Report of a Level 2 Flora and Vegetation Survey and Level 1 Fauna Survey along Collie-Lake King Road at Bowelling (SLK 64.5 - 71.0)

Prepared for Main Roads Western Australia
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Executive Summary

Ecoedge was engaged by Main Roads Western Australia in August 2016 to undertake a Level 2 Flora and Vegetation Survey and Level 1 Fauna Survey along the Collie-Lake King Road (Coalfields Road) at Bowelling ('Bowelling curves'). The survey area was 47.8 ha, approximately between SLK 64.5 and 71.0, in the Shire of West Arthur. Main Roads is conducting investigations for the future widening and re-alignment of Collie-Lake King Road.

The flora and vegetation survey was carried out by Russell Smith (B.Sc. (Hons), MPhil. – Botanist) during visits to the site on 2, 5 and 28 September and 8 November 2016. The fauna survey was carried out by Greg Harewood (B.Sc. - Zoology) over a period of six days (29 September, 6 October, 6, 7 and 9 November 2014 and 16 November 2016).

A total of 278 vascular flora taxa were identified within the 2016 Survey Area and in the 2014 survey area (both of which encompassed the 2016 Project Area) (Ecoedge, 2014)[1]. Of this total, 32 were introduced species.

Two Priority flora were found; *Leucopogon subsejunctus* (P2) and *Synaphea hians* (P3). No State or Federally-listed Threatened flora, or other species of conservation significant flora was found within the Project Area.

Nine vegetation units were identified within the Survey Area. Two of these consist of areas cleared of native vegetation or "parkland cleared" pasture with stands of Marri and Wandoo and one was an apparently planted *Amphibromus nervosus* tall grassland. The remaining six vegetation units were derived from a multivariate analysis of floristic data from 100m^2 quadrats placed throughout the Survey Area. Of these, two are of conservation significance, viz. Vegetation unit B2 and Vegetation unit C1.

Vegetation unit B2 (*Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland), which is rich in herbaceous species, is associated with the broad, shallow valley of the Collie River East, much of which has been cleared for agriculture. Of the vegetation units identified within the Survey Area, vegetation unit B2 is very likely a restricted "floristic community type". DPaW has given advice that vegetation unit B2 is potentially an occurrence of the Federally-listed TEC "Claypans of the Swan Coastal Plain"[2], which is Critically Endangered. This TEC comprises four separate State-listed TECs and one PEC. Of these, it would most likely be an occurrence of the "Clay pans with shrubs over herbs" PEC, which is included within the Federally-listed TEC and which occurs on the Darling Plateau (DPaW, 2015b).

Vegetation Unit C1 (*Hakea prostrata-H. varia- M. viminea* tall shrubland) is situated on alluvial soil adjacent to the Collie River. Some parts of this vegetation unit have the small tree *Melaleuca cuticularis* as a component. Areas where *M. cuticularis* is present are

[1] The total area of the 2014 and 2016 surveys was about 81 ha.
[2] Mr. A. Webb, DPaW, Bunbury, email 5/12/2016.

regarded by DPaW as of relatively high conservation value[3]. *M. cuticularis* occurred in the two quadrats placed within this vegetation unit (BOWE14, BOWE17), however both these quadrats are situated just outside the Project Area. *M. cuticularis* is quite uncommon within the Project Area.

A large proportion (49.6%) of the vegetation within the Survey Area was in Very Good or Excellent condition, with the majority (42.6%) of the remainder classed as Completely Degraded. Completely Degraded areas comprised roadways, tracks and pasture with few trees. Some degradation of vegetation has taken place adjacent to the old railway embankment due to the sinking of power or telephone cable(s) many years ago.

A total of 53 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area during the day time surveys. The presence of four introduced species was also confirmed.

Evidence of two listed threatened fauna species was observed (Carnaby's black-cockatoo (chewed marri and jarrah fruits) and forest red-tailed black-cockatoo (individuals and chewed marri and jarrah fruits). Several individuals of the listed migratory species, the rainbow bee-eater were also observed foraging onsite. No evidence of any DPaW priority species using the area was found.

The assessment identified a total of 584 "habitat trees" within the fauna survey area. The majority (422, ~72.3%) of the trees were not observed to contain hollows of any size. One hundred and sixty two (~27.7%) of the trees contained one or more "small" hollows (less than ~10cm entrance size) considered by the Author not to be suitable for black cockatoos to use for nesting purposes. Nine (~1.5%) trees appeared to contain hollows with larger entrances (greater than ~10cm) that appeared big enough to possibly allow the entry of a black cockatoo into a suitably sized and orientated branch/trunk, although none showed any sign of current or previous use for this purpose.

Almost all areas of remnant native vegetation present within the study area can be considered to represent potential black cockatoo foraging habitat as they contain a range of plant species documented as foraging habitat for one or more of the three black cockatoo species, all of which are known to frequent the area. The degree to which any one section of the route would be utilised for foraging purposes would however vary considerably based on species composition and density. Generally, the most dominant and widespread species are marri and jarrah though in some areas other species are also present (e.g. sheoak and banksia).

Foraging evidence left by Carnaby's and the forest red-tailed black-cockatoo was observed during the survey period at several locations and included chewed marri and jarrah fruits.

[3] Correspondence from Mr. A. Webb, DPaW, Bunbury, 2/08/2016.

With respect to fauna in general, no substantial impacts are anticipated as a consequence of the proposed realignment. In cases where some impact is anticipated, the degree of the impact is only expected to be low and relates to the loss of small areas of habitat, but as most species are common and/or widespread, no overall change in their conservation status is anticipated, despite a possible localised reduction in habitat extent.

It is most likely that the clearing required will necessitate the removal of relatively thin, discontinuous sections of vegetation located at various points along the proposed road realignment. Due to the large tracts of intact vegetation in the State Forest surrounding much of the Project Area, any clearing associated with the is not likely to have a significant impact on the function or viability of the nearby regional ecological linkage in regards to flora and vegetation, nor will it fragment any potential fauna habitat to the extent that it would represent a barrier to fauna movement above that already present in the area (i.e. the existing road and network of other tracks and powerline easements).

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Acronyms/Abbreviations

ALA: Atlas of Living Australia www.ala.org.au

BA: Birdlife Australia (Formerly RAOU, Birds Australia).

BC Bill: *Biodiversity Conservation Bill (2015)*. WA Government.

°C: Degrees Celsius.

CALM: Department of Conservation and Land Management (now DPaW), WA Government.

CAMBA: China Australia Migratory Bird Agreement 1998.

CBD: Central Business District.

DBH: Diametre at Breast Height – tree measurement.

DEC: Department of Environment and Conservation (now DPaW), WA Government.

DEH: Department of Environment and Heritage (now DotEE), Australian Government.

DEP: Department of Environment Protection (now DER), WA Government.

DER: Department of Environment Regulation (formerly DEC, DoE), WA Government.

DEWHA: Department of the Environment, Water, Heritage and the Arts (now DotEE), Australian Government

DMP: Department of Mines and Petroleum (formerly DoIR), WA Government.

DoE: Department of Environment (now DER/DPaW), WA Government.

DotE: Department of the Environment (now DotEE), Australian Government.

DotEE: Department of the Environment and Energy (formerly SEWPaC, DWEHA, DEH & DotE), Australian Government.

DoIR: Department of Industry and Resources (now DMP), WA Government.

DPaW: Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.

EP Act: *Environmental Protection Act 1986*, WA Government.

EPA: Environmental Protection Authority, WA Government.

EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999,* Australian Government.

ha: Hectare (10,000 square metres).

IBRA: Interim Biogeographic Regionalisation for Australia.

IUCN: International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.

JAMBA: Japan Australia Migratory Bird Agreement 1981.

km: Kilometre.

m: Metre.

mm: Millimetre.

P: Priority - DPaW fauna conservation ranking.

POS: Public Open Space.

RAOU: Royal Australia Ornithologist Union.

ROKAMBA: Republic of Korea-Australia Migratory Bird Agreement 2007.

S: Schedule - Western Australian *Wildlife Conservation Act (1950)* Threatened Fauna Category.

SEWPaC: Department of Sustainability, Environment, Water, Population and Communities (now DotEE), Australian Government.

SRE: Short Range Endemic.

SSC: Species Survival Commission, International.

WA: Western Australia.

WAM: Western Australian Museum, WA Government.

WAPC: Western Australian Planning Commission, WA Government.

WC Act: *Wildlife Conservation Act 1950*, WA Government.

WRP: Western Ringtail Possum

Statement of limitations

Reliance on Data

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

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1 Introduction

Ecoedge was engaged by Main Roads Western Australia (Main Roads) in August 2016 to undertake a Level 2 Flora and Vegetation Survey and Level 1 Fauna Survey of remnant vegetation along the Collie-Lake King Road (Coalfields Road) – at the part of the road called the "Bowelling Curves" - between straight line kilometres (SLK) 64.5 and 71.0, in the Shire of West Arthur.

Main Roads is conducting investigations for the future widening and re-alignment of Collie Lake King Road at "Bowelling Curves". The proposed alignment passes through a combination of uncleared native vegetation, cleared farmland, along the existing road alignment and along/over sections of the Collie-Darkan rail trail. The Survey Area covered 47.8 hectares (ha), which included a 20 metres (m) wide buffer around the proposed area of disturbance.

The flora survey was carried out by Russell Smith (B.Sc. (Hons.), MPhil (Plant Ecology) - Botanist) during visits to the site on 2, 5 and 28 September and 8 November 2016.

The fauna survey was carried out by Greg Harewood (B.Sc. - Zoology) over a period of six days (29 September, 6 October, 6, 7 and 9 November 2014 and 16 November 2016).

The surveys were undertaken in accordance with the Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) Technical Guide 2015 (Flora and Vegetation Survey) and EPA Guidance Statement No. 56, EPA and Department of Environment and Conservation (DEC) Technical Guide (2010) (Fauna survey).

This report compiles findings of the field surveys and desktop assessment.

1.1 Scope and Objectives

1.1.1 Level 2 Flora and Vegetation Survey

The primary objective of the Level 2 flora and vegetation survey was to determine whether there are any significant flora and/or vegetation values within the Survey Area. The following components of a Level 2 flora and vegetation survey listedin the new EPA and DPaW Technical Guide (EPA and DPaW, 2015):

- Review the documented flora and vegetation of significance, based on Department of Parks and Wildlife (DPaW) records (databases);
- Conduct a review of other literature to summarise the values of flora and vegetation significance in the project area;
- Conduct a field assessment to:
    - identify the vascular flora species present;

- determine the presence or absence of Declared Rare Flora (DRF), Priority or Significant Species;
- assess conservation significance of vegetation and flora;
- define and spatially map vegetation condition;
- define and spatially map vegetation communities (achieved through the installation of a minimum of three 10 x 10 m floristic quadrats per vegetation unit and unmarked floristic relevés as required);
- define and map threatened and priority ecological communities;
- determine whether the Survey Area are wholly or partly with an Environmentally Sensitive Area (ESA); and

- Prepare a report summarising findings
- Submit track logs showing the route(s) taken during the flora and vegetation field survey
- Submit shapefiles of all field survey data.

1.1.2 Level 1 Fauna Survey

The scope of works for the fauna survey was to conduct a level 1 fauna survey as defined by the EPA (EPA 2004). Because some listed threatened species (i.e. several species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include a targeted assessment of the site's significance to these particular species. The fauna assessment has therefore included:

1. Level 1 Fauna Survey (to EPA standard). This includes observations and recordings of fauna species, including any signs of occurrence and/or usage and an assessment of presence and potential occurrence of specially protected fauna species (including but not limited to those the subject of targeted surveys).
2. Targeted searches and recording of black cockatoo foraging, nesting and roosting habitat.
3. Preparation of a report detailing results including a discussion of habitat significance and linkages and potential requirement for federal referral or other clearances.

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

1.2 Biogeographic Region, Location and Site Description

The Survey Area is located within the Southern Jarrah Forest (JF2) sub-region of the Jarrah Forest Bioregion as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Australian Government, 2009).

It is situated approximately 26.3 km south-east of the Collie town site (**Figure 1**). The total Survey Area was 47.8 ha, which included a 20 m wide buffer around the proposed area of disturbance. The proposed realignment will pass through a combination of uncleared native vegetation, cleared farmland, along the existing road alignment and sections of the Collie-Darkan rail trail (**Figure 2**).

Elevation on site is fairly consistent, measuring between 230 and 250 m above sea level**.**

Land tenure within the Survey Area varies between road, state forest, railway, Crown and freehold land. Zonings under the Shire of West Arthur Town Planning Scheme 2 vary accordingly between 'state forest', 'road', 'railway' and 'rural'.

1.3 Geology

The Survey Area is situated within the Western Darling Range Zone (WDRZ) soil-landscape zone as defined by Tille (1996). The Western Darling Range Zone (which has an identification code '255') is a deeply dissected undulating lateritic plateau overlying crystalline rocks (e.g. granite and gneiss). Major river systems have cut into the plateau to form deep, steep sided valleys and expose fresh rock.

Three soil-landscape systems (containing 24 subsystems) have been identified and mapped within the WDRZ; the Coalfields (Cf), Darling Plateau (Dp) and Lowden Valleys (Lv) (Schoknecht, *et al.* 2004; Tille, 1996). The Survey Area is situated on soils of the Darling Plateau soil-landscape system (255Dp) (**Figure 3**), which is described below:

> The Darling Plateau system consists of an undulating plateau surface dominated by broad lateritic divides formed over a crystalline basement. These divides have gravels and sands. In some locations they have formed over deposits of Kirup Conglomerate. Some of the divides are almost level and have extensive areas of poor drainage. Most have formed over old sedimentary deposits. Ridges with gravels and loams run off the western and southern edges of the plateau. Some low hills rise above the plateau surface, which become more common to the east. Shallow, minor valleys with gravels, sands and loams are common. These are often U-shaped with swampy floors. There are also some shallowly incised, broad swampy flats of major rivers in the Wellington Catchment (Tille, 1996).

Soil-landscape systems have been further divided into subsystems by Tille (1996), and within these into soil phases or mapping units. Soils in the Survey Areas have been mapped as the Dwellingup (DW), Pindalup (PN), Harris (HS) and Mornington Hill (MH) subsystems of the Darling Plateau System. There are two soil mapping units within the Mornington Hill subsystem, MH and MHg; of these the Survey Area is situated only on MHg soils). Soil Mapping Units occurring within the Survey Area are described in **Table 1.**

Table 1. Soil Mapping Units occurring within the Survey Area.

Soil Mapping Unit	Description
255DpPNu	Pindalup upstream valleys: narrow swampy floor and prominent sideslopes. Pale deep sands, some with coffee rock, are often present in the headwaters.
255DpDW	Consists of broad, undulating lateritic divides formed over granite and gneiss. Loamy gravels and sandy gravels are the most common soils with pockets of deep sands.
255DpHS	Consists of broad (250 – 1500 m), poorly drained alluvial flats on the surface of the Darling Plateau System. These flats have wet soils which are often saline.
255DpMHg	Mornington granite hills: occurs mainly on the hillslopes where granite is a significant, though not necessarily dominant, parent material. Rock outcrop is sometimes present and there are more loamy earths, deep loamy duplexes and stony soils.

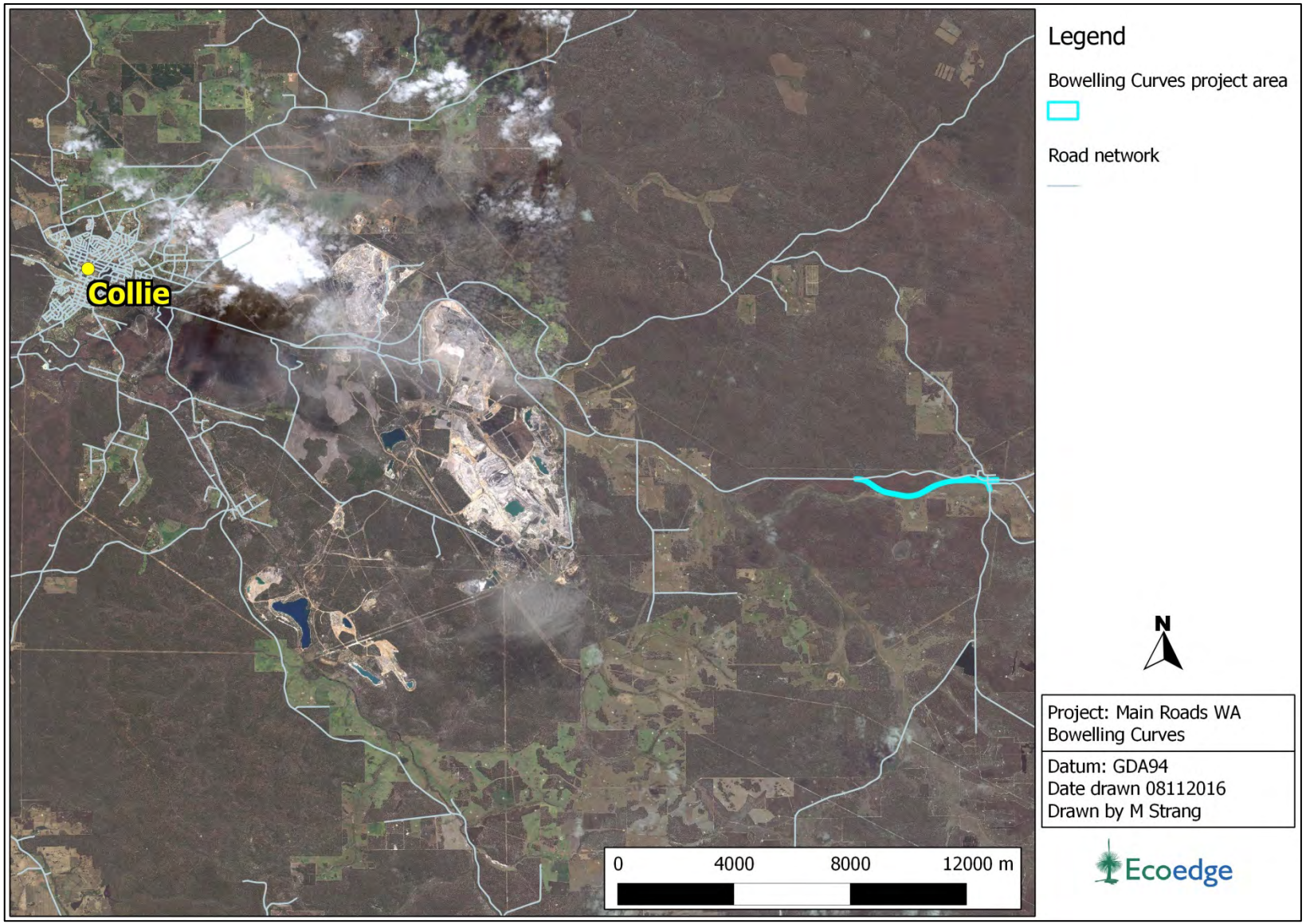


Figure 1. Aerial Photograph showing location of Project Area.

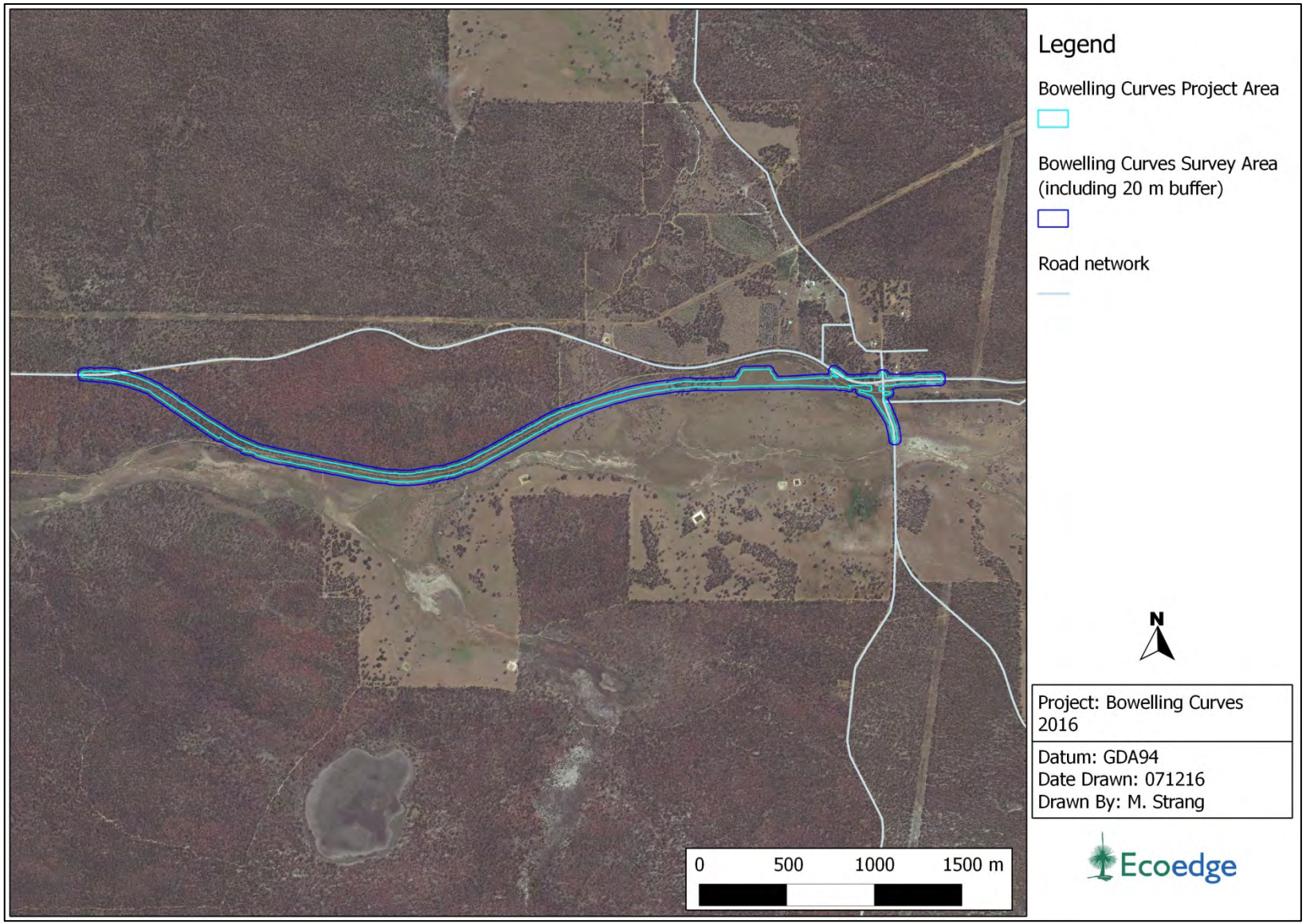


Figure 2. The Survey Area at Bowelling.

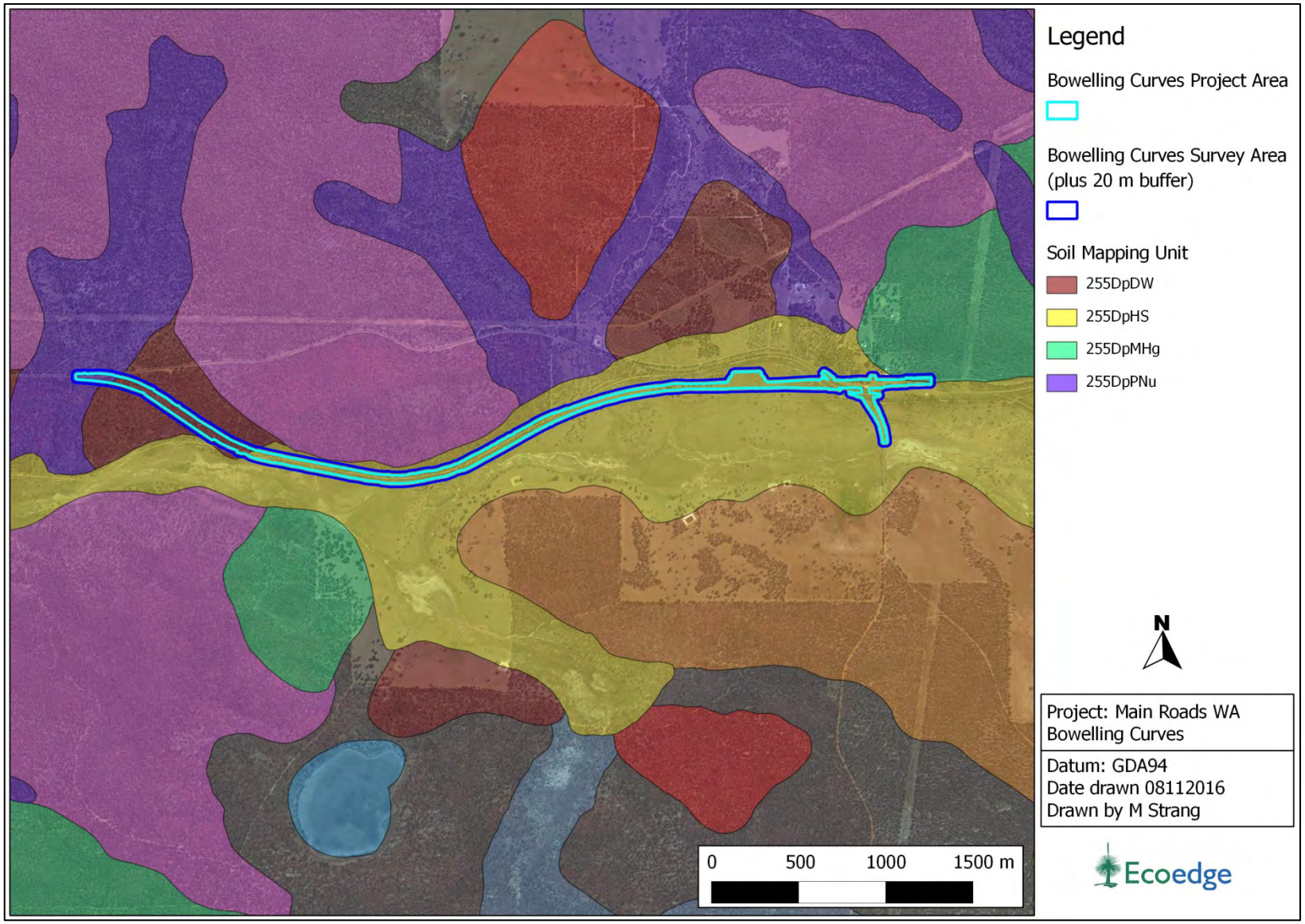


Figure 3. Soil mapping units occurring within the Project Area.

1.4 Regional Ecological Linkages

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

Ecological linkages are defined as:

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

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

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

Molloy *et al.* (2009) identify a regional ecological linkage axis line running along or close to approximately two thirds of the length of the Survey Area (**Figure 6**). This axis line is primarily associated with large tracts of State Forest.

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

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

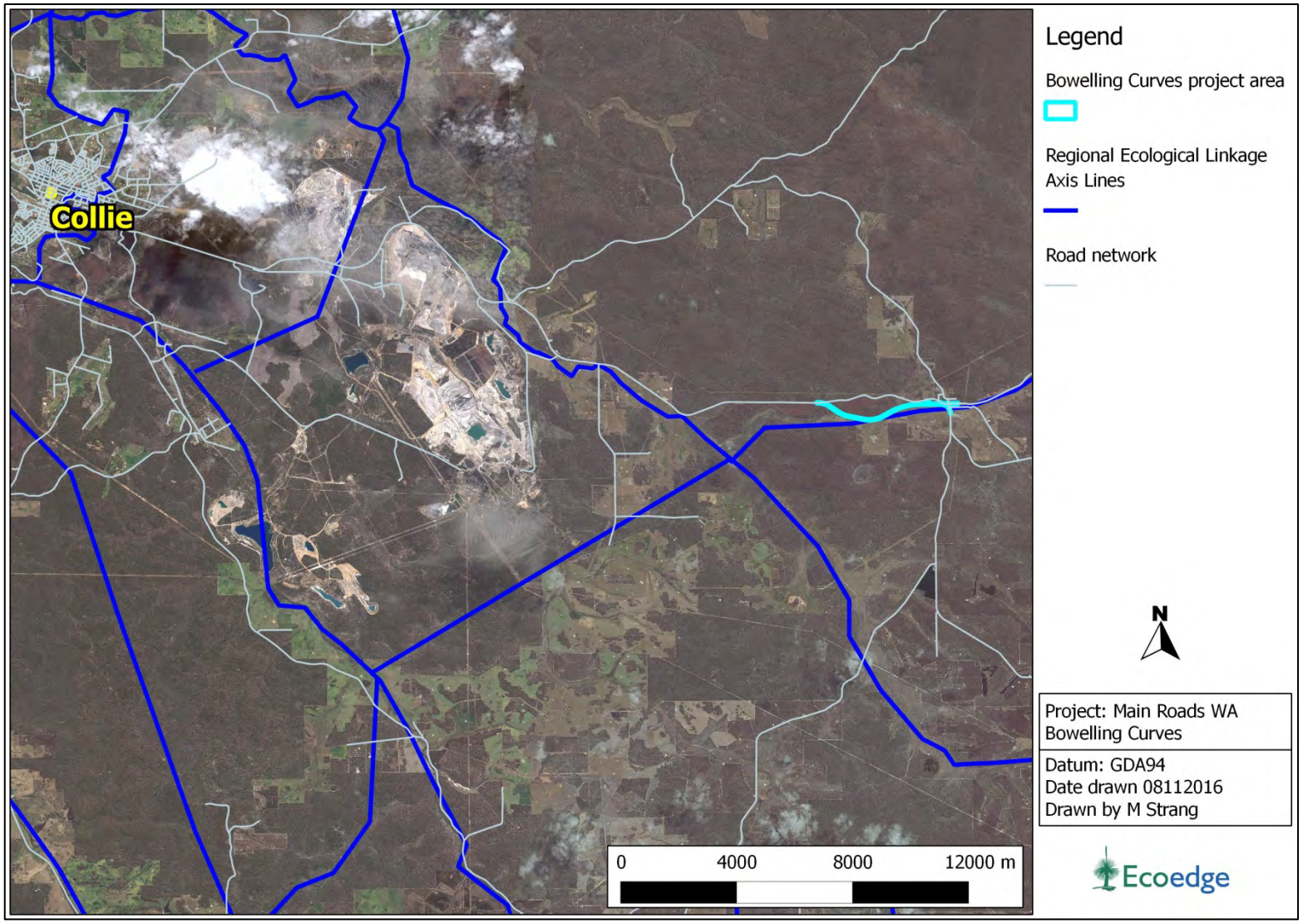


Figure 4. The Project Area in relation to regional ecological linkages (Molloy et al., 2009).

1.5 Environmentally Sensitive Areas

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

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

There are no known ESAs within the Survey Area.

1.6 Flora and Vegetation Survey Desktop Study

Prior to the field survey, a 'desktop study' was carried out. This involved assessments of reports of previous flora surveys in the area, a NatureMap report (DPaW, 2016c, **Appendix 1**) which listed all flora (including rare flora) occurring within 10 km of the Survey Area, and extracts from DPaW's and the Western Australian Museum's Rare and Priority flora databases (DPaW, 2016d). A Protected Matters Search Tool report was also generated, detailing all species listed under the EPBC Act known to occur, potentially occur or potentially have habitat occurring within 10 km of the Survey Area (Department of the Environment and Energy (DotEE), 2016c) (**Appendix 2**).

1.6.1 Previous Flora Surveys within the Local Area

Flora and vegetation surveys of parts of the Survey Area have been carried out in the past by Ecoedge (Ecoedge, 2014). Flora surveys, assessments and reviews have also been undertaken in nearby areas, although not all are publicly available and therefore could not be referenced. The most relevant and/or significant of those available that were referred to during the preparation of this report are listed below:

- Ecoedge (2014). Report of a Level 1 Flora and Vegetation survey along Collie Lake King Road, Bowelling Curves. Unpublished report for Main Roads Western Australia.
- Smith, R.S. (2007). A Preliminary Analysis of Floristic Quadrat Data from the Eastern Part of the South West Region (The Darkan-Boyup Brook Survey). Unpublished report, Department of Environment and Conservation, Bunbury, Western Australia, 25 pp.
- Gibson, N., Keighery, G.J., Lyons, M.N., Webb, A. (2004). Terrestrial flora and vegetation of the Western Australian wheatbelt. Records of the Western Australian Museum Supplement 67, pp. 139–189.

1.6.2 Vegetation of the Survey Area

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

Beard vegetation associations have been described to a minimum standard of Level 3 'Broad Floristic Formation' for the National Vegetation Inventory System (NVIS) (state-wide to regional scale). Two Beard vegetation associations mapped as occurring within the Survey Area; Association code 3, which is described as 'Medium forest; jarrah-marri', and Association code 1114, which is described as 'Shrublands tree-heath; paperbark over teatree thickets' (**Figure 4**).

More recently, Vegetation Complexes on the Darling Scarp and Plateau were mapped for the purposes of the Regional Forest Agreement by Mattiske and Havel (1998). This classification system emphasises the relationships between underlying geology and plant communities. A GIS dataset of this information was produced in 2000 (Havel and Mattiske, 2000).

According to the Havel and Mattiske GIS dataset, Havel and Mattiske (2000), vegetation within the Survey Area was mapped by as the Pindalup (Pn), Yalanbee (Y5) and Swamp (S) Vegetation Complexes (**Table 2, Figure 5**).

Table 2. Description of Vegetation Complexes mapped as occurring within the Survey Area (Mattiske and Havel, 1998).

Vegetation Complex	Description
Pindalup (Pn)	Open forest of *Eucalyptus marginata* subsp. *thalassica-Corymbia calophylla* on slopes and open woodland of *Eucalyptus wandoo* with some *Eucalyptus patens* on the lower slopes in semiarid and arid zones
Yalanbee (Y5)	Mixture of open forest of Eucalyptus marginata subsp. thalassica-Corymbia calophylla and woodland of Eucalyptus wandoo on lateritic uplands in semiarid to per-arid zones
Swamp (S)	Mosaic of low open woodland of *Melaleuca preissiana-Banksia littoralis,* closed scrub of Myrtaceae spp., closed heath of Myrtaceae spp. and sedgelands of *Baumea* and *Leptocarpus* spp. on seasonally wet or moist sand, peat and clay soils on valley floors in all climatic zones

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

Table 3 lists the percentage remaining of each Vegetation Complex mapped within the Survey Area and the percentage of each Vegetation Complex in formal and formal plus informal reserves. It also lists whether each Vegetation Complex meets the Commonwealth's 30% target (Environment Australia, 2001) and the EPA's 15% target (EPA, 2006). As is evident in **Table 3**, all Survey Area Complexes meet both the Commonwealth and EPA targets.

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

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	% in Formal Reserves	% in Formal + All Informal Reserves	Is the 15% Target Met?
Pindalup (Pn)	78.6%	Yes	26.3%	34.8%	Yes
Yalanbee (Y5)	78.9%	Yes	30.0%	47.5%	Yes
Swamp (S)	66.4%	Yes	22.2%	29.1%	Yes

In addition to the EPA and Commonwealth targets above, the Government of Western Australia, in its report on the *Statewide Vegetation Statistics incorporating the CAR Reserve Analysis,* provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the CAR reserve system for WA (Government of Western Australia, 2015). Only reserves managed by DPaW under the *Conservation and Land Management Act 1984* are considered for inclusion in the "CAR Reserve Analysis". For this analysis, the Beard vegetation associations are used, as this is the only mapping dataset that covers the entire state. An assessment of the vegetation associations in the Project Area against the *Statewide Vegetation Statistics* is presented in **Table 4.**

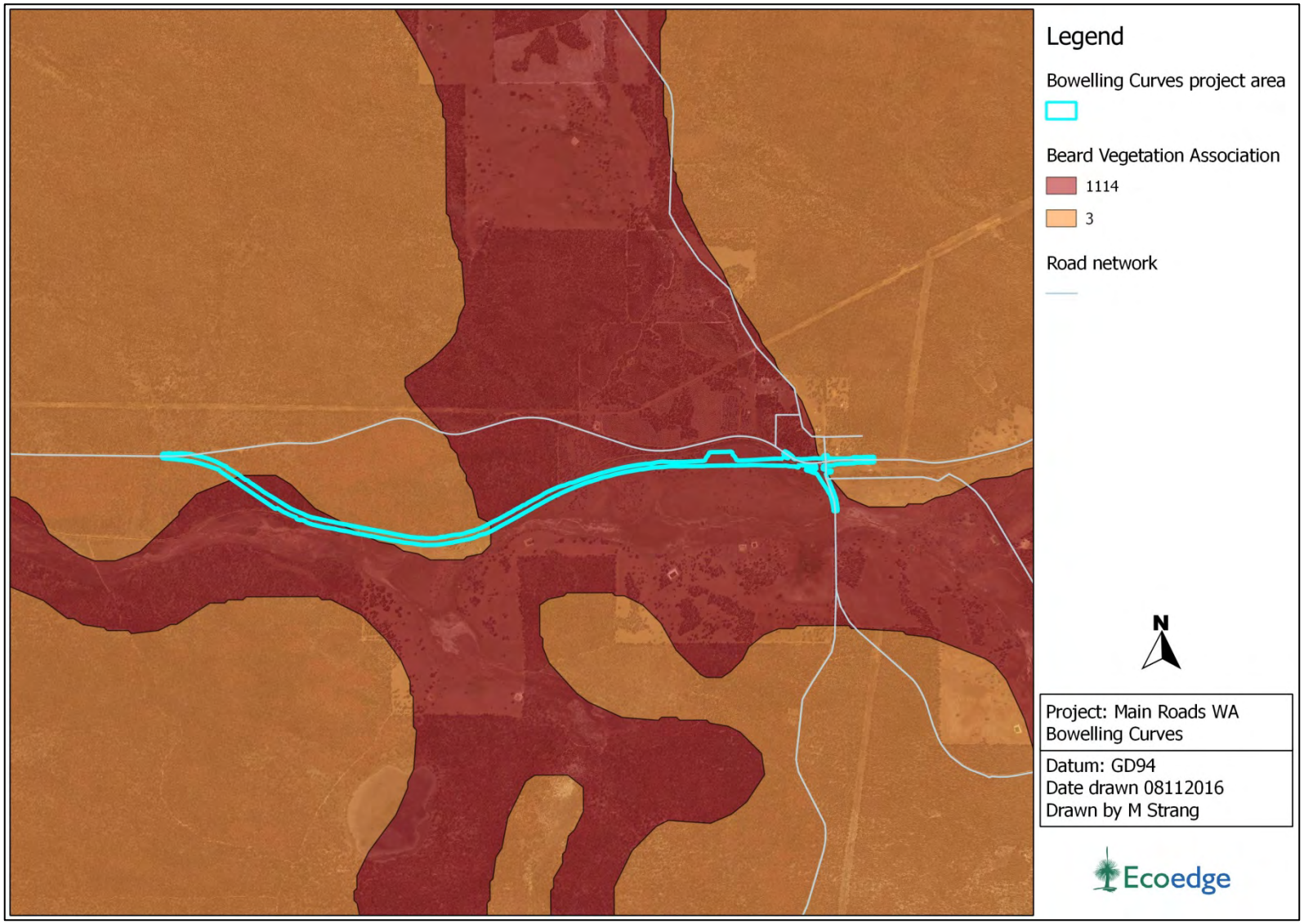


Figure 5. Beard Vegetation Associations mapped within the Bowelling Survey Area (Shepherd *et al.*, 2002).

