preissiana*		
Myrtaceae	*Melaleuca rhaphiophylla*		
Myrtaceae	*Melaleuca teretifolia*		
Myrtaceae	*Melaleuca thymoides*		
Myrtaceae	*Melaleuca viminea*		
Orchidaceae	*Caladenia flava*		
Orchidaceae	*Leporella fimbriata*		
Orchidaceae	*Pyrorchis nigricans*		
Physalacriaceae	*Rytidosperma setaceum*		
Poaceae	*Avena fatua*	*	
Poaceae	*Briza maxima*	*	
Proteaceae	*Adenanthos meisneri*		
Proteaceae	*Banksia attenuata*		
Proteaceae	*Banksia grandis*		
Proteaceae	*Banksia ilicifolia*		
Proteaceae	*Banksia littoralis*		
Proteaceae	*Stirlingia latifolia*		
Proteaceae	*Xylomelum occidentale*		
Restionaceae	*Desmocladus fasciculatus*		
Restionaceae	*Desmocladus flexuosus*		

FAMILY NAME	LATIN NAME	NATURALISED	CONSV CODE
Restionaceae	*Hypolaena exsulca*		
Restionaceae	*Loxocarya cinerea*		
Rhamnaceae	*Spyridium globulosum*		
Rubiaceae	*Opercularia hispidula*		
Solanaceae	*Solanum linnaeanum*	*	
Solanaceae	*Solanum nigrum*	*	
Stylidiaceae	*Stylidium adnatum*		
Stylidiaceae	*Stylidium amoenum*		
Stylidiaceae	*Stylidium brunonianum*		
Stylidiaceae	*Stylidium ciliatum*		
Xanthorrhoeaceae	*Xanthorrhoea brunonis*		
Xanthorrhoeaceae	*Xanthorrhoea gracilis*		
Zamiaceae	*Macrozamia riedlei*		

Appendix 8. EPBC Act Offsets Assessment Guide – Offset Calculator

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Banksia Woodlands of the
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes	Clearing of 6.37 ha of vegetation representative of the Banksia Woodlands of the Swan Coastal Plain TEC.	**Area**	6.37	Hectares	Eco Logical Australia 'Desktop Assessment of Selected Lots Within Kemerton Industrial Area' 2017 Eco Logical Australia 'Kemerton Industrial Area Sprin Flora and Fauna Survey' 2017 GHD 'Memorandum - Additional Area Assessment' 2017
			Quality	5	Scale 0-10	
			Total quantum of impact	3.19	Adjusted hectares	
Threatened species habitat						
Area of habitat	Yes		**Area**		Hectares	
			Quality		Scale 0-10	
			Total quantum of impact	0.00	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	3.19	Adjusted hectares	Land parcel within the Kemerton Strategic Industrial Park Buffer area	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	113.3	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	5%	28.33	90%	25.49	20.08	650.51%	Yes		
									Future area without offset (adjusted hectares)	79.3	**Future area with offset (adjusted hectares)**	107.6				20.72				
					Time until ecological benefit	1	**Start quality (scale of 0-10)**	7	**Future quality without offset (scale of 0-10)**	6	**Future quality with offset (scale of 0-10)**	7	1.00	85%	0.85	0.84				
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	3.185	20.72	650.51%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Black cockatoos (Carnaby's,
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	22.68ha low value foraging habitat (scatterd pines and Eucalyptus rudis). Incl 1 potential breeding tree, no hollow	**Area**	22.68	Hectares	Eco Logical Australia 'Desktop Assessment of Selected Lots Within Kemerton Industrial Area' 2017 Eco Logical Australia 'Kemerton Industrial Area Sprin Flora and Fauna Survey' 2017 GHD 'Memorandum - Additional Area Assessment' 2017
			Quality	**4**	Scale 0-10	
			Total quantum of impact	9.07	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	9.07	Adjusted hectares	Land parcel within the Kemerton Strategic Industrial Park Buffer area	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	40.8	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	5%	10.20	90%	9.18	7.23	9.86	108.68%	Yes	
									Future area without offset (adjusted hectares)	28.6	**Future area with offset (adjusted hectares)**	38.8								
					Time until ecological benefit	1	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	85%	1.70	1.68				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	9.072	9.86	108.68%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

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2 October 2012

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Matter of National Environmental Significance	
Name	Black cockatoos (Carnaby's,
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	23.05 ha mod to high value foraging habitat Incl 1 potential breeding tree, no hollow	**Area**	23.05	Hectares	Eco Logical Australia 'Desktop Assessment of Selected Lots Within Kemerton Industrial Area' 2017 Eco Logical Australia 'Kemerton Industrial Area Sprin Flora and Fauna Survey' 2017 GHD 'Memorandum - Additional Area Assessment' 2017
			Quality	**7**	Scale 0-10	
			Total quantum of impact	16.14	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	16.14	Adjusted hectares	Land parcel within the Kemerton Strategic Industrial Park Buffer area	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	72.5	**Risk of loss (%) without offset**	30%	**Risk of loss (%) with offset**	5%	18.13	90%	16.31	12.85	17.52	108.59%	Yes	
									Future area without offset (adjusted hectares)	50.8	**Future area with offset (adjusted hectares)**	68.9								
					Time until ecological benefit	1	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	85%	1.70	1.68				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	16.135	17.52	108.59%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**