ALLAWUNA LANDFILL VEGETATION AND FAUNA ASSESSMENT

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Prepared for

Bowman & Associates

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A GREENCAP CONSULTING COMPANY

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Scope of Services

This environmental site assessment report ('the report') has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and ENV.Australia Pty Ltd (ENV) ('scope of services'). In some circumstances the scope of services may have been limited by factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, ENV 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 ('the data'). Except as otherwise stated in the report, ENV 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 ("conclusions") are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. ENV 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 ENV.

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

Other Limitations

ENV will not be liable to update or revise the report to take into account any events or circumstances occurring or facts becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report, nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

EXECUTIVE SUMMARY

ENV. Australia Pty Ltd was commissioned by Bowman & Associates in June 2012 to undertake a Flora and Vegetation Assessment and a Level 1 Fauna Assessment for providing documentation for environmental assessment to establish a landfill facility at Allawuna ("the study area"). The study area is approximately 69 ha and is situated in St Ronans, in the Shire of York, approximately 70 km east of Perth, Western Australia. The Allawuna landfill is set to raise 150,000 - 250,000 tonnes of Municipal Solid Waste and commercial and industrial waste per annum. The initial design will be focused towards a tentative lifespan of 40 years.

The field survey was conducted on the 2nd August 2012 and comprised two fauna habitat assessments, opportunistic observations, a Black Cockatoo habitat assessment and a Graceful sun-moth habitat assessment.

Two fauna habitat types occur in the study area: 'cleared cropland' which consists predominantly of cleared pastures with scattered *Corymbia calophylla* (Marri) and *Eucalyptus wandoo* (Wandoo) and 'minor creekline', lined with Wandoo, *Eucalyptus rudis* (Flooded Gum) and *Allocasuarina fraseriana* (Sheoak). A total of 35 fauna species were recorded during the field survey comprising of five reptiles, 28 birds and two mammal species. Two species of conservation significance were recorded: Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Cockatoo (*Calyptorhynchus baudinii*).

The study area contains three plant species that are known foraging resources for Black Cockatoos. The study area contains 4.16 ha of foraging habitat, which primarily consists of isolated trees or small stands of mature Marri and Wandoo, this covers approximately 6% of the total area. Clearing of more than one hectare of quality foraging habitat is considered a 'high risk of significant impacts' as outlined by DSEWPaC (2011). Tall trees with a closed canopy that could potentially provide roosting habitat were recorded within the study area however, no evidence or signs of roosting was recorded. The study area contains a total of 144 trees that are suitable dimensions to be classified as potential breeding habitat (DBH over 500 mm). The clearing of any tree with a DBH over 500 mm is considered a 'high risk of significant impact'.

Broad scale mapping of the study area (Shepherd et al. 2001) described the vegetation as 'medium woodland with marri and wandoo'. The study area has been extensively cleared and contains few scattered trees of Marri and Wandoo as well as a small number of Flooded Gum and *Allocasuarina fraseriana* (Sheoak). The understorey is composed completely of introduced grazing and cropping species. Neither of the two near-coastal shrubs, *Lomandra maritima* and *Lomandra hermaphrodita*, which the Graceful sun-moth is commonly associated with, were recorded in the study area.

The database review revealed 18 threatened and priority flora species which are known to occur within the vicinity of the study area. No declared weeds, threatened or priority flora were identified during the survey.

The proposed development is likely to have minimal impact on the flora and fauna of the survey area and its surrounds, due to the limited habitat the site provides.

1 INTRODUCTION

1.1 THE PROJECT

ENV. Australia Pty Ltd was commissioned by Bowman & Associates in June 2012 to undertake a Flora and Vegetation Assessment and a Level 1 Fauna Assessment for providing documentation for environmental assessment to establish a landfill facility at Allawuna ("the study area").

The Allawuna landfill is set to raise 150,000 - 250,000 tonnes of Municipal Solid Waste and commercial and industrial waste per annum. The initial design will be focused towards a tentative lifespan of 40 years.

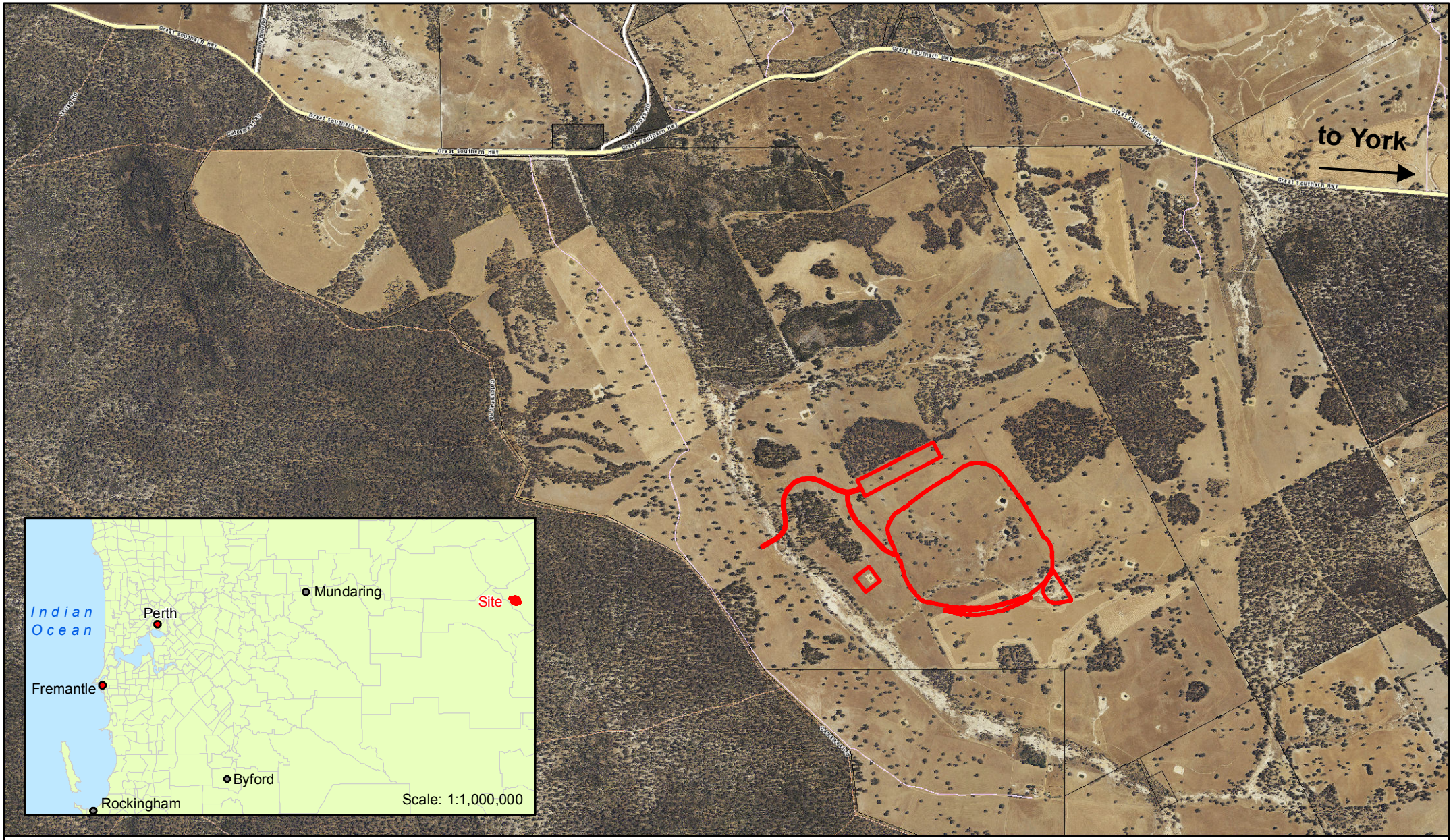
1.1.1 Objectives

The objectives of the assessment were to:

- document, describe and map the vertebrate fauna and fauna habitats present;
- identify fauna of conservation significance that may potentially occur in the study area;
- assess and record significant Black Cockatoo foraging sources;
- assess and record potential Black Cockatoo roosting sites;
- assess and record potential Black Cockatoo breeding trees; and
- assess and record the distribution of *Lomandra* spp., which provide suitable habitat for the Graceful Sun-moth (*Synemon gratiosa*; GSM).

1.1.2 Location

The study area is located approximately 70 km east of Perth in the locality of St Ronans in the Shire of York. The study area is approximately 69 ha in size (Figure 1). The study area is situated on farmland located to the south of the Great Southern Highway. The surrounding area consists of remnant vegetation and farmland.



CLIENT
Bowman & Associates

JOB NO.
J112235

AUTHOR
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DRAWN
T Ellis

DATE
29-08-12

SCALE
1:30,000 @ A4

PROJECTION
GDA94 MGA50

Legend

Landfill Footprint

N

0 500 1,000

Metres

Site Location

Allawuna Landfill
Fauna Assessment

FIGURE 1

1.2 BACKGROUND TO THE PROTECTION OF FLORA, VEGETATION AND FAUNA

Flora and fauna are protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative Protection

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*);
- *Wildlife Conservation Act 1950* (*WC Act*);
- *Environmental Protection Act 1986* (*EP Act*); and

Non-Legislative Protection

- Western Australian Department of Environment and Conservation (DEC) Priority lists for flora, fauna and vegetation; and
- Recognition of locally significant populations by the DEC.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix A.

EPBC Act

The *EPBC Act* aims to protect matters of national environmental significance. Under the *EPBC Act*, the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), lists threatened species and communities in categories determined by criteria set out in the Act (*www.environment.gov.au/epbc/index.html*) (Appendix A).

Projects likely to cause impacts on matters of national environmental significance should be referred to DSEWPaC for assessment under the *EPBC Act*.

WC Act

The Western Australian DEC lists flora and fauna under the provisions of the *WC Act* as protected according to their need for protection (Appendix A). Fauna are classified as Schedule 1 to Schedule 4 according to their need for protection (Appendix A).

EP Act

Threatened Ecological Communities (TECs) are given special consideration in environmental impact assessment, and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

DEC Priority Lists

The DEC lists 'Priority' flora and fauna that has not been assigned statutory protection under the *WC Act*, but which are under consideration for declaration as scheduled fauna. Fauna assessed as Priority 1-3 are in urgent need of further survey. Priority 4 species require monitoring every 5-10 years, and Priority 5 taxa are deemed to be dependent upon specific conservation programs for their continued survival (Appendix A). Although DEC Priority species have no formal legal protection, they are under consideration as Scheduled fauna under the *WC Act*.

In addition, the DEC maintains a list of Priority Ecological Communities (PECs) which identifies those communities that need further investigation before possible nomination for TEC status.

Once listed, a community is a PEC, and when endorsed by the Western Australian Minister of Environment becomes a TEC, and protected as an ESA.

Informal Recognition of Flora and Fauna

The World Conservation Union publishes an international listing of species of conservation importance, known as the IUCN Red List (IUCN, 2012). This list identifies those species most in need of conservation attention.

Certain populations or communities of fauna may be of local significance or interest because of their patterns of distribution and abundance. For example fauna may be locally significant because they are range extensions to the previously known distribution or are newly discovered taxa (and therefore have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (primarily land clearing), and relict populations of such species assume local importance for the DEC. It is not uncommon for the DEC to make comment on these species of interest.

Black Cockatoo Referral Guidelines

There is an increasing focus from the regulatory authorities on proposals that have the potential to impact on Black Cockatoo habitat. Draft referral guidelines for protected Black Cockatoos have been released by the DSEWPaC (2011) and are designed to determine likely impacts of clearing on black cockatoos and whether a referral is required (Table 1).

Table 1: DSEWPaC Black Cockatoo Referral Guidelines (DSEWPaC, 2011).

High risk of significant impacts: referral recommended
• Clearing of any known nesting tree. • Clearing of any part or degradation of breeding habitat. • Clearing of more than 1 ha of quality foraging habitat. • Creating a gap of greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting). • Clearing or degradation (including pruning the top canopy) of a known roosting site.
Uncertainty: referral recommended or contact the Department
• Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat. • Clearing or disturbance in areas surrounding Black Cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire. • Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows. • Actions with the potential to introduce known plant diseases such as *Phytophthora* spp.
Low risk of significant impacts: referral may not be required but you may refer for legal certainty
• Actions that do not affect Black Cockatoo habitat or individuals. • Actions whose impacts occur outside the modeled distribution of the three Black Cockatoos.

Three species of threatened Black Cockatoos that occur in the State's south-west are protected under the *EPBC Act 1999* and the *WC Act 1950* (Table 1):

- Carnaby's Cockatoo, (*Calyptorhynchus latirostris*);
- Forest Red-tailed Black Cockatoo (FRBC) (*Calyptorhynchus banksii naso*); and
- Baudin's Cockatoo (*Calyptorhynchus baudinii*).

Based on the modelled distribution maps presented in the DSEWPaC (2011) draft referral guidelines, all three species could potentially occur in the study area.