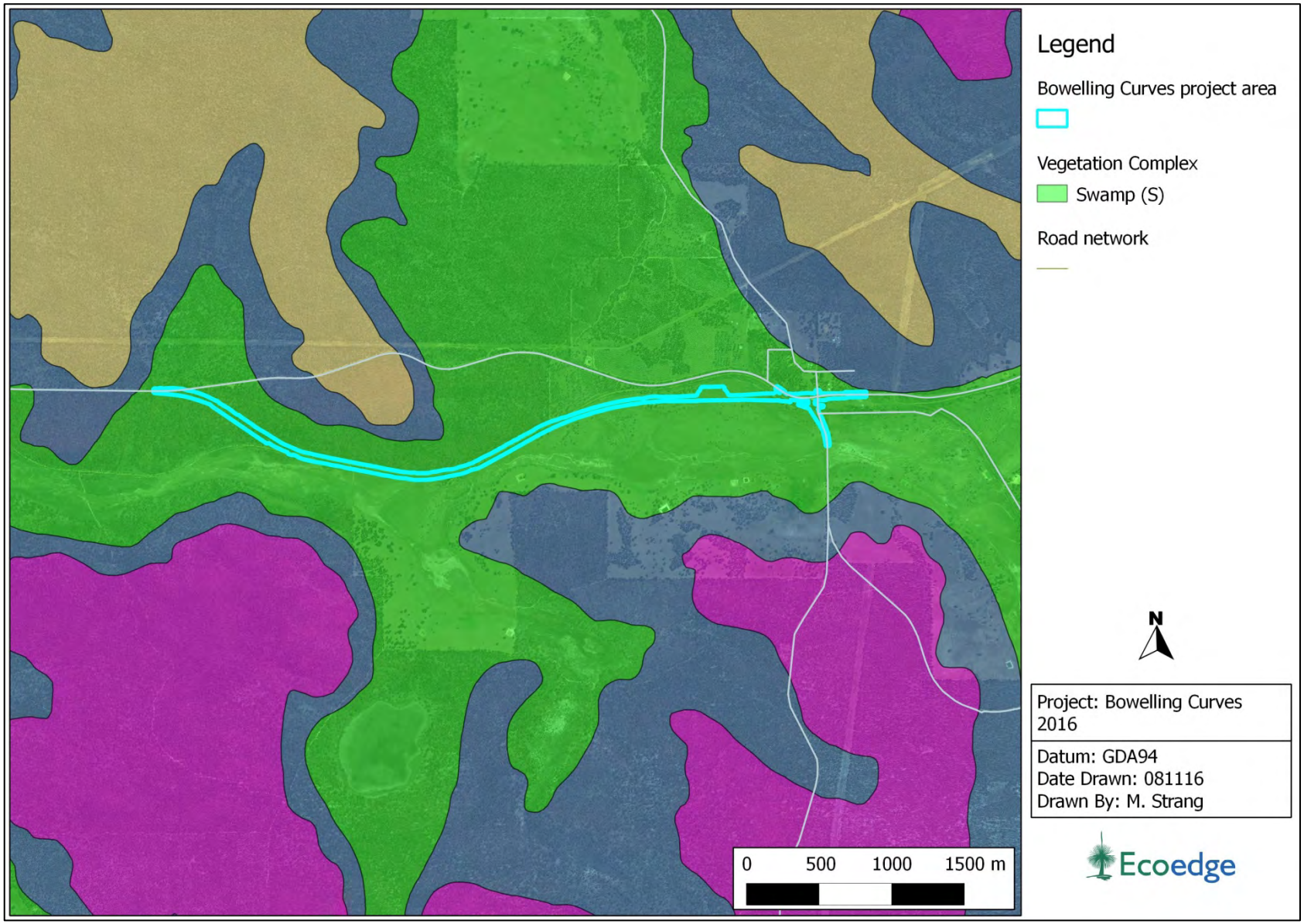


Figure 6. Vegetation complexes mapped as occurring within the Bowelling Survey Area (Havel and Mattiske, 2000).

Table 4. Beard Vegetation Associations of the Survey Area assessed against the Statewide Vegetation Statistics (Government of Western Australia, 2015).

Beard Vegetation Association	% Remaining of pre-European extent	% of pre-European extent in all DPaW managed land
Medium forest; jarrah-marri (3)	30.94%	Not stated
Shrublands tree-heath; paperbark over teatree thickets (1114)	79.15%	74.52%

1.6.3 Ecological Communities of Conservation Significance

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

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; 'presumed totally destroyed', Critically Endangered (CE), Endangered (E) or Vulnerable (Vu) (DEC, 2010). Possible threatened ecological communities that do not meet survey criteria are added to DPaW's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC, 2010). The current listing of Threatened and Priority Ecological Communities is specified in DPaW, 2016a and 2016b. Threatened Ecological Communities can also be listed under the EPBC Act (Department of the Environment and Energy (DotEE), 2016a; Department of Environment, Water, Heritage and the Arts (DEWHA, 1999)).

There are three categories of TEC under the EPBC Act: Critically Endangered (CE), Endangered (E) and Vulnerable (V) (DotEE, 2016b). These are defined in **Appendix 3**.

A Protected Matters Search Tool query for communities listed under the EPBC Act occurring within a 10 km radius of the Survey Area was undertaken (DotEE, 2015c, **Appendix 2**), and the current DPaW TEC and PEC listings were consulted (DPaW 2016a; 2016b).

No threatened or priority ecological communities are known to occur within or in the vicinity of the Survey Area.

1.6.4 Flora of Conservation Significance

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

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

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

Under the WC Act, Threatened Flora are ranked according to their level of threat using IUCN Red List categories and criteria of Extinct (EX), Critically Endangered (CE), Endangered (EN) or Vulnerable (VU). The categories of Declared Rare and Priority Flora as defined by the WC Act are presented in Appendix 4 (DPaW 2015a).

Under the EPBC Act, a species may be listed in one of six categories; the definitions of these categories are summarised in **Appendix 4** (DotEE, 2016d).

Threatened or Priority flora occurring within 10 km of the Survey Area generated from a NatureMap search (DPaW, 2016c), along with an indication of their likelihood of occurrence, are listed in **Table 5**.

Table 5. List of Declared Rare and Priority List flora known to occur within 10 km of the Survey Area (DPaW, 2016c; DotEE, 2016c).

Species	Cons Status (WA)	Cons Status (EPBC Act)	Flowering	Habitat	Likelihood of Occurrence
Caladenia lodgeana	T	CE	Oct	Tuberous, perennial, herb. Fl. whit. Black loam.	None
Commersonia erythrogyna	T	EN	Sep	Granite outcrops.	Low
Drakaea confluens	T	EN	Sep-Oct	Deep sandy soil, forest, woodland.	Low
Diuris micrantha	T	VU	Sep-Oct	Tuberous, perennial, herb, 0.3–0.6 m high. Fl. yellow, brown. Brown loamy clay. Winter-wet swamps, in shallow water.	Moderate
Caladenia leucochila	T	-	Sep	Allocasuarina fraseriana woodland, litter, lateritic soils.	Moderate
Caladenia validinervia	P1		Sep	Lateritic sands.	Moderate
Synaphea trinacriformis	P1		Sep-Oct	Prostrate shrub (subshrub), 0.15–0.3 m high. Fl. yellow. Bare white sand to grey-brown loamy sand and laterite gravel. Undulating landscape, roadsides.	Low
Banksia subpinnatifida var. *imberbis*	P2		Sep-Oct	Erect or straggling, non-lignotuberous shrub, 0.3–1.5 m high. Fl. yellow. Laterite.	Moderate
Leucopogon subsejunctus	P2		Sep-Oct	Lateritic soils. Jarrah-marri woodland.	High
Logania sylvicola	P2		Aug-Sep	Spreading, compact shrub to 40 cm x 50 cm. Inflorescence more or less pendant. Flowers cream. Mid slopes. Dry brown gravelly, sandy loam over laterite.	Moderate
Stylidium squamellosum	P2		Oct-Nov	Caespitose perennial, herb, 0.12-0.35 m high, leaves tufted, linear to narrowly oblanceolate, 1-5 cm long, 0.8-2.5 mm wide, apex subacute, margin entire, glandular. Scape glandular throughout. Inflorescence racemose. Fl. yellow. Brown to red-brown clay loam. Winter-wet habitats and depressions, open woodland, shrubland.	Low
Conospermum paniculatum	P3		Jul-Nov	Spreading, open shrub, 0.3-1.25 m high. Fl. blue, white. Sandy or clayey soils. Swampy areas, plains, slopes.	Low
Eryngium sp. Ferox (G.J. Keighery 16034)	P3		Oct, Nov	Seasonally wet areas. Brown clay.	Low
Isopogon buxifolius var. *obovatus*	P3		Sep-Oct	Various soils, sandy loam, laterite.	None
Meionectes tenuifolia	P3		Sep-Nov	Wetland margins, swamps.	Low

Species	Cons Status (WA)	Cons Status (EPBC Act)	Flowering	Habitat	Likelihood of Occurrence
Stylidium lepidum	P3		Oct-Nov	Spreading, rosetted perennial, herb, ca 0.05 m high, forming densely packed colonies. Fl. pink, orange. Gravelly sand or loam, clay. Winter-wet depressions.	Moderate
Stylidium rhipidium	P3		Oct-Nov	Slender annual, herb, ca 0.05 m high. Fl. white. Sandy soils. Wet creek flats, swamps, granite outcrops.	Moderate
Synaphea decumbens	P3		Sep-Oct	Decumbent shrub. Fl. yellow. Sand over laterite.	Moderate
Synaphea hians	P3		Jul-Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. Yellow. Sandy soils. Rises.	High
Tetratheca exasperata	P3		Sep-Oct	Few-branched shrub (subshrub), 0.1–0.35 m high. Fl. pink, purple. White-grey sand, sandy loam with gravel, orange-brown gravelly loam.	Moderate
Tetratheca similis	P3		Aug-Sep	Spreading shrub, to 0.3 m high. Fl. pink. Sandy clay with lateritic boulders.	Moderate
Banksia meisneri subsp. *ascendens*	P4		Apr-Sep	Shrub, 0.5-2 m high, leaves ascending, 8-15 mm long. Fl. yellow-orange-brown. White or grey sand. Swampy flats.	Low
Gastrolobium tomentosum	P4		Aug-Nov	Weak, decumbent, often clumped shrub, to 1 m high. Fl. orange, purple, red. Gravelly loam or clay, sometimes over sandier substrates. Hills, road verges.	Moderate
Persoonia sulcata	P4		Sep-Nov	Erect, spreading to decumbent shrub, 0.2–1 m high. Fl. yellow. Lateritic or granitic soils.	Low

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

1.6.5 Taxonomy and Nomenclature

Taxonomy and conservation status of flora species was checked against DPaW databases (DPaW, 2016f and 2016g).

1.6.6 Likelihood of Occurrence – Flora of Conservation Significance

Information regarding the likelihood of occurrence of flora of conservation significance is presented in **Table 5**.

1.6.7 Potential Flora Inventory

The NatureMap report generated for the survey provides an inventory of flora potentially occurring in the Survey Area.

1.7 Fauna Survey Desktop Study

Prior to the fauna field survey, a "desktop study" was undertaken which involved assessments of previous fauna survey reports from the local area and DPaW databases. Searches of the following databases were undertaken to aid in the compilation of a list of vertebrate fauna potentially occurring within the Survey Area:

- DPaW's NatureMap Database Search (combined data from DPaW, Western Australian Museum (WAM), Birdlife Australia (BA) and consultants reports), 20km buffer (DPaW 2016e); and
- Protected matters search tool, 10 km buffer (DotEE 2016e).

It should be noted that these lists are based on records/documented distributions from a broader area than the study site and therefore may include species that would only ever occur as vagrants/transients in the actual Survey Area due to a lack of suitable habitat or the presence of only marginal habitat. The databases also often included very old records and in some cases the species in question have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information needs also to be taken into consideration when determining what actual species may be present within the specific area of investigation.

1.7.1 Previous Fauna Surveys within the Local Area and Existing Publications

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, although not all are publically available and could not be referenced. The most significant of those available have been used as the primary reference material for compiling the potential fauna assemblage for the general area. Those reports referred to included, but were not limited to:

- Bancroft, W. and Bamford, M. (2006). Fauna Survey of the Muja South Extension Project. Unpublished report for Griffin Coal.
- Bancroft, W.J., Metcalf, B.M. and Bamford, M.J (2006). Fauna survey of Griffin Coal's Ewington II and Buckingham sites, January 2006. Unpublished report prepared for Kellogg Brown and Root (KBR) Pty Ltd on behalf of Griffin Coal Mining Company Pty Ltd.
- Bancroft, W. J. and Bamford, M. J. (2007). Fauna survey of Griffin Coal's Buckingham site, September 2006. Unpublished report to Griffin Coal Mining Co Pty Limited.
- Bancroft, W.J. Metcalf, B.M. and Bamford, M.J (2007). Fauna values of Griffin Coal's proposed Ewington conveyor alignment. Unpublished report prepared for The Griffin Group.
- Bancroft, W.J. and Bamford, M.J (2008). Inspection of Griffin Coal's proposed Ewington powerline clearing zones for Black-Cockatoo nesting activity, August 2008. Unpublished report prepared for The Griffin Group.
- Coffey Environments (2008). Fauna Relocation Program at Ewington Mine Site, Collie. Unpublished letter report prepared for The Griffin Coal Mining Company Pty Ltd by Coffey Environments. May 2008.
- Ecologia (1991). Ewington Consultative Environmental Review: Fauna Survey. Prepared for Halpern Glick Maunsell on behalf of Griffin Coal Mining Company. January 1991.
- GHD (2008). Collie Shotts Industrial Park, Spring Flora, Fauna and Wetland Assessment. Unpublished report for LandCorp.
- GHD (2009). Level 1 Fauna Assessment - Collie Urea Project. Unpublished report for Perdaman Industries.
- Griffin Coal (2008). Ewington Mining Operations Environmental Management Programme - Fauna Management Plan.
- Halpern Glick Maunsell (1994). Notice of Intent for: Ewington II Open-Cut Mine. Prepared on behalf of the Griffin Coal Mining Company Pty Ltd. July 1994.
- Halpern Glick Maunsell (2002). South West Project Strategic Environmental Review. Unpublished report for Griffin Energy.
- Harewood, G. (2010). Fauna Survey (Level 2) - Buckingham Way - Collie - Residential Development. Unpublished report for Strategen.
- Harewood, G. (2013). Fauna Assessment - Coalfields Highway Realignment (15.9 SLK to 26.3 SLK) Allanson. Unpublished report for RPS/MRWA.
- Maunsell (2003). Bluewater's Power Station Flora and Fauna Survey. Unpublished report for Griffin Energy.

- Maunsell (2004). Ewington I Open-Cut Mine: Environmental Management Programme. Prepared for Griffin Coal Mining Company, May 2004.
- Tonga, J. (2008). Ewington Mine Micro Bat Survey. Unpublished report prepared for Griffin Coal Mining Company by Natsync Environmental. May 2008.

As with the databases searches, some reports refer to species that would not occur in the Survey Area due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list for the Survey Area. It should also be noted that the NatureMap database is likely to include some records from previous fauna surveys in the area including some of those listed above.

The following represent the main publications used to identify and refine the potential fauna species list for the Survey Area:

- Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.
- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.
- Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.
- Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.
- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.
- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.
- Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.
- Morgan, D.L., Beatty, S.J., Klunzinger, M.W, Allen, M.G. and Burnham, Q.E (2011). Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia. Published by SERCUL.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.
- Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.
- Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.
- Wilson, S. and Swan, G. (2013). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

1.1.1 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- EPBC Act
- WC Act
- Red List produced by the Species Survival Commission of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the
- DPaW Priority Fauna list. A non-statutory list maintained by the DPaW for management purposes (DPaW 2015c).

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note - Species listed under JAMBA/CAMBA/ROKAMBA are also listed under Schedule 3 of the WC Act.)

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (MNES) under the EPBC Act.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the Survey Area has been assessed using the most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes are provided in **Appendix 5**.

A number of other species not listed in official lists can also be considered of local or regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of bird species have been listed as of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998 and 2000). The bird species are often referred to as Bush Forever Decreaser Species. The three categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh);
- Wide ranging species with reduced population's on the Swan Coastal Plain (code Bp); and
- Extinct in the Perth region (code Be).

While the Survey Area is not on the coastal plain, the presence of Bush Forever species should be taken into some consideration when determining the fauna values of an area. Bush Forever decreaser species are indicated as such within the species list held in **Appendix 6**.

1.1.2 Invertebrates of Conservation Significance

It can be difficult to identify what may be significant invertebrate species (e.g. Short Range Endemics (SREs)) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

For this project, the assessment for conservation significant invertebrates has been limited to those listed by the DPaW and EPBC Act database searches (which rely on distribution records and known habitat preferences). No assessment of the potential for SREs to be present has been made.

1.1.3 Taxonomy and Nomenclature

Taxonomy and nomenclature for fauna species used in this report is generally taken from the DPaW's WA Fauna Census Database which is assumed to follow Aplin and Smith (2001) for amphibians and reptiles, How *et al*. (2001) for mammals and Johnstone (2001) for birds.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Cogger (2014), Wilson and Swan (2013), Van Dyck & Strahan (2013), Christidis and Boles (2008), Bush *et al.* (2010), Bush *et al.* (2007), Tyler *et al*. (2000), and Glauret (1961). Not all common names are generally accepted.

1.1.4 Likelihood of Occurrence – Fauna of Conservation Significance

Fauna of conservation significance identified during the literature review as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the subject site itself. The rankings and criteria used were:

- Would Not Occur: There is no suitable habitat for the species in the subject site and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
    - Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km of the subject site. Populations do however persist outside of this area.
    - Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the southern forest regions. Populations do however persist outside of this area.
- Unlikely to Occur: The subject site is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the subject site itself would not support a population or part population of the species.
- Possibly Occurs: The subject site is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field assessment, supported in some cases by recent records being documented in literature from within or near the subject site. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- Known to Occur: The species in question was positively identified as being present (for sedentary species) or as using the subject site as habitat for some other purpose (for non-sedentary/mobile species) during the field survey. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. foraging debris, tracks and scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

1.7.2 Potential Fauna Inventory List Resulting from the Desktop Study

A list of fauna species considered most likely to occur in the Survey Area has been compiled from information obtained during the desktop study and is presented in **Appendix 6**. This listing was refined after information gathered during the site reconnaissance survey was assessed. The results of some previous fauna surveys carried out in the general area are summarised in this species listing as are the DPaW NatureMap database search results. The raw database search results from NatureMap (DPaW 2016) and the Protected Matters Search Tool (DotEE 2016) are contained within **Appendix 7**.

The list of potential fauna takes into consideration that firstly the species in question is not known to be locally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the Survey Area, although compiling an accurate list has limitations (see **Section 2.2.4**) and therefore as discussed, the listing is likely to be an overestimation of the fauna species actually present onsite at any one time.

2 Field Survey Methods

2.1 Flora and Vegetation Survey

The field survey was carried out by Russell Smith (SLC permit number SL011500, Regulation 4 permit number CE005402 for DPaW lands) within an area encompassing the Survey Area plus a 20 m "buffer" around it. To avoid confusion, where this smaller area (which covered 25.1 ha) is specifically referred to, it is called the "Project Area".

During spring of 2016, the flora and vegetation survey was carried out during visits to the site on 2, 5 and 28 September and 8 November 2016. During the first two visits, twenty-one 100m^2 floristic quadrats were installed per the method of Keighery (1994), and EPA and DPaW (2015). A further two quadrats were added later (28 September 2016) to improve sampling of some vegetation units. In addition, floristic data was collected at a further 19 unmarked relevés to help fill in "gaps" between the quadrats. At least three floristic quadrats were placed in each of the vegetation units that were mapped by Ecoedge during a previous survey in the same area (Ecoedge, 2014). Quadrats were not placed in Completely Degraded vegetation.

A comprehensive list of native and introduced species was compiled using quadrat lists and incidental identifications of taxa outside the quadrats and relevés during traverses through the Survey Area on foot. Photographs were taken at quadrats and relevés to be used, along with aerial photography, in mapping vegetation type and condition.

Flora species that were not identified in the field were photographed for later identification (specimens had been collected for identification during previous surveys at the site).

Vegetation condition was assessed according to the scale of the EPA and DPaW (2015a), which is defined in **Appendix 8**.

2.1.1 Flora and Vegetation Survey Limitations

Potential limitations of the assessment are addressed in **Table 6**.

Table 6. Limitations of assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	No	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Negligible	The survey was carried out in September and November and encompassed the flowering period of more than 95% of the flora.
Availability of contextual information	Minor	Comprehensive regional surveys of remnant vegetation have not been carried out in the region (with 25 km of the site).
Completeness of the survey	Negligible	Vegetation within the survey area was thoroughly searched on foot.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical survey in south west Australia over a period of 25 years.

2.2 Fauna Survey

Field survey work at the site was carried out by Greg Harewood (B.Sc. - Zoology) over a period of six days (29 September, 6 October, 6, 7 and 9 November 2014 and 16 November 2016).

2.2.1 Fauna Habitat Assessment

The vegetation communities mapped by Ecoedge during the 2016 flora and vegetation survey were used to classify the area into broad habitat types. This information has been supplemented by observations made during the field assessment.

The main aim of the habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that may be impacted on as a consequence of development at the site. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey the habitats within the Survey Area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them.

2.2.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species were made during all field survey work which involved a series of transects across the site during the day while searching microhabitats

such as logs, rocks, leaf litter and observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

2.2.3 Black Cockatoo Habitat Assessment

The following methods were employed to comply with the defined scope of works and are based on guidelines published by the DotEE (SEWPaC 2012), which state that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

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

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

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

So as to comply with the requested scope of works and in line with the published guidelines, the following was carried out:

<u>Breeding Habitat Assessment</u>:

The black cockatoo breeding habitat assessment involved the identification of all suitable breeding trees species within the Survey Area that have a Diameter at Breast Height (DBH) of equal to or over 50cm (30 cm for wandoo). The DBH of each tree was estimated using a pre-made 50 cm or 30cm "caliper".

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

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

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

- Tree ≤ 50cm (30 cm for wandoo) DBH (or an unsuitable species (not assessed/recorded);
- Tree ≥50cm DBH (30 cm for wandoo), no hollows seen;
- Tree ≥50cm DBH (30 cm for wandoo), one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree ≥50cm DBH (30 cm for wandoo), one or more hollows seen, with at least one considered suitable for black cockatoos to use for nesting.

For the purposes of this study 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 12cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, will be recorded as a "potential nest hollow".*

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

A review of available literature has been carried out to determine the location/extent of any known/likely black cockatoo breeding habitat areas in the vicinity of the Survey Area.

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 will also be documented irrespective of the presence of any actual foraging evidence.

A review of available literature has been carried out to determine the location/extent of any known/likely black cockatoo foraging habitat areas in the vicinity of the Survey Area.

Night Roosting Habitat Assessment:

Direct and indirect evidence of black cockatoos roosting within trees on site were noted if observed (e.g. branch clippings, droppings or moulted feathers). A single dusk survey was also undertaken and involved observing and listening for flocks of cockatoos congregating in roost trees over a period of about one hour either side of sunset.

A review of available literature has been carried out to determine the location/extent of any known/likely black cockatoo roosting habitat areas in the vicinity of the Survey Area.

2.2.4 Fauna Survey Limitations

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 be recognised that site conditions can change with time.

Some fauna species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the Survey Area or immediately adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during the field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection; and
- transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the site or does not utilise it for some purpose at times.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on an apparent lack of a specific habitat or microhabitat within the Survey Area. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the Survey Area for some purpose. Some species may be present in the general area but may only use the Survey Area itself on rare occasions or as vagrants/transients.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the Survey Area (or immediately adjacent), as identified through ecological databases, publications, discussions

with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the Survey Area.

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

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about three to five metres, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

3 Results

3.1 Flora and Vegetation Survey

For mapping purposes, the Survey Area has been divided into three sections, as shown in **Figure 7**.

3.1.1 Flora

A combined total of 278 vascular flora taxa were identified within the 2016 Survey Area and in the 2014 Survey Area (both of which encompassed the 2016 Project Area) (Ecoedge, 2014)[4] (**Appendix 9**). Of this total, 32 were introduced species. The genera with the highest number of taxa were Fabaceae (34 species), Proteaceae (31), Orchidaceae (20), Asteraceae (19), Myrtaceae (19) and Poaceae (17).

One of the introduced species – *Moraea flaccida* (One-leaf Capel Tulip) - is a declared pest under the *Biosecurity and Agriculture Management Act 2007*. It is in the C3 'Management' control category for the Shire of West Authur, which is defined below:

Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to —

(i) alleviate the harmful impact of the declared pest in the area; or

(ii) reduce the number or distribution of the declared pest in the area; or

(iii) prevent or contain the spread of the declared pest in the area (DAFWA, 2013).

Two Priority flora species were found within Section 1 of the 2016 Survey Area; *Leucopogon subsejunctus* (P2) and *Synaphea hians* (P3) (**Figure 8**). No State or Federally-listed Threatened flora, or other species of conservation significant flora was found within the Survey Area. DPaW Threatened and Priority Flora Report Forms are provided in **Appendix 10** and have been submitted to the Western Australian Herbarium and DPaW Species and Communities Branch.

Leucopogon subsejunctus covers an area of 0.41 ha within the Project Area, distributed in two main sub-populations and four very small outlying occurrences. About 4.8 ha of *L. subsejunctus* has previously been mapped within and adjacent to the 2016 Project Area (Ecoedge, 2014). *L. subsejunctus* appears to occur as individual plants scattered throughout the bushland within and adjacent to the Project Area, as well as occurring in the several larger, denser populations referred to above.

A single *Synaphea hians* plant was found within the Project Area.

[4] The total area of the 2014 and 2016 surveys was about 81 ha.

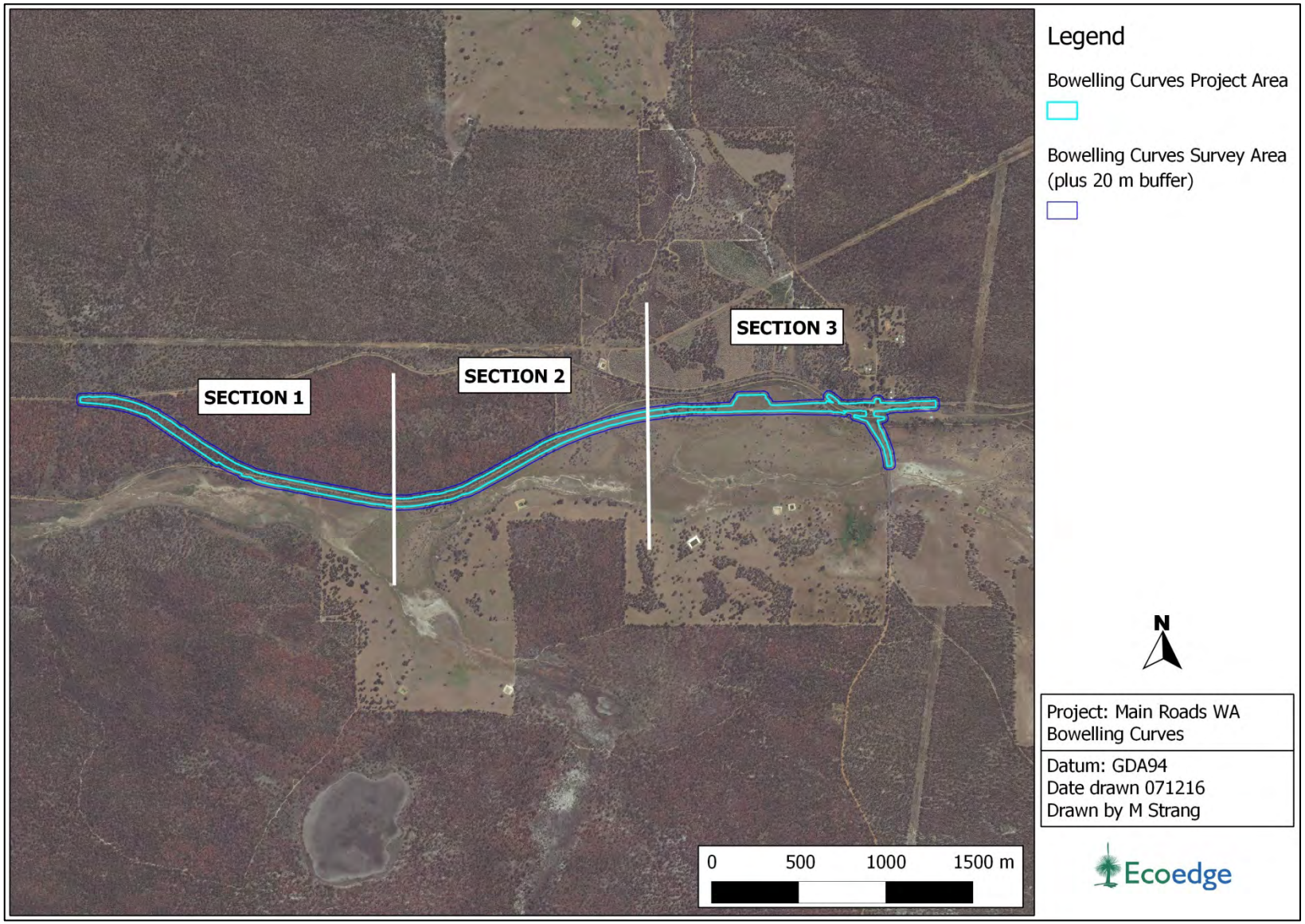


Figure 7. Mapping sections within the Survey Area at Bowelling.

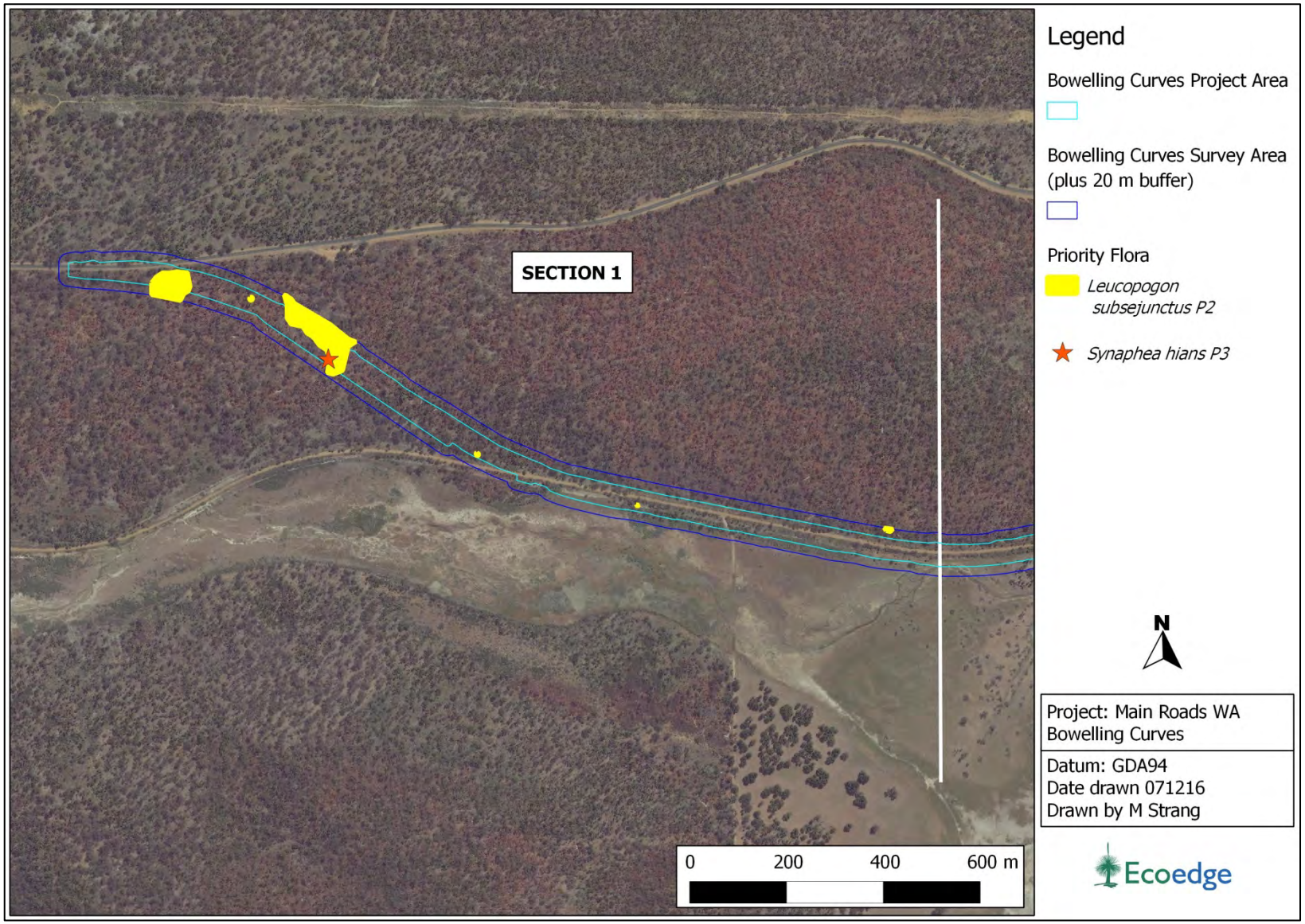


Figure 8. Locations of Priority flora within Section 1 of the Bowelling Survey Area.

3.1.2 Vegetation Types

3.1.2.1 Multivariate Analysis of Quadrat Data

The floristic data from the Survey Area quadrats (**Table 7, Figures 9 - 11**) was subjected to two multivariate analyses; firstly all the Survey Area quadrats were compared with each other, and secondly, they were compared with 15 other floristic quadrats from Bennelaking and Boolading (up to 15 km east of the Survey Area) sourced from Smith (2007) (**Appendix 11**).

A subset of the quadrat data from the Bowelling Project Area that were most superficially like the "Clay Pans of the Swan Coastal Plain" TEC (i.e. quadrats BOWE11, BOWE14, BOWE15, BOWE17 and BOWE19) – were compared to a selection of 48 wetland quadrats from the Swan Coastal Plain Survey dataset (Gibson, *et al*., 1994) - including 24 quadrats within the TEC. The details of the Swan Coastal Plain Survey quadrats chosen for comparison are provided in **Appendix 11**.

Before the analyses were carried out, the comparison quadrat data sets were updated and checked to ensure taxonomic consistency.

The multivariate analyses were carried out using the software program PATN (Belbin, 2003). The datasets were initially analysed using two-way classification (Agglomerative Hierarchical Fusion) of the presence/absence quadrat data. The flexible UPGMA classification strategy was used ($\beta = -0.1$), together with the Bray-Curtis site similarity measure.

The default number of quadrat and taxon groups was accepted. The main outputs were in the form dendrograms and two-way tables of taxa and quadrats.

Group	Quadrat	Soil	Landscape Posn.	Description
A1	BOWE01	Grey-brown loamy sand (light gravel)	Lower slope	Jarrah-Marri Open Forest with *Acacia pulchella* , *Banksia sessilis* , *Hakea lissocarpha* and *Xanthorrhoea preissii*
A1	BOWE18	Grey-brown sandy loam (medium gravel)	Mid/Lower slope	Jarrah-Marri Open Forest with *Acacia pulchella, Leucopogon capitellatus, Macrozamia reidlei and Xanthorrhoea preissii*
A1	BOWE02	Grey sand over laterite	Lower slope	Jarrah-Marri-Wandoo Open Forest with *Acacia pulchella* , *Hakea lissocarpha* and *Trymalium ledifolium*
A1	BOWE03	Grey sand (heavy gravel)	Lower slope	Wandoo-Jarrah Woodland with *Acacia pulchella, Bossiaea ornata, Hakea lissocarpha* and *Leucopogon capitellatus*
A1	BOWE12	Grey sand	Mid/Lower slope	Jarrah-Wandoo Open Forest with *Acacia pulchella, Daviesia cordata, Hakea lissocarpha* and *Xanthorrhoea preissii*
A1	BOWE04	Grey sandy-loam (heavy gravel)	Lower slope	Jarrah-Marri-Wandoo Open Forest with *Bossiaea eriocarpa, B. ornata, Hakea lissocarph* a and *Trymalium ledifolium*
A1	BOWE06	Grey-brown loamy sand (heavy gravel)	Upper slope	Wandoo Woodland with *Acacia pulchella, Hakea lissocarpha, Leucopogon subsejunctus* and *Trymalium ledifolium*
A2	BOWE13	Grey sand (heavy gravel)	Mid/Lower slope	Jarrah-Marri-Wandoo Open Forest with *Acacia pulchella, Bossieaea ornata, Daviesia cordata* and *Xanthorrhoea preissii*
A2	BOWE21	Brown sandy loam	Lower slope	Jarrah-Marri-Wandoo Open Forest with *Bossiaea eriocarpa, Hakea lissocarpha, Trymalium ledifolium* and *Xanthorrhoea preissii*
A2	BOWE08	Grey-brown loamy sand (heavy gravel)	Mid-slope	Jarrah-Marri Open Forest with *Persoonia longifolia, Acacia pulchella, Bossieaea eriocarpa* and *Macrozamia reidlei*
A2	BOWE05	Grey sandy-loam (heavy gravel)	Upper slope	Wandoo Woodland with *Allocasuarina humilis, Grevillea bipinnatifida, Hakea lissocarpha* and *Leucopogon subsejunctus*
A2	BOWE07	Grey-brown loamy sand (heavy gravel)	Upper slope	Jarrah-Marri Open Forest with *Allocasuarina humilis, Acacia pulchella, Hakea lissocarpha* and *Leucopogon subsejunctus*
A2	BOWE09	Grey-brown loamy sand (heavy gravel)	Mid-slope	Jarrah-Wandoo Open Forest with *Acacia pulchella, Grevillea bipinnatifida, Leucopogon subsejunctus* and *Olax bethamiana*
B1	BOWE10	Grey-brown loam	Lower slope	Marri Woodland with *Acacia pulchella, Hakea varia, Trymalium ledifolium* and *Hypocalymma angustifolium*
B1	BOWE20	Brown clay-loam	Lower slope	Wandoo Woodland with *Acacia pulchella, Trymalium ledifolium* and *Xanthorrhoea preissii*
B1	BOWP499	Grey-brown clay	Shallow valley	Wandoo Woodland with *Hakea varia, Melaleuca viminea* and *Grevillea bipinnatifida*
B2	BOWE11	Brown clay	Flat	Melaleuca viminea Tall Open Shrubland with *Apodasmia ceramophila, Babingtonia camphorosmae* and diverse herbland
B2	BOWE19	Grey-brown clay	Flat	*Hakea prostrata-Melaleuca viminea* Tall Open Shrubland and diverse herbland
C1	BOWE17	Grey sandy clay-loam	Flat	*Melaleuca cuticularis-M. viminea* Shrubland
C1	BOWE14	Grey sandy loam (light gravel)	Flat	*Melaleuca cuticularis, M. viminea, Hakea prostrata, H. varia* Tall Shrubland
C1	BOWE15	Grey sandy clay-loam	Flat	*Hakea varia, H. trifurcata, Pericalymma ellipticum, Xanthorrhoea preissii* Tall Shrubland
C2	BOWE16	Grey sand (heavy gravel)	Lower slope	Wandoo Woodland with *Allocasuarina humilis, Hakea prostrata* and *Xanthorrhoea preissii*
C2	BOWP505	Heavy gravel	Lower slope	Jarrah Open Forest with *Allocasuarina humilis, A. thuyoides, Hakea trifurcata, H. prostrata* and *Kunzea recurva*

Table 7. Description of floristic quadrats sited within the Project Area. Floristic groups are shown in the first column.

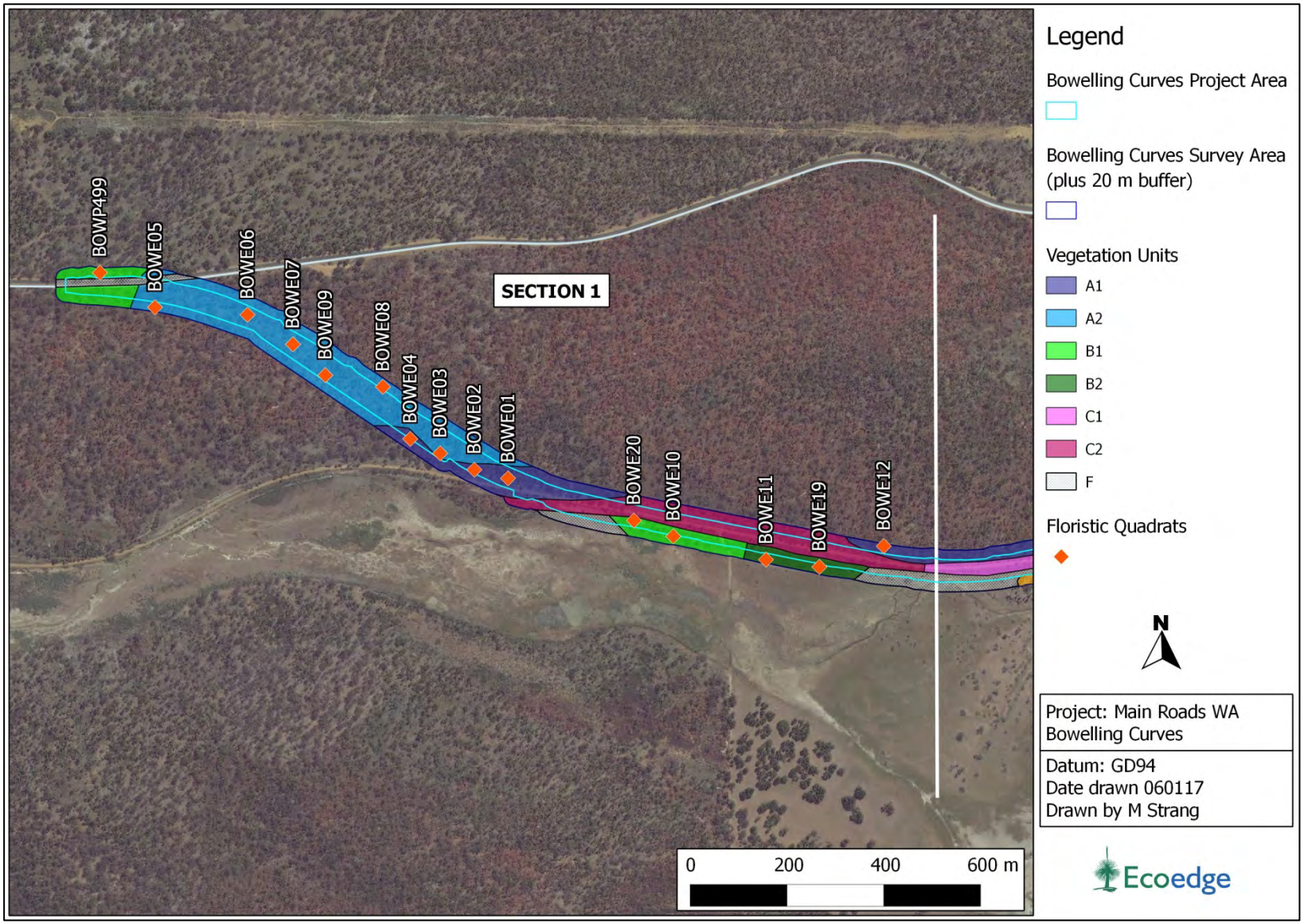


Figure 9. Vegetation units mapped within Section 1 of the Bowelling Survey Area. .

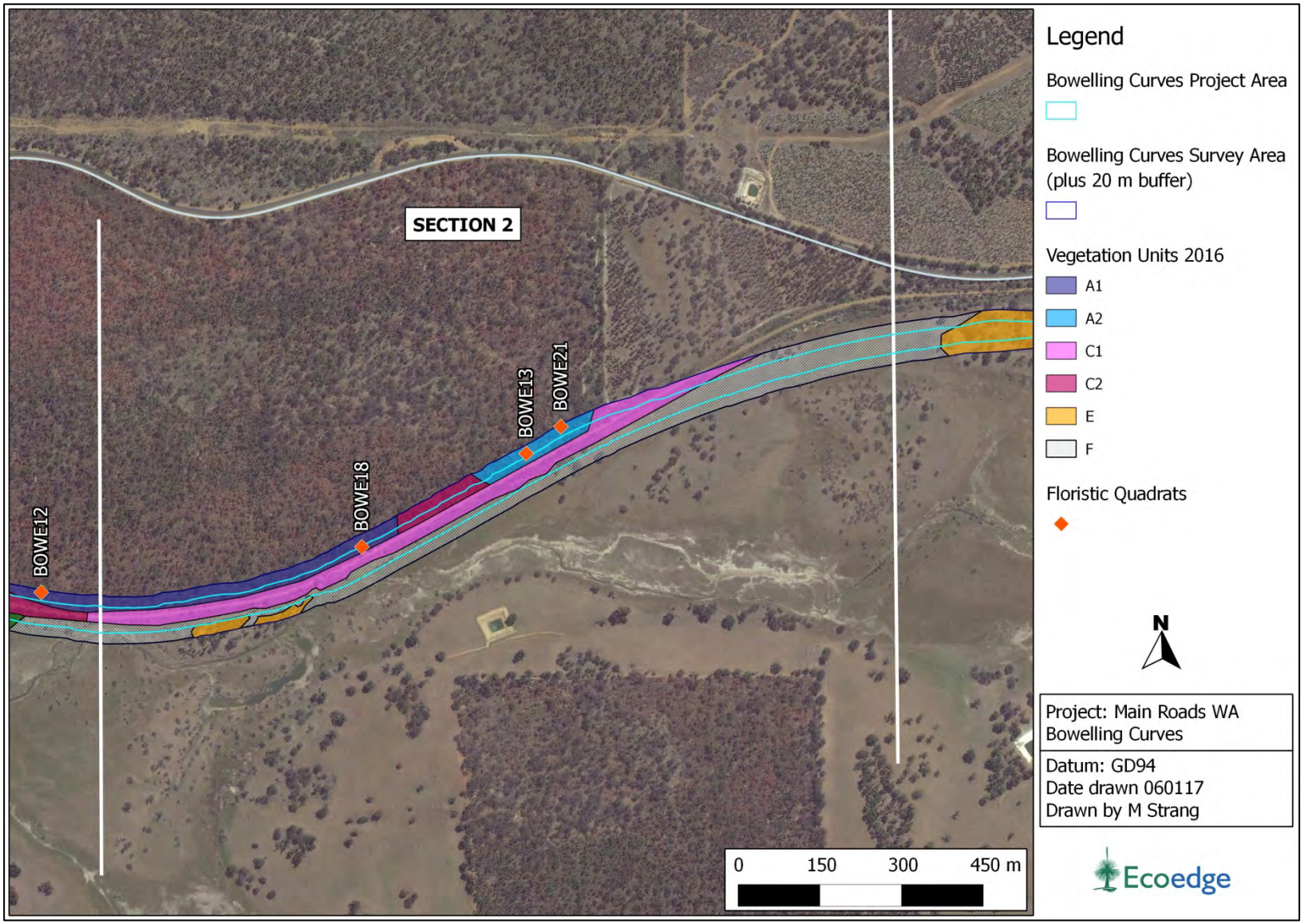


Figure 10. Vegetation units mapped within Section 2 of the Bowelling Survey Area.

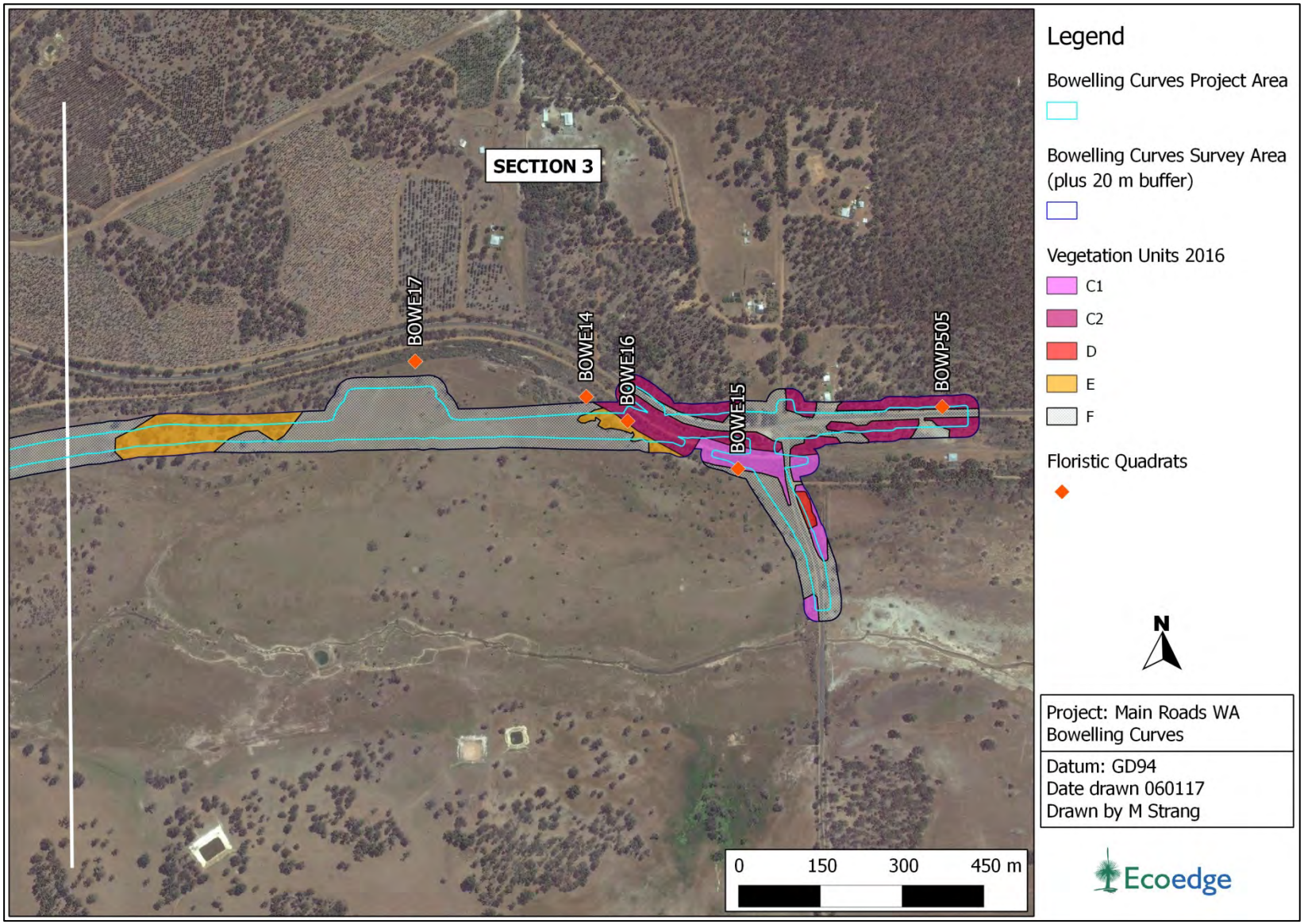


Figure 11. Vegetation units mapped within Section 3 of the Bowelling Survey Area.

3.1.2.2 Floristic Groups from the Multivariate Analysis of Project Area Quadrats

Six floristic groups were derived from the multivariate analysis; A1, A2, B1, B2, C1 and C2 (**Figure 12**). These have been recognised and mapped as vegetation units, along with three other highly modified vegetation units determined from visual and relevé data rather than quadrats (**Table 8**).

Table 8. Vegetation units within the Bowelling Survey Area.

Vegetation Unit	Description	Quadrat
A1	Jarrah-Marri-Wandoo woodland/open forest on mid-/lower slopes	1, 2, 3, 4, 6, 12, 18
A2	Jarrah-Marri-Wandoo woodland/open forest on upper slopes	5, 7, 8, 9, 13.
B1	Wandoo-Marri woodland on lower slopes	10, 20, 499
B2	*Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland	11, 19
C1	*Hakea prostrata-H. varia- M. viminea* tall shrubland	14, 15, 17
C2	Jarrah-Wandoo open forest on heavy gravel on lower slopes	16, 505
D	*Amphibromus nervosus* tall grassland	
E	Marri-Wandoo very open woodland in pasture	
F	Pasture or cleared areas	

Vegetation unit A1 (Jarrah-Marri-Wandoo woodland/open forest on mid and lower slopes), comprising 9 quadrats, was the most homogenous of the groups. In other words, the index of dissimilarity was lowest between the quadrats that make up that group. Unit A2 (Jarrah-Marri-Wandoo woodland/open forest on upper slopes) is floristically similar to A1, and the two units intergrade imperceptibly.

The remaining four floristic groups (Vegetation units B1, B2, C1 and C2) are floristically dissimilar to the aforementioned two groups, and quite dissimilar to each other. Most of the quadrats in these groups are situated in seasonally wet on lower slopes or the floodplain of the Collie River.

Unit B1 (Wandoo-Marri woodland on lower slopes) shares many of its herbaceous taxa with Unit B2, however they are structurally quite different, with B1 characterised by its woodland canopy and B2 being more shrub-dominant. Vegetation unit B2 (*Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland), is a diverse unit, particularly in herbaceous species. One of the quadrats in this unit (BOWE11) contained 40 species, 35 of which were herbaceous (**Appendix 12**).

Vegetation units C1 and C2, while grouped closed together in **Figure 12**, are quite different both structurally and floristically (indicated by the high level of dissimilarity at which they are separated in **Figure 12**). Unit C1 (*Hakea prostrata-H. varia- M. viminea* tall shrubland), like Unit B1, above, is situated on the alluvial soil adjacent to the Collie River. Much of unit C1 had signs of anthropogenic disturbance, primarily through cable-laying, and it was less species rich than vegetation unit C2. The presence of *Melaleuca cuticularis* in parts of this unit indicates that the soil on which it occurs may have relatively high levels of salt.

Vegetation unit C2 (Jarrah-Wandoo open forest on heavy gravel on lower slopes) is represented by two quadrats that are quite dissimilar in composition. However, relevés sampled within this community show that the presence of shrubs such as *Allocasuarina humilis*, *Leptospermum erubescens*, and *Petrophile serruriae*, and the fact that it occurs on "heavy gravels" (with very little sand intermixed with the gravel) sets it apart from units A1 and A2, which may appear superficially similar.

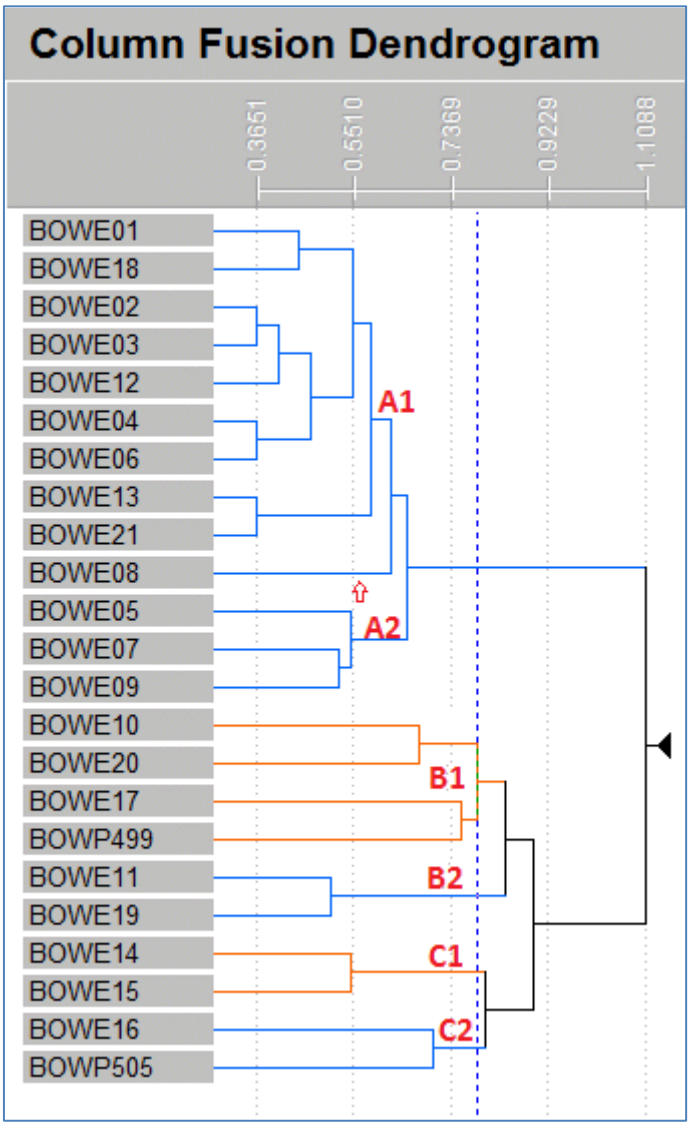


Figure 12. Dendrogram showing floristic groups.

(Note however that Quadrat 17 has been placed with group C1 because of its dominant species and structure)

3.1.2.3 Other Vegetation Units

Three other vegetation units, in which no quadrats were placed, were also identified and mapped within the Survey Area.

Vegetation unit D (*Amphibromus nervosus* grassland) is mainly found at one location near the junction of Coalfields Highway and Bowelling-Duranillin Road. Although *A. nervosus* is a native species, this appears to be an artificially planted community in that the native grass has colonised an old excavation that is flooded to a depth of 20-50 cm during winter and spring.

Vegetation unit E is comprised mainly of Wandoo and Marri trees over pasture, along with a small area of *Melaleuca cuticularis* over pasture.

Vegetation unit F has very few native species and consists mainly of pasture and roadways.

The location and extent of each of the vegetation units within the Survey Area is shown in **Figures 9 -11**; the area of each within the Survey Area is shown in **Table 9**. Photographs and short descriptions of each of the vegetation units are provided in **Appendix 13**.

Table 9. Area of each of the Vegetation units within the Survey Area.

Vegetation Unit	Area (ha)	%
A1	4.1	8.68
A2	7.4	15.53
B1	2.0	4.25
B2	0.8	1.68
C1	4.9	10.22
C2	7.4	15.40
D	0.1	0.28
E	2.5	5.28
F	18.6	38.68
Total	**47.8**	**100.00**

3.1.2.4 Comparison of the Project Area Quadrats with Bennelaking and Boolading Quadrats

The dendrogram output following the comparison of the Survey Area quadrats with 15 floristic quadrats from Bennelaking and Boolading (up to 15 km east of the Project Area) is shown in **Figure 13**, below. The location of the Bennelaking and Boolading quadrats used in the analysis is shown in **Figure 14**.

The grouping of the Bowelling quadrats is somewhat altered when compared with **Figure 12**, above. The A1 and A2 vegetation units are clumped together and form a "supergroup" with seven quadrats from Bennelaking (BENN02 to BENN09) which were also situated in Jarrah-Marri-Wandoo woodland or open forest on sandy gravels or rocky loams.

The "wetland" quadrats from the Bowelling Survey Area (vegetation units B1, B2, C1, and C2) group together mainly with quadrats from Wandoo woodland in the Bennelaking and Boolading areas. The two quadrats from the B2 vegetation unit (*Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland) cluster most closely with quadrats situated in Wandoo woodland on clay-loams in the Bennelaking area. This clumping with Wandoo woodland quadrats on clay-loams is because of a suite of shared herbaceous species, such as *Drosera gigantea*, *Hyalosperma cotula*, *Stylidium crassifolium* and *Philydrella drummondii*.

A larger floristic quadrat comparison dataset which included local wetland sites similar to those in the Survey Area would have provided more clarity with regard to the affinities of the Bowelling vegetation.

3.1.2.5 Comparison of the Bowelling Wetland Quadrats with Swan Coastal Plain Wetland Quadrats

The dendrogram produced by the multivariate analysis comparing the five wetland quadrats from Bowelling with 48 quadrats drawn from the Swan Coastal Plain dataset is shown in Figure 15, below. As can be seen from the dendrogram the five Bowelling quadrats cluster most closely with five SCP quadrats which were assigned to the floristic community type SWAFCT08 (Herb-rich shrublands in clay pans). This FCT is State-listed as a threatened ecological community (Vulnerable) and is also part of the Commonwealth-listed endangered community (Claypans of the Swan Coastal Plain; Department of Parks and Wildlife, 2015b).

However, although the Bowelling quadrats were most closely related to the five SWAFCT08 quadrats the dendrogram separating the two groups diverges at a relatively low level of similarity (shown by the scale at the top of the figure). The high level of dissimilarity between the Bowelling quadrats and SWAFCT is emphasized by the fact that seven of the nineteen "Typical" or "Other common" taxa that characterize SWAFCT08 are found within the Bowelling quadrats (and six of these are weeds). Another comparison was made between the species lists of the five SWAFCT08 quadrats (210 taxa in total) and the five Bowelling quadrats (89 taxa in total). Only 36 taxa (of which 8 were weeds) from the Bowelling quadrats (40%) occurred in at least one of the SWAFCT08 quadrats.

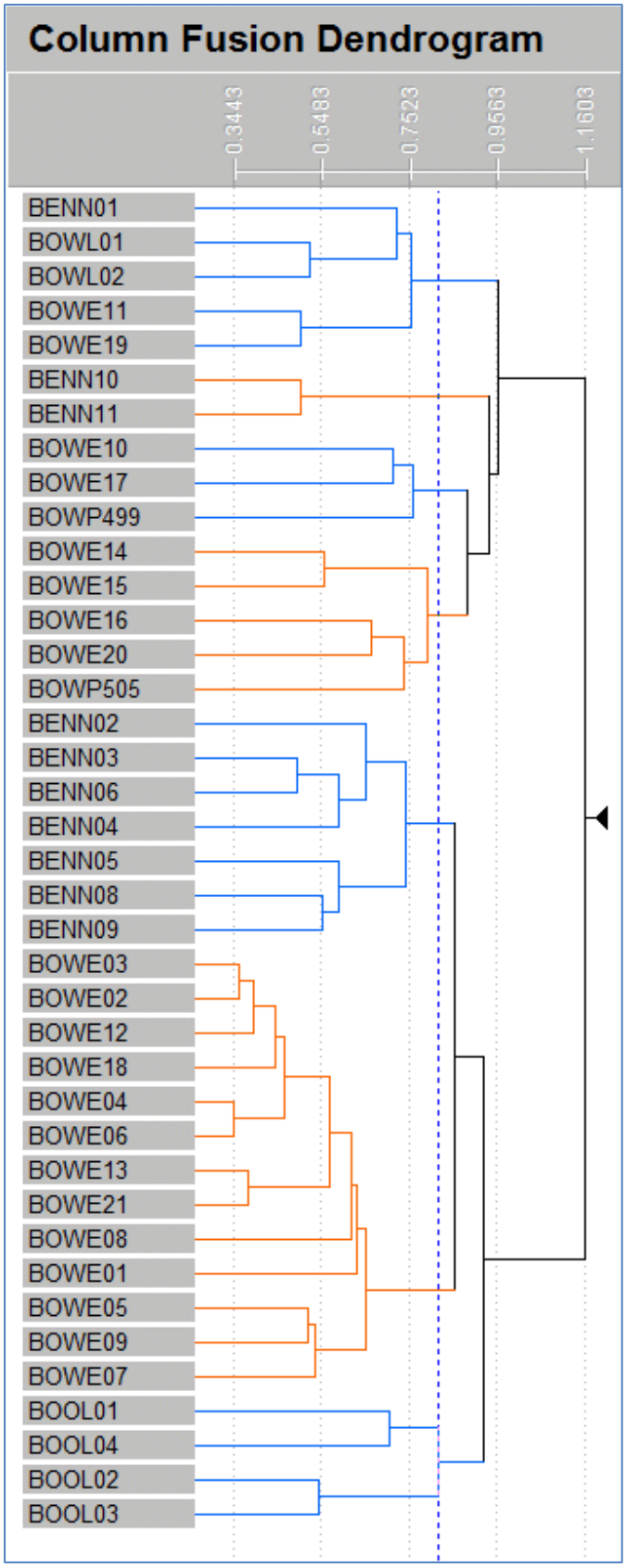


Figure 13. Dendrogram from multivariate comparison of Bowelling Survey Area quadrats with quadrats from the Bennelaking and Boolading areas to the east.

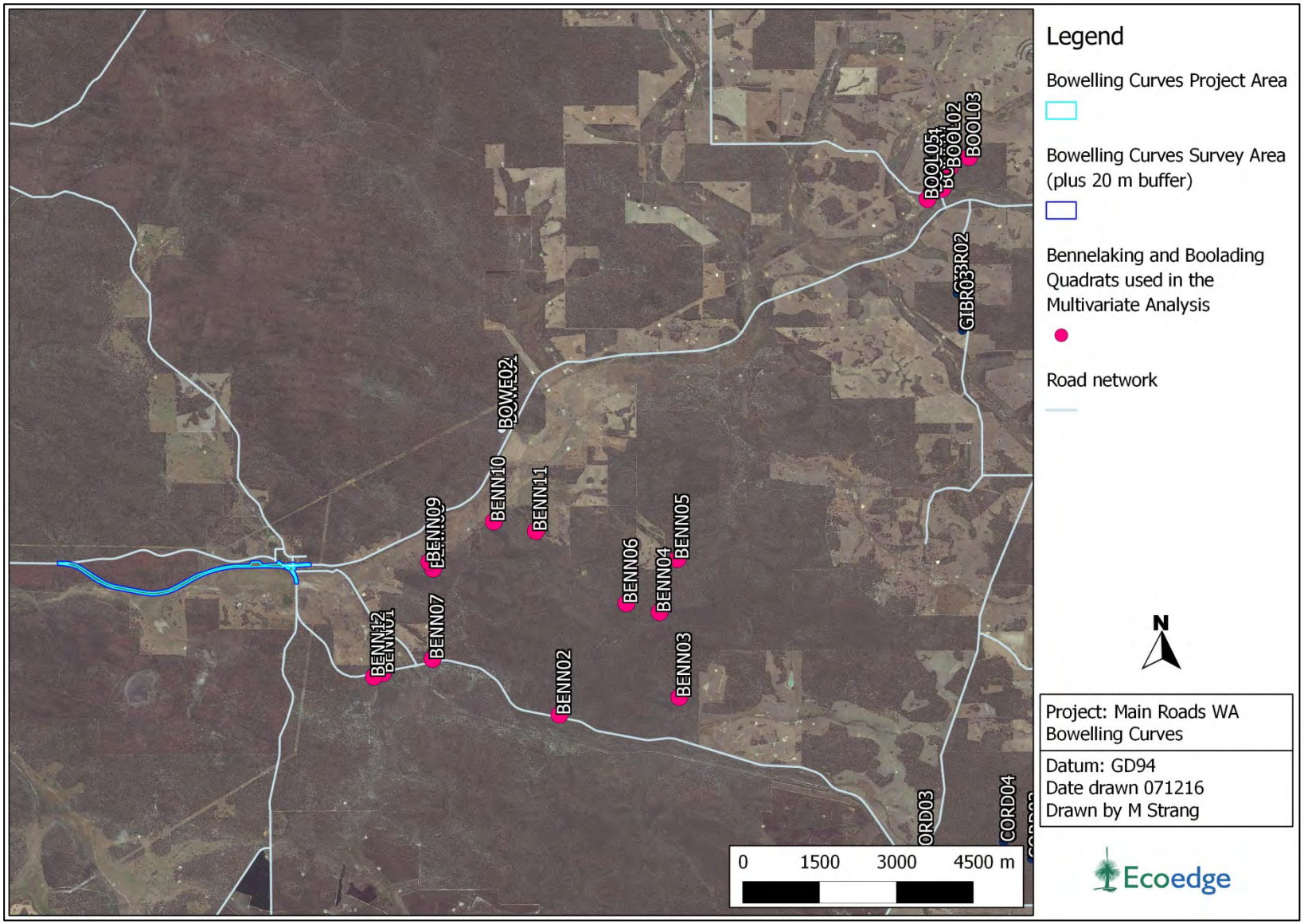


Figure 14. Bennelaking and Boolading quadrats used in the Multivariate Analysis.

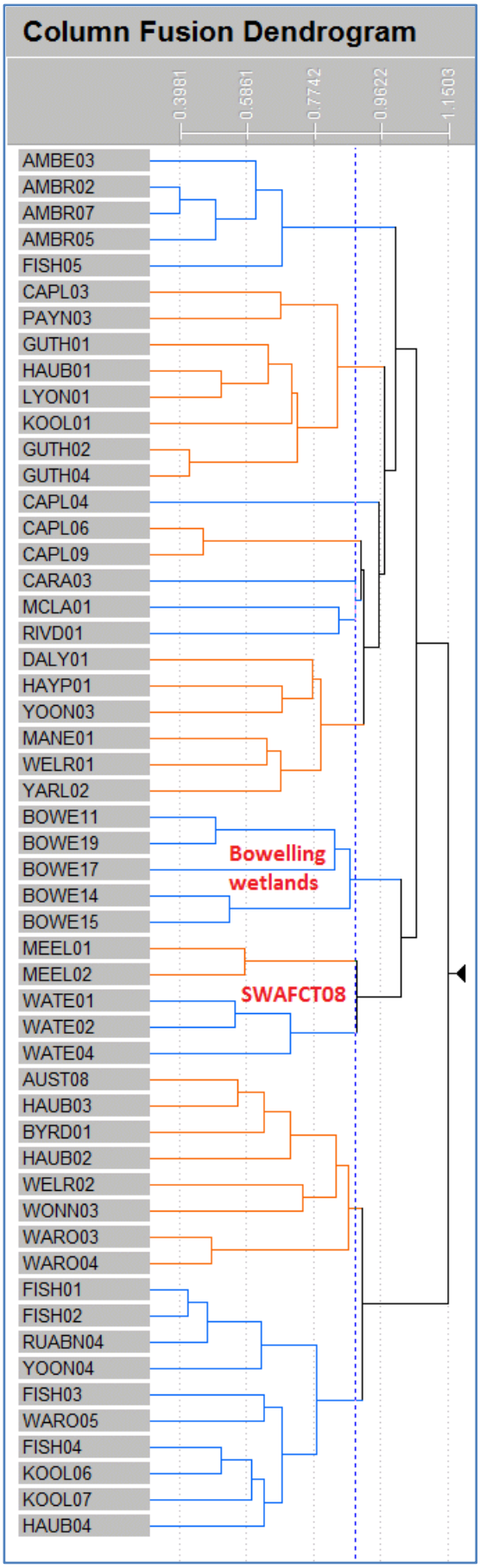


Figure 15. Dendrogram from multivariate comparison of Bowelling Survey Area wetland quadrats with wetland quadrats from the Swan Coastal Plain Survey (Gibson et al., 1994).

3.1.3 Vegetation Condition

A large proportion (49.6%) of the vegetation within the Survey Area was in Very Good or Excellent condition (**Table 14**, **Figures 15 - 17**), with most of the remainder (42%) being Completely Degraded. Much of the Completely Degraded portion consisted of roadways, tracks and pasture with few trees. As mentioned above, some degradation of vegetation has taken place adjacent to the old railway embankment due to the sinking of power or telephone cable(s) many years ago.

Table 10. Vegetation Condition within the Bowelling Survey Area.

Condition	Area (ha)	%
Excellent	16.1	33.7
Very Good/Excellent	6.2	12.7
Very Good	1.5	3.2
Good	0.9	1.9
Degraded	2.8	5.9
Completely Degraded	20.3	42.6
Total	**47.8**	**100.0**

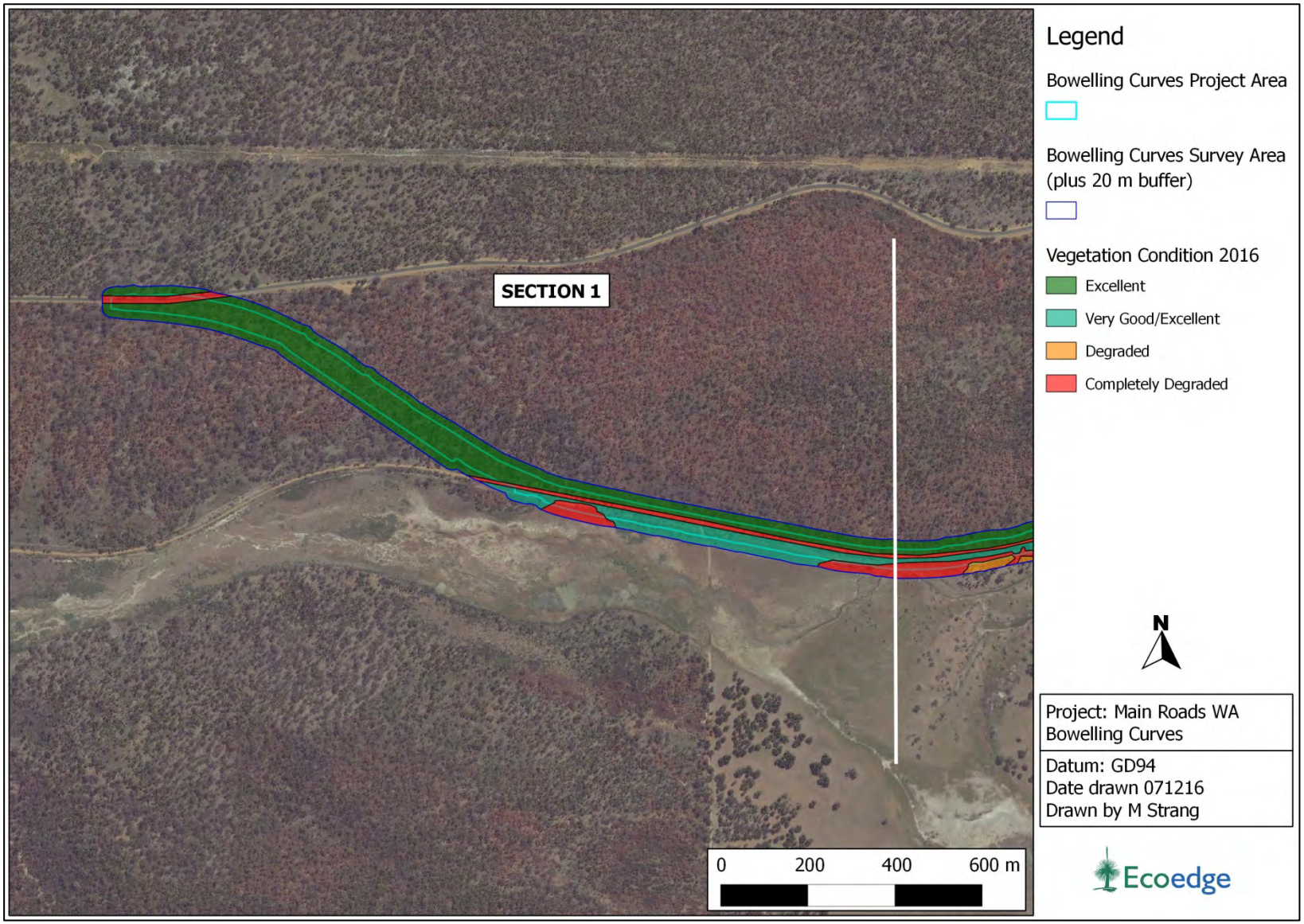


Figure 16. Condition of vegetation within Section 1 of the Bowelling Survey Area.