2 BIOPHYSICAL ENVIRONMENT

2.1 CLIMATE

The study area is located on the Darling Range, characterised by Mediterranean climate of hot, dry summers and cool, wet winters, with an average maximum summer temperature of 35.6°C and an average minimum winter temperature of 1.5°C (Bureau of Meteorology (BoM), 2012). The average annual rainfall recorded at York, located 15 km east of the study area, is 381.0 mm, with the majority of precipitation occurring in winter (BoM, 2012).

York recorded 407.9 mm of rain in the 12 months prior to survey (August 2011 – July 2012, Figure 2), 26.9 mm above the average rainfall of 381.0 mm for the same period (BoM, 2012). The three months prior to survey (May-July, 2012), York recorded 140.6 mm of rainfall, 30.6 mm below the average rainfall of 171.16 mm for the same period (BoM, 2012).

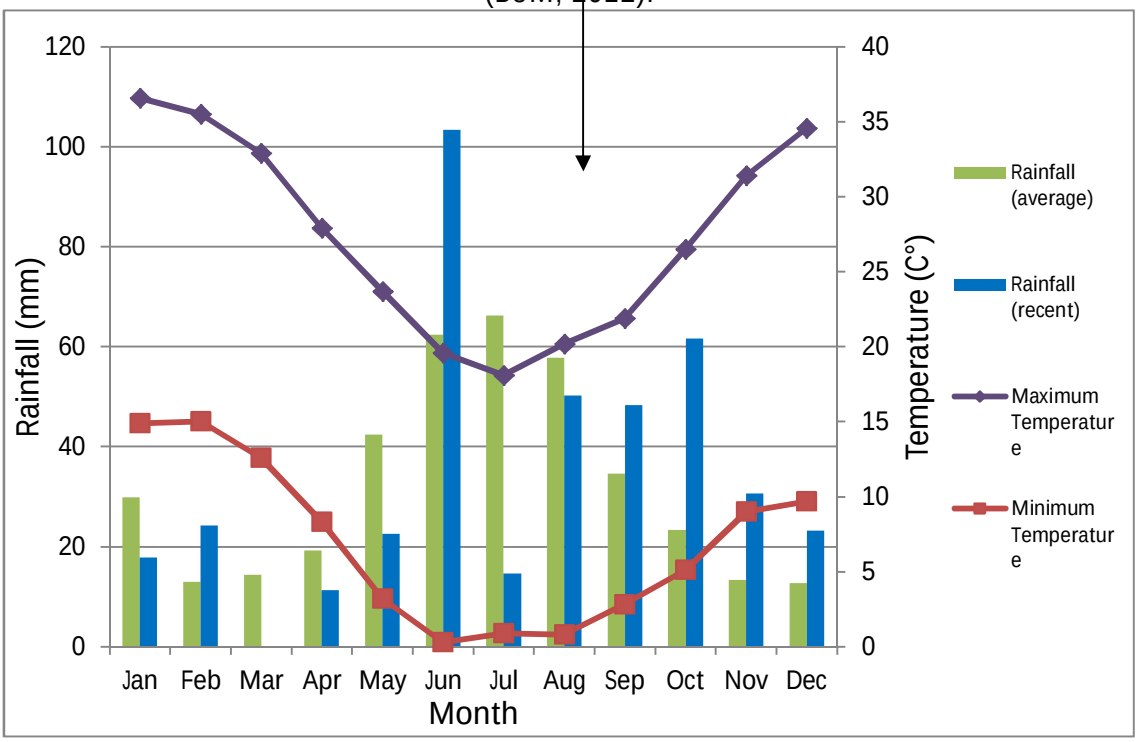

Figure 2: Average (1996-2012) and recent 2011-2012 monthly rainfall and average maximum and minimum temperatures recorded at York (BoM, 2012). Arrow indicates survey period.

2.2 GEOLOGY AND SOILS

The study area occurs across three broad geological units, captured at a scale of 1:250,000 (Geological Survey of Western Australia, 2000):

Table 2: Geological formation comprising the study area.

Geological Unit	Description	Total of Study Area (ha)
Agp	Porphyritic granite-medium to coarse-grained granite with microline megacrysts	46.4
Czl	Laterite-chiefly massive, but includes overlying pisolithic gravel and laterized sand	11.2
Qrc	Colluvium, including valley-fill deposits, variably lateritized and podsolised	11.3

Soil-landscape mapping of southwestern Australia has been captured at a scales ranging from 1:20 000 to 1:250 000 (Schoknecht et al., 2004). Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales. The study area lies within the Eastern Darling Range Zone of the Avon Province. The Eastern Darling Range Zone is characterised by moderately to strongly dissected lateritic plateau on granite with eastward-flowing streams in broad shallow valleys, some surficial Eocene sediments. Soils are formed in laterite colluvium or granite weathered in-situ. (Schoknecht et al., 2004).

2.3 BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) divided Australia into 85 bioregions based on major biological and geographical/geological attributes (Thackway & Cresswell, 1995). These bioregions were further subdivided into 403 subregions, as part of a refinement of the IBRA framework.

The study area is located in the Jarrah Forest bioregion within the Northern Jarrah Forest subregion (2,255,904 ha) which is characterised by Jarrah-Marri forest on laterite gravels and woodlands of Wandoo-Marri on clayey soils in eastern parts (Thackway & Cresswell, 1995; Williams & Mitchell, 2001). The Northern Jarrah Forest incorporates the area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks (Williams & Mitchell, 2001). Dominant land users include forestry, conservation and grazing (Williams & Mitchell, 2001).

2.4 BROAD VEGETATION

Vegetation types of the region were initially mapped by Beard (1979) and were re-assessed by Shepherd et al. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units. One Shepherd vegetation type is mapped across the study area and is summarised in Table 3 below:

Table 3: Vegetation Associations as mapped by Beard (1979) and Shepherd et al. (2001)

Vegetation Description[1]	Beard/ Shepherd Code[1]	Pre-European Extent (ha)[2]	Current Extent (ha)[2]	Proportion Remaining (%)[2]	Extent Within Survey Area (ha)
Medium woodland; marri & wandoo	e3,5Mi	208697.3	80215.1	38.44	68.87

[1]Shepherd et al. (2001)

[2]Government of Western Australia (2011)

The study area is situated in the Darling Botanical District, which forms part of the South West Botanical Province. The Darling Botanical District has been divided into four subregions or botanical subdistricts (Beard, 1990). The study area is situated on the Swan Coastal Plain in the Dale Botanical Subdistrict which consists of Jarrah forest of ironstone gravels, Marri-Wandoo woodlands on loamy soils, with sclerophyll understoreys (Beard, 1990).

2.5 PREVIOUS BIOLOGICAL SURVEYS

Previous biological surveys most relevant to the current survey include:

- Nature Reserves of the Shires of York and Northam Management Plan, Department of Conservation and Land Management (CALM) Management Plan No. 4 (Moore et al., 1987).

3 METHODS

The survey was carried out in a manner designed to be consistent with the Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of fauna surveys in Western Australia, as set out in the following documents:

The survey was consistent the EPA requirements for environmental surveying and reporting of vegetation in Western Australia, as set out in the following documents:

- *Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas. Position Statement No.2* (EPA, 2000);
- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3* (EPA, 2002); and
- *EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51* (EPA, 2004b).
- *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56* (EPA, 2004a);
- *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA-DEC, 2010); and

3.1 LITERATURE REVIEW

The purpose of the desktop review was to gather background information on the study area and the vegetation and vertebrate fauna that it may support. This involved a search of the following sources using a 10 km buffer of the location: 31°54' 38'' S, 116°36' 14'' E.

- DEC Threatened (Declared Rare) an Priority Flora database (DEC, 2012c);
- Western Australian Museum (WAM) and DEC combined biological database NatureMap (DEC, 2012a);
- DEC Threatened and Priority Fauna database (DEC, 2012b);
- Birds Australia's Birdata database(Birdata, 2012);
- DSEWPaC Protected Matters Search Tool (also known as an *EPBC* search) (DSEWPaC, 2012); and
- Previous fauna surveys/reports i.e. Moore et al. (1987).

Collectively, these sources were used to compile a list of species that have been recorded or that may potentially occur in the region (Appendix B). This list will invariably include some species that do not occur in the study area, as some fauna have a limited or patchy distribution, exhibit a high level of habitat specificity, are locally extirpated or were erroneously identified in previous surveys. Extinct species, clearly erroneous records and species with a high level of habitat specificity for habitats not present in the study area were excluded from this list.

3.2 FIELD SURVEY

The purpose of the field survey was to verify the accuracy of the desktop review and to further delineate and characterise the vegetation, fauna and faunal assemblages in the study area. The field survey was conducted on the 2nd August 2012 and composed of a vegetation assessment, two fauna habitat assessments in addition to opportunistic observations and a Black Cockatoo habitat assessment.

3.2.1 Habitat Assessment

Two habitat assessments were completed during the field survey (Appendix C). Each habitat was scored numerically on the basis of the presence and complexity of fauna microhabitats including vegetation cover, presence of water, tree hollows, loose bark, leaf litter etc. In addition the habitat assessment included the identification of landscape features such as soil type, rock type, vegetation type and disturbance levels. The numerical scoring system individually ranked 24 microhabitat variables as a value between 0-3 based on whether it was common (3), moderately common (2), rare (1) or not present (0). The composition and presence of ground and vegetation cover was also assessed and scores were given based on their percentage cover of the 100 x 100 m quadrat. Three was the highest possible score for each feature and corresponded to a high habitat value, while zero was the lowest value reflecting a feature that was absent and/or provided little to no fauna habitat value. For each assessment the scores were tallied to give a total numerical value out of a possible 70.

3.2.2 Opportunistic and Targeted Observations

Fauna were opportunistically observed and recorded during the foot traverse of site. Field staff investigated scats, tracks, burrows and other traces of animals throughout the entire survey area. Where conservation significant species were located, the coordinates were recorded by GPS.

3.2.3 Taxonomic Identification

The taxonomy and naming of wildlife species is dynamic because of the ongoing description of new species, and increased understanding of the relationships of taxa through genetic, morphological and vocal studies. The taxonomy and nomenclature (common and scientific names) in this report follows authorities supplemented by the latest scientific articles which update the established names for frogs (Tyler & Doughty,

2009); reptiles (Wilson & Swan, 2010); mammals (van Dyck & Strahan, 2008), and birds (Gill & Donsker, 2012). This latter authority has replaced the taxonomic treatment of Christidis and Boles (2008) for birds.

Fauna species were identified in the field, where needed, using standard field guides or scientific publications for frogs (Tyler & Doughty, 2009; Tyler & Knight, 2009); reptiles (Storr et al., 1999; 2002; Wilson & Swan, 2010), birds (Pizzey & Knight, 2007; Simpson & Day, 2010) and mammals (van Dyck & Strahan, 2008; Menkhorst & Knight, 2011).

3.2.4 Black Cockatoo Foraging Assessment

Black Cockatoo habitat assessments were conducted and sites were rated on the level of foraging, roosting and breeding (DSEWPaC, 2011).

During the field survey the distribution of foraging resources was recorded throughout the project area, particularly of species that are dominant on the site. To determine if Black Cockatoos forage on the site, potential foraging plants were identified, and the ground under these plants was searched for any evidence of Black Cockatoo foraging.

In areas where Black Cockatoos have been feeding, the food remains (often chewed eucalypt nuts) can be attributed to one of the three Black Cockatoo species. For example, one of the most important indicators is the fruit of the Marri tree (*Corymbia calophylla*) (Fleming, 2011). Marri fruit that has only minor damage to the outer lip of the fruit indicates Baudin's Cockatoo foraging, as it uses its long bill to access the seeds inside (Fleming, 2011). Where the fruit is damaged more extensively, especially on the main body of the fruit, it is likely that Carnaby's Cockatoo or FRBC have been feeding (Fleming, 2011). Recent damage to bark and with the stripping of pine needles and cones is regarded as Black Cockatoo feeding activity (Cale, 2003).

3.2.5 Black Cockatoo Roosting Assessment

All three black cockatoo species are known to use communal roosting sites (DSEWPaC, 2011). The DSEWPaC referral guidelines regard roosting habitat for Black Cockatoos as any tall tree, these are generally found in or near riparian environments or natural and artificial water sources for Baudin's and Carnaby's Cockatoos and tall Jarrah and Marri trees within or on the edge of forests for FRBC (DSEWPaC, 2011). Any trees that match the definition for roosting habitat were examined for evidence of roosting activity (presence of feathers and droppings) and if found were recorded (GPS location, species and height). Birds Australia and DEC's database (Burnham et al., 2010) was also checked to see whether any known roosting locations are found within the study area.

3.2.6 Black Cockatoo Breeding Assessment

Breeding habitat is a particularly important aspect for any assessment of impacts upon Black Cockatoos. To determine the breeding habitat classification of the site in accordance with DSEWPaC referral guidelines, a habitat assessment was undertaken.