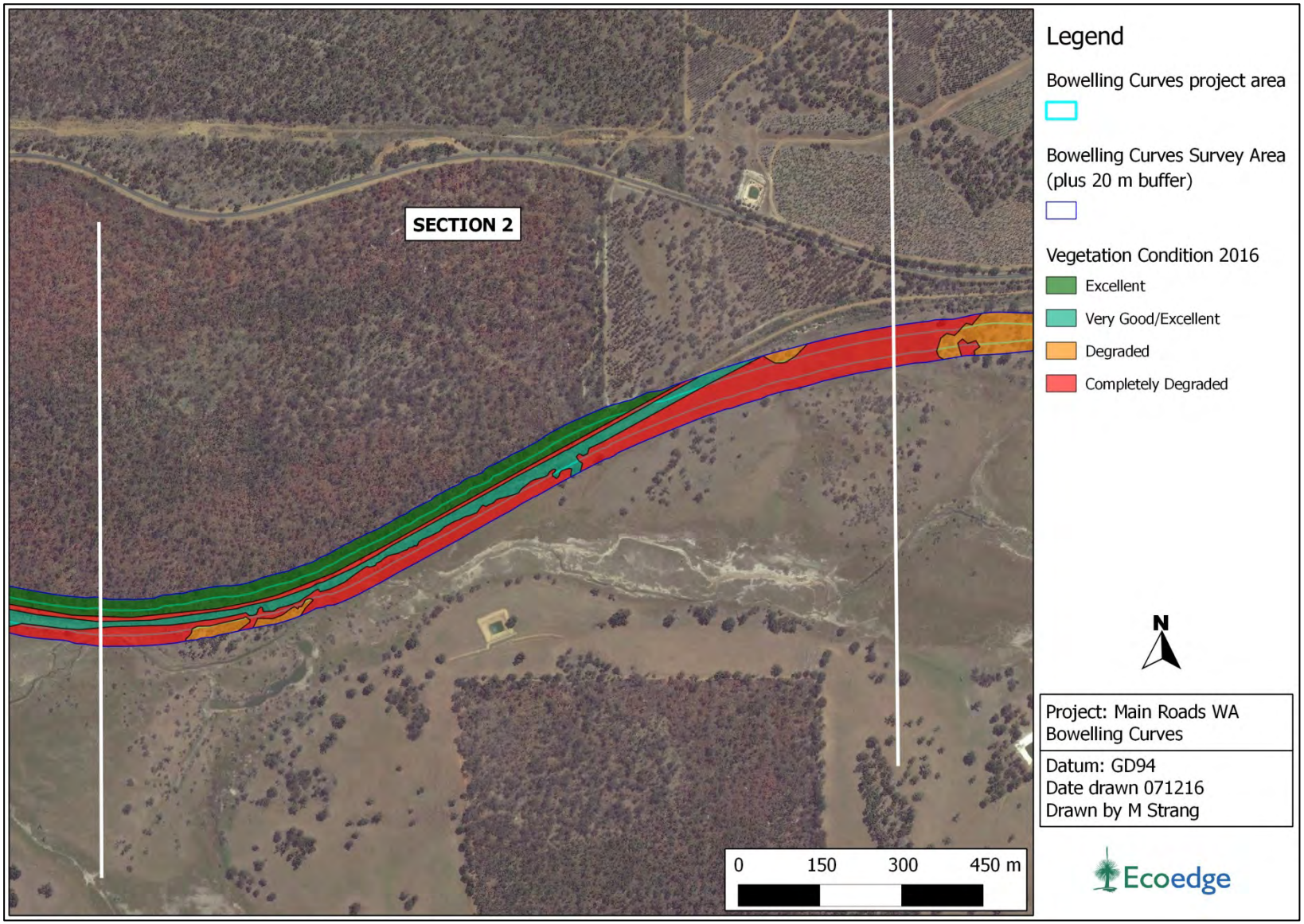


Figure 17. Condition of vegetation within Section 2 of the Bowelling Survey Area.

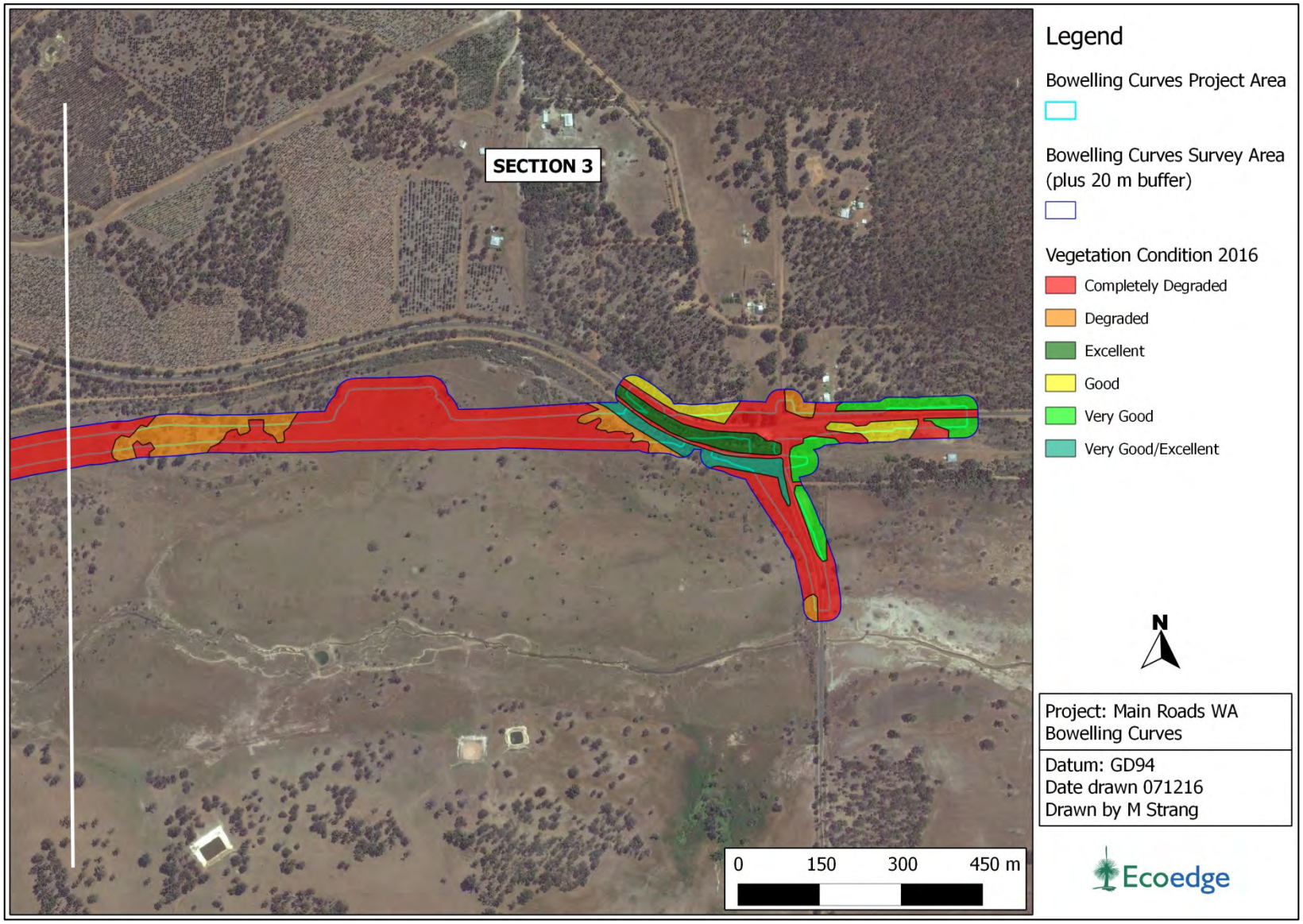


Figure 18. Condition of vegetation within Section 3 of the Bowelling Survey Area.

3.1.4 Flora Inventory

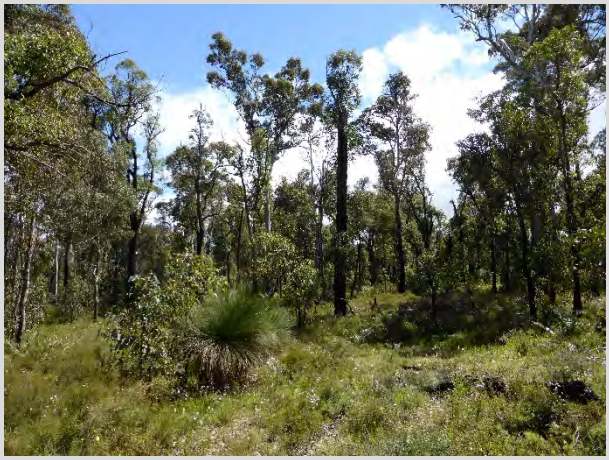
An inventory of flora recorded within the Survey Area is presented in **Appendix 9**.

3.2 Fauna Survey

3.2.1 Fauna Habitat Assessment

Descriptions of the main broadly defined fauna habitats present within the Survey Area, primarily based on the vegetation units identified by Ecoedge (2014) are provided in **Table 11** below.

Table 11. Main Fauna Habitats within the Survey Area.

Code	Fauna Habitat Description	Example Image
A1	**Open forest of Jarrah, (Marri), (Wandoo)** over shrubland/low shrubland of *Acacia pulchella*, *Banksia dallanneyi*, *Bossiaea ornata*, *Chamaescilla corymbosa*, *Leucopogon capitellatus*, *Trymalium ledifolium*, (Xanthorrhoea preissii) over open herbland of *Craspedia variabilis*, *Desmocladus fasciculatus*, *Drosera erythrorhiza*, *Lagenophora huegelii*, *Loxocarya cinerea*, *Stylidium affine* and *Trichocline spathulata*. Total Area = 4.1 ha (~8.7%)	
A2	**Open forest of Jarrah, Marri, (Wandoo)** over shrubland/low shrubland of *Acacia pulchella*, *Hakea lissocarpha*, (*Grevillea bipinnatifida*), *Hibbertia commutata*, (*Leucopogon subsejunctus*), (*Trymalium ledifolium*) over open herbland/grassland of *Drosera erythrorhiza*, *Hyalosperma cotula*, *Lagenophora huegelii*, *Loxocarya cinerea*, *Millotia tenuifolia*, *Neurachne alopecuroidea*, *Stylidium affine*, *S. piliferum* and *Trichocline spathulata*. Total Area = 7.4 ha (~15.5%)	

Code	Fauna Habitat Description	Example Image
B1	**<u>Woodland of Wandoo or Marri</u>** over open low shrubland of *Acacia pulchella*, *Grevillea bipinnatifida*, *Hakea varia*, *Hypocalymma angustifolium* over open herbland/grassland of **Briza maxima*, *Neurachne alopecuroidea*, **Lysimachia arvensis*, *Hypolaena exsulca*, *Sowerbaea laxiflora* and *Stylidium crassifolium*. Total Area = 2.0 ha (~4.2%)	
B2	**<u>Tall Open Shrubland</u>** of *Melaleuca viminea*, *Hakea prostrata*, *Kunzea ciliata* and *Verticordia pennigera* over a diverse herbland including *Drosera gigantea*, *D. glanduligera*, *Chamaescilla corymbosa*, *Stylidium crassifolium* and open sedgeland of *Apodasmia ceramophila*. Total Area = 0.8 ha (~1.7%)	
C1	**<u>Low woodland/ tall shrubland</u>** of *Hakea prostrata-H. varia- M. viminea* tall shrubland (sometimes with *M. cuticularis* as shown in the photograph), *Kunzea ciliata* and *Verticordia pennigera* or tall shrubland of *Hakea trifurcata*, *H. varia* and *Pericalymma ellipticum*. Total Area = 4.9 ha (~10.2%)	

Code	Fauna Habitat Description	Example Image
C2	**Open forest of Jarrah, Wandoo** over shrubland/low shrubland of *Allocasuarina humilis*, *Banksia squarrosa*, *Hakea lissocarpha*, *H. prostrata*, *H. trifurcata*, *Kunzea recurva*, *Petrophile serruriae* and *Xanthorrhoea preissii*. Total Area = 7.4 ha (~15.4%)	
E	**Woodland** of Marri, Wandoo, *Melaleuca cuticularis* (occasional) over pasture species. Total Area = 2.5 ha (~5.3%)	
D/F	Cleared, Pasture or Grassland. Includes road verges, paddocks of herbaceous weed species and a small area of tall native grassland of *Amphibromus nervosus.* Total Area = 18.7 ha (~39.0%)	

Code	Fauna Habitat Description	Example Image
-	Collie River East – Ephemeral stream with variable flows controlled by seasonal conditions, passing through cleared pasture. Linear Extent = ~70 metres.	

The quality of the various areas of native remnant vegetation within the Survey Area varies but most areas show signs of various degrees of historical disturbance from logging, frequent fire, gravel extraction and previous road/track making activities. Remnant vegetation within private landholdings has been open to livestock grazing and vegetation structure has been significantly altered with only larger trees persisting.

3.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in **Appendix 6**. A total of 53 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the Survey Area during the day time surveys. The presence of four introduced species was also confirmed.

Evidence of two listed threatened species was observed (Carnaby's Black-Cockatoo (chewed marri and jarrah fruits) and Forest Red-tailed Black-Cockatoo (individuals and chewed marri and jarrah fruits). Several individuals of the listed migratory species, the Rainbow Bee-eater, were also observed foraging onsite. No evidence of any DPaW priority species using the area was found.

3.2.3 Black Cockatoo Habitat Assessment

A summary of the potential black cockatoo breeding trees (using DotEE criteria i.e. any suitable tree species with a DBH $\geq$ 50cm ($\geq$30cm for wandoo) (SEWPaC 2012)) observed within the Survey Area is provided in **Table 12** below and their location shown in **Figure 18**.

The assessment identified a total of 584 "habitat trees" within the fauna survey area. The majority (422, ~72.3%) of the trees were not observed to contain hollows of any size. One hundred and sixty two (~27.7%) of the trees contained one or more "small" hollows (less than ~10cm entrance size) considered by the Author not to be suitable for black cockatoos to use for nesting purposes. Nine (~1.5%) trees appeared to contain hollows with larger entrances (greater than ~10cm) that appeared big enough to possibly allow the entry of a

black cockatoo into a suitably sized and orientated branch/trunk, though none showed any sign of current or previous use for this purpose.

Additional details on each habitat tree observed can be found in **Appendix 14**.

Table 12. Summary of potential cockatoo breeding habitat trees (DBH >50cm (>30cm for wandoo)).

Number of Trees ≥50cm DBH (≥30cm for wandoo)	Number of Trees with No Hollows Observed	Number of Trees with Hollows Considered Unsuitable for Nesting Black Cockatoos	Number of Trees with Hollows Considered Possibly Suitable for Nesting Black Cockatoos	Tree Species				
				Wandoo	jarrah	Marri	Flooded Gum	Unknown (Dead)
584	422	162	9	276	178	97	5	28

Almost all areas of remnant native vegetation present within the Survey Area can be considered to represent potential black cockatoo foraging habitat as they contain a range of plant species documented as foraging habitat for one or more of the three black cockatoo species, all of which are known to frequent the area. The degree to which any one section of the route would be utilised for foraging purposes would however vary considerably based on species composition and density. Generally, the most dominant and widespread species are marri and jarrah though in some areas other species are also present (e.g. sheoak and *banksia*).

Foraging evidence left by Carnaby's and the forest red-tailed black-cockatoo was observed during the survey period at several locations and included chewed marri and jarrah fruits.

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

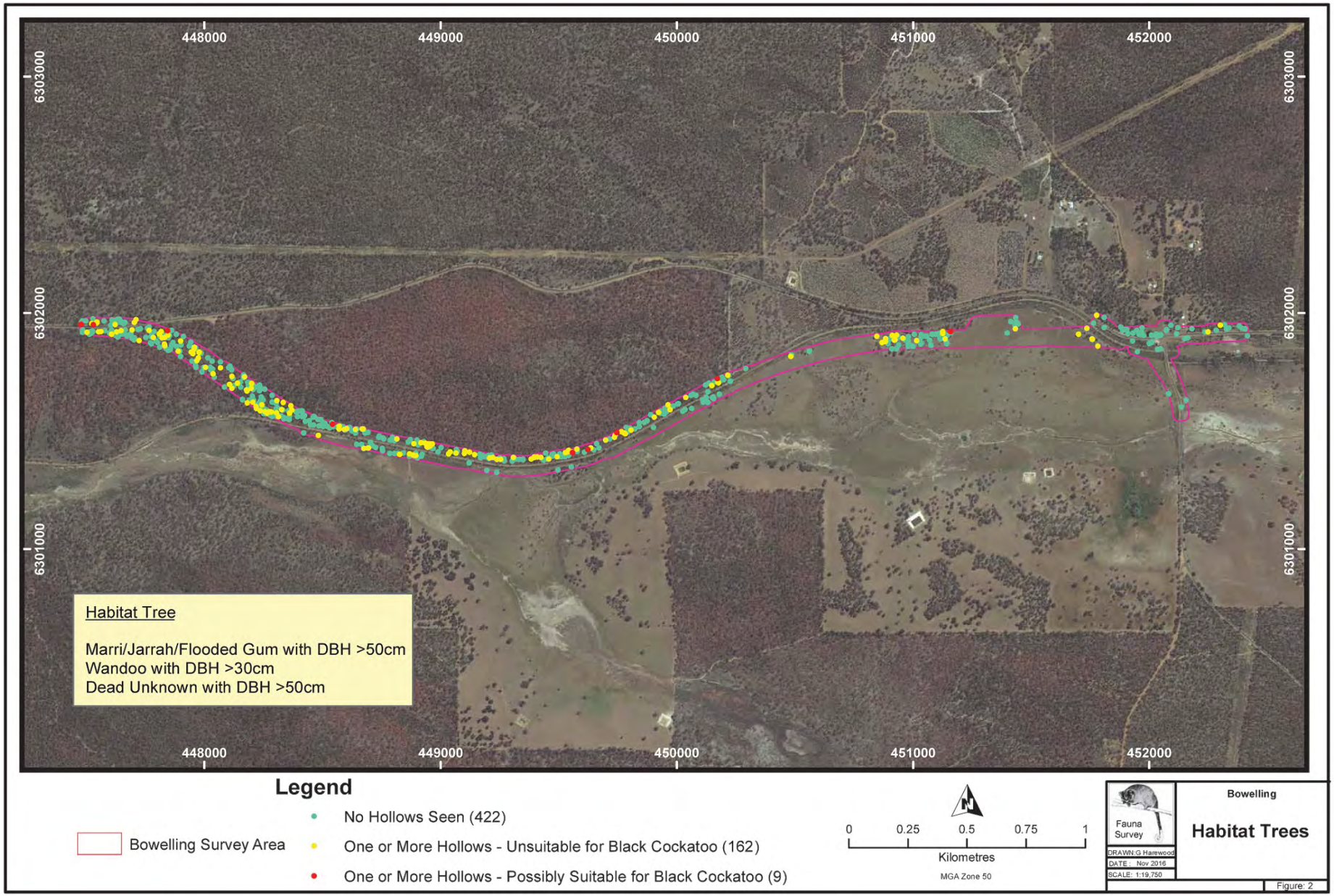


Figure 19. Habitat trees mapped within the Survey Area.

3.2.4 Fauna Inventory – Summary

3.2.4.1 Vertebrate Fauna

Table 13 summarises the number of vertebrate fauna species potentially occurring within or utilising at times the Survey Area, based on results from the desktop study and observations made during the field assessment. A complete list of vertebrate fauna possibly inhabiting or frequenting the Survey Area is located in **Appendix 6**.

Table 13. Summary of Potential Fauna Species (as listed in **Appendix 6**).

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species observed field survey 2014
Fish	4[1]	0	0	0	1[1]
Amphibians	12	0	0	0	1
Reptiles	37	0	0	0	3
Birds	104[1]	4	3	1	48[1]
Non-Volant Mammals	18[6]	2	0	2	4[2]
Volant Mammals (Bats)	9	0	0	1	0
Total	**184[8]**	**6**	**3**	**4**	**55[4]**

Superscript = number of introduced species included in total.

Not all species listed as potentially occurring within the Survey Area in existing databases and publications (i.e. EPBC Act Threatened Fauna and Migratory species lists, DPaW's NatureMap database, various reports and publications) are shown in the expected listing in **Appendix 6**. Some species have been excluded from this list based largely on the lack of suitable habitat at the study site and in the general area or known local extinction even if suitable habitat is present.

Despite the omission of some species, it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species are likely to be present within the bounds of the Survey Area.

3.2.4.2 Vertebrate Fauna of Conservation Significance

A review of the EPBC Act threatened fauna list, DPaW's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified over 24 specially protected, priority or migratory vertebrate fauna species as potentially occurring in the general vicinity of the Survey Area. Of these species, those that have no potential whatsoever to utilise the Survey Area for any purpose have been omitted from the potential list for the site (**Appendix 6**), principally due to lack of suitable habitat on-site (including extent and/or quality) or known local/regional extinction.

In summary, three vertebrate fauna species of conservation significance (listed as State or Federal threatened/migratory species or DPaW priority species) were positively identified as utilising the Survey Area for some purpose during the survey period, these being:

- *Calyptorhynchus latirostris* Carnaby`s Black-Cockatoo – S2 (WC Act), Endangered (EPBC Act)
  Foraging evidence attributed to this species found.

- *Calyptorhynchus banksii naso* Forest Red-tailed Black-Cockatoo – S3 (WC Act), Vulnerable (EPBC Act)
  Sighted several times within the survey area and nearby. Foraging evidence attributed to this species also found.

- *Merops ornatus* Rainbow Bee-eater – S5 (WC Act), Migratory (EPBC Act)
  Several individuals observed within the Survey Area foraging during the survey period.

Based on the habitats present and current documented distributions, it is considered possible that 10 additional species may use the Survey Area for some purpose at times, although as no evidence of presence or use was found at the time of the field survey, the status of some in the area remains uncertain. Habitat for some of these species on-site, while considered possibly suitable, may be marginal in extent/quality and the species listed may only be present within the survey area in low numbers and/or for short periods.

These species are:

- *Ardea alba* Great Egret – S5 (WC Act), Migratory (EPBC Act)
  Potentially utilises watercourses, wetlands, drains and paddocks though the quality of most of these habitats are marginal due to historical disturbance such as native vegetation clearing. Would not breed within the Survey Area.

- *Ardea ibis* Cattle Egret – S5 (WC Act), Migratory (EPBC Act)

Potentially utilises watercourses, wetlands, drains and paddocks though the quality of most of these habitats are marginal due to historical disturbance such as native vegetation clearing. Would not breed within the Survey Area.

- *Falco peregrinus* Peregrine Falcon – S7 (WC Act)
  Uncommon so unlikely to be resident in area but study site may form part of larger home range. No potential nest sites observed.

- *Calyptorhynchus baudinii* Baudin`s Black-Cockatoo – S2 (WC Act), Vulnerable (EPBC Act)
  The Survey Area is within the documented distribution of this species and while not observed it may occur on occasions.

- *Tyto novaehollandae* Masked Owl – P3 (DPaW Priority Species)
  Status on the site and in the general area difficult to determine. May occur on rare occasions.

- *Phascogale tapoatafa ssp* - Southern Brush-tailed Phascogale – S3 (WC Act)
  This species is known to persist in state forest and national park areas surrounding Collie and therefore it may frequent the study site.

- *Dasyurus geoffroii* Chuditch – S3 (WC Act), Vulnerable (EPBC Act)
  Actual status on the site difficult to determine. This species is however known to frequent the general area and therefore may utilise sections of the Survey Area at times.

- *Isoodon obesulus fusciventer* Quenda – P4 (DPaW Priority Species)
  Most of the Survey Area appears unsuitable for this species due to a lack of dense groundcover but it may persist at locations where native vegetation provides sufficient cover.

- *Macropus irma* Western Brush Wallaby – P4 (DPaW Priority Species)
  This species is known to frequent forest areas around Collie in low densities.

- *Falsistrellus mackenziei* Western False Pipistrelle - P4 (DPaW Priority Species)
  The current status of this species in general area is difficult to determine but may be utilising woodland areas as roosting and foraging habitat.

A number of other species of conservation significance, while possibly present in the general area, are not listed as potential species due to known localised extinction (and no subsequent recruitment from adjoining areas) and/or lack of suitable habitat and/or the presence of feral predators. Details on these species and reasons for their omission from the potential listing are provided in **Appendix 15** and **Table 14.**

3.2.4.3 Invertebrate Fauna of Conservation Significance

A single priority invertebrate species appeared in the DPaW database search (DPaW 2016) this being *Pachysaga munggai*, an unnamed cricket species classified as Priority 3. The status of this species within the Survey Area is difficult to determine however most the Survey Area appears unsuitable as heathland and leaf litter are typically absent/sparse.

Even if present, it is considered unlikely that any part of the proposed realignment that passes through native forest would represent an area of significance for this species given the extent of similar habitat in surrounding areas. Additional detail on this species is provided in **Appendix 15** and **Table 14**.

Table 14. Likelihood of Occurrence and Possible Impacts – Fauna Species of Conservation Significance.

Common Name	Genus & Species	Consv. Status	Habitat Present	Likelihood of Occurrence	Possible Impacts/ Significance of Possible Impacts	Area of Habitat Loss*
Unnamed cricket	*Pachysaga munggai*	P3	No?/ Marginal?	Unlikely to Occur	None Identified/Negligible	None
Darling Range Heath Ctenotus	*Ctenotus dell*	P4	Yes/ Marginal	Possibly Occurs but could be out of species range?	Loss/modification of small areas of habitat/Very Low	All forest/woodland areas with native understory Total Area = ~20.9 ha
Malleefowl	*Leipoa ocellata*	S3, VU	No	Would Not occur - species locally extinct	None Identified/Negligible	None
Great Egret	*Ardea alba*	S5, Mig	Yes/ Marginal	Possibly Occurs	Loss/modification of very small areas of degraded habitat/Negligible	Paddock areas (including very open woodlands) and Collie River Total Area = ~21.2ha
Cattle Egret	*Ardea ibis*	S5, Mig	Yes/ Marginal	Possibly Occurs	Loss/modification of very small areas of degraded habitat/Negligible	Paddock areas (including very open woodlands) and Collie River Total Area = ~21.2ha
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Mig	No	Would Not Occur	None Identified/Negligible	None
Peregrine Falcon	*Falco peregrinus*	S7	Yes	Possibly Occurs	Loss/modification of very small areas of foraging habitat/Negligible	None

Common Name	Genus & Species	Consv. Status	Habitat Present	Likelihood of Occurrence	Possible Impacts/ Significance of Possible Impacts	Area of Habitat Loss*
Migratory Shorebirds/Wetland Species	Various	S5, Mig	No/ Very Marginal	Would Not Occur	None Identified/Negligible	None
Carnaby`s Black Cockatoo	*Calyptorhynchus latirostris*	S2, EN	Yes	Known to Occur	Loss of small areas of habitat/Low	All forest/woodland and shrubland areas Total Area = ~29.1 ha
Baudin`s Black Cockatoo	*Calyptorhynchus baudinii*	S2, VU	Yes	Possibly Occurs	Loss of small areas of habitat/Low	All forest/woodland and shrubland areas Total Area = ~29.1 ha.
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	S3, VU	Yes	Known to Occur	Loss of small areas of habitat/Low	All forest/woodland and shrubland areas Total Area = ~29.1 ha
Barking Owl (SW population)	*Ninox connivens connivens*	P2	No	Would Not Occur	None Identified/Negligible	None
Masked Owl (SW population)	*Tyto n. novaehollandiae*	P3	Yes	Possibly Occurs	Loss/modification of small areas of habitat/Low	All forest/woodland areas Total Area = ~20.9 ha
Fork-tailed Swift	*Apus pacificus*	S5, Mig	Yes	Unlikely to Occur	None Identified/Negligible	None
Rainbow Bee-eater	*Merops ornatus*	S5, Mig	Yes	Known to occur	Loss/modification of small areas of habitat/Negligible	All forest/woodland areas Total Area = ~20.9 ha

Common Name	Genus & Species	Consv. Status	Habitat Present	Likelihood of Occurrence	Possible Impacts/ Significance of Possible Impacts	Area of Habitat Loss*
Chuditch	*Dasyurus geoffroii*	S3, VU	Yes/ Marginal	Possibly Occurs	Loss/modification of a very small area of habitat/Very Low	All forest/woodland areas with native understory Total Area = ~20.9 ha
Numbat	*Myrmecobius fasciatus*	S3, VU	Yes	Would Not Occur - species locally extinct	None Identified/Negligible	None
Southern Brush-tailed Phascogale	*Phascogale tapoatafa ssp*	S3	Yes	Possibly Occurs	Loss/modification of small areas of habitat/Very Low	All forest/woodland areas Total Area = ~20.9 ha
Southern Brown Bandicoot	*Isoodon obesulus fusciventer*	P4	Yes/ Marginal	Possibly Occurs	Loss/modification of small areas of habitat/Very Low	All forest/woodland areas with native understory Total Area = ~20.9 ha
Bilby	*Macrotis lagotis*	S3, VU	No	Would Not Occur - species regionally extinct	None Identified/Negligible	None
Western Brush Wallaby	*Macropus irma*	P4	Yes	Possibly Occurs	Loss/modification of small areas of habitat/Very Low	All forest/woodland areas with native understory Total Area = ~20.9 ha
Woylie	*Bettongia penicillata ogiby*	S2, EN	No	Would Not Occur - species locally extinct	None Identified/Negligible	None
Tammar	*Macropus eugenii*	P4	No	Would Not Occur - species locally extinct	None Identified/Negligible	None

Common Name	Genus & Species	Consv. Status	Habitat Present	Likelihood of Occurrence	Possible Impacts/ Significance of Possible Impacts	Area of Habitat Loss*
Quokka	*Setonix brachyurus*	S3, VU	No	Would Not Occur	None Identified/Negligible	None
Western False Pipistrelle	*Falsistrellus mackenziei*	P4	Yes	Possibly Occurs	Loss/modification of small areas of habitat/Negligible	All forest/woodland areas Total Area = ~20.9 ha

* Note: the figures provided in the 'Area of Habitat Loss' column relate to the total extent of each habitat type within the Survey Area, which is likely to be substantially greater than any actual area lost as a result of the proposed road widening and realignment.

4 Discussion and conclusions

4.1 Flora and Vegetation Survey

4.1.1 Conservation Status of the Flora

Based on herbarium records, *Leucopogon subsejunctus* is restricted to an area east of Collie, at the eastern margins of the jarrah forest stretching from Bowelling to Duranillin and south to near Haddleton Nature Reserve – a distance of 20 km North-South and 20 km East-West. There are 29 NatureMap (DPaW, 2016c) records for the species, and about 10 separate populations. The population within the Bowelling Survey Area appears to form the most northerly part of the species' distribution.

Synaphea hians has a much wider distribution, ranging from near Bowelling west to the Cowaramup area. It is represented by 67 records in NatureMap. During the 2014 survey, approximately 20 plants of *Synaphea hians* were located under the powerline about 180 m east of the present Survey Area.

4.1.2 Conservation Status of the Vegetation

No regional survey of the vegetation of the eastern jarrah forest has been undertaken that has defined vegetation units at the level of the "floristic community type", such as those undertaken for the Swan Coastal Plain (SCP) and Whicher Scarp. Consequently, unlike with the SCP and Whicher Scarp, it is not possible to determine if any of the vegetation units identified in this survey and listed in **Table 12** (which correspond to floristic community types) are restricted in distribution. At the broader level of the vegetation complex, the mapping by Mattiske and Havel (1998) demonstrates that they all meet the EPA's 15% reservation targets (EPA, 2006) (see **Table 3**, above).

The Jarrah, Marri and Wandoo open forests on gravelly sand within the Survey Area (vegetation units A1 and A2) are similar to several of the vegetation types identified by Smith (2007) that occur widely throughout the eastern jarrah forest (State forest) and reserves, from Boddington in the north to Boyup Brook in the south. There are some small patches in the Survey Area where only Wandoo occurs, however, generally there is a mixture of Wandoo and Marri or Jarrah and Marri.

Some woodlands with Wandoo as a dominant species are eligible for inclusion within the "Eucalypt Woodlands of the Western Australian Wheatbelt" TEC, which is listed as Critically Endangered under the *EPBC Act* (DotEE, 2015a). However, areas of Wandoo woodland that occur on the Darling Range (such as the Survey Area) or where Jarrah and Marri are co-dominants are not included within the "Eucalypt Woodlands of the Western Australian Wheatbelt" TEC (DotEE, 2015b).

4.1.2.1 Unit B2: Melaleuca viminea-Hakea prostrata-Kunzea ciliata tall open shrubland

The *Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland unit (Vegetation unit B2), which is rich in herbaceous species, is associated with the broad, shallow valley of

the Collie River East, much of which has been cleared for agriculture. Of the vegetation units identified within the Survey Area, Vegetation unit B2 is very likely a restricted "floristic community type".

Aerial photography demonstrates that most of the native vegetation of the Harris soil-landscape subsystem (Tille, 1996) (**Section 1.4**) found along the Collie River East has been cleared for agriculture, or has been used for livestock grazing over many years. A check of areas of native vegetation at several places along the Collie River East to the west of the Survey Area with similar *M. viminea* dominated vegetation, showed there had been degradation of these areas due to past livestock grazing. By contrast, the *Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland unit within the Survey Area appears not to have been subjected to livestock grazing and consequently is in better condition.

DPaW has given advice that Vegetation unit B2 is potentially an occurrence of the Federally-listed TEC "Claypans of the Swan Coastal Plain"[5], which is Critically Endangered. This TEC comprises four separate State-listed TECs and one PEC. Of these, it would most likely be an occurrence of the "Clay pans with shrubs over herbs" PEC, which is included within the Federally-listed TEC and which occurs on the Darling Plateau (DPaW, 2015b).

4.1.2.2 Unit C1: Hakea prostrata-H. varia- M. viminea tall shrubland

Vegetation Unit C1 is situated on alluvial soil adjacent to the Collie River. Some parts of this Vegetation unit have the small tree *Melaleuca cuticularis* as a component. Areas where *M. cuticularis* is present are regarded by DPaW as of relatively high conservation value[6]. *M. cuticularis* occurred in the two quadrats placed within this Vegetation unit (BOWE14, BOWE17), however both these quadrats are situated just outside the Project Area. *M. cuticularis* is quite uncommon within the Project Area.

As demonstrated by the multivariate analysis that compared five quadrats from Bowelling vegetation units B2 and C1 with a range of other wetland quadrats from the Swan Coastal Plain Survey (Gibson *et al*., 1994) – see Section 3.1.2.5 above – the Project Area quadrats clustered most closely with quadrats designated as the SWAFCT08 (part of the Claypans of the Swan Coastal Plain" TEC). Nevertheless, the fact that there is only a low level of floristic similarity (40%) between the Bowelling wetland quadrats and those from the SWAFCT08 quadrats and the low representation of "Typical" and "Other common" SWAFCT08 taxa in the Bowelling quadrats would cast doubt on any assignation of the Project Area quadrats to that particular threatened community.

However, the fact that it occurs within a clay pan and contains a very rich herbaceous flora indicates that it is very likely that unit B2, at least, would be placed in the "Clay pans with

[5] Mr. A. Webb, DPaW, Bunbury, email 5/12/2016.
[6] Correspondence from Mr. A. Webb, DPaW, Bunbury, 2/08/2016.

shrubs over herbs" community once further surveys have been carried out. Only 0.8 ha of this vegetation unit occurs within the Survey Area[7], and there is no other known occurrence within 5 km of the Project Area.

Consequently, it is strongly recommended that the B2 Vegetation unit within the Bowelling Project Area be treated as if it is an occurrence of the State-listed "Clay pans with shrubs over herbs" PEC and the Federally-listed TEC "Claypans of the Swan Coastal Plain".

4.2 Fauna Survey

4.2.1 Local and Regional Conservation Significance of the Survey Area

In relation to fauna, the conservation significance of the Survey Area has been assessed by applying site specific criteria such as:

- Fauna species and/or habitat present that is poorly represented in the general Survey Area;
- Fauna habitat within the general Survey Area supporting species of conservation or other significance;
- Fauna habitat in better condition than other similar locations in general Survey Area.

The results of the fauna assessment indicate that the study site hosts or potentially hosts a range of fauna species some of which are of special conservation significance. The extent of habitat suitable for those species identified as utilising the Survey Area does however extend well outside the Survey Area and these fauna habitats are therefore well represented in adjoining state forest areas.

No evidence was gathered that suggest habitats within the potential realignment corridor are in a significantly better condition that those found in adjoining areas. These facts suggest that the Survey Area itself does not have any specific local conservation significance above that of adjoining areas.

4.3 Value of the Survey Area as a Regional Ecological Linkage/Wildlife Corridor

Due to the large tracts of intact vegetation in the State Forest surrounding much of the Project Area, any clearing associated with the realignment of Collie-Lake King Road is not likely to have a significant impact on the function or viability of the nearby regional ecological linkage in regards to flora and vegetation.

With regards to fauna, the clearing required will necessitate the removal of relatively thin, discontinuous sections of vegetation located at various points along the proposed road realignment. The degree of clearing required will not fragment any potential fauna habitat

[7] About 0.4 ha of this occurrence is within the Project Area.

to the extent that it would represent a barrier to fauna movement above that already present in the area (i.e. the existing road and network of other tracks and powerline easements).

4.4 Environmentally Sensitive Areas

There are no known Declared Rare Flora or recognised TECs within the Project Area; as such, there are currently no Environmentally Sensitive Areas (ESA) associated with the Project Area.

However, should Vegetation Unit B2 be recognised as an occurrence of the Federally-listed TEC "Claypans of the Swan Coastal Plain" then this may trigger the creation of an ESA.

5 Conclusion

5.1 Flora and Vegetation

The flora and vegetation assessment was carried out to characterise the vegetation present and determine the presence of any Threatened or Priority flora or flora otherwise of conservation significance.

5.1.1 Potential Impacts in Regards to Flora and Vegetation

Potential impacts resulting from the proposed road realignment are the loss of vegetation communities of conservation significance, specifically Vegetation Units B2 and C1, and one or more individuals of the Priority listed species *Leucopogon subsejunctus* (P2) and *Synaphea hians* (P3).

5.2 Fauna

The fauna assessment within the Survey Area was undertaken for the purposes of delineating and characterising the fauna habitats and faunal assemblages present and to identify potential impacts of the proposed road works. A targeted assessment of black cockatoo habitat within the Survey Area was also carried out.

With respect to fauna in general, no substantial impacts are anticipated as a consequence of the proposed realignment. In cases where some impact is anticipated, the degree of the impact is only expected to be low and relates to the loss of small areas of habitat, but as most species are common and/or widespread no overall change in their conservation status is anticipated, despite a possible localised reduction in habitat extent.

5.2.1 Potential Impacts in Regards to Fauna and Fauna Habitat

In general the most significant potential impacts to fauna of any development include:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees);

- Fragmentation of vegetation/fauna habitat which may restrict the movement of some fauna species;
- Modifications to surface hydrology, siltation of creek lines;
- Changes to fire regimes;
- Pollution (e.g. oil spills);
- Noise/Light/Dust;
- Spread of plant pathogens (e.g. dieback) and weeds;
- Potential increase in the number of predatory introduced species (e.g. cats);
- Death or injury of fauna during clearing and construction; and
- An increase in fauna road kills subsequent to development.

The most likely potential impacts on fauna of the proposed construction and use of the road realignment are:

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees);
- Death or injury of fauna during clearing, construction and operation (including road kills).

The proposed realignment will pass through a combination of uncleared native vegetation, cleared farmland, along the existing road alignment and sections of the Collie-Darkan rail trail (**Figure 2**). Based on the likely scale of habitat loss and other factors such as the extent of similar vegetation in surrounding areas, its quality and degree of fragmentation, the possible impacts on species of conservation significance previously recorded in the general area has been assessed, a summary of which is provided in **Table 14.** Additional information on specific fauna species is provided in **Appendix 15**.

Most of the conservation significant species known from the wider area/south west region are unlikely to be impacted on by the proposal due to the fact that the Survey Area does not contain their preferred habitat and therefore they are unlikely to be present. In cases where some habitat is present likely impacts are anticipated to be low primarily due to the relatively small area of clearing likely to be required, the large expanse of adjoining bush land (e.g. state forest areas) and the fact that the relatively small impacts will be spread over several kilometres.

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Appendix 1. NatureMap Report generated for the Flora and Vegetation Survey.