Native trees of suitable species that are greater than 500 mm diameter at breast height (DBH) are classified as mature trees and have the potential for breeding hollows to develop (DSEWPaC, 2011). The details of any trees that match this definition were noted, and their location (GPS coordinates), species, DBH, number of hollows and height (in metres) were recorded so that the breeding potential of the study area can be assessed.

To determine if mature trees in the project area have suitable breeding hollows, the following criteria were assessed for each tree (based on Gibbons & Lindenmayer, 2002):

- Minimum entrance width of a hollow;
- Diameter of the branch on which the hollow occurred;
- Whether the branch was living, part-dead or dead; and
- Whether the tree has multiple hollows.

In the referral guidelines, any patch of woodland or forest that contains live or dead trees of the appropriate species with a DBH greater than 500 mm or the presence of a suitable nest hollow is classified as breeding habitat (DSEWPaC, 2011).

3.2.7 Graceful Sunmoth Habitat Assessment

The Graceful sun-moth (GSM) (*Synemon gratiosa*) is active only from late February to early April with peak activity only in March (Bishop et al., 2010). The known habitat of the GSM is often within dense stands of two species of the common coastal and near-coastal herbs *Lomandra maritima* and *Lomandra hermaphrodita* (Bishop et al., 2010). Under current guidelines when these species are located at sites, further survey effort is required to locate the GSM (Bishop et al., 2010). Searches for *Lomandra maritima* and *Lomandra hermaphrodita* were undertaken and recorded with a GPS where applicable.

3.2.8 Flora and Vegetation Assessment

The survey included the assessment of 2 sites, the tree species were identified and searches for any native understorey species made.

At least one specimen of each taxon was collected. In addition, where field identification of plant taxa was not possible, specimens were collected systematically for later identification by taxonomists utilising identification keys including Flora of Central Australia (Jessop 1981), Flora of Australia (1981-2011), AusGrass (Sharp and Simon 2002), EUCLID (EUCLID 2006), WATTLE (Maslin 2001), relevant taxonomic papers published in journals including Australian Systematic Botany (1988-2011) and Nuytsia (1975-2011).

4 RESULTS

4.1 SURVEY LIMITATIONS

It is important to note the variables associated with individual surveys, which are often difficult to predict, as is the extent to which they influence survey outcomes. Survey variables of the fauna survey are detailed in Table 4.

Table 4: Variables Associated with the Assessment

Variable	Impact on Survey Outcomes
Experience levels/ Resources	The biologists that executed this survey are regarded as suitably qualified in their respective fields: • Field Staff: John Trainer (Zoologist) and Chris Knuckey (Environmental Biologist) • Data Interpretation: Chris Knuckey (Environmental Biologist)
Scope: sampling methods/ Intensity	A Level 1 survey was carried out and as such, many species that occur at the site would not have been observed during the survey, particularly small ground-dwelling fauna that are normally found by trapping.
Sources of Information	At the bioregion level, the Northern Jarrah Forests of Western Australia has been the subject of many targeted biological surveys. Site-specific data is restricted, but this is not considered a limiting factor for this survey.
Timing, weather, season.	The survey was undertaken on the 2nd August 2012. The area had received 140.6 mm of rain in the three months prior to the survey (May – July 2012) which is slightly below the average 171.16 mm for the same period (1996 – 2012) (BoM, 2012). The maximum temperature for the day of the survey was 17.1°C and the preceding overnight temperature was 1°C (BoM, 2012). The weather conditions during the survey did not limit the survey outcomes and would not have impacted the occurrence of conservation significant fauna.
Disturbances	The study area contains a very high level of disturbance and was almost completely composed of cleared agricultural land with sparsely distributed remnant trees.
Access problems	No access problems affected the outcome of the survey.

4.2 FAUNA HABITAT ASSESSMENT

4.2.1 Fauna Habitat Types

The study area contains two habitat types, 'cleared cropland' with scattered Marri and *Eucalyptus wandoo* (Wandoo) and 'minor creekline', lined with *Eucalyptus wandoo* (Wandoo) and *Eucalyptus rudis* (Flooded Gum) (Figure 3 and Appendix C).

Cleared cropland

The vegetation consists of large areas of pasture and scattered mature Marri and Wandoo trees, with no understorey vegetation. The cleared cropland provides little suitable habitat for vertebrate fauna other than birds. It covers approximately 59.9 ha of the study area (87%). The scattered Marri and Wandoo provide suitable feeding habitat for birds such as the Australian Ringneck Parrot (*Barnardius zonarius*) which feeds on the nuts of the Marri and flowers of the Wandoo. Other species include honeyeaters and robins which feed on the flowers of scattered trees and insects which are found upon them. The sandy-loam soils across the area provide suitable burrowers such as the Southern Blind Snake (*Ramphotyphlops australis*). The Marri and Wandoo provide foraging habitat and potential roosting and breeding habitat for Black Cockatoos. The cleared cropland habitat has a value of 12 and is considered to have 'low' fauna habitat value.

Minor creekline

The minor creekline provides habitat for bird species and potentially seasonal breeding habitat for amphibian species. It covers approximately 9 ha of the study area (13%). Many large trees containing hollows were recorded from this habitat and it therefore provides potential breeding habitat for hollow nesting bird species including Parrots, Cockatoos, Owls and waterbirds such as the Maned Duck (*Chenonetta jubata*). This habitat contains an additional foraging species *Allocasuarina fraseriana* (Sheoak) in addition to Wandoo which provides potential foraging, roosting and breeding habitat for the EPBC listed Black Cockatoos. The minor creekline habitat has a value of 13 and is considered to have 'low' fauna habitat value.

4.3 FAUNA ASSEMBLAGE

All fauna previously recorded in the vicinity of the site are listed in Appendix B. As a Level 1 survey was conducted, a limited number of fauna were recorded during the survey, particularly ground dwelling reptiles and mammals. A total of 35 species were recorded from within the study area, 227 species have been previously recorded within the vicinity of the study area.

4.3.1 Amphibians

A total of seven species of amphibians have been previously recorded in vicinity of the study area (Appendix B). The amphibians most likely to occur are the Western Banjo Frog (*Limnodynastes dorsalis*) and the Crawling Toadlet (*Pseudophryne guentheri*).

No amphibians were recorded during the fauna assessment.

4.3.2 Reptiles

Twenty-seven species of reptile have been previously recorded in the vicinity of the study area (Appendix B). Reptiles likely to occur at the site include the Variegated tree Dtella (*Gehyra variegata*), the Bobtail (*Tiliqua rugosa rugosa*) and the Western Bearded Dragon (*Pogona minor minor*).

Five reptile species, the Southern Blind Snake (*Ramphotyphlops australis*), Common Dwarf Skink (*Menetia greyii*), Buchanan's Snake-eyed Skink (*Cryptoblepharus buchananii*), Marbled Gecko (*Christinus marmoratus*) and *Diplodactylus pulcher* were recorded during the fauna assessment.

4.3.3 Birds

One hundred and eighty-three species of birds have been previously recorded in the vicinity of the study area (Appendix B). Many of these are unlikely to occur at the site, since these records are from a larger area encompassing a wide range of habitats and include rare birds that only occur on a transitory basis.

Twenty-eight species of bird from eighteen families were recorded during this survey including five species belonging to the family Meliphagidae (Honeyeaters). Other common birds of the study area included the Australian Ringneck, Pallid Cuckoo (*Cacomantis pallidus*) and Red-capped Robin (*Petroica goodenovii*). Foraging evidence of two species of conservation significant bird were recorded during the fauna assessment, Carnaby's Cockatoo and Baudin's Cockatoo.

4.3.4 Mammals

Ten species of mammal have previously been recorded in the vicinity of the study area (Appendix B). Many of these are unlikely to occur at the site, since these records are from larger areas encompassing a wide range of habitats, and small mammals tend to be habitat-specific.

During the fauna assessment evidence of two mammal species were recorded. This included one native mammal, the Western Grey kangaroo (*Macropus fuliginosus*) and one introduced mammal species, the Rabbit (*Oryctolagus cuniculus*).

4.4 FAUNA OF CONSERVATION SIGNIFICANCE

Twenty-six conservation significant fauna species are known to potentially occur in the area (Appendix D). Some of these are unlikely to occur on the site as they have a limited or patchy distribution, high level of habitat specificity, are locally extinct or were erroneously recorded in previous surveys.

Evidence of two species, the Carnaby's Cockatoo and Baudin's Cockatoo, were recorded during the survey and two species of conservation significant species are considered 'Likely' to occur within the study area: Forest Red-tailed Cockatoo and the Rainbow Bee-eater (*Merops ornatus*) (Appendix D). A further eight species are considered 'possible' to occur, eleven species are considered 'unlikely' to occur and three are classified as 'highly unlikely' to occur; based on their ecology, habitat present and fauna records (Appendix D).

4.5 BLACK COCKATOO HABITAT ASSESSMENT

4.5.1 Foraging Assessment

Vegetation of the study area consists of isolated trees or small stands of mature Marri and Wandoo which are both known foraging resources for Black Cockatoos. A total of three plant species that were recorded from within the study area are known foraging resources for Black Cockatoos (Groom, 2011; Johnstone & Kirkby, 1999, 2008; Shah, 2006; Valentine & Stock, 2008) were recorded (Table 5). Foraging evidence of the Carnaby's Black Cockatoo and/or Baudin's Black Cockatoo were recorded beneath Marri trees at HT1, HT3, HT7, HT8, HT9, HT21, HT23, HT39, HT111 and HT128 (Plate 1). The study area comprises approximately 4.16 ha of foraging habitat (Figure 4).

Table 5: Black Cockatoo foraging resources found within the study area

Species	Common Name	Foraging Resource
Corymbia calophylla	Marri	flowers, seeds, nectar
Eucalyptus wandoo	Wandoo	flowers
Allocasuarina fraseriana	Sheoak	seeds

Plate 1: Foraging evidence recorded during the field survey: Carnaby's Cockatoo (left) and Baudin's Cockatoo (right).

4.5.2 Roosting Assessment

Tall trees containing a dense canopy (dead stags are not classified as roost sites) of Black Cockatoo roosting tree species (Marri, Wandoo and Flooded Gum) were present within the study area and provide potential roosting habitat for Black Cockatoos. No roosting evidence (droppings or feathers) were recorded around the trees. The nearest known roost site for Carnaby's Black Cockatoos is located approximately 16 km to the north-east of the study area (Burnham et al., 2010).

4.5.3 Breeding Assessment

Breeding habitat is a particularly important aspect for any assessment of the impacts on Black Cockatoos. Breeding habitat for Black Cockatoos is classified as any patch of woodland containing live or dead trees of specific species with a DBH of greater than 500 mm (DSEWPaC, 2011).

During the Black Cockatoo breeding habitat assessment a total of 144 trees, of specific species and with a DBH of 500 mm or more, were recorded in the study area. This consists of 52 Marri, 66 Wandoo, 1 Flooded Gum and 25 dead stags (Appendix E; Figure 5).

A total of 13 individual trees contained suitable breeding hollows (1 Marri, 4 Wandoo and 8 dead stags). Suitable breeding hollows are those considered for those trees with a hollow entrance diameter greater than 100 mm and are considered to be of suitable breeding habitat for Black Cockatoos (HT20, HT53, HT63, HT71, HT72, HT82, HT85, HT86, HT87, HT96, HT100, HT108 and HT110; Appendix E; Figure 5). All trees with suitable hollows were inspected for evidence of use as nest sites, such as chew marks and bark stripping from around the entrance of the hollow. No such evidence was recorded during the survey.

4.6 GRACEFUL SUN-MOTH HABITAT ASSESSMENT

The two near-coastal shrubs, *Lomandra maritima* and *Lomandra hermaphrodita*, which the GSM is commonly found in, were not recorded in the study area. There are no records of the GSM from within in the vicinity of the study area and the nearest record is situated over 60 km to the west of the study area.

4.7 VEGETATION ASSESSMENT

Shepherd et al. (2001) mapped the region at a scale of 1:250 000 describing the vegetation of an area encompassing the study area as 'medium woodland with marri and wandoo'. The study area has been extensively cleared and contains few scattered trees of Marri and Wandoo as well as a small number of Flooded Gum and *Allocasuarina fraseriana* (Sheoak). The understorey is completely free of any native vegetation and is composed completely of introduced grazing and cropping species. The database review revealed 18 threatened and priority flora species which are known to occur within the vicinity of the study area (Table 6). No threatened or priority flora were identified during the survey.