NatureMap Species Report

Created By Guest user on 02/09/2016

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	116° 27' 54" E,33° 25' 06" S
Buffer	10km
Group By	Kingdom

Kingdom	Species	Records
Plantae	530	1024
TOTAL	**530**	**1024**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Plantae					
1.	15466	*Acacia applanata*			
2.	3247	*Acacia browniana*			
3.	3331	*Acacia extensa (Wiry Wattle)*			
4.	3374	*Acacia huegelii*			
5.	3383	*Acacia incurva*			
6.	16165	*Acacia insolita subsp. insolita*			
7.	3454	*Acacia nervosa (Rib Wattle)*			
8.	3496	*Acacia preissiana*			
9.	3502	*Acacia pulchella (Prickly Moses)*			
10.	15481	*Acacia pulchella var. glaberrima*			
11.	15483	*Acacia pulchella var. pulchella*			
12.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
13.	30033	*Acacia saligna subsp. lindleyi*			
14.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
15.	3602	*Acacia willdenowiana (Grass Wattle)*			
16.	1791	*Adenanthos obovatus (Basket Flower)*			
17.	23474	*Agrostocrinum hirsutum*			
18.		*Aira sp.*			
19.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
20.	1739	*Allocasuarina thuyoides (Horned Sheoak)*			
21.	13101	*Amperea simulans*			
22.	197	*Amphipogon debilis*			
23.		*Amphipogon sp.*			
24.	200	*Amphipogon turbinatus*			
25.	2380	*Amyema miquelii (Stalked Mistletoe)*			
26.	6300	*Andersonia aristata (Rice Flower)*			
27.	6306	*Andersonia caerulea (Foxtails)*			
28.	8616	*Angianthus platycephalus*			
29.	1406	*Anigozanthos bicolor (Little Kangaroo Paw)*			
30.	11470	*Anigozanthos bicolor subsp. bicolor*			
31.	11931	*Anigozanthos bicolor subsp. decrescens*			
32.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
33.	41824	*Aotus sp. Diffusa (W.E. Blackall & C.A. Gardner 1739)*			
34.	1117	*Aphelia cyperoides*			
35.	17845	*Apodasmia ceramophila*			
36.	7838	*Arctotheca calendula (Cape Weed)*	Y		
37.	20350	*Astartea affinis*			
38.	20127	*Astartea glomerulosa*			
39.		*Astartea sp.*			
40.	42801	*Astartea zephyra*			
41.	6323	*Astroloma ciliatum (Candle Cranberry)*			
42.	6324	*Astroloma compactum*			
43.	6325	*Astroloma drummondii*			
44.	6334	*Astroloma pallidum (Kick Bush)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
45.	17234	*Austrostipa compressa*			
46.	17237	*Austrostipa elegantissima*			
47.		*Austrostipa sp.*			
48.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
49.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
50.	32678	*Banksia bipinnatifida subsp. bipinnatifida*			
51.	32616	*Banksia dallanneyi subsp. sylvestris*			
52.	32577	*Banksia dallanneyi var. mellicula*			
53.	1819	*Banksia grandis (Bull Banksia, Pulgarla)*			
54.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
55.	17107	*Banksia meisneri subsp. ascendens (Scott River Banksia)*		P4	
56.	17108	*Banksia meisneri subsp. meisneri*			
57.	32203	*Banksia nivea subsp. nivea*			
58.	32080	*Banksia sessilis var. sessilis*			
59.	12111	*Banksia sphaerocarpa var. sphaerocarpa (Fox Banksia)*			
60.	32040	*Banksia subpinnatifida var. imberbis*		P2	
61.	32315	*Barbula calycina*			
62.	15037	*Bartsia trixago*	Y		
63.	25788	*Billardiera fraseri (Elegant Pronaya)*			
64.	25798	*Billardiera fusiformis (Australian Bluebell)*			
65.	3165	*Billardiera variifolia*			
66.	7856	*Blennospora drummondii*			
67.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
68.	4413	*Boronia crenulata (Aniseed Boronia)*			
69.	17653	*Boronia crenulata subsp. pubescens*			
70.	11503	*Boronia crenulata var. crenulata*			
71.	4420	*Boronia fastigiata (Bushy Boronia)*			
72.	4430	*Boronia nematophylla*			
73.	4441	*Boronia spathulata (Boronia)*			
74.	1272	*Borya scirpoidea*			
75.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
76.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
77.	14291	*Bossiaea praetermissa*			
78.	15579	*Caladenia chapmanii*			
79.	44903	*Caladenia leucochila*		T	
80.	1602	*Caladenia longicauda (Common White Spider Orchid)*			
81.	15367	*Caladenia longicauda subsp. redacta*			
82.	1604	*Caladenia macrostylis (Leaping Spider Orchid)*			
83.	1605	*Caladenia marginata (White Fairy Orchid)*			
84.	1609	*Caladenia pectinata (King Spider Orchid)*			
85.	15376	*Caladenia polychroma*			
86.	1612	*Caladenia radiata (Ray Spider Orchid)*			
87.	1613	*Caladenia reptans (Little Pink Fairy Orchid)*			
88.	15377	*Caladenia reptans subsp. reptans*			
89.		*Caladenia sp.*			
90.	44898	*Caladenia validinervia*		P1	
91.	15398	*Caladenia xantha*			
92.	5395	*Callistemon phoeniceus (Lesser Bottlebrush, Dubarda)*			
93.	36600	*Callitris pyramidalis (Swamp Cypress)*			
94.	5416	*Calothamnus lehmannii*			
95.	5425	*Calothamnus preissii*			
96.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower, Pindak)*			
97.	5458	*Calytrix flavescens (Summer Starflower)*			
98.	32338	*Campylopus introflexus*	Y		
99.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
100.	6539	*Centaurium erythraea (Common Centaury)*	Y		
101.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
102.	1125	*Centrolepis drummondiana*			
103.		*Cephaloziella hirta*			
104.	17685	*Chaetanthus aristatus*			
105.	1280	*Chamaescilla corymbosa (Blue Squill)*			
106.	11299	*Chamaescilla corymbosa var. corymbosa*			
107.	763	*Chorizandra enodis (Black Bristlerush)*			
108.	13112	*Chorizema aciculare subsp. aciculare*			
109.	13111	*Chorizema aciculare subsp. laxum*			
110.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
111.	4552	*Comesperma confertum*			
112.	4559	*Comesperma polygaloides (Small Milkwort)*			
113.		*Comesperma sp.*			
114.	4566	*Comesperma volubile (Love Creeper)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
115.	40921	*Commersonia erythrogyna*		T	
116.	16878	*Conospermum caeruleum subsp. spathulatum*			
117.	16854	*Conospermum capitatum subsp. capitatum*			
118.	16847	*Conospermum paniculatum*		P3	
119.	1418	*Conostylis aculeata (Prickly Conostylis)*			
120.	11826	*Conostylis aculeata subsp. aculeata*			
121.	11552	*Conostylis aculeata subsp. bromelioides*			
122.	12035	*Conostylis caricina subsp. caricina*			
123.	1447	*Conostylis pusilla*			
124.	1453	*Conostylis serrulata*			
125.	1454	*Conostylis setigera (Bristly Cottonhead)*			
126.	11597	*Conostylis setigera subsp. setigera*			
127.	17104	*Corymbia calophylla (Marri)*			
128.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
129.	7946	*Cotula cotuloides (Smooth Cotula)*			
130.	13354	*Craspedia variabilis*			
131.	9076	*Cryptandra myriantha*			
132.	4804	*Cryptandra nutans*			
133.	1627	*Cryptostylis ovata (Slipper Orchid)*			
134.	15404	*Cyanicula sericea*			
135.	768	*Cyathochaeta avenacea*			
136.	10916	*Cyrtostylis huegelii*			
137.		*Cyrtostylis sp.*			
138.	7420	*Dampiera alata (Winged-stem Dampiera)*			
139.	7462	*Dampiera pedunculata*			
140.	5519	*Darwinia oederoides*			
141.	6218	*Daucus glochidiatus (Australian Carrot)*			
142.	11367	*Daviesia benthamii subsp. benthamii*			
143.	3799	*Daviesia cordata (Bookleaf)*			
144.	3800	*Daviesia costata*			
145.	3805	*Daviesia decurrens (Prickly Bitter-pea)*			
146.	41921	*Daviesia decurrens subsp. Hamata (M.D. Crisp 6610)*			
147.		*Daviesia decurrens subsp. Hamata (M.D.Crisp 6610)*			
148.	15505	*Daviesia incrassata subsp. incrassata*			
149.	3819	*Daviesia longifolia*			
150.	3835	*Daviesia preissii*			
151.	17691	*Desmocladus fasciculatus*			
152.	1259	*Dianella revoluta (Blueberry Lily)*			
153.	11636	*Dianella revoluta var. divaricata*			
154.	1287	*Dichopogon capillipes*			
155.		*Dichopogon sp.*			
156.	20367	*Dillwynia laxiflora*			
157.	19649	*Disa bracteata*	Y		
158.	12943	*Diuris brumalis*			
159.	1634	*Diuris laxiflora (Bee Orchid)*			
160.	1635	*Diuris longifolia (Common Donkey Orchid)*			
161.	12938	*Diuris micrantha*		T	
162.	15436	*Diuris porrifolia*			
163.	1638	*Diuris setacea (Bristly Donkey Orchid)*			
164.		*Diuris sp.*			
165.	4775	*Dodonaea pinifolia*			
166.	13211	*Drosera erythrorhiza subsp. collina*			
167.	3097	*Drosera gigantea (Giant Sundew)*			
168.	15453	*Drosera gigantea subsp. gigantea*			
169.	3098	*Drosera glanduligera (Pimpernel Sundew)*			
170.	19256	*Drosera intricata*			
171.	13209	*Drosera marchantii subsp. marchantii*			
172.	3109	*Drosera menziesii (Pink Rainbow)*			
173.	11853	*Drosera menziesii subsp. menziesii*			
174.	13216	*Drosera menziesii subsp. penicillaris*			
175.	3118	*Drosera pallida (Pale Rainbow)*			
176.	3130	*Drosera scorpioides (Shaggy Sundew)*			
177.	3133	*Drosera subhirtella (Sunny Rainbow)*			
178.	5541	*Eremaea pauciflora*			
179.	7200	*Eremophila drummondii*			
180.	15412	*Eriochilus dilatatus subsp. multiflorus*			
181.	6219	*Eryngium pinnatifidum (Blue Devils)*			
182.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
183.	41803	*Eryngium sp. Ferox (G.J. Keighery 16034)*		P3	
184.	13534	*Eucalyptus aspersa*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
185.	5686	*Eucalyptus kondininensis (Kondinin Blackbutt)*			
186.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
187.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
188.	12906	*Eucalyptus wandoo subsp. wandoo*			
189.	3872	*Euchilopsis linearis (Swamp Pea)*			
190.	3880	*Eutaxia virgata*			
191.	32370	*Funaria hygrometrica*			
192.	900	*Gahnia aristata*			
193.	20475	*Gastrolobium capitatum*			
194.	3910	*Gastrolobium obovatum (Boat-leaved Poison)*			
195.	3923	*Gastrolobium spathulatum (Poison Bush)*			
196.	3924	*Gastrolobium spinosum (Prickly Poison)*			
197.	3928	*Gastrolobium tomentosum (Woolly Poison)*		P4	
198.	4340	*Geranium retrorsum*			
199.	33620	*Glischrocaryon angustifolium*			
200.	10909	*Gompholobium confertum*			
201.	19216	*Gompholobium cyaninum*			
202.	3950	*Gompholobium knightianum*			
203.	3951	*Gompholobium marginatum*			
204.	3953	*Gompholobium ovatum*			
205.	3954	*Gompholobium polymorphum*			
206.	3955	*Gompholobium preissii*			
207.	11083	*Gompholobium scabrum*			
208.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
209.	6149	*Gonocarpus cordiger*			
210.	29362	*Goodenia coerulea*			
211.	7514	*Goodenia havilandii*			
212.	7517	*Goodenia incana (Hoary Goodenia)*			
213.	7538	*Goodenia pulchella*			
214.	19286	*Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)*			
215.	14282	*Gratiola pubescens*			
216.	19628	*Grevillea bipinnatifida subsp. bipinnatifida*			
217.	2080	*Grevillea quercifolia (Oak-leaf Grevillea)*			
218.	2102	*Grevillea tenuiflora (Tassel Grevillea)*			
219.	2112	*Grevillea trifida*			
220.	1465	*Haemodorum discolor*			
221.	1468	*Haemodorum laxum*			
222.	1472	*Haemodorum simplex*			
223.	1475	*Haemodorum spicatum (Mardja)*			
224.	2137	*Hakea ceratophylla (Horned Leaf Hakea)*			
225.	2175	*Hakea lissocarpha (Honey Bush)*			
226.	2197	*Hakea prostrata (Harsh Hakea)*			
227.	2203	*Hakea ruscifolia (Candle Hakea)*			
228.	2212	*Hakea sulcata (Furrowed Hakea)*			
229.	2215	*Hakea undulata (Wavy-leaved Hakea)*			
230.	2216	*Hakea varia (Variable-leaved Hakea)*			
231.	6838	*Hemiandra linearis (Speckled Snakebush)*			
232.	6839	*Hemiandra pungens (Snakebush)*			
233.		*Hemiandra sp.*			
234.	6855	*Hemigenia humilis*			
235.	33796	*Hemigenia wandooana*			
236.	5108	*Hibbertia acerosa (Needle Leaved Guinea Flower)*			
237.	5109	*Hibbertia amplexicaulis*			
238.	5114	*Hibbertia commutata*			
239.	5118	*Hibbertia cunninghamii*			
240.	20051	*Hibbertia diamesogenos*			
241.	19777	*Hibbertia glomerata subsp. glomerata*			
242.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
243.	5139	*Hibbertia lasiopus (Large Hibbertia)*			
244.	5144	*Hibbertia microphylla*			
245.	5157	*Hibbertia polystachya*			
246.	20032	*Hibbertia pulchra var. pulchra*			
247.	5161	*Hibbertia quadricolor*			
248.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
249.		*Hibbertia sp.*			
250.	5172	*Hibbertia stellaris (Orange Stars)*			
251.	5176	*Hibbertia vaginata*			
252.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
253.	3968	*Hovea trisperma (Common Hovea)*			
254.		*Hyalosperma sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
255.	6223	*Hydrocotyle alata*			
256.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
257.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
258.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
259.	1070	*Hypolaena exsulca*			
260.	20200	*Isolepis cernua var. setiformis*			
261.	14540	*Isolepis hystrix*	Y		
262.		*Isolepis sp.*			
263.	16719	*Isopogon buxifolius var. obovatus*		P3	
264.	8844	*Isopogon crithmifolius*			
265.	45553	*Isopogon spathulatus*			
266.	14439	*Isopogon teretifolius subsp. teretifolius (Nodding Coneflower)*			
267.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
268.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
269.	19700	*Isotropis cuneifolia subsp. cuneifolia*			
270.	4005	*Jacksonia condensata*			
271.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
272.	4024	*Jacksonia racemosa*			
273.		*Jamesoniella colorata*			
274.	1188	*Juncus pallidus (Pale Rush)*			
275.	4037	*Kennedia coccinea (Coral Vine)*			
276.	4044	*Kennedia prostrata (Scarlet Runner)*			
277.		*Kennedia sp.*			
278.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
279.	5835	*Kunzea micrantha*			
280.	5841	*Kunzea recurva*			
281.	3669	*Labichea punctata (Lance-leaved Cassia)*			
282.	17209	*Lachnostachys verbascifolia var. verbascifolia*			
283.	18585	*Lagenophora huegelii*			
284.	11464	*Laxmannia sessiliflora subsp. australis*			
285.	1309	*Laxmannia squarrosa*			
286.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
287.	7572	*Lechenaultia expansa*			
288.	42741	*Lepidosperma apricola*			
289.	934	*Lepidosperma gracile (Slender Sword Sedge)*			
290.	936	*Lepidosperma leptostachyum*			
291.	940	*Lepidosperma pubisquameum*			
292.		*Lepidosperma sp.*			
293.	2342	*Leptomeria cunninghamii*			
294.	5847	*Leptospermum erubescens (Roadside Teatree)*			
295.	1085	*Lepyrodia glauca*			
296.	1090	*Lepyrodia muirii*			
297.		*Lethocolea pansa*			
298.	6360	*Leucopogon australis (Spiked Beard-heath)*			
299.	6367	*Leucopogon capitellatus*			
300.	6374	*Leucopogon conostephioides*			
301.	6375	*Leucopogon cordatus*			
302.	6396	*Leucopogon glabellus*			
303.	6416	*Leucopogon nutans (Drooping Leucopogon)*			
304.	6425	*Leucopogon oxycedrus*			
305.	6436	*Leucopogon propinquus*			
306.	6439	*Leucopogon pulchellus (Beard-heath)*			
307.		*Leucopogon sp.*			
308.	28311	*Leucopogon sp. Great Southern (R.S. Cowan A 586)*			
309.	44225	*Leucopogon subsejunctus*		P2	
310.	7676	*Levenhookia pusilla (Midget Stylewort)*			
311.	7677	*Levenhookia stipitata (Common Stylewort)*			
312.	4363	*Linum trigynum (French Flax)*	Y		
313.	36160	*Liparophyllum capitatum*			
314.	9289	*Lobelia anceps (Angled Lobelia)*			
315.	7406	*Lobelia rhombifolia (Tufted Lobelia)*			
316.	6511	*Logania serpyllifolia*			
317.	13128	*Logania serpyllifolia subsp. angustifolia*			
318.	38000	*Logania sylvicola*		P2	
319.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
320.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
321.	1225	*Lomandra drummondii*			
322.	1228	*Lomandra hermaphrodita*			
323.	1236	*Lomandra odora (Tiered Matrush)*			
324.	1240	*Lomandra purpurea (Purple Mat Rush)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
325.	1243	*Lomandra sericea (Silky Mat Rush)*			
326.	1244	*Lomandra sonderi*			
327.		*Lomandra sp.*			
328.	1246	*Lomandra suaveolens*			
329.		*Lotus sp.*			
330.	18049	*Lyginia imberbis*			
331.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
332.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
333.	17635	*Marianthus drummondianus*			
334.	33638	*Meionectes tenuifolia*		P3	
335.	37580	*Melaleuca acutifolia*			
336.	5902	*Melaleuca densa*			
337.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
338.	5946	*Melaleuca pauciflora*			
339.	5952	*Melaleuca preissiana (Moonah)*			
340.	5964	*Melaleuca seriata*			
341.		*Melaleuca sp.*			
342.	5968	*Melaleuca spathulata*			
343.	5975	*Melaleuca subtrigona*			
344.	18232	*Melaleuca tuberculata var. tuberculata*			
345.	5986	*Melaleuca urceolaris*			
346.	13280	*Melaleuca viminea subsp. viminea*			
347.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
348.	1657	*Microtis alba (White Mignonette Orchid)*			
349.	10954	*Microtis media (Tall Mignonette Orchid)*			
350.	8106	*Millotia tenuifolia (Soft Millotia)*			
351.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
352.	4100	*Mirbelia spinosa*			
353.	4104	*Mirbelia trichocalyx*			
354.	19585	*Monotaxis grandiflora var. grandiflora*			
355.	14187	*Myriocephalus occidentalis*			
356.	6195	*Myriophyllum limnophilum*			
357.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
358.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
359.	2365	*Olax benthamiana*			
360.	8131	*Olearia ciliata (Fringed Daisy Bush)*			
361.	8143	*Olearia paucidentata (Autumn Scrub Daisy)*			
362.	18254	*Opercularia apiciflora*			
363.	7346	*Opercularia echinocephala (Bristly Headed Stink Weed)*			
364.	18255	*Opercularia vaginata (Dog Weed)*			
365.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		
366.	1542	*Patersonia babianoides*			
367.	1546	*Patersonia juncea (Rush Leaved Patersonia)*			
368.	1549	*Patersonia maxwellii*			
369.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
370.	30476	*Patersonia occidentalis var. latifolia*			
371.	30472	*Patersonia occidentalis var. occidentalis*			
372.	1551	*Patersonia pygmaea (Pygmy Patersonia)*			
373.	43780	*Pauridia gardneri*			
374.	43762	*Pauridia occidentalis var. quadriloba*			
375.	4346	*Pelargonium littorale*			
376.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
377.	16477	*Pericalymma ellipticum var. ellipticum*			
378.	2255	*Persoonia angustiflora*			
379.	2267	*Persoonia longifolia (Snottygobble)*			
380.	2278	*Persoonia sulcata*		P4	
381.	20605	*Petrophile filifolia subsp. filifolia*			
382.	2299	*Petrophile linearis (Pixie Mops)*			
383.	2302	*Petrophile media*			
384.	2309	*Petrophile serruriae*			
385.	17765	*Petrophile squamata subsp. squamata*			
386.	2312	*Petrophile striata*			
387.	20460	*Pheladenia deformis*			
388.	1478	*Phlebocarya ciliata*			
389.	4675	*Phyllanthus calycinus (False Boronia)*			
390.	6985	*Physalis pubescens*	Y		
391.	5251	*Pimelea imbricata*			
392.	11402	*Pimelea imbricata var. piligera*			
393.		*Pimelea sp.*			
394.	12041	*Pimelea suaveolens subsp. suaveolens*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
395.		*Platysace sp.*			
396.	4524	*Platytheca galioides*			
397.	573	*Poa drummondiana (Knotted Poa)*			
398.		*Poa sp.*			
399.	8175	*Podolepis gracilis (Slender Podolepis)*			
400.	4690	*Poranthera huegelii*			
401.	4691	*Poranthera microphylla (Small Poranthera)*			
402.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
403.	1679	*Prasophyllum ovale (Little Leek Orchid)*			
404.	10853	*Prasophyllum plumiforme*			
405.		*Prasophyllum sp.*			
406.	13255	*Pterochaeta paniculata*			
407.	1693	*Pterostylis recurva (Jug Orchid)*			
408.		*Pterostylis sp.*			
409.	4187	*Pultenaea verruculosa*			
410.	16367	*Pyrorchis nigricans (Red beaks, Elephants ears)*			
411.	2932	*Ranunculus colonorum (Common Buttercup)*			
412.	6012	*Regelia ciliata*			
413.	13300	*Rhodanthe citrina*			
414.	13234	*Rhodanthe manglesii*			
415.	13312	*Rhodanthe pyrethrum*			
416.	6022	*Rinzia fumana*			
417.	32426	*Rosulabryum campylothecium*			
418.	32427	*Rosulabryum capillare*			
419.		*Rytidosperma sp.*			
420.	6483	*Samolus junceus*			
421.	7602	*Scaevola calliptera*			
422.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
423.	7619	*Scaevola lanceolata (Long-leaved Scaevola)*			
424.	7635	*Scaevola pilosa (Hairy Fan-flower)*			
425.	984	*Schoenus curvifolius*			
426.	1009	*Schoenus pleiostemoneus*			
427.	16251	*Schoenus subflavus subsp. long leaves (K.L. Wilson 2865)*			
428.	1026	*Schoenus unispiculatus*			
429.	20663	*Senecio multicaulis subsp. multicaulis*			
430.	20161	*Senecio pinnatifolius*			
431.	25884	*Senecio pinnatifolius var. latilobus*			
432.	8217	*Senecio quadridentatus*			
433.	8224	*Siloxerus filifolius*			
434.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
435.		*Siloxerus sp.*			
436.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
437.	8900	*Spergularia marina*			
438.	4207	*Sphaerolobium medium*			
439.	6930	*Stachys arvensis (Staggerweed)*	Y		
440.	9070	*Stackhousia pubescens (Downy Stackhousia)*			
441.	4735	*Stackhousia scoparia*			
442.		*Stackhousia sp.*			
443.	13473	*Stenanthemum coronatum*			
444.	7681	*Stylidium affine (Queen Triggerplant)*			
445.	7684	*Stylidium amoenum (Lovely Triggerplant)*			
446.	25831	*Stylidium araeophyllum (Stilt Walker)*			
447.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
448.	7696	*Stylidium calcaratum (Book Triggerplant)*			
449.	7698	*Stylidium caricifolium (Milkmaids)*			
450.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
451.	7702	*Stylidium ciliatum (Golden Triggerplant)*			
452.	7708	*Stylidium crassifolium (Thick-leaved Triggerplant)*			
453.	7712	*Stylidium despectum (Dwarf Triggerplant)*			
454.	7713	*Stylidium dichotomum (Pins-and-needles)*			
455.	7734	*Stylidium guttatum (Dotted Triggerplant)*			
456.	7745	*Stylidium junceum (Reed Triggerplant)*			
457.	7747	*Stylidium lepidum (Redcaps)*		P3	
458.	17849	*Stylidium paulineae*			
459.	18419	*Stylidium pingrupense*			
460.	7776	*Stylidium plantagineum (Plantagenet Triggerplant)*			
461.	7781	*Stylidium pubigerum (Yellow Butterfly Triggerplant)*			
462.	7782	*Stylidium pulchellum (Thumbelina Triggerplant)*			
463.	7785	*Stylidium repens (Matted Triggerplant)*			
464.	7786	*Stylidium rhipidium (Fan Triggerplant)*		P3	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
465.	7798	*Stylidium schoenoides (Cow Kicks)*			
466.		*Stylidium sp.*			
467.	7799	*Stylidium spathulatum (Creamy Triggerplant)*			
468.	7801	*Stylidium squamellosum (Maize Trigger Plant)*		P2	
469.	7805	*Stylidium uniflorum*			
470.	45393	*Stylidium uniflorum subsp. uniflorum (Pincushion Triggerplant)*			
471.	1260	*Stypandra glauca (Blind Grass)*			
472.	6476	*Styphelia tenuiflora (Common Pinheath)*			
473.	16869	*Synaphea cuneata*			
474.	16883	*Synaphea damopsis*			
475.	12914	*Synaphea decorticans*			
476.	16937	*Synaphea decumbens*		P3	
477.	15529	*Synaphea floribunda*			
478.	2323	*Synaphea gracillima*			
479.	16769	*Synaphea hians*		P3	
480.	12911	*Synaphea obtusata*			
481.	16864	*Synaphea petiolaris subsp. petiolaris*			
482.		*Synaphea sp.*			
483.	31780	*Synaphea trinacriformis*		P1	Y
484.	20135	*Taxandria linearifolia*			
485.	31718	*Tecticornia lepidosperma*			
486.	1036	*Tetraria octandra*			
487.	35579	*Tetraria sp. Jarrah Forest (R. Davis 7391)*			
488.	667	*Tetrarrhena laevis (Forrest Ricegrass)*			
489.	31761	*Tetratheca exasperata*		P3	
490.	4535	*Tetratheca hirsuta (Black Eyed Susan)*			
491.	4545	*Tetratheca similis*		P3	
492.	4546	*Tetratheca virgata*			
493.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
494.	1338	*Thysanotus manglesianus (Fringed Lily)*			
495.	1343	*Thysanotus patersonii*			
496.		*Thysanotus sp.*			
497.	1351	*Thysanotus sparteus*			
498.	1354	*Thysanotus tenellus*			
499.	6280	*Trachymene pilosa (Native Parsnip)*			
500.		*Trachymene sp.*			
501.	17684	*Tremulina tremula*			
502.	1483	*Tribonanthes longipetala*			
503.	1485	*Tribonanthes violacea*			
504.	8251	*Trichocline spathulata (Native Gerbera)*			
505.	147	*Triglochin mucronata*			
506.	4737	*Tripterococcus brunonis (Winged Stackhousia)*			
507.	13479	*Trymalium ledifolium var. rosmarinifolium*			
508.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
509.	7126	*Utricularia benthamii*			
510.	7138	*Utricularia inaequalis*			
511.	7148	*Utricularia multifida*			
512.	7157	*Utricularia violacea (Violet Bladderwort)*			
513.	7665	*Velleia trinervis*			
514.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
515.	12411	*Verticordia densiflora var. cespitosa*			
516.	15432	*Verticordia densiflora var. densiflora*			
517.	12439	*Verticordia lindleyi subsp. purpurea*			
518.	14717	*Verticordia multiflora subsp. multiflora*			
519.	6107	*Verticordia pennigera*			
520.	12449	*Verticordia plumosa var. brachyphylla*			
521.	8266	*Vittadinia gracilis*			
522.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
523.	13333	*Waitzia suaveolens var. suaveolens*			
524.	1402	*Wurmbea sinora*			
525.	1253	*Xanthorrhoea gracilis (Graceful Grass Tree, Mimidi)*			
526.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
527.	6283	*Xanthosia atkinsoniana*			
528.	6289	*Xanthosia huegelii*			
529.	6293	*Xanthosia singuliflora*			
530.	44861	*Xerochrysum macranthum*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

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.

Appendix 1. Protected Matters Search Tool Report generated for the Flora and Vegetation Survey.

Australian Government

Department of the Environment

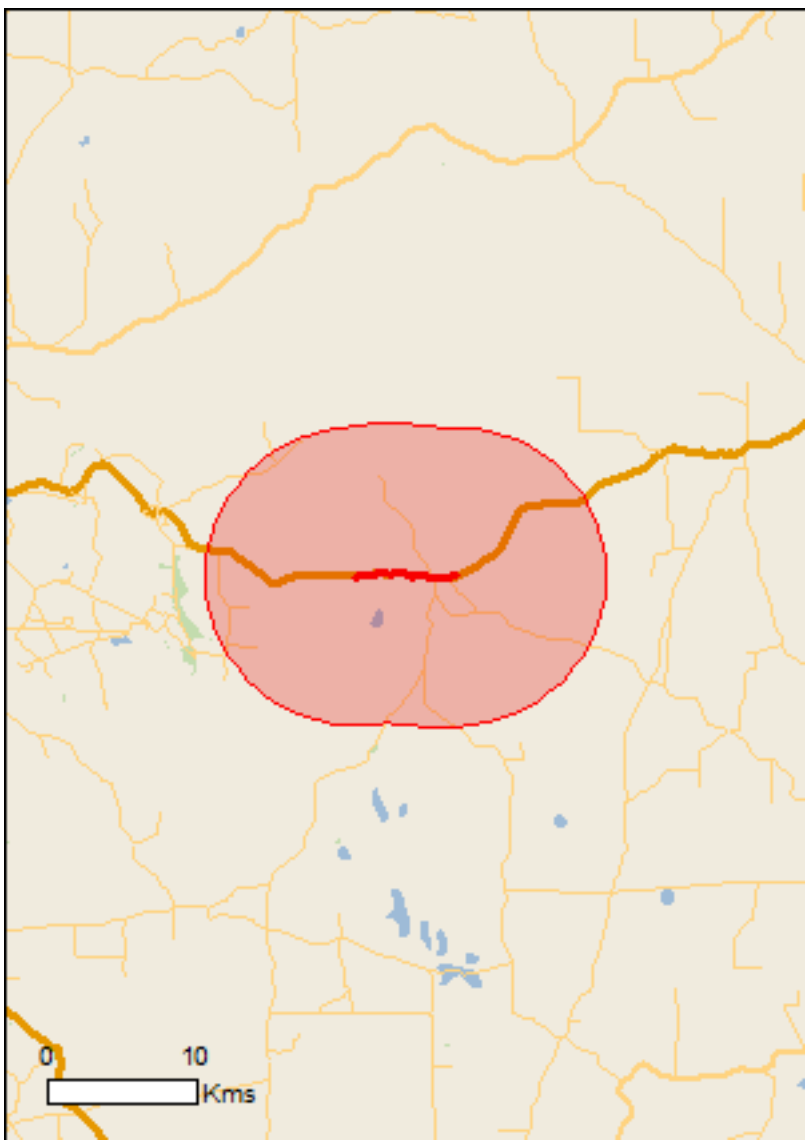
EPBC Act Protected Matters Report

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: 02/09/16 19:40:06



Coordinates

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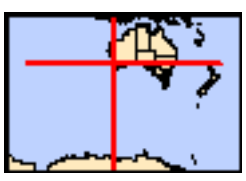

Summary

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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	13
Listed Migratory Species:	2

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	7
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:	2
Regional Forest Agreements:	1
Invasive Species:	19
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
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, Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Mammals		
Bettongia penicillata Brush-tailed Bettong, Woylie [213]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Myrmecobius fasciatus Numbat [294]	Vulnerable	Species or species habitat known to occur within area
Phascogale calura Red-tailed Phascogale [316]	Endangered	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat may occur within area
Plants		
Caladenia lodgeana Lodge's Spider-orchid [68664]	Critically Endangered	Species or species habitat known to occur within area
Commersonia erythrogyna Trigwell's Rulingia [86397]	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

Name	Status	Type of Presence
Drakaea confluens		
Late Hammer-orchid [56778]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat may 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
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Muja	WA
Yallatup	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 senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
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

Name	Status	Type of Presence
		habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
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

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.

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.420613 116.436578,-33.420255 116.441385,-33.419968 116.444303,-33.419897 116.447736,-33.418392 116.452886,-33.41918 116.456062,-33.419324 116.457349,-33.418464 116.462156,-33.418965 116.465675,-33.42004 116.469194,-33.420685 116.472284,-33.420255 116.474516,-33.419682 116.477434,-33.419968 116.479751,-33.421473 116.482841,-33.421258 116.486274,-33.42133 116.490823,-33.421258 116.493742,-33.420327 116.498977

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
-Parks and Wildlife Commission NT, Northern Territory Government
-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, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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

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

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Appendix 3. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2016b).

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

Appendix 4. State and Federal Definitions and Categories of Threatened Flora.

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

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

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

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

Appendix 5. Fauna Conservation Codes

***EPBC Act (1999)* Threatened Fauna Categories**

Threatened fauna may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) in any one of the following categories:

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) 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 species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the *EPBC Act*

Note: Only species in those categories marked with an asterix are matters of national environmental significance (NES) under the *EPBC Act*.

Wildlife Conservation (Specially Protected Fauna) Notice 2015 Categories

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

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 as detailed below.

Category	Code	Description
Schedule 1: Critically Endangered species	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2: Endangered species	EN	Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3: Vulnerable species	VU	Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4: Presumed extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5: Migratory birds protected under an international agreement	IA	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6: Fauna that is of special conservation need as conservation dependent fauna	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7: Other specially protected fauna.	OS	Fauna otherwise in need of special protection to ensure their conservation.

Western Australian DPaW Priority Fauna Categories

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Description
Priority 1 Poorly Known Species.	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 Poorly Known Species.	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 Poorly Known Species.	P3	Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 Rare, Near Threatened	P4	(a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on

Category	Code	Description
and other species in need of monitoring.		conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

***IUCN Red List* Threatened Species Categories**

The *IUCN Red List of Threatened Species*™ is a checklist of taxa that have undergone an extinction risk assessment using the *IUCN Red List Categories and Criteria*.

Categories are summarised below.

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	Taxa which has not been evaluated.

1.5A full list of categories and their meanings are available at:

http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

Appendix 6. Fauna Observed or Potentially in Survey Area

Bowelling Curves (~SLK 64.74 - 69.84), Shire of West Arthur, W.A.

Compiled by Greg Harewood - November 2016

Recorded (Trapped/Sighted/Heard/Signs) = X

Approx Centroid -33.421554°S and 116.459834°E

A = Harewood, G. (2016). Fauna Assessment Collie Lake King Road, Boweliing Curves (SLK 64.74 - 69.84), Shire of West Arthur. Unpublished report for MRWA/EcoEdge.

B = Harewood, G. (2013). Fauna Assessment Coalfields Highway Realignment (15.9 SLK to 26.3 SLK), Allanson. Unpublished report for RPS.

C = Harewood, G. (2010). Fauna Survey (Level 2) Buckinghma Way, Collie. Unpublished report for Stategen.

D = Ecologia (1991). Ewington Consultative Environmental Review: Fauna Survey. Unpublished report for HGM.

HGM (1994). Notice of Intent for: Ewington II Open-Cut Mine. Unpublished report for Griffin Coal Mining Company Pty Ltd.

Bancroft, W. et al. (2006). Fauna survey of Griffin Coal's Ewington II and Buckingham sites. Unpublished report for KBR Pty Ltd.

Bancroft, W. J. and Bamford, M. J. (2007). Fauna survey of Griffin Coal's Buckingham site. Unpublished report to Griffin Coal Mining Co Pty Limited.

Bancroft, W.J. and Bamford, M.J (2008). Inspection of Griffin Coal's proposed Ewington powerline clearing zones for Black-Cockatoo nesting activity. Unpublished report for The Griffin Group.

Coffey Environments (2008). Fauna Relocation Program at Ewington Mine Site, Collie. Unpublished letter report prepared for The Griffin Coal Mining Company Pty Ltd.

Tonga, J. (2008). Ewington Mine Micro Bat Survey. Unpublished report for Griffin Coal Mining Company.

E = GHD (2009). Level 1 Fauna Assessment - Collie Urea Project. Unpublished report for Perdaman Industries.

F = GHD (2008). Collie Shotts Industrial Park, Spring Flora, Fauna and Wetland Assessment. Unpublished report for LandCorp.

G = Bancroft, W. and Bamford, M. (2006). Fauna Survey of the Muja South Extension Project. Unpublished report for Griffin Coal.