Table 6: Threatened and priority flora known from within the vicinity of the study area

Conservation Status	Taxa	Common Name	Life Form
T	*Tetraria australiensis*		Perennial Herb
	Lechenaultia laricina	Scarlet Leschenaultia	Perennial Shrub
P2	*Stylidium asymmetricum*		Annual Herb
P3	*Acacia pulchella* var. *reflexa acuminate bracteole* variant (R.J. Cumming 882)		Perennial Shrub
	Verticordia serrata var. *linearis*		Perennial Shrub
	Thelymitra yorkensis		Perennial Herb
	Synaphea diabolica		Perennial Shrub
	Synaphea sp. Darkin (F. Hort et al. 586)		Perennial Shrub
	Stylidium asteroideum	Star Triggerplant	Annual Herb
P4	*Schoenus natans*	Floating Bog-rush	Aquatic Annual Herb
	Hibbertia montana		Perennial Shrub
	Acacia cuneifolia		Perennial Shrub
	Ornduffia submersa		Annual Herb
	Calothamnus rupestris	Mouse Ears	Perennial Shrub

Conservation Status	Taxa	Common Name	Life Form
	Darwinia thymoides subsp. St Ronans (J.J. Alford & G.J. Keighery 64)		Perennial Shrub
	Caladenia integra		Perennial Herb
	Cyanicula ixioides subsp. *ixioides*		Perennial Herb
	Asterolasia grandiflora		Perennial Shrub

5 DISCUSSION

5.1 FAUNA HABITAT TYPES

The study area consists of two habitat types; 'cropland with scattered Marri and Wandoo' and 'minor creekline lined with Wandoo and Flooded Gum'. Both these habitat types are severely degraded, contain low fauna habitat value and are well represented in the local vicinity.

5.2 FAUNAL ASSEMBLAGE

A total of 35 species were recorded from within the study area, comprising five reptiles, 28 birds and two mammals. A total of 227 species have been previously recorded within the vicinity of the study area. As this was a Level One survey to assess fauna habitat types, many of the potentially occurring species were not recorded. For example, many of the ground dwelling reptiles and mammals are mainly recorded or captured from trapping techniques employed during a Level Two survey. In addition, some potentially occurring species are nocturnal and the surveys were conducted during the day.

The expected fauna assemblage of the study area consists of species that are generally common and widespread throughout the region and are not dependent upon the habitat found within the study area.

5.3 CONSERVATION SIGNIFICANT FAUNA

Evidence of two conservation significant species, Carnaby's Black Cockatoo and Baudin's Black Cockatoo were recorded during the survey and two species of conservation significant species are considered as 'likely' to occur in the study area; the Forest Red-tailed Black Cockatoo and the Rainbow Bee-eater.

Carnaby's Cockatoo (*Calyptorhynchus latirostris*)

The Carnaby's Cockatoo is listed as Endangered under the *EPBC Act* and Schedule 1 under the *WC Act*. Carnaby's Cockatoo is endemic to southwest Western Australia, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale, 2003). The species was once common, but the population has declined significantly in the last half century, and is now locally extinct in some areas (Johnstone & Storr, 1998; Shah, 2006). In the last 45 years the species has suffered a 50% reduction in its abundance due to the extensive clearing of core breeding habitat in the wheatbelt, and the clearing of food resources upon the Swan Coastal Plain (Cale, 2003). The total population of Carnaby's Cockatoo is currently estimated at 40,000 (Garnett, et al., 2011).

Breeding usually occurs from early July to mid-December, in the semi-arid and subhumid interior of WA's wheatbelt (Johnstone & Storr, 1998). Two records exist in the vicinity of the study area for the Carnaby's Black Cockatoo (DEC, 2012b) and foraging evidence was

recorded during the current survey. The study area contains suitable foraging, roosting and breeding habitat for the Carnaby's Cockatoo.

Baudin's Cockatoo (*Calyptorhynchus baudinii*)

Baudin's Cockatoo is distributed throughout the south western humid and sub humid zones, from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Storr, 1998). This species forages primarily in eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds (Johnstone & Kirkby, 2008). They also feed on a wide range of seeds of *Eucalyptus, Banksia, Hakea* and exotic *Pinus* (Pine) species, as well as fruiting apples and pears and beetle larvae from under the bark of trees (Johnstone & Kirkby, 2008; Johnstone & Storr, 1998).

Baudin's Cockatoo is mostly a postnuptial nomad, although some populations are resident (Johnstone & Kirkby, 2008). Most Baudin's Cockatoos breed in the deep south-west in spring-summer, from around October to March. Following breeding birds leave nesting areas and amalgamate to form large foraging flocks. These flocks generally migrate north to the main non-breeding wintering area in the northern Darling Range between Collie and Mundaring (Johnstone & Kirkby, 2008). The total population of Baudin's Cockatoo is estimated to be about 15 000 birds, and has declined greatly in the last 50 years primarily from habitat destruction (Johnstone & Kirkby, 2008). Three records of the Baudin's Black Cockatoo exist in the vicinity of the study area (DEC 2012b) and foraging evidence that was recorded during the current survey. The study area contains suitable foraging, roosting and breeding habitat for the Baudin's Cockatoo.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black Cockatoo is distributed throughout the humid and subhumid southwest of Western Australia from Gingin through the Darling Ranges to the southwest, from approximately Bunbury to Albany (Johnstone & Storr, 1998). The FRBC occurs in pairs or small flocks, or occasionally in large flocks of up to 200 birds (Johnstone & Storr, 1998). The FRBC usually inhabits dense Jarrah (*Eucalyptus marginata*), Karri (*Eucalyptus diversicolor*) and Marri forests that receive more than 600 mm average annual rainfall (Chapman, 2007). This species breeds in the southwest between October and November.

The FRBC feeds primarily on Marri and Jarrah fruit (DSEWPaC, 2011). They also have been known to feed on Blackbutt (*Eucalyptus patens*), Albany Blackbutt (*Eucalyptus staeri*), Karri, Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) (Johnstone & Kirkby, 1999). The FRBC population is estimated at approximately 15,000 birds (Johnstone & Kirkby, 1999). The primary threat to the FRBC is the loss of habitat loss due to clearing and forestry (Garnett et al., 2011). The study area occurs slightly east of the modelled distribution for the species (DSEWPaC, 2011; Johnstone & Storr,

1998) however in recent years there has been expansion of foraging of the species east into the wheatbelt in search of food (Johnstone et al., 2010). The FRBC has been recorded previously within the vicinity of the study area (DEC, 2012b). The study area provides suitable foraging, roosting and breeding habitat for the species and

Rainbow Bee-eater

The Rainbow Bee-eater is listed as Migratory under the EPBC Act. This species is one of the most common and widespread birds in Australia with a distribution that covers the majority of Australia (Barrett et al. 2003). In Western Australia this bird can occur as a 'resident, breeding visitor, postnuptial nomad, passage migrant and winter visitor' (Johnstone & Storr, 1998). Although the species was not recorded during this survey it has been previously recorded in the vicinity of the study area (DEC, 2012a). The study area provides suitable foraging habitat and suitable nest sites in the sandy soil. The species is not however, dependent on the habitats represented in the study area, and the common and widespread distribution of this species ensures that the proposed development will not impact upon its conservation status.

5.4 BLACK COCKATOO HABITAT ASSESSMENT

The study area was assessed on three key factors that are provided by vegetation and considered important to Black Cockatoo ecology, namely, foraging, roosting and breeding. The draft referral guidelines state that "any area within the range of Black Cockatoos that contains known food or nesting plant species is considered to be habitat for this species" (DSWEPC, 2011).

The study area contains three species that are known foraging resources for Black Cockatoos. As such, all of the vegetation of the study area (4.16 ha, 6%) is classified as foraging habitat for Black Cockatoos. The referral guidelines state that if the proposed development requires the clearing of more than one hectare of foraging habitat, this would be classified as a 'high risk of significant impact' on a matter of national environmental significance (DSEWPaC, 2011) (Table 1).

According to the DSEWPaC (2011) draft referral guidelines the clearing of a 'known roosting site' would be considered high risk of significant impact'. Tall trees with a closed canopy that could potentially provide roosting habitat were recorded within the study area however, no evidence or signs of roosting was recorded. In addition, there are no known roosting locations within the study area, the closest known Carnaby's Cockatoo roosting site is situated more 16km to the northwest (Burnham et al., 2010).

The study area contains a total of 144 trees (Marri, Wandoo, Flooded Gum and dead stags) that are suitable dimensions to be classified as potential breeding habitat. The clearing of any tree with a DBH over 500 mm would be considered a 'high risk of significant impact' on a matter of national environmental significance based on the DSEWPaC (2011) draft referral guidelines.

The draft referral guidelines identify that creating a gap greater than 4 km between patches of Black Cockatoo habitat (foraging, roosting and breeding) will be classified as a 'high risk of significant impacts'.

The study area is located in a highly cleared landscape. Three nature reserves occur within close proximity (less than 4 km) to the study area, namely: Wambyn Nature Reserve (215.2 ha), St Ronans Nature Reserve (118.2 ha) and Wandoo Conservation Reserve (46,338 ha). The vegetation of these reserves (Moore et al. 1987) contain known foraging and breeding plant species for Black Cockatoos. However, the quality and extent of these habitats within each reserve remains unknown owing to the amount of time since the Moore et al. (1987) survey was completed. The cleared cropland habitat containing scattered Marri and Wandoo is prominent throughout the areas surrounding the study area. As such the proposed development will not produce a gap of greater than 4 km between patches of Black Cockatoo habitat.

5.5 GRACEFUL SUN-MOTH HABITAT ASSESSMENT

The two near-coastal shrubs, *Lomandra maritima* and *Lomandra hermaphrodita*, which the GSM is commonly found in (Bishop et al., 2010), were not recorded in the study area. There are no records of the GSM from within in the vicinity of the study area and the nearest known record is situated over 60 km to the west (Burnham et al., 2010). As such it is highly unlikely that the GSM inhabits the study area.

5.6 VEGETATION ASSESSMENT

The study area has been previously cleared for agriculture and as such, the extent of native vegetation is extremely limited with only few scattered Marri, Wandoo, Flooded Gum and Sheoak trees remaining. The understorey is completely composed of introduced cropping and grazing species and no native vegetation. The vegetation of the region has been previously mapped at a scale of 1:250 000, described as 'medium woodland with marri and wandoo' (Shepherd et al., 2001). Vegetation of this description had a pre-European extent of 208,969 ha and currently has over 38% remaining. Due to the extensive clearing in the study area, the vegetation is considered highly degraded. Of the 18 threatened and priority flora species identified during the database review none were recorded in the study area and it is highly unlikely that any of these species would occur in the study area.

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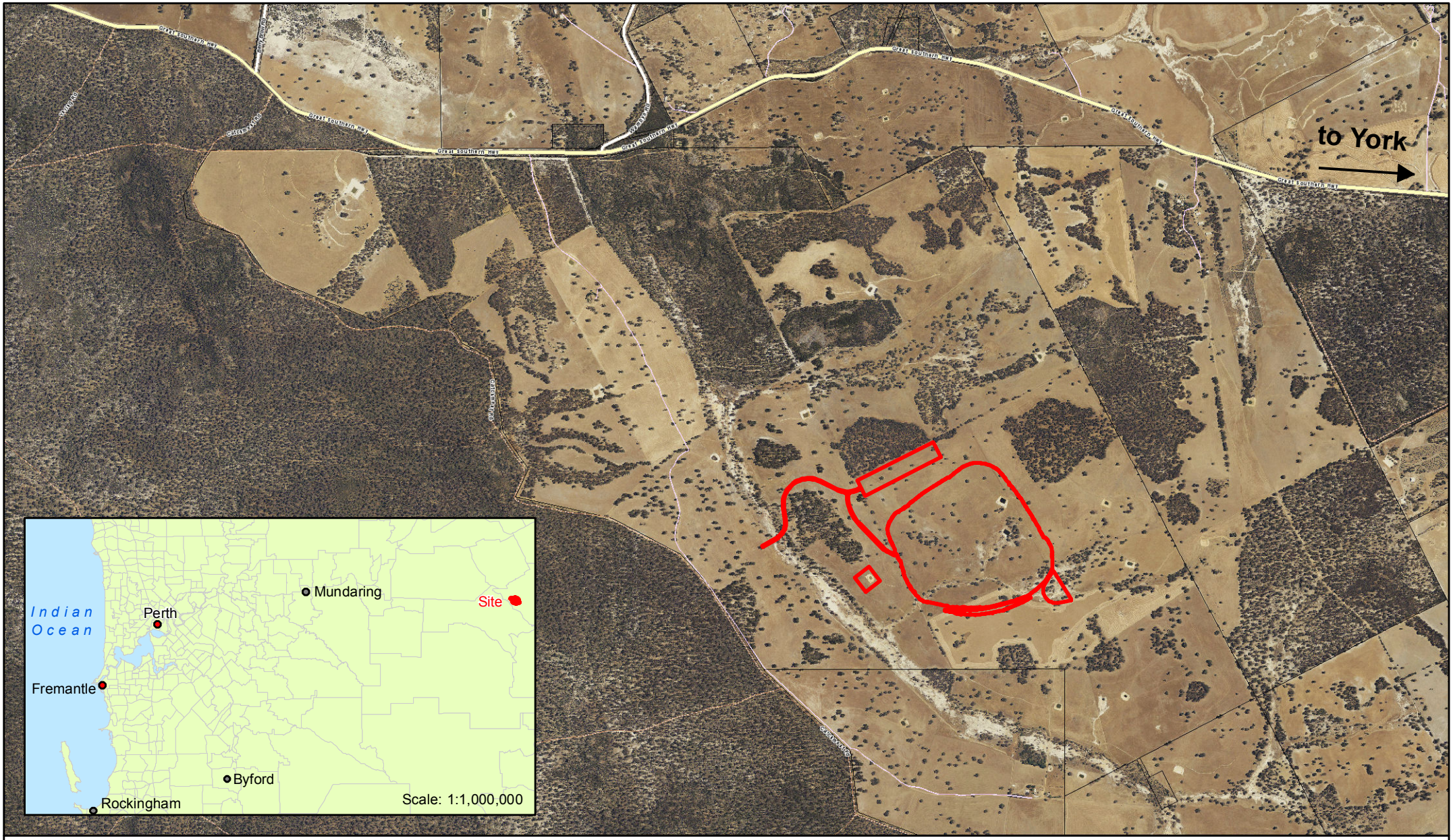
FIGURES