H = DPaW (2016). NatureMap Database search. "By Circle" 116° 27' 35'' E, 33° 25' 17'' S – Study area (plus 20 km buffer). Accessed 21/11/2016.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Fish										
Percichthyidae Basses and Cods										
Bostockia porosa	Nightfish									

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Galaxiidae Galaxiids										
Galaxias occidentalis	Western Minnow									
Nannopercidae Pygmy Perches										
Edelia vittata	Western Pygmy Perch									
Poeciliidae Livebearers										
Gambusia holbrooki	Mosquito Fish	Introduced	X							

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Amphibians										
Myobatrachidae Ground or Burrowing Frogs										
Crinia georgiana	Quacking Frog	LC				X		X	X	X
Crinia glauerti	Glauert`s Froglet	LC				X	X	X	X	X
Crinia pseudinsignifera	Bleating Froglet	LC	X				X	X		X
Geocrinia leai	Lea`s Frog	LC					X	X		X
Heleioporus barycragus	Western Marsh Frog	LC							X	
Heleioporus eyrei	Moaning Frog	LC				X			X	X
Heleioporus inornatus	Whooping Frog	LC				X			X	X
Heleioporus psammophilus	Sand Frog	LC				X	X		X	
Limnodynastes dorsalis	Banjo Frog	LC				X			X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Pseudophryne guentheri	Güenther`s Toadlet	LC							X	X
Hylidae Tree or Water-Holding Frogs										
Litoria adelaidensis	Slender Tree Frog	LC							X	X
Litoria moorei	Motorbike Frog	LC							X	

Reptiles

Gekkonidae Geckoes										
Christinus marmoratus	Marbled Gecko									X
Diplodactylus polyophthalmus	Speckled Stone Gecko					X				
Underwoodisaurus milii	Barking Gecko									X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Pygopodidae Legless Lizards										
Aprasia pulchella	Pretty Worm Lizard					X			X	
Aprasia repens	Sand-plain Worm Lizard					X			X	
Lialis burtonis	Common Snake Lizard					X				X
Pygopus lepidopodus	Southern Scaleyfoot									
Agamidae Dragon Lizards										
Pogona minor	Western Bearded Dragon					X			X	
Varanidae Monitor's or Goanna's										
Varanus gouldii	Gould's Sand Monitor					X			X	X
Varanus rosenbergi	Heath Monitor					X			X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Scincidae Skinks										
Acritoscincus trilineatum	South-western Cool Skink					X			X	
Cryptoblepharus buchananii	Fence Skink		X	X		X			X	X
Ctenotus catenifer	Chain-striped Heath Ctenotus									
Ctenotus impar	South-western Odd-striped Ctenotus					X			X	X
Ctenotus labillardieri	Red-legged Skink					X				X
Egernia kingii	King's Skink									
Egernia napoleonis	Salmon-bellied Skink			X		X			X	X
Egernia pulchra	Spectacled Rock Skink									
Hemiergis gracilipes	Southwestern Mulch Skink					X				
Hemiergis initialis	Five-toed Earless Skink									

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Hemiergis peronii peronii	Four-toed Mulch Skink									
Lerista distinguenda	South-western Four-toed Lerista			X		X			X	X
Lerista microtis microtis	Southwestern Five-toed Lerista									
Menetia greyii	Dwarf Skink					X			X	X
Morethia obscura	Dusky Morethia			X		X			X	X
Tiliqua rugosa rugosa	Western Bobtail		X	X	X	X		X	X	
Typhlopidae Blind Snakes										
Ramphotyphlops australis	Southern Blind Snake					X			X	
Ramphotyphlops pinguis	Stout Blind Snake									
Boidae Pythons, Boas										
Morelia spilota imbricata	Southern Carpet Python									

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Elapidae Elapid Snakes										
Echiopsis curta	Bardick									
Elapognathus coronatus	Crowned Snake									
Neelaps bimaculatus	Black-naped Snake									
Notechis scutatus	Tiger Snake							X	X	X
Parasuta gouldii	Gould's Hooded Snake						X		X	X
Parasuta nigriceps	Black-backed Snake									
Pseudonaja affinis	Dugite		X			X		X	X	X
Simoselaps bertholdi	Jan`s Banded Snake									

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Birds										
Casuariidae Emus, Cassowarries										
Dromaius novaehollandiae	Emu	Bp LC	X						X	X
Phasianidae Quails, Pheasants										
Coturnix pectoralis	Stubble Quail	LC	X							
Coturnix ypsilophora	Brown Quail	LC							X	
Anatidae Geese, Swans, Ducks										
Anas gracilis	Grey Teal	LC	X						X	X
Anas superciliosa	Pacific Black Duck	LC				X	X	X	X	X
Chenonetta jubata	Australian Wood Duck	LC				X		X	X	X
Tadorna tadornoides	Australian Shelduck	LC	X						X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Ardeidae Herons, Egrets, Bitterns										
Ardea alba	Great Egret	S5 Mig CA JA								
Ardea ibis	Cattle Egret	S5 Mig CA JA								
Ardea pacifica	White-necked Heron	LC							X	X
Egretta novaehollandiae	White-faced Heron	LC	X			X			X	X

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Accipitridae Kites, Goshawks, Eagles, Harriers										
Accipiter cirrocephalus	Collared Sparrowhawk	Bp LC	X	X					X	
Accipiter fasciatus	Brown Goshawk	Bp LC				X			X	
Aquila audax	Wedge-tailed Eagle	Bp LC	X	X		X			X	X
Aquila morphnoides	Little Eagle	Bp LC		X		X			X	
Circus approximans	Swamp Harrier	LC							X	X
Elanus caeruleus	Black-shouldered Kite	LC		X		X				
Haliastur sphenurus	Whistling Kite	Bp LC								
Hamirostra isura	Square-tailed Kite	Bp LC								

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Falconidae Falcons										
Falco berigora	Brown Falcon	Bp LC							X	
Falco cenchroides	Australian Kestrel	LC				X			X	
Falco longipennis	Australian Hobby	LC								X
Falco peregrinus	Peregrine Falcon	S7 Bp LC								X
Turnicidae Button-quails										
Turnix varia	Painted Button-quail	Bp LC				X				
Turnix velox	Little Button-quail	LC				X				
Charadriidae Lapwings, Plovers, Dotterels										
Charadrius melanops	Black-fronted Dotterel					X			X	

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Columbidae Pigeons, Doves										
Ocyphaps lophotes	Crested Pigeon	LC							X	X
Phaps chalcoptera	Common Bronzewing	Bh LC	X	X	X	X	X	X	X	X
Cacatuidae Cockatoos, Corellas										
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S3 VU Be VU A2c+3c+4c	X	X	X	X	X		X	
Calyptorhynchus baudinii	Baudin`s Black-Cockatoo	S2 EN Bp VU C2a(ii)		X	X	X	X	X		X
Calyptorhynchus latirostris	Carnaby`s Black-Cockatoo	S2 EN Bp EN A2bcde+3bcd	X	X		X	X		X	X
Eolophus roseicapilla	Galah	LC			X	X				

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Psittacidae Parrots										
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC	X						X	X
Neophema elegans	Elegant Parrot	LC	X			X			X	X
Platycercus icterotis icterotis	Western Rosella (Western ssp)	Bp LC		X		X	X	X		
Platycercus spurius	Red-capped Parrot	LC	X		X	X	X	X	X	X
Platycercus zonarius	Australian Ringneck Parrot	LC	X	X	X	X	X	X	X	X
Polytelis anthopeplus	Regent Parrot	LC								

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Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Cuculidae Parasitic Cuckoos										
Cacomantis flabelliformis	Fan-tailed Cuckoo	LC	X			X		X	X	X
Chrysococcyx basalis	Horsfield`s Bronze Cuckoo	LC				X			X	
Chrysococcyx lucidus	Shining Bronze Cuckoo	LC	X		X	X			X	
Cuculus pallidus	Pallid Cuckoo	LC				X		X	X	
Strigidae Hawk Owls										
Ninox novaeseelandiae	Boobook Owl	LC		X		X				X
Tytonidae Barn Owls										
Tyto alba	Barn Owl	LC								
Tyto n. novaehollandiae	Masked Owl (SW population)	P3 Bp								

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Podargidae Frogmouths										
Podargus strigoides	Tawny Frogmouth	LC				X			X	X
Aegothelidae Owlet-nightjars										
Aegotheles cristatus	Australian Owlet-nightjar	LC							X	
Halcyonidae Tree Kingfishers										
Dacelo novaeguineae	Laughing Kookaburra	Introduced	X	X	X	X	X	X	X	X
Todiramphus sanctus	Sacred Kingfisher	LC	X			X		X	X	X
Meropidae Bee-eaters										
Merops ornatus	Rainbow Bee-eater	S5 Mig JA LC	X	X		X			X	X
Climacteridae Treecreepers										
Climacteris rufa	Rufous Treecreeper	Bh	X	X		X				

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Maluridae Fairy Wrens, GrassWrens										
Malurus elegans	Red-winged Fairy-wren	Be LC		X	X	X				X
Malurus splendens	Splendid Fairy-wren	Bh LC	X	X		X	X	X	X	X

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Pardalotidae Pardalotes, Bristlebirds, Scrubwrens, Gerygones, Thornbills										
Acanthiza apicalis	Broad-tailed Thornbill	Bh LC	X	X	X	X	X		X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Bh LC	X	X		X		X	X	X
Acanthiza inornata	Western Thornbill	Bh LC	X	X	X	X			X	X
Gerygone fusca	Western Gerygone	LC	X	X	X	X	X	X	X	X
Pardalotus punctatus	Spotted Pardalote	LC			X	X			X	X
Pardalotus striatus	Striated Pardalote	LC	X		X	X			X	X
Sericornis frontalis	White-browed Scrubwren	Bh LC		X		X		X	X	X
Smicrornis brevirostris	Weebill	Bh LC	X		X	X	X	X	X	X

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Meliphagidae Honeyeaters, Chats										
Acanthorhynchus superciliosus	Western Spinebill	LC	X	X	X	X			X	X
Anthochaera carunculata	Red Wattlebird	LC	X	X	X	X	X	X	X	X
Anthochaera lunulata	Western Little Wattlebird	Bp	X						X	X
Lichenostomus ornatus	Yellow-plumed Honeyeater	Bh LC	X							
Lichenostomus virescens	Singing Honeyeater	LC	X			X			X	
Lichmera indistincta	Brown Honeyeater	LC	X	X	X	X	X	X	X	X
Melithreptus brevirostris	Brown-headed Honeyeater	LC								X
Melithreptus chloropsis	Western White-naped Honeyeater	LC		X						X
Phylidonyris melanops	Tawny-crowned Honeyeater	Bp LC				X		X		
Phylidonyris nigra	White-cheeked Honeyeater	Bp LC								

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Phylidonyris novaehollandiae	New Holland Honeyeater	Bp LC	X		X	X		X	X	X
Petroicidae Australian Robins										
Eopsaltria australis	Western Yellow Robin	Bh LC		X			X		X	X
Eopsaltria georgiana	White-breasted Robin	Bh LC		X						X
Microeca fascinans	Jacky Winter	LC					X			
Petroica cucullata	Hooded Robin	Bh				X				
Petroica goodenovii	Red-capped Robin	LC				X				
Petroica multicolor	Scarlet Robin	Bh LC	X	X	X	X	X		X	X
Pomatostomidae Babblers										
Pomatostomus superciliosus ashbyi	White-browed Babbler									

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Neosittidae Sitellas										
Daphoenositta chrysoptera	Varied Sittella	Bh LC		X	X	X			X	X
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers										
Colluricincla harmonica	Grey Shrike-thrush	Bh LC	X	X		X	X	X	X	X
Falcunculus frontatus leucogaster	Western Shrike-tit	Be								
Pachycephala pectoralis	Golden Whistler	Bh LC	X	X	X	X	X		X	X
Pachycephala rufiventris	Rufous Whistler	LC			X	X			X	X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo										
Grallina cyanoleuca	Magpie-lark	LC	X	X	X	X	X		X	X
Rhipidura fuliginosa	Grey Fantail	LC	X	X	X	X	X	X	X	X
Rhipidura leucophrys	Willie Wagtail	LC		X	X	X	X	X	X	X

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Campephagidae Cuckoo-shrikes, Trillers										
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC	X	X	X	X	X	X	X	X
Lalage sueurii	White-winged Triller	LC				X				
Artamidae Woodswallows, Butcherbirds, Currawongs										
Artamus cyanopterus	Dusky Woodswallow	Bp LC		X		X		X	X	X
Cracticus nigrogularis	Pied Butcherbird	LC						X		
Cracticus tibicen	Australian Magpie	LC	X	X	X	X	X	X	X	X
Cracticus torquatus	Grey Butcherbird	LC	X	X	X	X			X	X
Strepera versicolor	Grey Currawong	Bp LC	X						X	X
Corvidae Ravens, Crows										
Corvus coronoides	Australian Raven	LC	X	X	X	X	X	X	X	X

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Motacillidae Old World Pipits, Wagtails										
Anthus novaeseelandiae	Australian Pipit	LC				X			X	
Passeridae Grass Finches, Mannikins, Sparrows										
Stagonopleura oculata	Red-eared Firetail	LC				X	X			
Dicaeidae Flowerpeckers										
Dicaeum hirundinaceum	Mistletoebird	LC								
Hirundinidae Swallows, Martins										
Hirundo ariel	Fairy Martin	LC				X				
Hirundo neoxena	Welcome Swallow	LC	X			X	X	X	X	X
Hirundo nigricans	Tree Martin	LC	X	X		X			X	X

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Sylviidae Old World Warblers										
Cincloramphus cruralis	Brown Songlark	LC								
Cincloramphus mathewsi	Rufous Songlark	LC	X							X
Zosteropidae White-eyes										
Zosterops lateralis	Grey-breasted White-eye	LC	X	X	X	X	X	X	X	X

Mammals

Tachyglossidae Echidnas										
Tachyglossus aculeatus	Echidna	LC	X			X	X		X	X

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Dasyuridae Carnivorous Marsupials										
Antechinus flavipes	Yellow-footed Antechinus	LC				X	X		X	X
Dasyurus geoffroii	Chuditch	S3 VU VU C1				X	X		X	X
Phascogale tapoatafa ssp	Southern Brush-tailed Phascogale	S3 NT								X
Sminthopsis gilberti	Gilbert`s Dunnart	LC							X	
Peramelidae Bandicoots										
Isoodon obesulus fusciventer	Southern Brown Bandicoot	P4 LC				X			X	
Phalangeridae Brushtail Possums, Cuscuses										
Trichosurus vulpecula	Common Brushtail Possum	LC		X	X	X	X	X	X	
Burramyidae Pygmy Possums										
Cercartetus concinnus	Western Pygmy-possum	LC								X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Tarsipedidae Honey Possum										
Tarsipes rostratus	Honey Possum	LC								
Macropodidae Kangaroos, Wallabies										
Macropus fuliginosus	Western Grey Kangaroo	LC	X	X	X	X	X	X	X	X
Macropus irma	Western Brush Wallaby	P4 NT				X	X	X	X	X
Molossidae Freetail Bats										
Mormopterus planiceps	Southern Freetail Bat	LC			X				X	
Tadarida australis	White-striped Freetail-bat	LC			X	X				

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Vespertilionidae Ordinary Bats										
Chalinolobus gouldii	Gould`s Wattled Bat	LC			X	X			X	
Chalinolobus morio	Chocolate Wattled Bat	LC			X					
Falsistrellus mackenziei	Western False Pipistrelle	P4 NT			X					
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC			X				X	
Nyctophilus gouldi	Gould`s Long-eared Bat	LC								
Nyctophilus timoriensis	Western Long-eared Bat	DD								
Vespadelus regulus	Southern Forest Bat	LC			X				X	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Muridae Rats, Mice										
Mus musculus	House Mouse	Introduced				X			X	X
Rattus fuscipes	Western Bush Rat	LC								
Rattus rattus	Black Rat	Introduced								X
Canidae Dogs, Foxes										
Vulpes vulpes	Red Fox	Introduced			X	X	X		X	
Felidae Cats										
Felis catus	Cat	Introduced	X		X					
Suidae Pigs										
Sus scrofa	Pig	Introduced				X	X			X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H
Leporidae Rabbits, Hares										
Oryctolagus cuniculus	Rabbit	Introduced	X	X		X	X	X	X	X

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DEC Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria for others.

Appendix 7. Protected Matters Search Tool and NatureMap Reports generated for the Fauna Survey

Appendix X. Vegetation condition scale.

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 9. List of vascular flora found within the Survey Area at Bowelling.

FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
Apiaceae	*Daucus glochidiatus*		
Apocynaceae	*Vinca major*	*	
Araliaceae	*Trachymene pilosa*		
Asparagaceae	*Chamaescilla corymbosa*		
	Dichopogon preissii		
	Lomandra hermaphrodita		
	Lomandra purpurea		
	Lomandra sericea		
	Sowerbaea laxiflora		
	Thysanotus dichotomus		
	Thysanotus gracilis		
	Thysanotus multiflorus		
	Thysanotus patersonii		
	Thysanotus tenellus		
Asteraceae	*Arctotheca calendula*	*	
	Brachyscome iberidifolia		
	Cotula coronopifolia	*	
	Cotula turbinata	*	
	Craspedia variabilis		
	Hyalosperma pusillum		
	Hypochaeris glabra	*	
	Lagenophora huegelii		
	Millotia tenuifolia		
	Podolepis lessonii		
	Podotheca angustifolia		
	Quinetia urvillei		
	Rhodanthe citrina		
	Rhodanthe manglesii		
	Senecio pinnatifolius		
	Trichocline spathulata		
	Ursinia anthemoides	*	
	Waitzia suaveolens		
	Waitzia suaveolens		
Boryaceae	*Borya scirpoidea*		
Casuarinaceae	*Allocasuarina fraseriana*		
	Allocasuarina humilis		
	Allocasuarina thuyoides		
Celastraceae	*Stackhousia monogyna*		
Centrolepidaceae	*Centrolepis drummondiana*		
Colchicaceae	*Burchardia monantha*		
	Burchardia multiflora		
	Wurmbea dioica		
Cupressaceae	*Callitris pyramidalis*		
Cyperaceae	*Baumea juncea*		

FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
	Chorizandra enodis		
Cyperaceae	*Cyathochaeta avenacea*		
	Cyperus eragrostis	*	
	Ficinia nodosa		
	Lepidosperma leptostachyum		
	Lepidosperma longitudinale		
	Lepidosperma pubisquameum		
	Lepidosperma squamatum		
	Mesomelaena tetragona		
	Schoenus curvifolius		
	Tetraria octandra		
	Tetraria sp. Jarrah Forest (R. Davis 7391)		
Dilleniaceae	*Hibbertia amplexicaulis*		
	Hibbertia commutata		
	Hibbertia diamesogenos		
	Hibbertia furfuracea		
	Hibbertia hibbertioides		
	Hibbertia hypericoides		
	Hibbertia quadricolor		
	Hibbertia stellaris		
Droseraceae	*Drosera erythrorhiza*		
	Drosera gigantea		
	Drosera glanduligera		
	Drosera macrantha		
	Drosera neesii		
	Drosera nitidula		
	Drosera pallida		
	Drosera scorpioides		
Elaeocarpaceae	*Tetratheca hirsuta*		
	Tetratheca virgata		
Ericaceae	*Astroloma ciliatum*		
	Astroloma pallidum		
	Leucopogon capitellatus		
	Leucopogon conostephioides		
	Leucopogon glabellus		
	Leucopogon propinquus		
	Leucopogon pulchellus		
	Leucopogon subsejunctus		2
Fabaceae	*Acacia browniana*		
	Acacia dealbata	*	
	Acacia extensa		
	Acacia incurva		
	Acacia insolita subsp. *insolita*		
	Acacia nervosa		
	Acacia pulchella		

FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
Fabaceae	*Acacia saligna*		
	Acacia stenoptera		
	Bossiaea eriocarpa		
	Bossiaea ornata		
	Chamaecytisus palmensis	*	
	Chorizema aciculare		
	Chorizema dicksonii		
	Daviesia cordata		
	Daviesia incrassata		
	Daviesia longifolia		
	Daviesia preissii		
	Dillwynia laxiflora		
	Gastrolobium calycinum		
	Gastrolobium praemorsum		
	Gompholobium confertum		
	Gompholobium knightianum		
	Gompholobium marginatum		
	Gompholobium preissii		
	Jacksonia condensata		
	Kennedia coccinea		
	Kennedia prostrata		
	Labichea punctata		
	Lotus subbiflorus	*	
	Lupinus cosentinii	*	
	Lupinus luteus		
	Trifolium campestre	*	
Geraniaceae	*Erodium cicutarium*	*	
	Geranium retrorsum		
	Pelargonium australe		
Goodeniaceae	*Dampiera alata*		
	Dampiera linearis		
	Lechenaultia biloba		
	Scaevola calliptera		
	Velleia trinervis		
Haemodoraceae	*Anigozanthos bicolor*		
	Anigozanthos manglesii		
	Conostylis aculeata		
	Conostylis pusilla		
	Conostylis setigera		
	Haemodorum laxum		
	Haemodorum simplex		
	Haemodorum spicatum		
	Tribonanthes longipetala		
Haloragaceae	*Glischrocaryon aureum*		
Hemerocallidaceae	*Agrostocrinum hirsutum*		

FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
	Caesia micrantha		
	Dianella revoluta		
	Stypandra glauca		
Hypoxidaceae	*Pauridia glabella*		
	Pauridia occidentalis var. *quadriloba*		
Iridaceae	*Freesia alba* x *leichtlinii*	*	
	Gladiolus angustus	*	
	Moraea flaccida	*	
	Patersonia juncea		
	Patersonia occidentalis		
	Romulea rosea	*	
	Sparaxis bulbifera	*	
	Watsonia meriana	*	
Lamiaceae	*Hemiandra pungens*		
Lentibulariaceae	*Utricularia multifida*		
Linaceae	*Linum marginale*		
Myrtaceae	*Astartea scoparia*		
	Astartea zephyra		
	Babingtonia camphorosmae		
	Calothamnus sanguineus		
	Corymbia calophylla		
	Eucalyptus decipiens		
	Eucalyptus marginata		
	Eucalyptus rudis		
	Eucalyptus wandoo		
	Hypocalymma angustifolium		
	Kunzea micrantha subsp. *oligandra*		
	Kunzea recurva		
	Leptospermum erubescens		
	Melaleuca cuticularis		
	Melaleuca viminea		
	Pericalymma ellipticum		
	Rinzia fumana		
	Verticordia densiflora var. *densiflora*		
	Verticordia pennigera		
Olacaceae	*Olax benthamiana*		
Orchidaceae	*Caladenia flava*		
	Caladenia hiemalis		
	Caladenia longicauda subsp. *redacta*		
	Caladenia longiclavata		
	Caladenia macrostylis		
	Caladenia radiata		
	Caladenia reptans		
Orchidaceae	*Cyanicula gemmata*		
	Cyanicula sericea		

FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
	Diuris corymbosa		
	Diuris insignis		
	Diuris longifolia		
	Microtis alba		
	Prasophyllum gracile		
	Pterostylis recurva		
	Thelymitra antennifera		
	Thelymitra benthamiana		
	Thelymitra crinita		
Orobanchaceae	*Bartsia trixago*	*	
	Parentucellia latifolia	*	
	Parentucellia viscosa	*	
Papaveraceae	*Fumaria muralis*	*	
Philydraceae	*Philydrella drummondii*		
Phyllanthaceae	*Phyllanthus calycinus*		
	Poranthera huegelii		
Pittosporaceae	*Billardiera heterophylla*		
Poaceae	*Aira caryophyllea*	*	
	Amphibromus nervosus		
	Amphipogon amphipogonoides		
	Austrostipa campylachne		
	Austrostipa compressa		
	Austrostipa hemipogon		
	Austrostipa semibarbata		
	Avena barbata	*	
	Briza maxima	*	
	Briza minor	*	
	Bromus catharticus	*	
	Ehrharta calycina	*	
	Ehrharta longiflora	*	
	Neurachne alopecuroidea		
	Poa drummondiana		
	Rytidosperma pilosum		
	Tetrarrhena laevis		
Polygonaceae	*Rumex obtusifolius*	*	
Primulaceae	*Lysimachia arvensis*	*	
Proteaceae	*Banksia bipinnatifida*		
	Banksia dallanneyi		
	Banksia grandis		
	Banksia sessilis		
	Banksia sphaerocarpa		
	Banksia squarrosa		
Proteaceae	*Conospermum caeruleum*		
	Grevillea bipinnatifida		
	Grevillea pilulifera		

FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
	Grevillea pulchella		
	Grevillea quercifolia		
	Grevillea trifida		
	Hakea lissocarpha		
	Hakea marginata		
	Hakea prostrata		
	Hakea ruscifolia		
	Hakea sulcata		
	Hakea trifurcata		
	Hakea undulata		
	Hakea varia		
	Persoonia longifolia		
	Petrophile serruriae		
	Petrophile squamata		
	Stirlingia simplex		
	Synaphea cuneata		
	Synaphea damopsis		
	Synaphea floribunda		
	Synaphea gracillima		
	Synaphea hians		3
	Synaphea obtusata		
	Synaphea petiolaris		
Ranunculaceae	*Ranunculus colonorum*		
Restionaceae	*Apodasmia ceramophila*		
	Desmocladus asper		
	Desmocladus fasciculatus		
	Desmocladus flexuosus		
	Harperia lateriflora		
	Hypolaena exsulca		
	Leptocarpus canus		
	Leptocarpus coangustatus		
	Leptocarpus scariosus		
	Loxocarya cinerea		
Rhamnaceae	*Trymalium ledifolium*		
Rubiaceae	*Opercularia apiciflora*		
Rutaceae	*Boronia crenulata*		
	Boronia ramosa		
Santalaceae	*Santalum acuminatum*		
Stylidiaceae	*Levenhookia pusilla*		
	Levenhookia stipitata		
	Stylidium affine		
Stylidiaceae	*Stylidium calcaratum*		
	Stylidium crassifolium		
	Stylidium dichotomum		
	Stylidium ecorne		

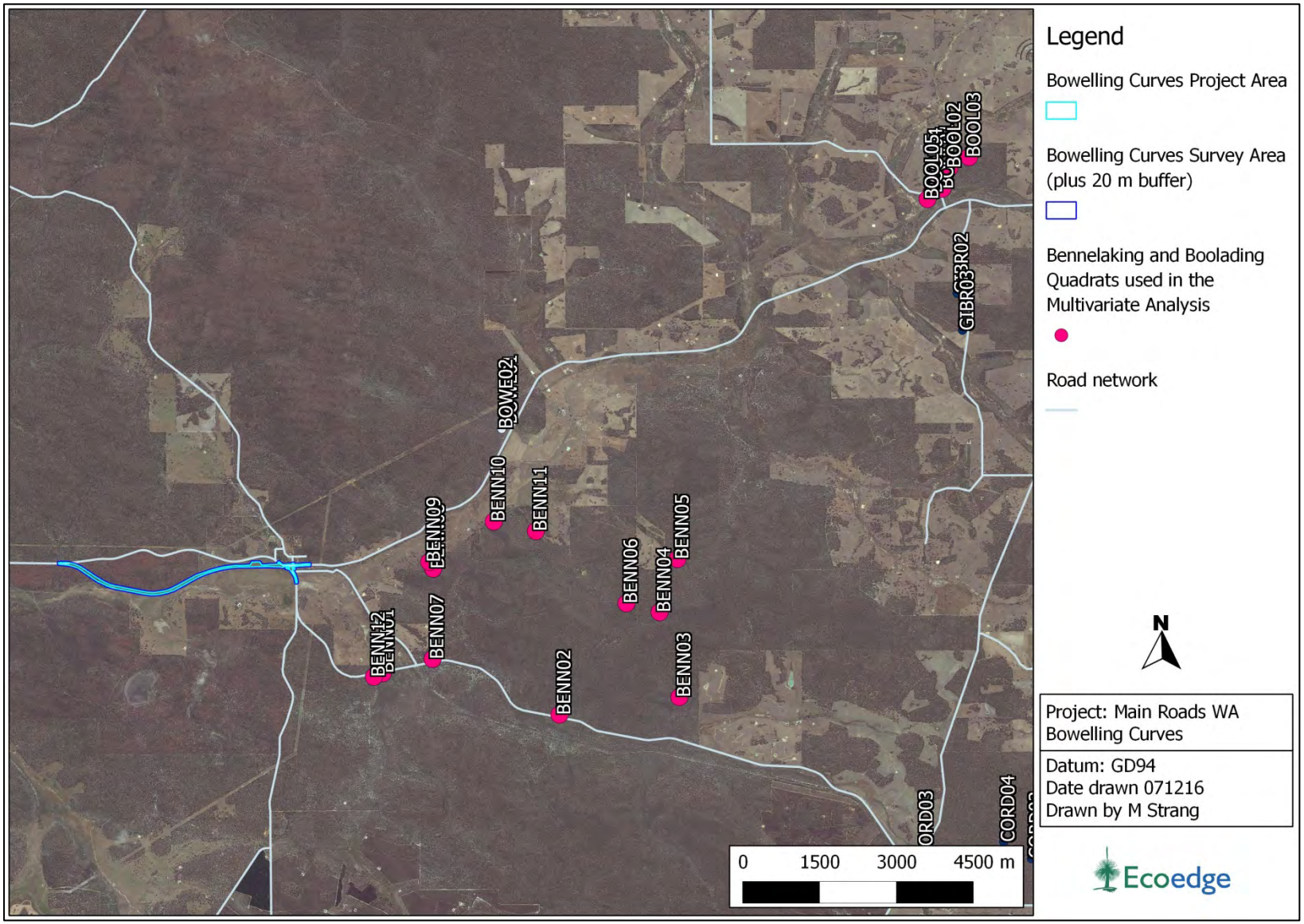
FAMILY NAME	SPECIES NAME	NATURALISED	CONSV_CODE
	Stylidium piliferum		
	Stylidium schoenoides		
	Stylidium uniflorum		
Thymelaeaceae	*Pimelea imbricata*		
	Pimelea suaveolens		
Xanthorrhoeaceae	*Xanthorrhoea gracilis*		
	Xanthorrhoea preissii		
Zamiaceae	*Macrozamia riedlei*		

Appendix 10. Completed Threatened and Priority Flora Report Forms.

Appendix 11. Floristic Quadrats from Bennelaking and Boolading and the Swan Coastal Plain Dataset used for comparison in the Multivariate Analyses.

Bennelaking and Boolading Comparison Quadrats (Smith, 2007).

Site Code	Landscape Position	Soil Colour	Soil Type	Geology	Vegetation
BENN01	Plain/Flat	Grey-Brown	Clay Loam	No	Wandoo woodland
BENN02	Mid Slope	Yellow-Brown	Sandy Loam	Gravelly	Wandoo-Jarrah-Marri woodland
BENN03	Mid Slope	Grey-Brown	Sandy Loam	Gravelly	Wandoo-Jarrah-Marri woodland
BENN04	Upper Slope	Yellow-Brown	Sand	Gravelly	Jarrah-Sheoak open forest
BENN05	Lower Slope	Yellow-Brown	Sandy Clay	Light gravel	Wandoo woodland
BENN06	Upper Slope	Yellow-Brown	Sand	Gravelly	Wandoo-Jarrah-Marri open forest
BENN08	Lower Slope	Red-Brown	Loam	Rocky	Wandoo-Marri woodland
BENN09	Lower Slope	Brown	Loam	Rocky	Wandoo woodland
BENN10	Mid Slope	Yellow-Brown	Sand	Gravelly	*Eucalyptus decipiens* mallee woodland
BENN11	Mid Slope	Yellow-Brown	Sand	Gravelly	Wandoo woodland
BOOL01	Lower Slope	Grey-Brown	Loam	No	Jarrah woodland
BOOL02	Mid Slope	Red-Brown	Loam	Rocky	Wandoo-Marri open forest
BOOL03	Upper Slope	Grey-Brown	Sandy Loam	Gravelly	Wandoo-Jarrah open forest
BOWL01	Plain	Grey-Brown	Clay Loam	No	Wandoo woodland
BOWL02	Plain	Grey-Brown	Clay Loam	No	Wandoo woodland



The locations of the 14 Bennelaking and Boolading comparison quadrats in relation to the Survey Area are denoted in pink.

Swan Coastal Plain Comparison Quadrats (Gibson *et al.* 1994)

SITE NAME	SITE	LATITUDE	LONGITUDE	SWAFCT	CP
Byrd Swamp 1	BYRD01	-33.11	115.81	9	yes
Manea Park 1	MANE01	-33.37	115.66	9	yes
Wellard Road 1	WELR01	-33.05	115.81	9	yes
Wellard Road 2	WELR02	-33.05	115.81	9	yes
Wonnerup Road	WONN03	-33.67	115.58	9	yes
Yarloop 2	YARL02	-32.94	115.9	9	yes
Haub Bridge 3	HAUB03	-32.86	115.76	8	yes
Hay Park 1	HAYP01	-33.37	115.64	8	yes
Meelon NR 1	MELN01	-32.69	115.93	8	yes
Meelon NR 2	MELN02	-32.69	115.93	8	yes
Waroona 3	WARO03	-32.81	115.9	8	yes
Waroona 4	WARO04	-32.81	115.9	8	yes
Waterloo 4	WATE04	-33.33	115.76	8	yes
Austin Bay 8	AUST08	-32.64	115.78	7	yes
Fish Road NR 1	FISH01	-33.73	115.39	7	yes
Fish Road NR 2	FISH02	-33.73	115.39	7	yes
Ruabon NR 7	RUAB07	-33.65	115.51	7	yes
Yoongarillup 4	YOON04	-33.72	115.43	7	yes
Fish Road NR 3	FISH03	-33.73	115.39	10a	yes
Fish Road NR 4	FISH04	-33.74	115.39	10a	yes
Haub Bridge 4	HAUB04	-32.86	115.77	10a	yes
Koolierrenup 6	KOOL06	-32.76	115.74	10a	yes
Koolierrenup 7	KOOL07	-32.76	115.74	10a	yes
Waroona 5	WARO05	-32.81	115.9	10a	yes
Ambergate 2	AMBR02	-33.74	115.32	2	
Ambergate 5	AMBR05	-33.74	115.34	2	
Ambergate 7	AMBR07	-33.74	115.32	2	
Fish Road NR 5	FISH05	-33.74	115.39	2	
Yoongarillup 3	YOON03	-33.72	115.44	2	
Guthrie Block 2	GUTH02	-33.08	115.77	5	
Guthrie Block 4	GUTH04	-33.08	115.78	5	
Ambergate 3	AMBR03	-33.74	115.33	4	
Capel NR 3	CAPL03	-33.57	115.55	4	
Guthrie Block 1	GUTH01	-33.08	115.78	4	
Haub Bridge 1	HAUB01	-32.86	115.77	4	
Koolierrenup 1	KOOL01	-32.73	115.71	4	
Lyons Block 1	LYON01	-33	115.77	4	
Payne Road	PAYN03	-33.75	115.19	4	
Capel NR 4	CAPL04	-33.58	115.55	13	
Haub Bridge 2	HAUB02	-32.86	115.76	13	
McLarty NR 1	MCLA01	-32.69	115.71	13	
Waterloo 1	WATE01	-33.33	115.76	13	
Waterloo 2	WATE02	-33.33	115.76	13	
Capel NR 6	CAPL06	-33.57	115.55	12	
Capel NR 9	CAPL09	-33.57	115.54	12	
Riverdale NR 1	RIVD01	-32.99	115.78	12	
Carabooda 3	CARA03	-32.64	115.72	11	
Dalyellup 1	DALY01	-33.41	115.63	11	

Appendix 12. List of taxa occurring in the B2 vegetation unit (*Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland).

Also shown are the species also listed as occurring in the "Clay pans with shrubs over herbs" component of the Federally-listed TEC "Claypans of the Swan Coastal Plain".

FAMILY NAME	SPECIES	NATURALISED	TEC
Apiaceae	*Daucus glochidiatus*		
Asparagaceae	*Chamaescilla corymbosa*		x
	Dichopogon preissii		
	Lomandra hermaphrodita		
	Sowerbaea laxiflora		
	Thysanotus gracilis		
Asteraceae	*Hyalosperma pusillum*		
	Podolepis lessonii		
	Quinetia urvillei		
	Ursinia anthemoides	*	x
	Waitzia suaveolens		
Boryaceae	*Borya scirpoidea*		
Colchicaceae	*Burchardia monantha*		
	Burchardia multiflora		
	Wurmbea dioica		x
Cyperaceae	*Ficinia nodosa*		
	Mesomelaena tetragona		
Droseraceae	*Drosera erythrorhiza*		
	Drosera gigantea		x
	Drosera glanduligera		x
	Drosera neesii		
Fabaceae	*Acacia incurva*		
	Acacia saligna		
	Gompholobium marginatum		
	Jacksonia condensata		
	Trifolium campestre	*	x
Haemodoraceae	*Anigozanthos bicolor*		
	Haemodorum simplex		
	Haemodorum spicatum		
	Tribonanthes longipetala		x
	Tribonanthes violacea		x
Hemerocallidaceae	*Caesia micrantha*		x
Hypoxidaceae	*Pauridia glabella*		x
	Pauridia occidentalis var. *quadriloba*		x
Iridaceae	*Moraea flaccida*	*	
	Romulea rosea	*	x
	Sparaxis bulbifera	*	
	Watsonia meriana	*	
Lentibulariaceae	*Utricularia multifida*		x

FAMILY NAME	SPECIES	NATURALISED	TEC
Myrtaceae	*Babingtonia camphorosmae*		
	Hypocalymma angustifolium		
	Kunzea micrantha subsp. *oligandra*		
	Melaleuca viminea		x
	Verticordia pennigera		
Orchidaceae	*Caladenia hiemalis*		
	Caladenia radiata		
	Caladenia reptans		
	Diuris insignis		
	Prasophyllum gracile		x
	Thelymitra antennifera		x
	Thelymitra vulgaris		x
Orobanchaceae	*Bartsia trixago*	*	
	Parentucellia viscosa	*	
Philydraceae	*Philydrella drummondii*		x
Poaceae	*Aira caryophyllea*	*	x
	Austrostipa campylachne		
	Briza minor	*	
	Neurachne alopecuroidea		
	Rytidosperma pilosum		
Primulaceae	*Lysimachia arvensis*	*	
Proteaceae	*Hakea prostrata*		
	Hakea varia		x
Ranunculaceae	*Ranunculus colonorum*		
Restionaceae	*Apodasmia ceramophila*		
	Desmocladus asper		
	Harperia lateriflora		
	Leptocarpus coangustatus		x
Rhamnaceae	*Trymalium ledifolium*		
Stylidiaceae	*Levenhookia pusilla*		
	Stylidium calcaratum		x
	Stylidium crassifolium		
	Stylidium ecorne		x
	Stylidium uniflorum		
Thymelaeaceae	*Pimelea imbricata*		
Xanthorrhoeaceae	*Xanthorrhoea preissii*		x

Appendix 13. Photographs and descriptions of Vegetation Units within the Bowelling Survey Area.

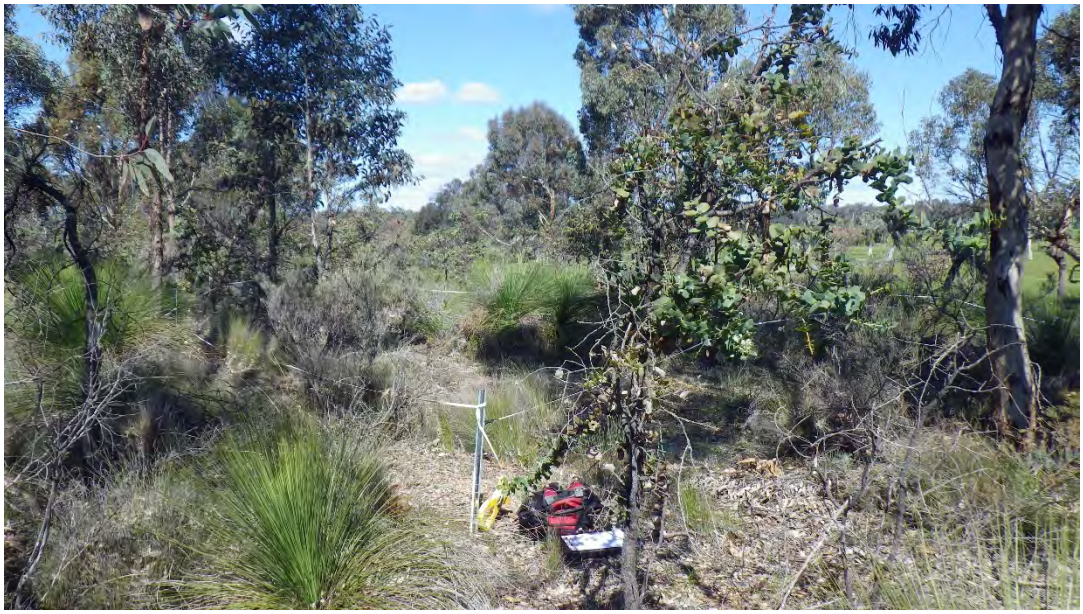
Vegetation Unit A1 – Jarrah-Marri-Wandoo woodland/open forest on mid-/lower slopes
Quadrats: BOWE01, BOWE18, BOWE02, BOWE03, BOWE12, BOWE04, BOWE06
Grey gravelly sandy-loam, mid- and lower slopes
Open forest of Jarrah, (Marri), (Wandoo) over shrubland/low shrubland of *Acacia pulchella*, *Banksia dallanneyi*, *Bossiaea ornata*, *Chamaescilla corymbosa*, *Leucopogon capitellatus*, *Trymalium ledifolium*, (Xanthorrhoea preissii) over open herbland of *Craspedia variabilis*, *Desmocladus fasciculatus*, *Drosera erythrorhiza*, *Lagenophora huegelii*, *Loxocarya cinerea*, *Stylidium affine* and *Trichocline spathulata*.

Vegetation Unit A2 - Jarrah-Marri-Wandoo woodland/open forest on upper slopes
Quadrats: BOWE13, BOWE21, BOWE08, BOWE05, BOWE07, BOWE09
Grey-brown gravelly sand, mainly upper and mid-slopes
Open forest of Jarrah, Marri, (Wandoo) over shrubland/low shrubland of *Acacia pulchella*, *Hakea lissocarpha*, (*Grevillea bipinnatifida*), *Hibbertia commutata*, (*Leucopogon subsejunctus*), (*Trymalium ledifolium*) over open herbland/grassland of *Drosera erythrorhiza*, *Hyalosperma cotula*, *Lagenophora huegelii*, *Loxocarya cinerea*, *Millotia tenuifolia*, *Neurachne alopecuroidea*, *Stylidium affine*, *S. piliferum* and *Trichocline spathulata*.

Vegetation Unit B1 – Wandoo-Marri woodland on lower slopes
Quadrats: BOWE10, BOWE20, BOWP499
Brown or Grey-brown clay-loam or clay, lower slopes, shallow valleys
Woodland of Wandoo or Marri over open low shrubland of *Acacia pulchella*, *Grevillea bipinnatifida*, *Hakea varia*, *Hypocalymma angustifolium* over open herbland/grassland of **Briza maxima*, *Neurachne alopecuroidea*, **Lysimachia arvensis*, *Hypolaena exsulca*, *Sowerbaea laxiflora* and *Stylidium crassifolium*.

Vegetation Unit B2 - *Melaleuca viminea-Hakea prostrata-Kunzea ciliata* tall open shrubland
Quadrats: BOWE11, BOWE19
Brown or grey-brown clay, flats
Tall open shrubland of *Melaleuca viminea*, *Hakea prostrata*, *Kunzea ciliata* and *Verticordia pennigera* over a diverse herbland including *Drosera gigantea*, *D. glanduligera*, *Chamaescilla corymbosa*, *Stylidium crassifolium* and open sedgeland of *Apodasmia ceramophila*.

Vegetation Unit C1 - *Hakea prostrata-H. varia- M. viminea* tall shrubland
Quadrats: BOWE14, BOWE15, BOWE17
Grey-sandy loam or clay-loam, flats
Low woodland/ tall shrubland of *Hakea prostrata-H. varia- M. viminea* tall shrubland (sometimes with *M. cuticularis* as shown in the photograph), *Kunzea ciliata* and *Verticordia pennigera* or tall shrubland of *Hakea trifurcata*, *H. varia* and *Pericalymma ellipticum*.



Vegetation Unit C2 – Jarrah-Wandoo open forest on heavy gravel on lower slopes
Quadrats: BOWE16, BOWP505
Grey sand on heavy gravel, lower slopes
Open forest of Jarrah, Wandoo over shrubland/low shrubland of *Allocasuarina humilis*, *Banksia squarrosa*, *Hakea lissocarpha*, *H. prostrata*, *H. trifurcata*, *Kunzea recurva*, *Petrophile serruriae* and *Xanthorrhoea preissii*.

Vegetation Unit D - *Amphibromus nervosus* tall grassland
No quadrats
Tall grassland of *Amphibromus nervosus*

Vegetation Unit E – Marri-Wandoo very open woodland in pasture
No quadrats
Woodland of Marri, Wandoo, *Melaleuca cuticularis* (occasional) over pasture species

Vegetation unit F – Pasture or cleared areas
No quadrats
Pasture or herbaceous weed species, cleared

Appendix 14. Details of Habitat Trees mapped within the Bowelling Survey Area.

Habitat Trees (DBH>50cm, 30 cm for wandoo)
Datum - GDA94

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001B	50H	447608	6301969	Wandoo	20+	0											No Signs	No Signs	No	
wpt002B	50H	447575	6301965	Wandoo	20+	0											No Signs	No Signs	No	
wpt003B	50H	447528	6301974	Jarrah	15-20	0											No Signs	No Signs	No	
wpt004B	50H	447631	6301972	Wandoo	20+	0											No Signs	No Signs	No	
wpt005B	50H	447640	6301972	Wandoo	20+	0											No Signs	No Signs	No	
wpt007B	50H	452405	6301932	Jarrah	15-20	0											No Signs	No Signs	No	
wpt008B	50H	452393	6301933	Jarrah	15-20	0											No Signs	No Signs	No	
wpt009B	50H	452381	6301943	Jarrah	15-20	0											No Signs	No Signs	No	
wpt010B	50H	452338	6301936	Jarrah	15-20	0											No Signs	No Signs	No	
wpt011B	50H	452328	6301930	Jarrah	15-20	0											No Signs	No Signs	No	
wpt012B	50H	452319	6301948	Jarrah	15-20	0											No Signs	No Signs	No	
wpt013B	50H	452300	6301947	Jarrah	15-20	3	Branch	<5	Branch	5-12	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt014B	50H	452283	6301925	Jarrah	20+	0											No Signs	No Signs	No	
wpt015B	50H	452180	6301932	Wandoo	20+	0											No Signs	No Signs	No	
wpt016B	50H	452121	6301937	Jarrah	15-20	0											No Signs	No Signs	No	
wpt017B	50H	452072	6301923	Jarrah	20+	0											No Signs	No Signs	No	
wpt018B	50H	452073	6301927	Wandoo	20+	0											No Signs	No Signs	No	
wpt019B	50H	452073	6301928	Wandoo	20+	0											No Signs	No Signs	No	
wpt020B	50H	452092	6301947	Marri	15-20	0											No Signs	No Signs	No	
wpt021B	50H	452030	6301908	Marri	10-15	0											No Signs	No Signs	No	
wpt022B	50H	451977	6301904	Jarrah	20+	0											No Signs	No Signs	No	
wpt023B	50H	451967	6301917	Marri	20+	0											No Signs	No Signs	No	
wpt024B	50H	451970	6301936	Marri	20+	0											No Signs	No Signs	No	
wpt025B	50H	451970	6301936	Marri	20+	0											No Signs	No Signs	No	
wpt026B	50H	451956	6301909	Wandoo	20+	0											No Signs	No Signs	No	
wpt027B	50H	451946	6301926	Wandoo	15-20	0											No Signs	No Signs	No	
wpt028B	50H	451932	6301913	Jarrah	20+	0											No Signs	No Signs	No	
wpt029B	50H	451905	6301929	Wandoo	20+	0											No Signs	No Signs	No	
wpt030B	50H	451901	6301928	Wandoo	20+	0											No Signs	No Signs	No	
wpt031B	50H	451894	6301928	Wandoo	20+	0											No Signs	No Signs	No	
wpt032B	50H	451888	6301926	Wandoo	20+	0											No Signs	No Signs	No	
wpt033B	50H	451910	6301912	Wandoo	15-20	0											No Signs	No Signs	No	
wpt034B	50H	451880	6301938	Wandoo	20+	0											No Signs	No Signs	No	
wpt035B	50H	451809	6301981	Wandoo	20+	0											No Signs	No Signs	No	
wpt036B	50H	451777	6301989	Dead Unknown	20+	2	Knot Hole	<5	Branch	<5							No Signs	No Signs	No	Depth of hollows unknown
wpt037B	50H	451764	6301955	Wandoo	15-20	0											No Signs	No Signs	No	
wpt038B	50H	451810	6301937	Wandoo	20+	0											No Signs	No Signs	No	
wpt039B	50H	452049	6301847	Wandoo	15-20	0											No Signs	No Signs	No	
wpt040B	50H	452035	6301845	Wandoo	15-20	0											No Signs	No Signs	No	
wpt041B	50H	452082	6301657	Flooded Gum	15-20	0											No Signs	No Signs	No	
wpt042B	50H	452137	6301601	Marri	15-20	0											No Signs	No Signs	No	
wpt043	50H	447484	6301927	Wandoo	15-20	0											No Signs	No Signs	No	
wpt043B	50H	452156	6301629	Marri	20+	0											No Signs	No Signs	No	
wpt044	50H	447483	6301917	Wandoo	15-20	0											No Signs	No Signs	No	
wpt044B	50H	451949	6301835	Wandoo	15-20	0											No Signs	No Signs	No	
wpt045B	50H	451735	6301933	Dead Unknown	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt046B	50H	451700	6301909	Wandoo	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt047B	50H	451435	6301979	Wandoo	10-15	0											No Signs	No Signs	No	
wpt048	50H	447503	6301917	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt048B	50H	451436	6301961	Wandoo	10-15	0											No Signs	No Signs	No	
wpt049	50H	447507	6301917	Wandoo	15-20	0											No Signs	No Signs	No	
wpt049B	50H	451443	6301953	Wandoo	10-15	0											No Signs	No Signs	No	
wpt050	50H	447516	6301918	Wandoo	15-20	0											No Signs	No Signs	No	
wpt050B	50H	451445	6301952	Jarrah	15-20	0											No Signs	No Signs	No	
wpt051	50H	447513	6301909	Wandoo	15-20	0											No Signs	No Signs	No	
wpt051B	50H	451434	6301932	Wandoo	15-20	3	Branch	<5	Branch	<5	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt052	50H	447522	6301915	Wandoo	15-20	0											No Signs	No Signs	No	
wpt052B	50H	451432	6301947	Jarrah	15-20	0											No Signs	No Signs	No	
wpt053	50H	447523	6301916	Wandoo	15-20	0											No Signs	No Signs	No	
wpt053B	50H	451399	6301913	Wandoo	15-20	0											No Signs	No Signs	No	
wpt054	50H	447523	6301919	Wandoo	15-20	0											No Signs	No Signs	No	
wpt054B	50H	451414	6301962	Wandoo	15-20	0											No Signs	No Signs	No	
wpt055	50H	447525	6301922	Wandoo	15-20	0											No Signs	No Signs	No	
wpt055B	50H	450172	6301721	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Spout Branch	20+	No Signs	No Signs	Yes	Depth of hollows unknown
wpt056	50H	447528	6301921	Wandoo	15-20	0											No Signs	No Signs	No	
wpt056B	50H	450135	6301702	Jarrah	20+	0											No Signs	No Signs	No	
wpt057B	50H	450121	6301693	Marri	20+	0											No Signs	No Signs	No	
wpt058B	50H	450068	6301654	Jarrah	20+	0											No Signs	No Signs	No	
wpt059B	50H	450059	6301649	Marri	20+	0											No Signs	No Signs	No	
wpt060B	50H	450038	6301641	Jarrah	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt061	50H	447552	6301918	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt061B	50H	449963	6301609	Marri	20+	1	Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt062B	50H	449950	6301595	Jarrah	20+	0											No Signs	No Signs	No	
wpt063B	50H	449890	6301568	Jarrah	20+	0											No Signs	No Signs	No	
wpt064B	50H	449785	6301515	Jarrah	20+	0											No Signs	No Signs	No	
wpt065B	50H	449746	6301492	Dead Jarrah	20+	5+	Branch	<5	Branch	5-12	Spout Branch	<5	Spout Branch	5-12	Spout Branch	12-20	No Signs	No Signs	Yes	Depth of hollows unknown
wpt066B	50H	449660	6301445	Jarrah	20+	0											No Signs	No Signs	No	
wpt067B	50H	449576	6301423	Jarrah	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt068B	50H	449542	6301417	Dead Jarrah	20+	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt069B	50H	449536	6301411	Jarrah	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt070B	50H	449529	6301408	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt071	50H	447634	6301897	Wandoo	15-20	0											No Signs	No Signs	No	
wpt071B	50H	449445	6301405	Jarrah	20+	0											No Signs	No Signs	No	
wpt1010	50H	448162	6301631	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1011	50H	448161	6301633	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1012	50H	448183	6301673	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1013	50H	448178	6301673	Marri	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1014	50H	448198	6301679	Dead Marri	15-20	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt1015	50H	448206	6301674	Marri	20+	0											No Signs	No Signs	No	
wpt1016	50H	448234	6301670	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1017	50H	448239	6301679	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1018	50H	448255	6301677	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1029	50H	448644	6301507	Marri	15-20	0											No Signs	No Signs	No	
wpt1049	50H	448492	6301548	Jarrah	20+	0											No Signs	No Signs	No	
wpt1050	50H	448480	6301548	Marri	20+	0											No Signs	No Signs	No	
wpt1051	50H	448465	6301559	Wandoo	20+	0											No Signs	No Signs	No	
wpt1052	50H	448462	6301561	Marri	20+	0											No Signs	No Signs	No	
wpt1053	50H	448460	6301557	Marri	20+	0											No Signs	No Signs	No	
wpt1054	50H	448424	6301564	Marri	15-20	0											No Signs	No Signs	No	
wpt1061	50H	448399	6301582	Marri	20+	0											No Signs	No Signs	No	
wpt1062	50H	448414	6301579	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1063	50H	448414	6301585	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1064	50H	448387	6301581	Jarrah	20+	0											No Signs	No Signs	No	
wpt1065	50H	448371	6301587	Jarrah	15-20	1	Branch	<5									No Signs	No Signs	No	Depth of hollows unknown
wpt1066	50H	448366	6301606	Jarrah	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1067	50H	448334	6301620	Marri	15-20	3	Knot Hole	5-12	Branch	<5	Branch	5-12					No Signs	No Signs	No	Depth of hollows unknown
wpt1068	50H	448360	6301584	Jarrah	20+	0											No Signs	No Signs	No	
wpt1069	50H	448356	6301584	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1070	50H	448360	6301575	Dead Unknown	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt1071	50H	448332	6301587	Marri	15-20	0											No Signs	No Signs	No	
wpt1072	50H	448327	6301590	Dead Jarrah	5-10	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt1073	50H	448304	6301593	Wandoo	20+	0											No Signs	No Signs	No	
wpt1074	50H	448309	6301597	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1075	50H	448304	6301616	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1076	50H	448307	6301628	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Too shallow
wpt1077	50H	448287	6301622	Wandoo	20+	0											No Signs	No Signs	No	
wpt1078	50H	448286	6301649	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt1079	50H	448248	6301631	Wandoo	20+	0											No Signs	No Signs	No	
wpt1080	50H	448237	6301626	Marri	20+	0											No Signs	No Signs	No	
wpt1081	50H	448244	6301609	Dead Unknown	15-20	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt1082	50H	448251	6301594	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1083	50H	448263	6301588	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1084	50H	448235	6301606	Wandoo	20+	0											No Signs	No Signs	No	
wpt1085	50H	448229	6301615	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1086	50H	448218	6301602	Wandoo	20+	3	Branch	<5	Branch	5-12	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt1087	50H	448205	6301621	Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1088	50H	448209	6301631	Marri	20+	0											No Signs	No Signs	No	
wpt1089	50H	448203	6301632	Marri	20+	0											No Signs	No Signs	No	
wpt1090	50H	448203	6301646	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1091	50H	448191	6301629	Marri	20+	0											No Signs	No Signs	No	
wpt1093	50H	448181	6301618	Wandoo	20+	5+	Knot Hole	5-12	Spout Branch	5-12	Branch	5-12	Branch	<5	Spout Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1100	50H	448153	6301684	Marri	15-20	0											No Signs	No Signs	No	
wpt1101	50H	448179	6301668	Dead Unknown	10-15	1	Spout Trunk	12-20									No Signs	No Signs	No	Too shallow
wpt1102	50H	448240	6301643	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1130	50H	447911	6301898	Wandoo	20+	0											No Signs	No Signs	No	
wpt1133	50H	447861	6301925	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1134	50H	447844	6301924	Marri	15-20	2	Spout Branch	20+	Spout Trunk	20+							No Signs	No Signs	Yes	Depth of hollows unknown
wpt1135	50H	447817	6301921	Marri	20+	5+	Knot Hole	5-12	Knot Hole	<5	Knot Hole	<5	Branch	<5	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt1136	50H	447787	6301920	Marri	20+	0											No Signs	No Signs	No	
wpt1137	50H	447776	6301916	Jarrah	20+	0											No Signs	No Signs	No	
wpt1138	50H	447765	6301925	Marri	5-10	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt1139	50H	447766	6301938	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1140	50H	447758	6301933	Marri	20+	0											No Signs	No Signs	No	
wpt1141	50H	447728	6301932	Marri	20+	0											No Signs	No Signs	No	
wpt1142	50H	447718	6301929	Jarrah	20+	0											No Signs	No Signs	No	
wpt1143	50H	447693	6301927	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1144	50H	447688	6301911	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1145	50H	447685	6301909	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1146	50H	447671	6301900	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1147	50H	447671	6301904	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1148	50H	447655	6301910	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1149	50H	447665	6301927	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1150	50H	447647	6301923	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1151	50H	447646	6301918	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1152	50H	447646	6301913	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1153	50H	447644	6301909	Wandoo	20+	0											No Signs	No Signs	No	
wpt1154	50H	447632	6301911	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1155	50H	447628	6301919	Wandoo	15-20	2	Branch	<5	Spout Branch	<5							No Signs	No Signs	No	Depth of hollows unknown
wpt1156	50H	447624	6301905	Wandoo	20+	0											No Signs	No Signs	No	
wpt1157	50H	447606	6301908	Wandoo	15-20	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt1158	50H	447598	6301914	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1159	50H	447607	6301926	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1160	50H	447579	6301923	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1161	50H	447577	6301923	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1162	50H	447562	6301920	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	12-20	Branch	<5	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt1163	50H	447693	6301892	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1164	50H	447694	6301894	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1165	50H	447704	6301893	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1166	50H	447702	6301886	Jarrah	20+	0											No Signs	No Signs	No	
wpt1167	50H	447723	6301882	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1171	50H	447772	6301872	Jarrah	20+	0											No Signs	No Signs	No	
wpt1172	50H	447776	6301869	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1174	50H	447796	6301880	Jarrah	20+	0											No Signs	No Signs	No	
wpt1175	50H	447800	6301873	Jarrah	20+	0											No Signs	No Signs	No	
wpt1176	50H	447810	6301853	Marri	20+	0											No Signs	No Signs	No	
wpt1185	50H	447899	6301815	Marri	15-20	0											No Signs	No Signs	No	
wpt1187	50H	447948	6301795	Jarrah	20+	0											No Signs	No Signs	No	
wpt1188	50H	447967	6301797	Jarrah	10-15	1	Spout Trunk	20+									No Signs	No Signs	No	Too shallow
wpt1189	50H	447974	6301809	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Spout Branch	<5	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt1190	50H	447962	6301777	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1191	50H	447965	6301768	Wandoo	5-10	0											No Signs	No Signs	No	
wpt1200	50H	447989	6301750	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1207	50H	448085	6301684	Marri	20+	0											No Signs	No Signs	No	
wpt1212	50H	448116	6301679	Marri	15-20	1	Spout Trunk	12-20									No Signs	No Signs	No	Too shallow
wpt1213	50H	448124	6301691	Marri	20+	0											No Signs	No Signs	No	
wpt1214	50H	448140	6301702	Marri	15-20	1	Spout Trunk	12-20									No Signs	No Signs	No	Too shallow
wpt1215	50H	448152	6301706	Jarrah	20+	0											No Signs	No Signs	No	
wpt1216	50H	448164	6301724	Jarrah	5-10	0											No Signs	No Signs	No	
wpt1217	50H	448167	6301726	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1218	50H	448169	6301728	Marri	15-20	3	Knot Hole	12-20	Branch	<5	Branch	5-12					No Signs	No Signs	No	Too low
wpt1220	50H	448166	6301736	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1221	50H	448183	6301705	Marri	20+	0											No Signs	No Signs	No	
wpt1222	50H	448191	6301703	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1223	50H	448199	6301700	Dead Jarrah	15-20	1	Spout Trunk	12-20									No Signs	No Signs	No	Too shallow
wpt1224	50H	448208	6301691	Marri	20+	0											No Signs	No Signs	No	
wpt1225	50H	448187	6301691	Jarrah	20+	0											No Signs	No Signs	No	
wpt1226	50H	448219	6301685	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1227	50H	448233	6301693	Marri	20+	0											No Signs	No Signs	No	
wpt1250	50H	448122	6301722	Marri	20+	0											No Signs	No Signs	No	
wpt1251	50H	448117	6301730	Dead Unknown	20+	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt1252	50H	448115	6301759	Marri	20+	0											No Signs	No Signs	No	
wpt1256	50H	448107	6301696	Dead Unknown	0-5	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt1257	50H	448041	6301727	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1258	50H	448036	6301741	Jarrah	0-5	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt1259	50H	448034	6301762	Jarrah	20+	0											No Signs	No Signs	No	
wpt1260	50H	448026	6301759	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1261	50H	448025	6301769	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1262	50H	448004	6301769	Flooded Gum	15-20	3	Branch	<5	Branch	5-12	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt1263	50H	447997	6301769	Jarrah	20+	0											No Signs	No Signs	No	
wpt1264	50H	448015	6301809	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1283	50H	448108	6301773	Marri	20+	0											No Signs	No Signs	No	
wpt1285	50H	448106	6301766	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1286	50H	448103	6301766	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1287	50H	448068	6301767	Dead Jarrah	5-10	1	Spout Trunk	12-20									No Signs	No Signs	No	Too shallow
wpt1288	50H	448032	6301795	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1289	50H	448068	6301792	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1308	50H	447978	6301834	Dead Jarrah	15-20	5+	Spout Trunk	12-20	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	No Signs	No Signs	No	Too low/shallow
wpt1309	50H	447977	6301832	Dead Jarrah	15-20	5+	Spout Trunk	12-20	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	No Signs	No Signs	No	Too low/shallow
wpt1310	50H	447986	6301828	Marri	15-20	0											No Signs	No Signs	No	
wpt1311	50H	447962	6301851	Marri	15-20	0											No Signs	No Signs	No	
wpt1312	50H	447957	6301853	Dead Jarrah	0-5	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt1313	50H	447956	6301846	Marri	20+	1	Knot Hole	5-12									Bees	No Signs	No	Depth of hollows unknown
wpt1314	50H	447956	6301842	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1315	50H	447950	6301827	Jarrah	15-20	2	Spout Branch	12-20	Spout Branch	12-20							No Signs	No Signs	No	Too low/shallow
wpt1316	50H	447944	6301834	Dead Jarrah	0-5	2	Spout Trunk	12-20	Spout Trunk	12-20							No Signs	No Signs	No	Too low/shallow
wpt1317	50H	447935	6301859	Jarrah	20+	0											No Signs	No Signs	No	
wpt1318	50H	447937	6301860	Jarrah	20+	0											No Signs	No Signs	No	
wpt1319	50H	447943	6301875	Marri	20+	0											No Signs	No Signs	No	
wpt1320	50H	447900	6301864	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1321	50H	447882	6301857	Jarrah	20+	0											No Signs	No Signs	No	
wpt1322	50H	447889	6301836	Jarrah	0-5	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt1323	50H	447895	6301837	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1324	50H	447856	6301845	Jarrah	20+	0											No Signs	No Signs	No	
wpt1325	50H	447847	6301840	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1326	50H	447837	6301849	Jarrah	20+	0											No Signs	No Signs	No	
wpt1327	50H	447832	6301860	Jarrah	10-15	3	Branch	<5	Branch	5-12	Branch	5-12					No Signs	No Signs	No	Depth of hollows unknown
wpt1328	50H	447830	6301866	Jarrah	15-20	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt1329	50H	447784	6301895	Jarrah	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1330	50H	447774	6301899	Marri	20+	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt1331	50H	447752	6301896	Jarrah	20+	0											No Signs	No Signs	No	
wpt1332	50H	447811	6301901	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1333	50H	447808	6301911	Dead Unknown	0-5	1	Spout Trunk	12-20									No Signs	No Signs	No	Too low/shallow
wpt1334	50H	447821	6301893	Jarrah	15-20	3	Branch	<5	Branch	<5	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt1335	50H	447832	6301896	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1336	50H	447828	6301906	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1337	50H	447845	6301906	Dead Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt1338	50H	447852	6301904	Wandoo	15-20	0											No Signs	No Signs	No	
wpt1339	50H	447848	6301894	Marri	15-20	0											No Signs	No Signs	No	
wpt1340	50H	447867	6301874	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1341	50H	447861	6301861	Jarrah	15-20	0											No Signs	No Signs	No	
wpt1342	50H	447899	6301880	Jarrah	15-20	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt1343	50H	447880	6301908	Jarrah	0-5	0											No Signs	No Signs	No	
wpt180	50H	448421	6301490	Marri	20+	0											No Signs	No Signs	No	
wpt201	50H	452249	6301919	Wandoo	15-20	3	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt202	50H	452235	6301918	Jarrah	15-20	0											No Signs	No Signs	No	
wpt203	50H	452115	6301910	Marri	15-20	0											No Signs	No Signs	No	
wpt204	50H	452048	6301905	Wandoo	20+	0											No Signs	No Signs	No	
wpt205	50H	452048	6301907	Wandoo	20+	0											No Signs	No Signs	No	
wpt206	50H	452042	6301903	Wandoo	15-20	0											No Signs	No Signs	No	
wpt207	50H	452031	6301901	Wandoo	20+	0											No Signs	No Signs	No	
wpt208	50H	452010	6301904	Jarrah	15-20	0											No Signs	No Signs	No	
wpt209	50H	452010	6301906	Jarrah	15-20	0											No Signs	No Signs	No	
wpt210	50H	451929	6301881	Wandoo	15-20	0											No Signs	No Signs	No	
wpt211	50H	451999	6301870	Jarrah	15-20	0											No Signs	No Signs	No	
wpt212	50H	452011	6301876	Jarrah	15-20	0											No Signs	No Signs	No	
wpt213	50H	452150	6301891	Jarrah	15-20	0											No Signs	No Signs	No	
wpt214	50H	452164	6301894	Jarrah	15-20	0											No Signs	No Signs	No	
wpt215	50H	452416	6301902	Jarrah	15-20	0											No Signs	No Signs	No	
wpt233	50H	451782	6301859	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt234	50H	451759	6301887	Dead Unknown	0-5	1	Spout Trunk	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt235	50H	451758	6301888	Dead Unknown	10-15	2	Spout Trunk	<5	Spout Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt238	50H	451096	6301908	Wandoo	15-20	0											No Signs	No Signs	No	
wpt239	50H	451109	6301912	Wandoo	15-20	0											No Signs	No Signs	No	
wpt240	50H	451125	6301912	Wandoo	15-20	2	Branch	<5	Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt241	50H	451125	6301921	Wandoo	20+	3	Knot Hole	<5	Branch	5-12	Branch	5-12					Bees	No Signs	No	Depth of hollows unknown
wpt242	50H	451133	6301908	Wandoo	15-20	0											No Signs	No Signs	No	
wpt243	50H	451145	6301904	Wandoo	15-20	0											No Signs	No Signs	No	
wpt244	50H	451160	6301916	Wandoo	15-20	0											No Signs	No Signs	No	
wpt245	50H	451159	6301921	Wandoo	15-20	5+	Branch	5-12	Branch	12-20	Branch	5-12	Branch	5-12	Spout Branch	12-20	No Signs	No Signs	Yes	Depth of hollows unknown
wpt423	50H	450132	6301620	Wandoo	15-20	0											No Signs	No Signs	No	
wpt424	50H	450132	6301621	Wandoo	15-20	0											No Signs	No Signs	No	
wpt425	50H	450156	6301637	Wandoo	20+	0											No Signs	No Signs	No	
wpt430	50H	449554	6301347	Marri	15-20	0											No Signs	No Signs	No	
wpt431	50H	449497	6301333	Marri	20+	0											No Signs	No Signs	No	
wpt433	50H	448827	6301400	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt434	50H	448869	6301393	Wandoo	15-20	0											No Signs	No Signs	No	
wpt435	50H	448888	6301393	Wandoo	15-20	0											No Signs	No Signs	No	
wpt436	50H	448902	6301385	Wandoo	15-20	0											No Signs	No Signs	No	
wpt437	50H	448820	6301404	Wandoo	15-20	0											No Signs	No Signs	No	
wpt438	50H	448805	6301404	Wandoo	15-20	0											No Signs	No Signs	No	
wpt439	50H	448784	6301404	Flooded Gum	15-20	0											No Signs	No Signs	No	
wpt440	50H	448754	6301416	Marri	15-20	0											No Signs	No Signs	No	
wpt441	50H	448695	6301428	Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt442	50H	448692	6301427	Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt443	50H	448675	6301425	Wandoo	15-20	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt445	50H	450846	6301900	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt446	50H	450869	6301873	Dead Unknown	15-20	3	Fissure	<5	Spout Branch	12-20	Fissure	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt447	50H	450881	6301877	Dead Unknown	0-5	1	Spout Trunk	20+									No Signs	No Signs	No	Too low
wpt448	50H	450883	6301878	Wandoo	15-20	3	Branch	<5	Branch	5-12	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt449	50H	450884	6301891	Wandoo	15-20	1	Spout Trunk	12-20									No Signs	No Signs	No	Too shallow
wpt450	50H	450895	6301879	Wandoo	15-20	0											No Signs	No Signs	No	
wpt451	50H	450894	6301869	Wandoo	20+	0											No Signs	No Signs	No	
wpt452	50H	450905	6301892	Wandoo	15-20	0											No Signs	No Signs	No	
wpt453	50H	450912	6301903	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt454	50H	450924	6301886	Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt455	50H	450921	6301883	Dead Wandoo	15-20	5+	Knot Hole	5-12	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt456	50H	450929	6301896	Wandoo	15-20	0											No Signs	No Signs	No	
wpt457	50H	450930	6301905	Wandoo	15-20	3	Branch	<5	Branch	5-12	Spout Branch	5-12					No Signs	No Signs	No	Depth of hollows unknown
wpt458	50H	450937	6301899	Wandoo	20+	0											No Signs	No Signs	No	
wpt459	50H	450937	6301896	Wandoo	15-20	0											No Signs	No Signs	No	
wpt460	50H	450938	6301863	Marri	20+	0											No Signs	No Signs	No	
wpt461	50H	450957	6301892	Dead Unknown	15-20	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt462	50H	450980	6301899	Wandoo	20+	0											No Signs	No Signs	No	
wpt463	50H	450967	6301884	Wandoo	10-15	0											No Signs	No Signs	No	
wpt464	50H	450979	6301884	Wandoo	10-15	0											No Signs	No Signs	No	
wpt465	50H	450979	6301881	Wandoo	15-20	0											No Signs	No Signs	No	
wpt466	50H	450979	6301865	Wandoo	15-20	0											No Signs	No Signs	No	
wpt467	50H	450978	6301858	Wandoo	15-20	0											No Signs	No Signs	No	
wpt468	50H	450979	6301857	Wandoo	15-20	0											No Signs	No Signs	No	
wpt470	50H	450992	6301860	Marri	20+	0											No Signs	No Signs	No	
wpt471	50H	451001	6301856	Wandoo	20+	0											No Signs	No Signs	No	
wpt472	50H	451015	6301882	Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt473	50H	451006	6301908	Marri	20+	0											No Signs	No Signs	No	
wpt474	50H	451034	6301898	Marri	20+	0											No Signs	No Signs	No	
wpt475	50H	451034	6301896	Wandoo	15-20	0											No Signs	No Signs	No	
wpt476	50H	451035	6301871	Wandoo	15-20	0											No Signs	No Signs	No	
wpt477	50H	451033	6301868	Wandoo	15-20	0											No Signs	No Signs	No	
wpt478	50H	451032	6301866	Wandoo	15-20	0											No Signs	No Signs	No	
wpt479	50H	451071	6301884	Marri	20+	0											No Signs	No Signs	No	
wpt480	50H	451057	6301900	Marri	20+	0											No Signs	No Signs	No	
wpt481	50H	451052	6301901	Wandoo	20+	0											No Signs	No Signs	No	
wpt482	50H	451035	6301907	Dead Jarrah	15-20	0											No Signs	No Signs	No	
wpt483	50H	451075	6301861	Flooded Gum	15-20	0											No Signs	No Signs	No	
wpt484	50H	451081	6301908	Wandoo	15-20	0											No Signs	No Signs	No	
wpt485	50H	451116	6301888	Wandoo	15-20	0											No Signs	No Signs	No	
wpt486	50H	451114	6301898	Wandoo	15-20	0											No Signs	No Signs	No	
wpt487	50H	451130	6301896	Wandoo	15-20	0											No Signs	No Signs	No	
wpt488	50H	451136	6301889	Dead Unknown	15-20	2	Spout Branch	5-12	Spout Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt489	50H	451140	6301877	Wandoo	20+	0											No Signs	No Signs	No	
wpt490	50H	451143	6301868	Flooded Gum	15-20	0											No Signs	No Signs	No	
wpt493	50H	450931	6301846	Wandoo	15-20	0											No Signs	No Signs	No	
wpt494	50H	450910	6301847	Wandoo	15-20	0											No Signs	No Signs	No	
wpt498	50H	450486	6301821	Wandoo	10-15	0											No Signs	No Signs	No	
wpt499	50H	450482	6301815	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt500	50H	450561	6301837	Wandoo	10-15	0											No Signs	No Signs	No	
wpt501	50H	450226	6301709	Wandoo	15-20	0											No Signs	No Signs	No	
wpt502	50H	450292	6301764	Dead Unknown	20+	0											No Signs	No Signs	No	
wpt503	50H	450292	6301764	Wandoo	20+	0											No Signs	No Signs	No	
wpt504	50H	450215	6301734	Dead Unknown	20+	1	Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt505	50H	450219	6301733	Wandoo	10-15	0											No Signs	No Signs	No	
wpt506	50H	450198	6301716	Wandoo	20+	0											No Signs	No Signs	No	
wpt507	50H	450189	6301715	Wandoo	20+	0											No Signs	No Signs	No	
wpt508	50H	450191	6301727	Wandoo	20+	0											No Signs	No Signs	No	
wpt509	50H	450181	6301716	Wandoo	20+	0											No Signs	No Signs	No	
wpt510	50H	450174	6301705	Dead Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt511	50H	450176	6301703	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt512	50H	450159	6301706	Wandoo	15-20	0											No Signs	No Signs	No	
wpt513	50H	450149	6301692	Dead Unknown	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt514	50H	450132	6301665	Wandoo	15-20	0											No Signs	No Signs	No	
wpt515	50H	450082	6301650	Wandoo	15-20	0											No Signs	No Signs	No	
wpt516	50H	450112	6301622	Wandoo	10-15	0											No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt517	50H	450112	6301632	Wandoo	15-20	0											No Signs	No Signs	No	
wpt518	50H	450110	6301632	Wandoo	15-20	0											No Signs	No Signs	No	
wpt519	50H	450125	6301642	Wandoo	15-20	0											No Signs	No Signs	No	
wpt520	50H	450150	6301640	Wandoo	15-20	0											No Signs	No Signs	No	
wpt521	50H	450153	6301643	Wandoo	15-20	0											No Signs	No Signs	No	
wpt522	50H	450180	6301655	Wandoo	10-15	0											No Signs	No Signs	No	
wpt523	50H	450063	6301594	Wandoo	15-20	0											No Signs	No Signs	No	
wpt524	50H	450034	6301589	Wandoo	10-15	0											No Signs	No Signs	No	
wpt525	50H	450025	6301583	Wandoo	15-20	0											No Signs	No Signs	No	
wpt526	50H	449985	6301604	Marri	20+	0											No Signs	No Signs	No	
wpt527	50H	450003	6301612	Jarrah	20+	0											No Signs	No Signs	No	
wpt528	50H	450007	6301614	Marri	20+	0											No Signs	No Signs	No	
wpt529	50H	449971	6301590	Jarrah	20+	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt530	50H	449956	6301581	Jarrah	20+	0											No Signs	No Signs	No	
wpt531	50H	449954	6301580	Wandoo	20+	0											No Signs	No Signs	No	
wpt532	50H	449946	6301571	Jarrah	15-20	0											No Signs	No Signs	No	
wpt533	50H	449932	6301574	Wandoo	15-20	0											No Signs	No Signs	No	
wpt534	50H	449931	6301574	Wandoo	20+	0											No Signs	No Signs	No	
wpt535	50H	449931	6301583	Jarrah	15-20	0											No Signs	No Signs	No	
wpt536	50H	449922	6301578	Jarrah	10-15	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt537	50H	449905	6301557	Jarrah	20+	5+	Knot Hole	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt538	50H	449875	6301543	Wandoo	20+	0											No Signs	No Signs	No	
wpt539	50H	449862	6301536	Wandoo	15-20	0											No Signs	No Signs	No	
wpt540	50H	449841	6301534	Jarrah	15-20	0											No Signs	No Signs	No	
wpt541	50H	449840	6301517	Jarrah	20+	0											No Signs	No Signs	No	
wpt542	50H	449823	6301508	Marri	20+	0											No Signs	No Signs	No	
wpt543	50H	449805	6301503	Jarrah	5-10	1	Spout Trunk	12-20									No Signs	No Signs	No	Too low/shallow
wpt544	50H	449802	6301511	Marri	15-20	0											No Signs	No Signs	No	
wpt545	50H	449791	6301494	Marri	20+	0											No Signs	No Signs	No	
wpt546	50H	449782	6301487	Dead Unknown	20+	5+	Fissure	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt547	50H	449778	6301490	Jarrah	15-20	5+	Knot Hole	<5	Branch	<5	Branch	5-12	Branch	<5	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt548	50H	449766	6301496	Jarrah	15-20	3	Branch	<5	Branch	5-12	Spout Trunk	12-20					No Signs	No Signs	No	Too low/shallow
wpt549	50H	449738	6301481	Jarrah	20+	5+	Knot Hole	5-12	Branch	<5	Branch	5-12	Branch	5-12	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt550	50H	449736	6301472	Jarrah	10-15	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt551	50H	449715	6301466	Jarrah	15-20	0											No Signs	No Signs	No	
wpt552	50H	449698	6301460	Dead Jarrah	20+	2	Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt553	50H	449901	6301514	Wandoo	10-15	0											No Signs	No Signs	No	
wpt554	50H	449671	6301428	Marri	20+	0											No Signs	No Signs	No	
wpt555	50H	449649	6301419	Marri	20+	0											No Signs	No Signs	No	
wpt556	50H	449635	6301427	Marri	15-20	2	Branch	<5	Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt557	50H	449623	6301420	Marri	10-15	3	Knot Hole	20+	Spout Branch	12-20	Spout Trunk	20+					No Signs	No Signs	Yes	Depth of hollows unknown
wpt558	50H	449608	6301409	Marri	20+	0											No Signs	No Signs	No	
wpt559	50H	449578	6301412	Marri	15-20	0											No Signs	No Signs	No	
wpt560	50H	449559	6301408	Jarrah	20+	3	Knot Hole	5-12	Branch	5-12	Spout Trunk	20+					No Signs	No Signs	Yes	Depth of hollows unknown
wpt561	50H	449557	6301409	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt562	50H	449541	6301396	Jarrah	15-20	0											No Signs	No Signs	No	
wpt563	50H	449527	6301390	Marri	20+	0											No Signs	No Signs	No	
wpt564	50H	449513	6301390	Jarrah	20+	0											No Signs	No Signs	No	
wpt565	50H	449505	6301402	Jarrah	15-20	0											No Signs	No Signs	No	
wpt566	50H	449501	6301391	Jarrah	20+	0											No Signs	No Signs	No	
wpt567	50H	449494	6301391	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Spout Branch	5-12	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt568	50H	449478	6301403	Marri	20+	0											No Signs	No Signs	No	
wpt569	50H	449472	6301399	Marri	15-20	0											No Signs	No Signs	No	
wpt570	50H	449472	6301393	Marri	20+	0											No Signs	No Signs	No	
wpt571	50H	449457	6301385	Dead Jarrah	5-10	0											No Signs	No Signs	No	
wpt572	50H	449458	6301381	Jarrah	20+	2	Branch	5-12	Spout Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt573	50H	449449	6301380	Jarrah	15-20	0											No Signs	No Signs	No	
wpt574	50H	449437	6301375	Marri	15-20	0											No Signs	No Signs	No	
wpt575	50H	449425	6301387	Jarrah	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt576	50H	449409	6301389	Jarrah	15-20	3	Branch	<5	Branch	<5	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt577	50H	449397	6301388	Marri	20+	5+	Knot Hole	<5	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt578	50H	449396	6301389	Jarrah	15-20	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt579	50H	449383	6301381	Jarrah	0-5	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt580	50H	449347	6301380	Marri	20+	0											No Signs	No Signs	No	
wpt581	50H	449349	6301377	Marri	15-20	0											No Signs	No Signs	No	
wpt582	50H	449332	6301379	Jarrah	15-20	0											No Signs	No Signs	No	
wpt583	50H	449316	6301380	Jarrah	15-20	0											No Signs	No Signs	No	
wpt584	50H	449307	6301387	Jarrah	15-20	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt585	50H	449302	6301373	Marri	15-20	0											No Signs	No Signs	No	
wpt586	50H	449269	6301372	Marri	20+	0											No Signs	No Signs	No	
wpt587	50H	449267	6301383	Wandoo	10-15	0											No Signs	No Signs	No	
wpt589	50H	449254	6301379	Jarrah	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt590	50H	449251	6301385	Jarrah	20+	0											No Signs	No Signs	No	
wpt591	50H	449238	6301379	Jarrah	20+	4	Branch	<5	Branch	<5	Branch	<5	Branch	<5			No Signs	No Signs	No	Depth of hollows unknown
wpt592	50H	449221	6301387	Jarrah	15-20	3	Branch	<5	Branch	5-12	Spout Branch	5-12					No Signs	No Signs	No	Depth of hollows unknown
wpt593	50H	449215	6301397	Wandoo	15-20	0											No Signs	No Signs	No	
wpt594	50H	449204	6301395	Wandoo	15-20	0											No Signs	No Signs	No	
wpt595	50H	449207	6301386	Marri	5-10	1	Spout Trunk	20+									No Signs	No Signs	No	Too low/shallow
wpt596	50H	449204	6301382	Wandoo	10-15	0											No Signs	No Signs	No	
wpt597	50H	449190	6301390	Wandoo	20+	0											No Signs	No Signs	No	
wpt598	50H	449183	6301391	Jarrah	15-20	0											No Signs	No Signs	No	
wpt599	50H	449177	6301396	Wandoo	15-20	0											No Signs	No Signs	No	
wpt600	50H	449174	6301390	Wandoo	20+	0											No Signs	No Signs	No	
wpt601	50H	449169	6301385	Jarrah	15-20	0											No Signs	No Signs	No	
wpt602	50H	449166	6301401	Marri	20+	0											No Signs	No Signs	No	
wpt603	50H	449144	6301399	Jarrah	0-5	1	Spout Trunk										No Signs	No Signs	No	Too low/shallow
wpt604	50H	449100	6301404	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt605	50H	449102	6301415	Wandoo	20+	1	Branch	5-12									No Signs	No Signs	No	BOP Nest/Depth of hollows unknown
wpt606	50H	449123	6301409	Marri	20+	5+	Spout Branch	5-12	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt607	50H	449121	6301363	Wandoo	10-15	0											No Signs	No Signs	No	
wpt608	50H	449196	6301332	Marri	10-15	0											No Signs	No Signs	No	
wpt609	50H	449238	6301324	Wandoo	15-20	0											No Signs	No Signs	No	
wpt611	50H	449066	6301406	Wandoo	20+	3	Branch	<5	Branch	<5	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt612	50H	449066	6301407	Wandoo	15-20	0											No Signs	No Signs	No	
wpt613	50H	449062	6301408	Wandoo	10-15	0											No Signs	No Signs	No	
wpt614	50H	449071	6301414	Wandoo	20+	0											No Signs	No Signs	No	
wpt615	50H	449067	6301421	Wandoo	20+	0											No Signs	No Signs	No	
wpt616	50H	449067	6301421	Wandoo	15-20	0											No Signs	No Signs	No	
wpt617	50H	449040	6301411	Wandoo	20+	1	Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt618	50H	449033	6301403	Wandoo	15-20	5+	Knot Hole	5-12	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt619	50H	449002	6301429	Wandoo	20+	0											No Signs	No Signs	No	
wpt620	50H	448988	6301410	Wandoo	15-20	0											No Signs	No Signs	No	
wpt621	50H	448968	6301426	Wandoo	15-20	0											No Signs	No Signs	No	
wpt622	50H	448966	6301426	Wandoo	15-20	0											No Signs	No Signs	No	
wpt623	50H	448959	6301429	Wandoo	15-20	0											No Signs	No Signs	No	
wpt624	50H	448965	6301444	Wandoo	15-20	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt625	50H	448957	6301444	Wandoo	10-15	1	Spout Trunk	12-20									No Signs	No Signs	No	Too low/shallow
wpt626	50H	448955	6301436	Wandoo	15-20	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt627	50H	448946	6301444	Wandoo	15-20	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt628	50H	448942	6301432	Wandoo	15-20	3	Branch	<5	Branch	5-12	Branch	<5		5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt629	50H	448945	6301431	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	Bees	No Signs	No	Depth of hollows unknown
wpt630	50H	448935	6301447	Wandoo	15-20	1	Spout Trunk	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt631	50H	448928	6301454	Wandoo	15-20	0											No Signs	No Signs	No	
wpt632	50H	448916	6301449	Wandoo	15-20	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Spout Branch	5-12	No Signs	No Signs	No	Depth of hollows unknown
wpt633	50H	448907	6301447	Wandoo	15-20	0											No Signs	No Signs	No	
wpt634	50H	448905	6301440	Wandoo	15-20	0											No Signs	No Signs	No	
wpt635	50H	448897	6301449	Wandoo	15-20	0											No Signs	No Signs	No	
wpt636	50H	448900	6301460	Wandoo	15-20	0											No Signs	No Signs	No	
wpt637	50H	448887	6301446	Wandoo	20+	1	Knot Hole	<5									No Signs	No Signs	No	Depth of hollows unknown
wpt638	50H	448871	6301463	Wandoo	15-20	0											No Signs	No Signs	No	
wpt639	50H	448863	6301452	Wandoo	15-20	0											No Signs	No Signs	No	
wpt640	50H	448815	6301466	Wandoo	20+	5+	Knot Hole	5-12	Spout Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	Number of Hollows	Hollow Type 1	Hollow Size 1 (cm)	Hollow Type 2	Hollow Size 2 (cm)	Hollow Type 3	Hollow Size 3 (cm)	Hollow Type 4	Hollow Size 4 (cm)	Hollow Type 5	Hollow Size 5 (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt641	50H	448803	6301458	Wandoo	15-20	0											No Signs	No Signs	No	
wpt642	50H	448796	6301473	Wandoo	20+	0											No Signs	No Signs	No	
wpt643	50H	448786	6301460	Wandoo	15-20	0											No Signs	No Signs	No	
wpt644	50H	448759	6301465	Marri	15-20	0											No Signs	No Signs	No	
wpt645	50H	448756	6301469	Jarrah	15-20	0											No Signs	No Signs	No	
wpt646	50H	448738	6301472	Marri	15-20	0											No Signs	No Signs	No	
wpt647	50H	448739	6301477	Jarrah	15-20	0											No Signs	No Signs	No	
wpt649	50H	448693	6301492	Wandoo	15-20	0											No Signs	No Signs	No	
wpt650	50H	448679	6301490	Wandoo	15-20	0											No Signs	No Signs	No	
wpt651	50H	448668	6301508	Jarrah	15-20	3	Branch	<5	Spout Branch	5-12	Spout Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt652	50H	448672	6301508	Jarrah	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt653	50H	448640	6301506	Wandoo	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt654	50H	448640	6301490	Wandoo	15-20	0											No Signs	No Signs	No	
wpt655	50H	448624	6301499	Wandoo	15-20	0											No Signs	No Signs	No	
wpt656	50H	448621	6301504	Wandoo	15-20	0											No Signs	No Signs	No	
wpt657	50H	448614	6301514	Wandoo	15-20	0											No Signs	No Signs	No	
wpt658	50H	448596	6301510	Wandoo	15-20	0											No Signs	No Signs	No	
wpt659	50H	448603	6301510	Wandoo	15-20	3	Branch	<5	Branch	<5	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt660	50H	448597	6301504	Wandoo	15-20	0											No Signs	No Signs	No	
wpt661	50H	448592	6301506	Wandoo	20+	1	Knot Hole	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt662	50H	448585	6301518	Wandoo	15-20	0											No Signs	No Signs	No	
wpt663	50H	448577	6301519	Wandoo	15-20	0											No Signs	No Signs	No	
wpt664	50H	448570	6301519	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt666	50H	448563	6301516	Wandoo	20+	0											No Signs	No Signs	No	
wpt667	50H	448571	6301507	Wandoo	20+	3	Branch	<5	Branch	5-12	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt668	50H	448544	6301517	Wandoo	10-15	0											No Signs	No Signs	No	
wpt669	50H	448543	6301527	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	12-20	Branch	<5	Branch	5-12	No Signs	No Signs	Yes	Depth of hollows unknown
wpt671	50H	448539	6301534	Wandoo	15-20	0											No Signs	No Signs	No	
wpt672	50H	448531	6301513	Wandoo	20+	0											No Signs	No Signs	No	
wpt673	50H	448533	6301515	Jarrah	15-20	0											No Signs	No Signs	No	
wpt674	50H	448522	6301517	Jarrah	15-20	0											No Signs	No Signs	No	
wpt675	50H	448511	6301531	Jarrah	20+	0											No Signs	No Signs	No	
wpt676	50H	448502	6301535	Jarrah	15-20	0											No Signs	No Signs	No	
wpt677	50H	448500	6301526	Jarrah	20+	0											No Signs	No Signs	No	
wpt678	50H	448503	6301518	Wandoo	15-20	0											No Signs	No Signs	No	
wpt679	50H	448502	6301519	Wandoo	20+	0											No Signs	No Signs	No	
wpt680	50H	448485	6301521	Jarrah	15-20	0											No Signs	No Signs	No	
wpt681	50H	448462	6301525	Jarrah	15-20	0											No Signs	No Signs	No	
wpt682	50H	448449	6301526	Jarrah	15-20	0											No Signs	No Signs	No	
wpt683	50H	448444	6301543	Marri	15-20	0											No Signs	No Signs	No	
wpt684	50H	448427	6301540	Marri	20+	0											No Signs	No Signs	No	
wpt685	50H	448413	6301559	Jarrah	15-20	0											No Signs	No Signs	No	
wpt686	50H	448421	6301561	Jarrah	15-20	0											No Signs	No Signs	No	
wpt687	50H	448393	6301559	Jarrah	15-20	0											No Signs	No Signs	No	
wpt688	50H	448360	6301562	Marri	15-20	0											No Signs	No Signs	No	
wpt689	50H	448359	6301547	Jarrah	15-20	0											No Signs	No Signs	No	
wpt690	50H	448344	6301553	Jarrah	20+	0											No Signs	No Signs	No	
wpt691	50H	448337	6301556	Wandoo	15-20	0											No Signs	No Signs	No	
wpt692	50H	448335	6301551	Wandoo	15-20	0											No Signs	No Signs	No	
wpt693	50H	448325	6301563	Wandoo	15-20	0											No Signs	No Signs	No	
wpt694	50H	448310	6301566	Wandoo	20+	0											No Signs	No Signs	No	
wpt695	50H	448305	6301576	Jarrah	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt696	50H	448306	6301568	Wandoo	15-20	0											No Signs	No Signs	No	
wpt697	50H	448301	6301567	Wandoo	15-20	0											No Signs	No Signs	No	
wpt698	50H	448307	6301561	Marri	15-20	0											No Signs	No Signs	No	
wpt699	50H	448314	6301559	Jarrah	20+	2	Knot Hole	<5	Knot Hole	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt700	50H	448288	6301564	Wandoo	20+	0											No Signs	No Signs	No	
wpt701	50H	448287	6301561	Wandoo	10-15	0											No Signs	No Signs	No	
wpt702	50H	448284	6301580	Wandoo	20+	2	Branch	5-12	Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt703	50H	448275	6301581	Wandoo	15-20	3	Branch	<5	Branch	5-12	Branch	<5					No Signs	No Signs	No	Depth of hollows unknown
wpt704	50H	448276	6301567	Jarrah	20+	0											No Signs	No Signs	No	
wpt705	50H	448265	6301574	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt706	50H	448258	6301572	Wandoo	15-20	0											No Signs	No Signs	No	
wpt707	50H	448257	6301581	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt708	50H	448252	6301572	Wandoo	15-20	0											No Signs	No Signs	No	
wpt710	50H	448237	6301584	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt714	50H	448220	6301594	Jarrah	15-20	2	Knot Hole	5-12	Spout Branch	5-12							No Signs	No Signs	No	Depth of hollows unknown
wpt722	50H	448483	6301481	Dead Unknown	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt723	50H	448645	6301443	Wandoo	15-20	0											No Signs	No Signs	No	
wpt724	50H	448664	6301442	Wandoo	15-20	0											No Signs	No Signs	No	
wpt725	50H	448703	6301450	Wandoo	10-15	0											No Signs	No Signs	No	
wpt726	50H	448711	6301437	Wandoo	15-20	0											No Signs	No Signs	No	
wpt727	50H	448724	6301429	Marri	15-20	0											No Signs	No Signs	No	
wpt728	50H	448753	6301426	Marri	15-20	0											No Signs	No Signs	No	
wpt729	50H	448841	6301405	Jarrah	15-20	0											No Signs	No Signs	No	
wpt730	50H	448869	6301403	Dead Unknown	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt731	50H	448876	6301398	Wandoo	15-20	0											No Signs	No Signs	No	
wpt732	50H	448884	6301398	Dead Unknown	15-20	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt733	50H	448895	6301396	Dead Unknown	15-20	4	Branch	<5	Branch	<5	Branch	<5	Branch	<5			No Signs	No Signs	No	Depth of hollows unknown
wpt734	50H	448895	6301406	Wandoo	10-15	0											No Signs	No Signs	No	
wpt735	50H	448918	6301393	Wandoo	10-15	0											No Signs	No Signs	No	
wpt736	50H	448922	6301400	Wandoo	10-15	0											No Signs	No Signs	No	
wpt839	50H	447710	6301970	Jarrah	20+	5+	Branch	<5	Branch	<5	Branch	<5	Branch	<5	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt840	50H	447703	6301959	Jarrah	15-20	4	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12			No Signs	No Signs	No	Depth of hollows unknown
wpt841	50H	447664	6301959	Jarrah	15-20	0											No Signs	No Signs	No	
wpt842	50H	447659	6301954	Jarrah	15-20	0											No Signs	No Signs	No	
wpt843	50H	447645	6301964	Marri	20+	0											No Signs	No Signs	No	
wpt844	50H	447643	6301960	Wandoo	15-20	0											No Signs	No Signs	No	
wpt845	50H	447620	6301967	Wandoo	15-20	0											No Signs	No Signs	No	
wpt846	50H	447621	6301950	Wandoo	20+	4	Branch	<5	Branch	<5	Branch	<5	Branch	<5			No Signs	No Signs	No	Depth of hollows unknown
wpt847	50H	447604	6301947	Wandoo	15-20	0											No Signs	No Signs	No	
wpt848	50H	447544	6301960	Wandoo	20+	1	Spout Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt849	50H	447544	6301957	Wandoo	20+	1	Branch	5-12									No Signs	No Signs	No	Depth of hollows unknown
wpt850	50H	447543	6301956	Wandoo	20+	0											No Signs	No Signs	No	
wpt851	50H	447541	6301959	Wandoo	15-20	0											No Signs	No Signs	No	
wpt852	50H	447530	6301949	Wandoo	15-20	5+	Spout Trunk	12-20	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	No Signs	No Signs	Yes	Depth of hollows unknown
wpt853	50H	447523	6301953	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	<5	Branch	5-12	Branch	<5	No Signs	No Signs	No	Depth of hollows unknown
wpt854	50H	447498	6301965	Wandoo	20+	0											No Signs	No Signs	No	
wpt855	50H	447483	6301965	Wandoo	15-20	0											No Signs	No Signs	No	
wpt856	50H	447480	6301960	Wandoo	15-20	0											No Signs	No Signs	No	
wpt857	50H	447478	6301951	Wandoo	20+	5+	Branch	<5	Branch	5-12	Branch	12-20	Branch	<5	Branch	5-12	No Signs	No Signs	Yes	Depth of hollows unknown