CLIENT
Bowman & Associates

JOB NO.
J112235

AUTHOR
C Knuckey

DRAWN
T Ellis

DATE
29-08-12

SCALE
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PROJECTION
GDA94 MGA50

Legend

Landfill Footprint

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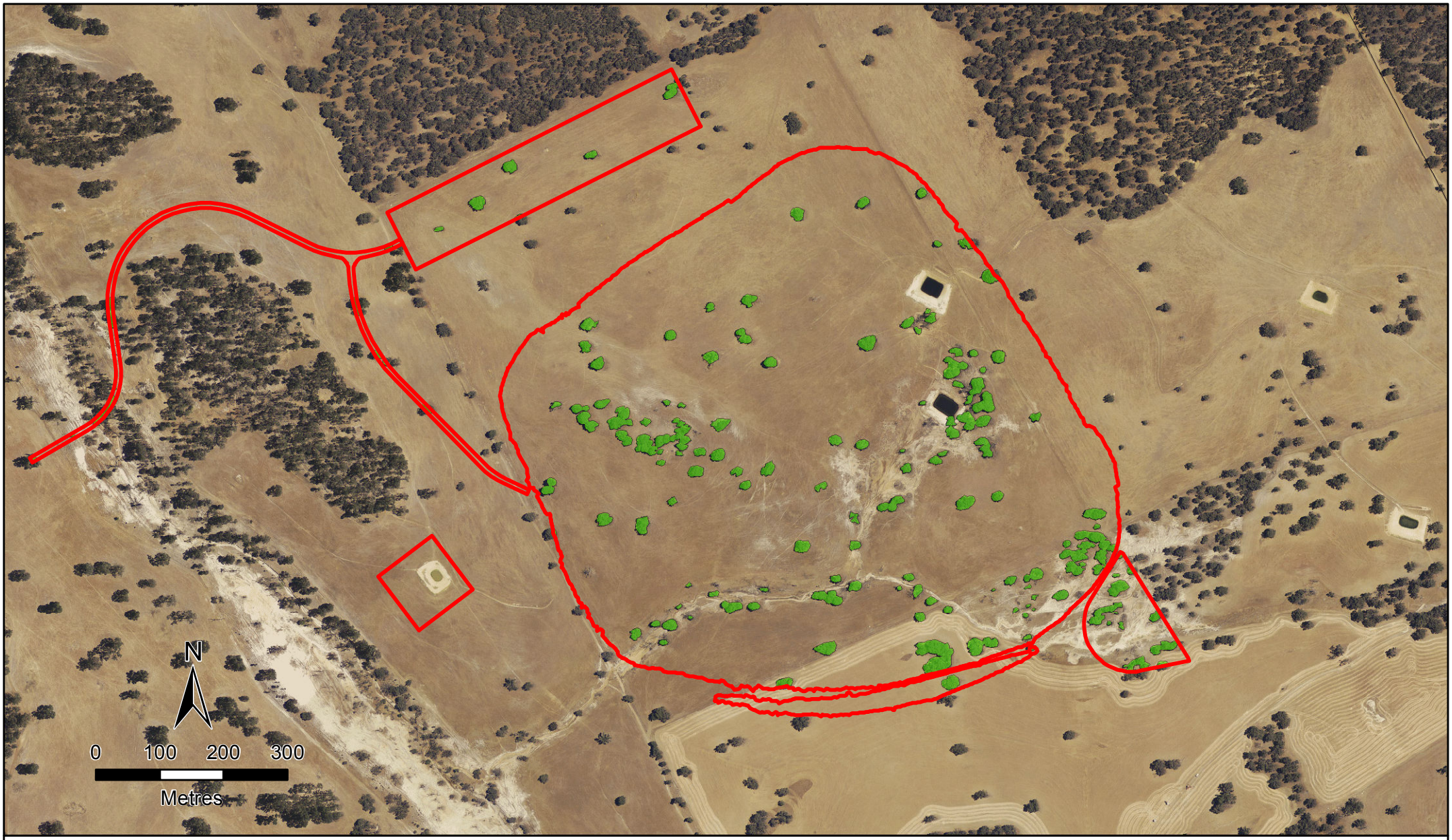
Metres

Site Location

Allawuna Landfill
Fauna Assessment

FIGURE 1



CLIENT
Bowman & Associates

JOB NO.
J112235

AUTHOR
C Knuckey

DRAWN
T Ellis

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29-08-12

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PROJECTION
GDA94 MGA50

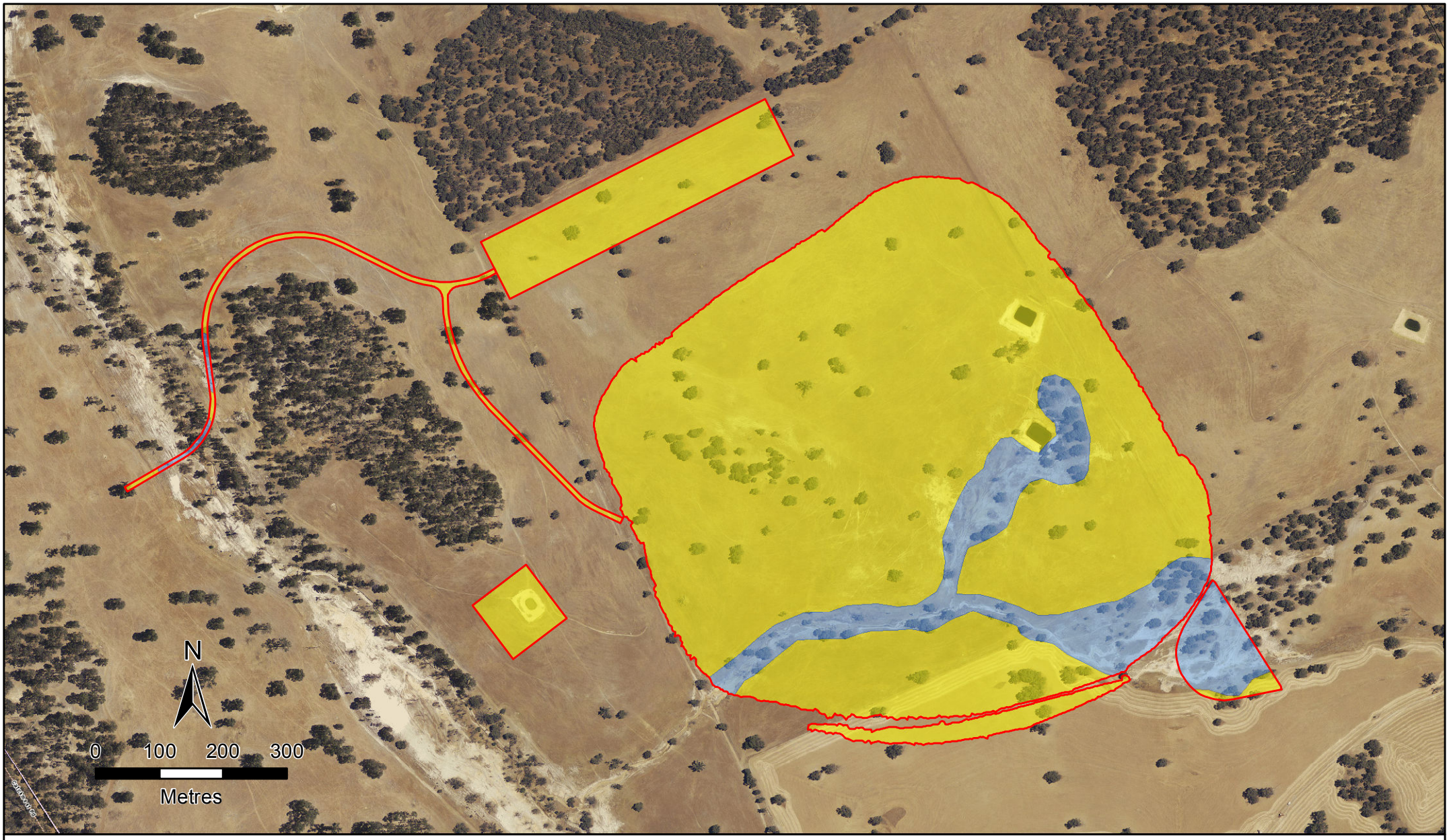
Legend

- Landfill Footprint
- Potential Foraging Habitat

Black Cockatoo Potential Foraging Habitat

Allawuna Landfill
Fauna Assessment

FIGURE **2**



env Australia

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Bowman & Associates

JOB NO.
J112235

AUTHOR
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DRAWN
M Mikkonen

DATE
30-08-12

SCALE
1:8,000 @ A4

PROJECTION
GDA94 MGA50

Legend

Survey Area

Habitat

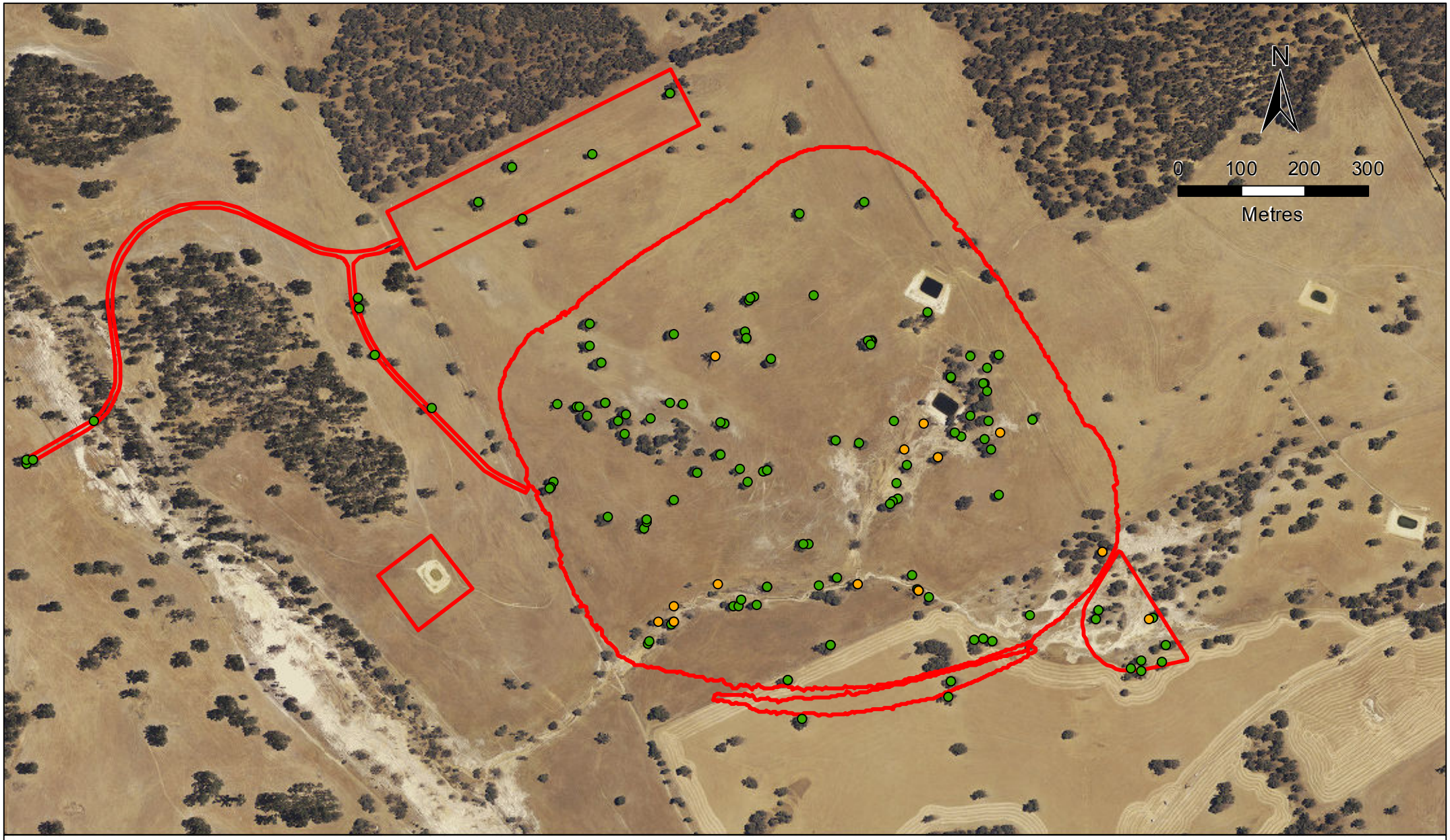
Cleared Cropland

Minor Creekline

Fauna Habitat Map

Allawuna Landfill
Fauna Assessment

FIGURE 3



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DATE
29-08-12

SCALE
1:8,000 @ A4

PROJECTION
GDA94 MGA50

Legend

- Landfill Footprint
- Potential Breeding Tree
- Potential Breeding Tree with Hollows

Black Cockatoo Potential Breeding Trees

Allawuna Landfill
Fauna Assessment

FIGURE 4

APPENDIX A

DEFINITIONS OF CONSERVATION CODES FOR FAUNA OF CONSERVATION SIGNIFICANCE

APPENDIX A

DEFINITIONS OF CONSERVATION CODES FOR FAUNA OF CONSERVATION SIGNIFICANCE

A1: National Threatened Species Codes

Environment Protection and Biodiversity Conservation Act 1999

The *EPBC Act* prescribes seven matters of national environmental significance:-

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance;
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

Species in the categories ExW, CE, E, V and M (see below) are protected as matters of national environmental significance under the *EPBC Act*.

Category	Code	Category
Extinct	Ex	Taxa for which there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	ExW	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or not recorded in its known and/or expected habitat at appropriate seasons anywhere in its past range despite exhaustive surveys over a timeframe appropriate to its life cycle and form.
Critically Endangered	CE	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	E	Taxa not critically endangered and facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vulnerable	V	Taxa not critically endangered or endangered and 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	Taxa which are the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within five years.

Category	Code	Category
Migratory	Mi	Taxa that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations, that are included in an international agreement approved by the Minister for the Environment, Heritage and the Arts and that have been placed on the national List of Migratory Species under the provisions of the EPBC Act. At present there are four such agreements: • the Bonn Convention • the China-Australia Migratory Bird Agreement (CAMBA) • the Japan-Australia Migratory Bird Agreement (JAMBA) • the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
Marine	Ma	Taxa protected in a Commonwealth Marine Protected Area by virtue of section 248 of the *EPBC Act*. These taxa include certain seals, crocodiles, turtles and birds, as well as various marine fish. Commonwealth marine areas are matters of national environmental significance under the *EPBC Act*. An action will require approval if the: • action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment, or • action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment in a Commonwealth marine area[1] The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Commonwealth marine area stretches from 3 to 200 nautical miles (approximately 5-370 km) from the coast. Marine protected areas are marine areas which are recognised to have high conservation value.

A2: Western Australian Threatened Fauna Categories

Wildlife Conservation Act 1950 (WA)

Category	Code	Description
Schedule 1	S1	Rare or likely to become extinct.
Schedule 2	S2	Presumed extinct.
Schedule 3	S3	Birds subject to an agreement between the governments of Australia and Japan, the People's Republic of China & the Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Other specially protected fauna.

A3: Department of Environment and Conservation Fauna Priority Codes

Category	Code	Description
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring: not currently threatened or in need of special protection, but could become so. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring: not considered threatened, but the subject of a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX B

FAUNA SPECIES RECORDED IN THE REGION

APPENDIX D

D1: AMPHIBIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environment Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap (2012), B = Listed by Birds Australia (2012), C = Listed on the DEC Threatened and Priority Fauna Database, D = Listed by the DSEWPaC Protected Matters Search Tool, E = Nature Reserves of the Shires of York and Northam management Plan, F = Current survey

Note: For Definitions of Conservation Codes see Appendix A.

AMPHIBIANS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
LIMNODYNASTIDAE										
Heleioporus albopunctatus	Western Spotted Frog				x				x	
Heleioporus barycragus	Hooting Frog				x					
Limnodynastes dorsalis	Western Banjo Frog				x				x	
Neobatrachus pelobatoides	Humming Frog				x				x	
MYOBATRACHIDAE										
Crinia pseudinsignifera	Bleating Froglet				x					
Myobatrachus gouldii	Turtle Frog				x					
Pseudophryne guentheri	Crawling Toadlet				x				x	

[X] fauna species recorded.
[*] denotes introduced species.

APPENDIX D

D2: REPTILIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environment Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap (2012), B = Listed by Birds Australia (2012), C = Listed on the DEC Threatened and Priority Fauna Database, D = Listed by the DSEWPaC Protected Matters Search Tool, E = Nature Reserves of the Shires of York and Northam management Plan, F = Current survey

Note: For Definitions of Conservation Codes see Appendix A.

REPTILES		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
AGAMIDAE										
Ctenophorus ornatus	Ornate Crevice Dragon				x				x	
Pogona minor minor	Bearded Dragon				x				x	
DIPLODACTYLIDAE										
Crenadactylus ocellatus subsp. *ocellatus*	Clawless Gecko				x				x	
Diplodactylus granariensis	Western Stone Gecko								x	
Diplodactylus pulcher									x	x
Oedura reticulata	Reticulated Velvet Gecko				x				x	
Underwoodisaurus milii	Barking Gecko								x	
GEKKONIDAE										
Christinus marmoratus	Marbled Gecko								x	x
Gehyra variegata	Variegated Tree Dtella				x				x	
PYGOPODIDAE										
Delma fraseri									x	
Lialis burtonis	Burton's Legless Lizard								x	
Pygopus lepidopodus	Common Scaly Foot				x				x	
SCINCIDAE										
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink				x					x
Cryptoblepharus plagiocephalus					x				x	
Ctenotus pantherinus	Leopard Ctenotus				x					
Egernia multiscutata	Bull Skink								x	
Egernia napoleonis					x					
Eremiascincus richardsonii	Broad-banded Sand Swimmer				x					
Lerista distinguenda					x				x	
Menetia greyii	Common Dwarf Skink				x				x	x
Morethia obscura					x				x	
Tiliqua rugosa rugosa	Bobtail								x	
VARANIDAE										
Varanus gouldii	Sand Monitor				x				x	
Varanus tristis	Racehorse Monitor				x				x	
TYPHLOPIDAE										
Ramphotyphlops australis	Southern Blind Snake				x					x
BOIDAE										
Morelia spilota imbricata	Southwest Carpet Python			P4	x		x			
ELAPIDAE										
Brachyurophis semifasciata	Southern Shovel-nosed Snake								x	

[X] fauna species recorded.
[*] denotes introduced species.

APPENDIX D

D3: AVIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environment Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap (2012), B = Listed by Birds Australia (2012), C = Listed on the DEC Threatened and Priority Fauna Database, D = Listed by the DSEWPaC Protected Matters Search Tool, E = Nature Reserves of the Shires of York and Northam management Plan, F = Current survey

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
CASUARIIFORMES										
Dromaiidae	Emu									
Dromaius novaehollandiae	Emu				x	x			x	x
GALLIFORMES										
Megapodiidae	Megapodes									
Leipoa ocellata	Malleefowl	VU	S1					x		
Phasianidae	Pheasants, Fowl & Allies									
Coturnix pectoralis	Stubble Quail				x	x				
ANSERIFORMES										
Anatidae	Ducks, Geese & Swans									
Cygnus atratus	Black Swan				x	x				
Tadorna tadornoides	Australian Shelduck				x	x				
Malacorhynchus membranaceus	Pink-eared Duck					x				
Chenonetta jubata	Maned Duck				x	x				x
Anas superciliosa	Pacific Black Duck				x	x				
Anas rhynchotis	Australasian Shoveler					x				
Anas gracilis	Grey Teal				x	x				
Anas castanea	Chestnut Teal					x				
Aythya australis	Hardhead				x	x				
Oxyura australis	Blue-billed Duck					x				
Biziura lobata	Musk Duck					x				
PODICIPEDIFORMES										
Podicipedidae	Grebes									
Tachybaptus novaehollandiae	Australasian Grebe				x	x				
Poliocephalus poliocephalus	Hoary-headed Grebe					x				
Podiceps cristatus	Great Crested Grebe					x				
PELECANIFORMES										
Threskiornithidae	Ibises, Spoonbills									
Threskiornis moluccus	Australian White Ibis				x	x				
Threskiornis spinicollis	Straw-necked Ibis				x	x				
Plegadis falcinellus	Glossy Ibis	Mi	S3			x				
Platalea flavipes	Yellow-billed Spoonbill				x	x				
Ardeidae	Herons, Bitterns									
Nycticorax caledonicus	Nankeen Night Heron				x	x				
Bubulcus coromandus	Eastern Cattle Egret	Mi	S3					x		
Ardea pacifica	White-necked Heron					x				
Egretta novaehollandiae	White-faced Heron					x				
Ardea alba	Great Egret	Mi	S3			x		x		
Pelecanidae	Pelicans									
Pelecanus conspicillatus	Australian Pelican					x				
SULIFORMES										

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
Phalacrocoracidae	Cormorants, shags									
Microcarbo melanoleucos	Little Pied Cormorant					x				
Phalacrocorax sulcirostris	Little Black Cormorant				x	x				
Phalacrocorax varius	Australian Pied Cormorant					x				
Phalacrocorax carbo	Great Cormorant					x				
Anhingidae	Anhingas, darters									
Anhinga novaehollandiae	Australasian Darter					x				
ACCIPITRIFORMES										
Accipitridae	Kites, Hawks & Eagles									
Elanoides axillaris	Black-shouldered Kite					x				
Haliastur sphenurus	Whistling Kite				x	x				
Haliaeetus leucogaster	White-bellied Sea Eagle	Mi	S3					x		
Hamirostra isura	Square-tailed Kite					x			x	
Circus approximans	Swamp Harrier					x				
Circus assimilis	Spotted Harrier					x				
Accipiter fasciatus	Brown Goshawk				x	x				
Accipiter cirrocephalus	Collared Sparrowhawk				x	x			x	
Aquila audax	Wedge-tailed Eagle				x	x				
Hieraaetus morphnoides	Little Eagle					x			x	
FALCONIFORMES										
Falconidae	Caracaras, Falcons									
Falco cenchroides	Nankeen Kestrel				x	x				
Falco longipennis	Australian Hobby				x	x				x
Falco berigora	Brown Falcon				x	x			x	
Falco peregrinus	Peregrine Falcon		S4		x	x	x			
OTIDIFORMES										
Otididae	Bustards									
Ardeotis australis	Australian Bustard			P4		x				
GRUIFORMES										
Rallidae	Rails, Crakes & Coots									
Gallirallus philippensis	Buff-banded Rail					x				
Porzana pusilla	Baillon's Crake					x				
Porzana tabuensis	Spotless Crake					x				
Porphyrio porphyrio	Purple Swamphen					x				
Gallinula tenebrosa	Dusky Moorhen					x				
Tribonyx ventralis	Black-tailed Nativehen					x				
Fulica atra	Eurasian Coot				x	x				
CHARADRIIFORMES										
Turnicidae	Buttonquail									
Turnix varius	Painted Buttonquail					x			x	
Turnix velox	Little Buttonquail					x				
Burhinidae	Stone-curlews									
Burhinus grallarius	Bush Stone-curlew			P4	x	x	x			
Recurvirostridae	Stilts, Avocets									
Himantopus leucocephalus	White-headed Stilt				x	x				
Cladorhynchus leucocephalus	Banded Stilt					x				
Recurvirostra novaehollandiae	Red-necked Avocet					x				
Charadriidae	Plovers									
Vanellus tricolor	Banded Lapwing				x	x				
Erythrogonys cinctus	Red-kneed Dotterel					x				
Charadrius ruficapillus	Red-capped Plover					x				