Appendix 15. Potential impacts of the proposed realignment of Collie-Lake King Road on specific fauna species

Unnamed cricket *Pachysaga munggai*

Status and Distribution: Listed as Priority 3 by the DPaW. Distribution is poorly documented. NatureMap database contains only five records, the closest one being over 18km west of the study area (DPaW 2016).

Habitat: Heathland habitat with occasional eucalypts and abundant leaf litter. Vegetation and leaf litter must be sufficient to provide this ground dwelling species with cover. Most NatureMap records are in the Jarrah forest belt.

Likely presence in study area: Status in the study area difficult to determine. The majority of the study area appears unsuitable for this species as heathland and leaf litter are typically absent/sparse.

Potential impacts: Loss of a small area of potential habitat. It is however unlikely that any part of the proposed realignment that passes through native forest would represent an area of significance for this species given the extent of similar habitat in surrounding areas.

Darling Range Heath Ctenotus *Ctenotus delli*

Status and Distribution: Listed as Priority 4 by DPaW. Main distribution is in the Darling Range from the Darlington/Mundaring area to near Collie (Storr *et al* 1999).

Habitat: Humid zone, mainly laterite and clays (Storr *et al.* 1999) supporting jarrah/marri woodland with a shrub dominated understorey, sheltering in dense vegetation, inside grass trees and beneath rocks, sometimes in burrows (Nevill 2005). Occasionally found on granite outcrops (Bush 2002).

Likely presence in study area: Actual status onsite is difficult to determine. Study area is near the eastern and southern limit of this species main documented range. Closest NatureMap records are just east of Collie. Not listed as a potential species.

Potential impacts: If this species is actually present then development may result in the loss of some habitat though it is unlikely to alter the species overall status given the relatively small area involved and the extent of similar habitat in surrounding areas.

Malleefowl *Leipoa ocellata*

Status and Distribution: This species is listed as Schedule 3 under the *WC Act,* Vulnerable under the *EPBC Act* and as Vulnerable (A2bce) by the IUCN. Originally common, but now generally rare to uncommon and patchily distributed.

Current distribution mainly southern arid and semi-arid zones, north to Shark Bay, Jingemarra, Colga Downs and Yeelirrie, east to Earnest Giles Range, Yeo Lake, lower Ponton Creek and to Eucla and west and south to Cockleshell Gully, the Wongan Hills, Stirling Range, Beaufort Inlet, Hatters Hill, Mt Ragged and Point Malcolm (Johnstone and Storr 1998).

Habitat: Mainly scrubs and thickets of mallee *Eucalyptus* spp., boree *Melaleuca lanceolata* and bowgada *Acacia linophylla*, also dense litter forming shrublands.

Likely presence in study area: This species is locally extinct and would not under normal circumstance occur in the area.

Potential impacts: No impact on this species or its preferred habitat will occur as a consequence of this project proceeding.

Great Egret *Ardea alba/Ardea modesta*

Status and Distribution: This species is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The great egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe 2004).

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe 2004).

Likely presence in study area: Potentially utilises watercourses, wetlands, drains and paddocks though the quality of most of these habitats are marginal due to historical disturbance such as native vegetation clearing. Would not breed within the study area.

Potential impacts: Some potential for the loss areas of marginal habitat possibly utilised by this species though this would not be significant enough to affect the overall status of this species in the area given the extent of similar habitat (i.e. cleared paddocks and degraded wetlands) in the vicinity.

Cattle Egret *Ardea ibis*

Status and Distribution: This species is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The cattle egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe 2004).

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe 2004).

Likely presence in study area: Potentially utilises watercourses, wetlands, drains and paddocks though the quality of most of these habitats are marginal due to historical disturbance such as native vegetation clearing. Would not breed within the study area.

Potential impacts: Some potential for the loss areas of marginal habitat possibly utilised by this species though this would not be significant enough to affect the overall status of this species in the area given the extent of similar habitat (i.e. cleared paddocks and degraded wetlands) in the vicinity.

White-bellied Sea Eagle *Haliaeetus leucogaster*

Status and Distribution: This species is listed as Migratory under international agreements to which Australia is a signatory. White-bellied sea eagles are moderately common to common on Kimberley and Pilbara islands, coasts and estuaries, on Bernier, Dorre and Dirk Hartog Is., in Houtman Abrolhos and in the Archipelago of the Recherche; rare to uncommon elsewhere (Johnstone and Storr 1998). Also found in New Guinea, Indonesia, China, southeast Asia and India. Scarce near major coastal cities (Morcombe 2004).

Habitat: They nest and forage usually near the coast over islands, reefs, headlands, beaches, bays, estuaries, mangroves, but will also live near seasonally flooded inland swamps, lagoons and floodplains, often far inland on large pools of major rivers. Established pairs usually sedentary, immatures dispersive (Morcombe 2004). White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession.

Likely presence in study area: No suitable habitat.

Potential impacts: No impact on this species or its preferred habitat will occur as a consequence of this project proceeding.

Peregrine Falcon *Falco peregrinus*

Status and Distribution: This species is listed as Schedule 7 under the *WC Act*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe 2004). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.

Likely presence in study area: Individuals of this species potentially utilise some sections of the study area as part of a much larger home range but would only occur rarely. No potential nest sites observed.

Potential impact of proposed development: Modification of potential foraging habitat and potential for the loss of potential breeding sites (i.e. tall trees with broken spouts).

Migratory Shorebirds/Wetland Species

A number of species of migratory shorebirds and wetland species are listed within various databases and publications as potential inhabitants or visitors to the general area.

Status and Distribution: All the listed species are listed as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. Some are also listed under Schedule 3 of the *WC Act*. All species are either widespread summer migrants to Australia or residents. Actual conservation status varies between species.

Habitat: Varies between species but includes beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats, sandbars, pastures, airfields, sports fields and lawns.

Likely presence in study area: Most of the habitats present are unsuitable for migratory shorebirds birds to utilise. Some species (e.g. common sandpiper) may very occasionally utilise the degraded rivers and dams but the frequency of occurrence and degree of utilisation would be very low and hence none are listed as potential species.

Potential impacts: No impact on migratory shorebirds/wetland species or their preferred habitat will occur as a consequence of this project proceeding.

Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*

Status and Distribution: Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Found in the humid and subhumid south west, mainly hilly interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998).

Habitat: Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble. The forest red-tailed black cockatoo nests in the large hollows of marri, jarrah and karri (Johnstone and Kirkby 1999). In marri, the nest hollows of the forest red-tailed black cockatoo range from 8-14m above ground, the entrance is 12 – 41cm in diameter and the depth is one to five metres (Johnstone and Storr 1998).

Breeding commences in winter/spring. There are few records of breeding in the forest red-tailed black cockatoo (Johnstone and Storr 1998), but eggs are laid in October and November (Johnstone 1997; Johnstone and Storr 1998). Recent data however indicates that breeding in all months of the year occurs with peaks in spring and autumn–winter (Ron Johnstone pers comms). Incubation period 29 – 31 days. Young fledge at 8 to 9 weeks (Simpson and Day 2010).

Period in which breeding is most likely to commence
Period in which fledging/weening could extend through

Likely presence in study area: Sighted several times within the survey area and nearby. Foraging evidence (chewed marri and jarrah fruits) observed. Remnant vegetation containing jarrah and marri within the study area represents potential foraging habitat for this species.

The larger trees (≥50cm DBH) identified during the habitat tree survey are also considered by the DotEE as potential breeding habitat, though no actual evidence of breeding seen. This species may also roost on site on occasions, though no evidence of this was found.

Potential impacts: Loss of foraging, breeding and roosting opportunities.

Baudin's Black-Cockatoo *Calyptorhynchus baudinii*

Status and Distribution: Listed as Scheduled 2 under the *WC Act* and as Vulnerable under the *EPBC Act*. Confined to the south-west of Western Australia, north to Gidgegannup, east to Mt Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury (Johnstone and Storr 1998). On the southern Swan Coastal Plain this cockatoo is in some areas resident but mainly a migrant moving from the deep south-west to the central and northern Darling Range. Between March and September most flocks move north and are concentrated in the northern parts of the Darling Range. During this period birds forage well out onto the southern Swan Coastal Plain to areas such as Harvey, Myalup, Bunbury, Capel, Dunsborough and Meelup. While generally more common in the Darling Range this species can also be common on parts of the southern Swan Coastal Plain especially in mid-August – September when flocks begin to return to their breeding quarters (Johnstone 2008).

Habitat: Mainly eucalypt forests where it feeds primarily on the marri seeds, (Morcombe 2004), Banksia, Hakeas and *Erodium* sp. Also strips bark from trees in search of beetle larvae (Johnstone and Storr 1998). This species of cockatoo nests in large tree hollows, 30–40 cm in diameter and more than 30 cm deep (Saunders 1974).

Baudin's Black-Cockatoo breeds in late winter and spring, from August to November or December (Gould 1972; Johnstone 1997; Saunders 1974; Saunders *et al.* 1985). Eggs laid in October (Johnstone and Storr 1998). Based on observations at currently known nest sites breeding mainly occurs within the October-December period (Ron Johnstone pers comms). Incubation is 28 – 30 days. Young fledge at 8 to 9 weeks (Simpson and Day 2010).

J	F	M	A	M	J	J	A	S	O	N	D

Period in which breeding is most likely to commence
Period in which fledging/weening could extend through

Likely presence in study area: The study area is within the documented distribution of this species and while not observed it may occur on occasions. Remnant vegetation containing marri within the study area represents potential foraging habitat for this species.

The larger trees (≥50cm DBH) identified during the habitat tree survey are also considered by the DotEE as potential breeding habitat, though no actual evidence of breeding seen. This species may also roost on site on occasions, though no evidence of this was found.

Potential impacts: Loss of foraging, breeding and roosting opportunities.

Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*

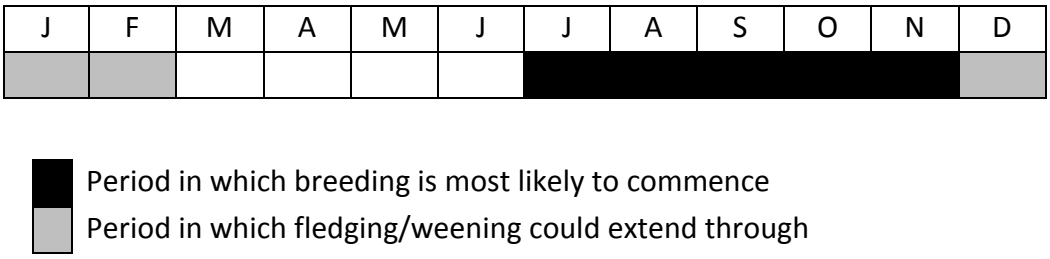
Status and Distribution: Carnaby's Black Cockatoo is listed as Scheduled 2 under the *WC Act* and as Endangered under the *EPBC Act*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).

Habitat: Forests, woodlands, heathlands, farms; feeds on Banksia, Hakeas and Marri. Carnaby's Cockatoo has specific nesting site requirements. Nests are mostly in smoothed-barked eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone and Storr, 1998).

Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe 2004). Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the Jarrah – Marri forest of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including the region between Mandurah and Bunbury. Carnaby's Black Cockatoo has been known to breed close to the town of Mandurah, as well as at Dawesville, Lake Clifton and Baldivis (pers. comm., Ron Johnstone, WA Museum) and there are small resident populations on the southern Swan Coastal Plain near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone 2008).

Carnaby's Black-Cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders 1986). Birds in inland regions may

begin laying up to three weeks earlier than those in coastal areas (Saunders 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10–12 weeks after hatching (Saunders 1977; Smith & Saunders 1986).



Likely presence in study area: A small amount of foraging evidence attributed to this species was found during the site survey (chewed marri fruits). Remnant vegetation containing marri and jarrah within the study area represents potential foraging habitat for this species.

The larger trees (≥50cm DBH) identified during the habitat tree survey are also considered by the DotEE as potential breeding habitat, though no actual evidence of breeding seen. This species may also roost on site on occasions, though no evidence of this was found.

Potential impacts: Loss of foraging, breeding and roosting opportunities.

Barking Owl *Ninox connivens connivens*

Status and Distribution: Listed as Priority 2 by DPaW. Found north to Perth (formerly) and east to Northam, Katanning and nearly to Bremer Bay. Declining in south west (Johnstone and Storr 1998).

Habitat: Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas (Johnstone and Storr 1998). Roosts in tree hollows.

Likely presence in study area: No suitable habitat.

Potential impacts: No impact on this species or its preferred habitat is considered likely.

Masked Owl *Tyto novaehollandae novaehollandae*

Status and Distribution: Listed as Priority 3 by DPaW. Found north to Yanchep and east to Yealering, Gnowangerup and Albany, casual further north. Locally common in south west but generally uncommon (Johnstone and Storr 1998).

Habitat: Roosts and nests in heavy forest, hunts over open woodlands and farmlands (Morcombe 2004). Probably breeding in forested deep south west with some autumn–winter wanderings northwards (Johnstone and Storr 1998).

Likely presence in study area: Status in the general area is difficult to determine. May utilise forest and woodland areas within and near the survey area for roosting and therefore may forage in more open areas at night. Probably only present rarely.

Potential impacts: Loss/modification of small areas of habitat.

Fork-tailed Swift *Apus pacificus*

Status and Distribution: The fork-tailed swift is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. It is a summer migrant (Oct-Apr) to Australia (Morcombe 2004).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe 2004).

Likely presence in study area: Very uncommon in south west and rarely utilises terrestrial habitats (i.e. almost entirely aerial). May occur very occasionally but not listed as a potential species.

Potential impacts: No impact on this species will occur.

Rainbow Bee-eater *Merops ornatus*

Status and Distribution: This species is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The rainbow bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe 2004).

Habitat: Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe 2004). Breeds underground in areas of suitable soft soil firm enough to support tunnel building.

Likely presence in study area: Observed foraging and roosting within some sections of the study area. Common seasonal visitor to south west. Possibly breeds where ground conditions permit though most areas appear unsuitable.

Potential impacts: Modification and/or loss of some habitat but impact will not be significant. This species can be expected to continue to utilise the area, as it does now, despite any future development.

Chuditch *Dasyurus geoffroii*

Status and Distribution: Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act.* Formerly occurred over nearly 70 per cent of Australia. The chuditch now has a patchy distribution throughout the Jarrah forest and mixed karri/marri/jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and

South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation along road sides in the wheatbelt (CALM 1994). The estimated home range of a male chuditch is over 15 km^2 whilst that for females is 3-4 km^2 (Sorena and Soderquist 1995).

Likely presence in study area: Actual status on the site difficult to determine. This species is however known to frequent the general area and therefore may utilise sections of the study area at times.

Potential impacts: Loss of some potential habitat. Some possibility that individuals maybe killed or injured during clearing operations.

Numbat *Myrmecobius fasciatus*

Status and Distribution: Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Once occurred across much of arid and semi arid southern Australia, now restricted to a few remnant forests of Wandoo, Powderbark Wandoo or jarrah in South west WA (Menkhorst & Knight 2001). Rare, scattered. Found only at Dryandra, Perup and six other translocation sites (Van Dyck & Strahan 2008). The closest records shown in NatureMap are from the Batalling State Forest to the north of the study area. These records represent translocated individuals released by DPaW in 1992/94. There appears to be no records from that area since.

Habitat: Generally dominated by eucalypts that provide hollow logs and branches for shelter and termites for food (Van Dyck & Strahan 2008).

Likely presence in study area: Available evidence suggests this species is locally and regionally extinct.

Potential impacts: No impact on this species or its preferred habitat is considered likely.

Southern Brush-tailed Phascogale *Phascogale tapoatafa ssp.*

Status and Distribution: Listed as Scheduled 3 under the *WC Act*. Present distribution is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DPaW information pamphlet). Records are less common from wetter forests.

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A nocturnal carnivore relying on tree hollows as nest sites. The home range for a female Brush-tailed Phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist 1995).

Likely presence in study area: This species is known to persist in state forest and national park areas surrounding Collie and therefore it may frequent the study site.

Potential impacts: Loss of some potential habitat. Some possibility that individuals maybe killed or injured during clearing operations.

Southern Brown Bandicoot (Quenda) *Isoodon obesulus fusciventer*

Status and Distribution: Listed as Priority 4 by DPaW. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the jarrah and karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Has been translocated to Julimar State Forest, Hills Forest Mundaring, Tutanning Nature Reserve, Boyagin Nature Reserve, Dongolocking Nature Reserve, Leschenault Conservation Park, and Karakamia and Paruna Sanctuaries and Nambung National Park (DPaW information pamphlet).

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting jarrah and wandoo forests are usually associated with watercourses. Quendas can thrive in more open habitat subject to exotic predator control (DPaW information pamphlet).

Likely presence in study area: Most of the study area appears unsuitable for this species due to a lack of dense groundcover but it may persist at locations where native vegetation provides sufficient cover.

Potential impacts: Loss of some potential habitat. Some possibility that individuals maybe killed or injured during clearing operations.

Bilby *Macrotis lagotis*

Status and Distribution: The Bilby is listed as Schedule 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Current distribution in suitable habitat from Tanami Desert west to near Broome and south to Warburton. Former distribution extended south to Margaret River, though apparently absent from the coastal plain (Burbidge 2004).

Habitat: Current habitat included Acacia shrublands, spinifex and hummock grassland (Menkhorst *et al.* 2011).

Likely presence in study area: Regionally extinct.

Potential impacts: No impact on this species or its preferred habitat is considered likely.

Woylie *Bettongia penicillata ogibyi*

Status and Distribution: Listed as Schedule 2 under the *WC Act* and as Endangered under the *EPBC Act*. Restricted to remnant habitat patches in south west WA where populations are managed by way of fox control and reintroduction programs (e.g. Batalling State forest, Avon Valley, Walyunga National Park and Paruna Sanctuary). Woylie populations have declined by about 80% since 2001. The declines of affected populations in Western Australia and South Australia have been rapid, substantial (>90% lost) and apparently biased toward the largest and most important populations. The declines are continuing in some areas and as yet there have been no clear signs of a sustained post decline recovery. Most of the remaining unaffected populations are small (<300 individuals), isolated and inherently vulnerable (DEC 2009).

Habitat: Open forest and woodland with a low, dense, understorey of tussock grasses or woody scrub. Formerly occurred in a wider range of habitats including spinifex hummock grasslands.

Likely presence in study area: Most of the study area appears to lack sufficient understory required for this species to persist. Not listed as a potential species.

Potential impacts: No impact on this species or its preferred habitat is considered likely.

Tammar *Macropus eugenii derbianus*

Status and Distribution: Listed as Priority 4 by DPaW. Formerly widespread in SW WA and Eyre Peninsula SA, now reduced to tiny populations on the mainland and some offshore islands. The Tammar Wallaby is currently known to inhabit three islands in the Houtman Abrolhos group, Garden Island near Perth, Middle and North Twin Peak Islands in the Archipelago of the Recherche, and at least nine sites on the mainland — including, Dryandra, Boyagin, Tutanning, Batalling (reintroduced), Perup, private property near Pingelly, Jaloran Road timber reserve near Wagin, Hopetoun, Stirling Range National Park, and Fitzgerald River National Park. The species remains relatively abundant at these sites which are subject to fox control. They have also been reintroduced to the Darling scarp near Dwellingup, Julimar Forest near Bindoon, Avon Valley National Park and to Karakamia and Paruna Sanctuaries (DPaW information pamphlet, nd)

Habitat: Inhabits dense coastal heath and scrub and some dry sclerophyll forest with dense patches of cover.

Likely presence in study area: Very few records from the area suggest a population of this species does not persist in or near the study area. Suitable habitat appears absent. Not listed as a potential species.

Potential impacts: No impact on this species or its preferred habitat is considered likely.

Western Brush Wallaby *Macropus irma*

Status and Distribution: Listed as Priority 4 by DPaW. The western brush wallaby is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid (DPaW information pamphlet).

Habitat: The species optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (DPaW information pamphlet).

Likely presence in study area: This species is relatively common in the Collie area and is likely to frequent sections of the study area at times.

Potential impacts: Loss of some potential habitat.

Western False Pipistrelle *Falsistrellus mackenziei*

Status and Distribution: Listed as Priority 4 by DPaW and as near threatened by the ICUN. Confined to south west W.A. south of Perth and east to the wheat belt. Most records from karri forests but also recorded in wetter stands of jarrah and tuart and woodlands on the Swan Coastal Plain (Menkhorst and Knight 2011). Range appears to be contracting southwards, presumably due to drying climate.

Habitat: This species of bat occurs in high forest and coastal woodlands. It roosts in small colonies in tree hollows and forages at canopy level and in the cathedral-like spaces between trees.

Likely presence in study area: Potentially present with the study area when it is likely to forage and possibly roost given presence of suitable tree hollows.

Potential impacts: Loss/modification of foraging habitat and loss of potential roosting habitat.