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
Elseyornis melanops	Black-fronted Dotterel					x				
Rostratulidae	Painted Snipes									
Rostratula australis	Australian Painted Snipe	VU	S1			x		x		
Scolopacidae	Sandpipers, Snipes									
Actitis hypoleucos	Common Sandpiper	Mi	S3			x				
Calidris ruficollis	Red-necked Stint					x				
Laridae	Gulls, Terns & Skimmers									
Chroicocephalus novaehollandiae	Silver Gull					x				
COLUMBIFORMES										
Columbidae	Pigeons, Doves									
Columba livia	Rock Dove					x				
Spilopelia senegalensis	Laughing Dove				x	x				
Phaps chalcoptera	Common Bronzewing				x	x			x	x
Phaps elegans	Brush Bronzewing				x	x				
Ocyphaps lophotes	Crested Pigeon				x	x				
Geopelia cuneata	Diamond Dove					x				
PSITTACIFORMES										
Cacatuidae	Cockatoos									
Calyptorhynchus banksii naso	Red-tailed Black Cockatoo	VU	S1		x	x		x		
Calyptorhynchus baudinii	Baudin's Black Cockatoo	VU	S1		x	x	x	x	x	x
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	EN	S1		x	x	x	x		x
Lophochroa leadbeateri	Major Mitchell's Cockatoo		S4			x				
Eolophus roseicapilla	Galah					x				x
Cacatua pastinator subsp. *butleri*	Western Corella				x	x				
Cacatua sanguinea	Little Corella					x				
Nymphicus hollandicus	Cockatiel					x				
Psittacidae	Parrots									
Glossopsitta porphyrocephala	Purple-crowned Lorikeet				x	x			x	
Purpureicephalus spurius	Red-capped Parrot					x			x	
Barnardius zonarius	Australian Ringneck					x			x	x
Platycercus icterotis xanthogenys	Western Rosella		S1	VU	x	x	x			
Psephotus varius	Mulga Parrot					x				
Neophema elegans	Elegant Parrot				x	x			x	x
Melopsittacus undulatus	Budgerigar					x				
Polytelis anthopeplus	Regent Parrot				x	x				
CUCULIFORMES										
Cuculidae	Cuckoos									
Chrysococcyx basalis	Horsfield's Bronze Cuckoo					x			x	x
Chrysococcyx osculans	Black-eared Cuckoo					x				
Chrysococcyx lucidus	Shining Bronze Cuckoo					x			x	
Cacomantis pallidus	Pallid Cuckoo					x			x	x
Cacomantis flabelliformis	Fan-tailed Cuckoo				x	x				
STRIGIFORMES										
Tytonidae	Barn Owls									
Tyto delicatula	Eastern Barn Owl					x				
Strigidae	Owls									
Ninox connivens connivens	Barking Owl			P2		x				
Ninox boobook	Southern Boobook				x	x			x	
CAPRIMULGIFORMES										
Podargidae	Frogmouths									
Podargus strigoides	Tawny Frogmouth				x	x			x	

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
Caprimulgidae	Nightjars									
Eurostopodus argus	Spotted Nightjar					x				
APODIFORMES										
Aegothelidae	Owlet-nightjars									
Aegotheles cristatus	Australian Owlet-nightjar					x			x	
Apodidae	Swifts									
Apus pacificus	Pacific Swift	Mi	S3			x		x		
CORACIIFORMES										
Alcedinidae	Kingfishers									
Dacelo novaeguineae	Laughing Kookaburra				x	x			x	
Todiramphus sanctus	Sacred Kingfisher				x	x				
Todiramphus pyrrhopygius	Red-backed Kingfisher					x				
Meropidae	Bee-eaters									
Merops ornatus	Rainbow Bee-eater	Mi	S3		x	x		x		
PASSERIFORMES										
Climacteridae	Australasian Treecreepers									
Climacteris rufus	Rufous Treecreeper				x	x			x	
Maluridae	Australasian Wrens									
Malurus lamberti	Variegated Fairywren					x				
Malurus pulcherrimus	Blue-breasted Fairywren					x				
Malurus splendens	Splendid Fairywren					x			x	
Malurus leucopterus	White-winged Fairywren					x				
Stipiturus malachurus	Southern Emu-wren				x					
Meliphagidae	Honeyeaters									
Lichenostomus virescens	Singing Honeyeater				x	x			x	x
Lichenostomus leucotis	White-eared Honeyeater					x				
Lichenostomus ornatus	Yellow-plumed Honeyeater				x	x				
Purnella albifrons	White-fronted Honeyeater					x				
Manorina flavigula	Yellow-throated Miner				x	x				
Melithreptus brevirostris	Brown-headed Honeyeater				x	x			x	
Melithreptus lunatus	White-naped Honeyeater					x			x	x
Acanthagenys rufogularis	Spiny-cheeked Honeyeater				x	x				
Anthochaera lunulata	Western Wattlebird				x	x			x	
Anthochaera carunculata	Red Wattlebird				x	x			x	x
Lichmera indistincta	Brown Honeyeater				x	x			x	x
Phylidonyris novaehollandiae	New Holland Honeyeater				x	x			x	x
Phylidonyris niger	White-cheeked Honeyeater					x			x	
Gliciphila melanops	Tawny-crowned Honeyeater					x			x	
Acanthorhynchus superciliosus	Western Spinebill				x	x			x	
Certhionyx variegatus	Pied Honeyeater					x				
Epthianura tricolor	Crimson Chat					x				
Epthianura albifrons	White-fronted Chat				x	x				
Pardalotidae	Pardalotes									
Pardalotus punctatus	Spotted Pardalote				x	x				x
Pardalotus striatus	Striated Pardalote				x	x			x	
Acanthizidae	Australasian Warblers									
Calamanthus cautus	Shy Heathwren			P4		x				
Pyrrholaemus brunneus	Redthroat					x				
Sericornis frontalis	White-browed Scrubwren				x	x				
Smicrornis brevirostris	Weebill				x	x			x	x
Gerygone fusca	Western Gerygone				x	x			x	

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
Acanthiza apicalis	Inland Thornbill				x	x			x	
Acanthiza uropygialis	Chestnut-rumped Thornbill					x				
Acanthiza inornata	Western Thornbill				x	x			x	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				x	x			x	
Pomatostomidae	Australasian Babblers									
Pomatostomus superciliosus ashbyi	White-browed Babbler			P4	x	x	x		x	
Cracticidae	Butcherbirds and Allies									
Cracticus torquatus	Grey Butcherbird				x	x				
Cracticus nigrogularis	Pied Butcherbird				x	x				
Gymnorhina tibicen	Australian Magpie				x	x			x	x
Strepera versicolor	Grey Currawong				x	x				
Artamidae	Woodswallows									
Artamus personatus	Masked Woodswallow					x				
Artamus cinereus	Black-faced Woodswallow				x	x				x
Artamus cyanopterus	Dusky Woodswallow				x	x				
Campephagidae	Cuckooshrikes									
Coracina novaehollandiae	Black-faced Cuckooshrike				x	x			x	x
Lalage tricolor	White-winged Triller					x			x	
Neosittidae	Sittellas									
Daphoenositta chrysoptera	Varied Sittella					x			x	x
Pachycephalidae	Whistlers and Allies									
Falcunculus frontatus leucogaster	Crested Shriketit			P4	x	x	x			
Pachycephala pectoralis	Australian Golden Whistler				x	x			x	
Pachycephala rufiventris	Rufous Whistler					x			x	x
Colluricincla harmonica	Grey Shrikethrush				x	x			x	
Oreoica gutturalis	Crested Bellbird			P4		x				
Rhipiduridae	Fantails									
Rhipidura leucophrys	Willie Wagtail				x	x			x	x
Rhipidura albiscapa	Grey Fantail					x			x	x
Monarchidae	Monarchs									
Grallina cyanoleuca	Magpie-lark				x	x				
Myiagra inquieta	Restless Flycatcher				x	x				
Corvidae	Crows, Jays									
Corvus bennetti	Little Crow				x	x				
Corvus coronoides	Australian Raven				x	x			x	x
Petroicidae	Australasian Robins									
Eopsaltria griseogularis	Western Yellow Robin				x	x			x	
Eopsaltria georgiana	White-breasted Robin					x				
Melanodryas cucullata	Hooded Robin					x				
Microeca fascinans	Jacky Winter				x	x				
Petroica boodang	Scarlet Robin					x			x	x
Petroica goodenovii	Red-capped Robin				x	x			x	x
Hirundinidae	Swallows, Martins									
Cheramoeca leucosterna	White-backed Swallow					x				
Hirundo neoxena	Welcome Swallow				x	x				
Petrochelidon ariel	Fairy Martin					x				
Petrochelidon nigricans	Tree Martin					x			x	
Acrocephalidae	Reed Warblers and Allies									
Acrocephalus australis	Australian Reed Warbler					x				
Locustellidae	Grassbirds and allies									
Megalurus gramineus	Little Grassbird					x				

Note: For Definitions of Conservation Codes see Appendix A.

BIRDS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
Cincloramphus mathewsi	Rufous Songlark				x	x			x	
Cincloramphus cruralis	Brown Songlark					x				
Zosteropidae	White-eyes									
Zosterops lateralis	Silvereye				x	x			x	
Dicaeidae	Flowerpeckers									
Dicaeum hirundinaceum	Mistletoebird				x	x				
Estrildidae	Waxbills, Munias & Allies									
Stagonopleura oculata	Red-eared Firetail					x				
Neochmia temporalis	Red-browed Finch					x				
Taeniopygia guttata	Zebra Finch					x				
Motacillidae	Wagtails, Pipits									
Anthus australis	Australian Pipit					x			x	

[X] fauna species recorded.
[*] denotes introduced species.

APPENDIX D

D4: MAMMALIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environment Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DEC = Department of Conservation Priority Code, A = Listed in Naturemap (2012), B = Listed by Birds Australia (2012), C = Listed on the DEC Threatened and Priority Fauna Database, D = Listed by the DSEWPaC Protected Matters Search Tool, E = Nature Reserves of the Shires of York and Northam management Plan, F = Current survey

Note: For Definitions of Conservation Codes see Appendix A.

MAMMALS		Conservation Codes								
Scientific Name	Common Name	EPBC	WC	DEC	A	B	C	D	E	F
MONOTREMES										
Tachyglossus aculeatus									x	
DASYURIDAE										
Dasyurus geoffroii	Chuditch/Western Quoll	VU	S1		x		x	x		
Phascogale calura	Red-tailed Phascolgale	EN	S1					x		
Sminthopsis dolichura	Little Long-tailed Dunnart								x	
MYRMECOBIIDAE										
Myrmecobius fasciatus	Numbat	VU	S1		x		x			
MACROPODIDAE										
Macropus fuliginosus	Western Grey Kangaroo				x				x	x
Macropus irma	Western Brush Wallaby			P4	x		x		x	
PHALANGERIDAE										
Trichosurus vulpecula vulpecula	Common Brush-tailed Possum				x					
BURRAMYIDAE										
Cercartetus concinnus	Western Pygmy-possum				x				x	
VESPERTILIONIDAE										
Nyctophilus geoffroyi	Lesser Long-eared Bat				x					
MOLOSSIDAE										
Tadarida australis	White-striped Freetail-bat								x	
MURIDAE										
**Mus musculus*	House Mouse				x				x	
LEPORIDAE										
**Oryctolagus cuniculus*	Rabbit								x	x
FELIDAE										
**Felis catus*	Cat								x	

[X] fauna species recorded.
[*] denotes introduced species.

APPENDIX C
FAUNA HABITAT ASSESSMENT DATA SHEETS

APPENDIX C
FAUNA HABITAT ASSESSMENT DATA SHEETS

Habitat Assessment – HA1

Broad Fauna Habitat:	Minor creekline	Total Area of Habitat:	9 ha
UTM Co-ordinates:	462943 E	Proportion of Project Area:	13%
	6469165 N	Soil Texture:	Sandy loam
Zone:	50	Soil Colour:	Brown
Quadrat Size:	100 x 100	Last Fire:	Long unburnt
Aspect:	East	Vegetation Description:	Scattered Wandoo

Condition Scale: 0 (degraded) Disturbance (other): 0 (heavy)

Habitat Features

	Species	Avg Height (m)	Score
Overstorey:	*Corymbia calophylla, Eucalyptus wandoo*	15	1 (<20% cover)
Midstorey:	-	-	0 (<5% cover)
Ground Cover:	Crop	-	3 (60-100%)

	Score		Score		Score
Bare ground	3 (<5% cover)	Burrowing Suitability	3 (sand)	Peeling Bark	0 (none)
Rock	0 (<5% cover)	Pebbles/Stones (0-200 mm)	0 (none)	Large Tree Hollows (>10cm diameter)	0 (none)
Leaf Litter	0 (<5% cover)	Exfoliating Slabs	0 (none)	Small Tree Hollows (<10cm diameter)	1 (rare)
Logs	0 (<5% cover)	Rock Crevices	0 (none)	Water Presence	1 (rare)
Grasses	0 (none)	Boulders	0 (none)	Distance to Water	3 (<0.5 km)
Woody debris	0 (none)	No. of Caves	0	Suitability for Bats	0
			Total =		12/70

Black Cockatoo Assessment

Black Cockatoo Foraging Habitat

Species:	% Cover	Foraging Evidence
Corymbia calophylla	2	Yes
Eucalyptus wandoo	2	-

Hollows

Small (<50 mm)	No:	2
Medium (50-120 mm)	No:	
Large (130-250 mm)	No:	-
Very Large (>250 mm)	No:	-

Habitat Assessment – HA2

Broad Fauna Habitat:	Cleared cropland	Total Area of Habitat:	59.9 ha
UTM Co-ordinates:	462838 E	Proportion of Project Area:	87%
	6469257 N	Soil Texture:	Loam
Zone:	50	Soil Colour:	Black/brown
Quadrat Size:	100 x 100	Last Fire:	Long unburnt
Aspect:	East	Vegetation Description:	Scattered Marri and Wandoo

Condition Scale: 0 (degraded) Disturbance (other): 0 (heavy)

Habitat Features

	Species	Avg Height (m)	Score
Overstorey:	*Eucalyptus wandoo, Eucalyptus rudis, Allocasuarina fraseriana*	15	1 (<20% cover)
Midstorey:	-	-	0 (<5% cover)
Ground Cover:	-	-	0 (<5% cover)

	Score		Score		Score
Bare ground	0 (>60% cover)	Burrowing Suitability	3 (sand)	Peeling Bark	2 (moderate)
Rock	0 (<5% cover)	Pebbles/Stones (0-200 mm)	0 (none)	Large Tree Hollows (>10cm diameter)	2 (moderate)
Leaf Litter	0 (<5% cover)	Exfoliating Slabs	0 (none)	Small Tree Hollows (<10cm diameter)	1 (rare)
Logs	0 (<5% cover)	Rock Crevices	0 (none)	Water Presence	1 (rare)
Grasses	0 (none)	Boulders	0 (none)	Distance to Water	3 (<0.5 km)
Woody debris	0 (none)	No. of Caves	0	Suitability for Bats	0
		Total =			13/70

Black Cockatoo Assessment

Black Cockatoo Foraging Habitat

Species:	% Cover	Foraging Evidence
Allocasuarina fraseriana	1	-
Eucalyptus wandoo	3	-

Hollows

Small (<50 mm)	No: 2
Medium (50-120 mm)	No:
Large (130-250 mm)	No: -
Very Large (>250 mm)	No: 2

APPENDIX D

CONSERVATION SIGNIFICANT FAUNA POTENTIALLY OCCURRING IN THE STUDY AREA

APPENDIX D

CONSERVATION SIGNIFICANT FAUNA POTENTIALLY OCCURRING IN THE STUDY AREA

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
REPTILES				
Southwest Carpet Python (*Morelia spilota imbricata)*	P4	This species shelters in hollow trunks and limbs, disused burrows, caves, rock crevices and beneath boulders (Pearson, 1993). This sub species is thought to be declining markedly as urban areas expand. It is still widespread on the south west mainland but seems most abundant on offshore islands (Wilson & Swan, 2010).	The cleared cropland and minor creekline habitats of the study area lack understorey vegetation and microhabitat complexity that the carpet python requires. The carpet python has however, been recorded in St Ronan's nature Reserve *c.* situated 2 km to the north of the study area (DEC, 2012b).	Possible
BIRDS				
Malleefowl (*Leipoa ocellata*)	VU; S1	The Malleefowl occurs in scattered locations across much of southern Australia, in southwest WA the Malleefowl inhabits remnant vegetation of agricultural zones (Johnstone & Storr, 1998). The Malleefowl requires sandy substrate and abundant leaf litter to create large mounds which are used for breeding (Johnstone & Storr, 1998). Declines of the Mallefowl are strongly linked to alteration of habitat by clearing and fragmentation as well as the alterations of fire regimes. (Parsons *et al*., 2008) Since 1981 the species range has contracted by ~30% in WA (Garnett *et al.*, 2011).	The Malleefowl prefers low woodland and shrublands of mallee that contain an abundant litter layer which provides essential material for the construction of its nest mounds. The cleared cropland and minor creekline habitats of the study area lack understorey vegetation and deemed unsuitable to support the Malleefowl. The nearest record of the Malleefowl is situated 20 km north of the study area near Clackline Nature Reserve (DEC, 2012a).	Unlikely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
International Migratory Species (Glossy Ibis; Eastern Cattle Egret; Great Egret; Common Sandpiper;	Mi; S3	These species occur throughout Western Australia, inhabiting shallow salt and fresh water bodies. All species with exception to the Great Egret, are non-breeding vagrant visitors to the state, inhabiting inland water bodies of Western Australia primarily September – March (Johnstone & Storr, 1998). The Great Egret breeds colonially at wooded swamps and river pools, nesting in various riparian trees (Johnstone & Storr, 1998).	There are three water bodies located within the study area in addition to the minor creekline habitat which runs along the southern margin of the study area. All waterbodies are artificial, highly degraded and are lacking fringing and aquatic vegetation. There are no known records of these species within close proximity to the study area (DEC, 2012a, 2012b)	Unlikely
Australian Painted Snipe (*Rostratula australis*)		The Australian Painted Snipe is a rare waterbird which is typically found in a wide range of shallow inland wetlands. It nests on the ground amongst tall reed-like vegetation near water and feeds on invertebrates, worms and seeds near the water's edge (Garnett *et al.*, 2011). The Australian Painted Snipe is extremely cryptic and is probably nomadic in most areas. Their distribution across Australia is extremely dispersed although slightly concentrated in the south-east of Australia (Geering *et al*., 2007; Barrett *et al*., 2003).	The Australian is an extremely cryptic species; as such it requires dense vegetation fringing wetlands. There is no fringing vegetation surrounding waterbodies within the study area. Furthermore the Australian Snipe inhabits shallow waterbodies, all waterbodies within the study area are deep and do not provide habitat for the Painted Snipe.	Highly Unlikely
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Mi; S3	The White-bellied Sea Eagle is distributed along the coast, islands and estuaries of Western Australia (Johnstone & Storr, 1998). They feed on fish, sea snakes and nesting seabirds. Nests are usually placed on high ground such as rock pinnacles, rigid shrubs or in tall trees (Johnstone & Storr, 1998).	The White-bellied Sea-Eagle is predominantly marine in nature and the survey area lacks the preferred habitat of this species. The nearest known record (DEC, 2012a) is situated more than 70 km to the west.	Unlikely
Peregrine Falcon (*Falco peregrinus*)	S4	The Peregrine Falcon is uncommon but wide-ranging across Australia. They mainly occur along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes (Johnstone & Storr, 1998). The Peregrine Falcon nests primarily on cliffs, granite outcrops, quarries and in the wheatbelt in old Raven and Whistling Kite nests (Johnstone & Storr, 1998).	The Peregrine Falcon may utilise habitats of the study area for foraging as part of a wider home range. However the survey area lacks the cliffs and has limited trees suitable for nesting sites for this species, as such this species is unlikely to resident within the study area and may only utilise the area on a non-permanent basis. There are several records of the species from within the vicinity of the study area (DEC, 2012a)	Possible

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Australian Bustard (*Ardeotis australis*)	P4	The Australian Bustard is typically widespread and nomadic, but locally scarce. This species is distributed across most of Western Australia, although is most prevalent in grasslands, especially tussock grasses, arid scrub and dry open woodlands (Ziembicki, 2010). The abundance of this species varies according to habitat and season, in particular with the abundance of grasshoppers (Ziembicki, 2010). Declines in the Australian Bustard have been attributed to by the loss of habitat (Johnstone & Storr, 1998).	The cropland and creekline habitats of the study area provides unsuitable habitat for this species. As such it is unlikely that the Australian Bustard will utilise the study area. There are no records of this species within vicinity of the study area.	Unlikely
Bush Stone-curlew (*Burhinus grallarius*)	P4	The Bush Stone-curlew inhabits dry open woodlands with a groundcover of small sparse shrubs and grass avoiding dense forest and closed-canopy habitats (Johnstone & Storr, 1998). The species generally occurs near watercourses and swamps (Geering *et al.,* 2007). Bush Stone-curlews are locally rare because of predation by foxes, which is the main concern for their regional decline (Johnstone & Storr, 1998).	The cropland and creekline habitats of the study area provide unsuitable habitat for this species. As such it is unlikely that the Bush Stone-curlew will utilise the study area. There are however historical records (1977) of the species at the nearby Wambyn Nature Reserve (DEC, 2012b) and other bushland remnants within the vicinity of the study area.	Possible
Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)	VU; S1	The Forest Red-tailed Black Cockatoo is endemic to the southwest of WA, distributed from Gingin through the Darling Ranges to Albany (Johnstone & Storr, 1998). The species lives in forests of the southwest, feeding primarily on seeds of Marri nuts and nesting in large tree hollows, of Marri, Jarrah and Karri. Nest hollow shortage is considered the principal threat to the species with over 36% of the species former habitat cleared for agriculture (Garnett *et al*., 2011; Johnstone & Kirkby, 1999). Expected population declines >30% have been postulated over the next three generations (Chapman, 2007).	The study area occurs slightly east of the species known distribution however the species has previously been recorded from within the vicinity of the study area (DEC 2012b). In addition, the scattered Marri trees and *Allocasuarina fraseriana* of the cropland and minor creekline habitats provide the potential foraging, roosting and breeding habitat for the species (DSEWPC, 2011).	Likely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)	VU; S1	Baudin's Cockatoo is distributed from the northern Darling Range, south to Bunbury and across to Albany (Johnstone & Storr, 1998). This species forages primarily in Eucalypt forest, feeding on Marri nuts, flowers, nectar and buds as well as a wide range of seeds of *Eucalyptus*, *Banksia* and *Hakea*, (Johnstone & Kirkby, 2008; Johnstone & Storr, 1998). Baudin's Cockatoo nests in tree hollows in the deep south-west of Western Australia. Primary nesting trees are Karri, Marri, and Wandoo (Johnstone & Kirkby, 2008). Nest hollow shortage is considered the principal threat, as such the species no longer occupies over 25% of former habitat due to clearing (Chapman, 2007)	The study area occurs slightly east of the species known distribution however the species has previously been recorded from within the vicinity of the study area and foraging evidence was recorded during the current survey (DEC 2012b). In addition, the scattered Marri and Wandoo trees of the cropland and minor creekline habitats provide the potential foraging, roosting and breeding habitat for the species (DEC, 2012b).	Recorded (from secondary evidence)
Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)	VU; S1	Carnaby's Cockatoo is endemic to south-west Western Australia, and is distributed from the Murchison River to Esperance (Cale, 2003). Breeding has been recorded from early July to mid-December and usually occurs in the Wheatbelt (Johnstone & Storr, 1998). Carnaby's Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants including *Pinus* spp., Marri, Jarrah, as well as *Banksia* and other Proteaceous species (Shah, 2006). Trees used as nest sites by Carnaby's Cockatoo are mature, hollow-bearing trees, usually with a crown containing dead limbs and a sparse canopy (Cale 2003; Johnstone & Storr, 1998), especially Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*). Primary threats are reductions of foraging and breeding habitat and populations are thought to be declining at a rate >50% in 3 generations (Garnett *et al*., 2011)	The wheatbelt contains important breeding areas for the Carnaby's Cockatoo. The area sits well within the known distribution of the species and the species have been recorded within the study area previously. Foraging evidence that was also found during the current survey. Carnaby's Cockatoo primarily nest in Wandoo (Saunders, 1979) but will also nest in Marri, (DESEWPC, 2011; Groom, 2011) both species with suitable nesting structure were scattered across the survey area.	Recorded (from secondary evidence)

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Major Mitchell's Cockatoo (*Lophochroa leadbeateri*)	S4	Major Mitchell's Cockatoo has a widespread but disjunct distribution in arid and semi-arid zones of Western Australia (Johnstone & Storr, 1998). They prefer open woodlands with access to water, and require Eucalypts with hollows for nesting, particularly River-gum and Salmon Gum. Major Mitchell feeds primarily on seed, fruit and flowers of a wide range of species including *Grevillea* spp. and *Acacia* spp. The primary threat to the species within wheatbelt populations is the clearing of breeding habitat.	The study area provides scattered hollow bearing trees although there are few foraging species of the Major Mitchell which occur within the study area. Furthermore the study area is situated on the outer margins of the species distribution and the species has not previously been recorded within the vicinity of the study area.	Unlikely
Western Rosella (*Platycercus icterotis xanthogenys*)	S1; (DEC: VU)	This subspecies of the Western Rosella is found in eucalypt woodlands and scrubs, especially those containing wandoo, flooded gum, salmon gum and sheok (Mawson & Long, 1994). *Platycercus icterotis xanthogenys* occurs in the Wheatbelt region from Toodyay south and east to Ravensthorpe (Johnstone & Storr, 1998). The western Rosella feeds predominately on *Eucalyptus* and *Allocasurina* sp and is considered rare in cleared areas of the wheatbelt (Johnstone & Storr, 1998).	The study area provides potential habitat for the species however the cleared openness of the study area is not favoured by this species. There are previous records of this species from within the vicinity of the study area (Wambyn Nature Reserve, 2002; DEC, 2012b). The study however sits in the western margin of this threatened species distribution (Johnstone & Storr, 1998).	Possible
Barking Owl (*Ninox connivens connivens*)	P2	This subspecies is distributed through southwest WA, north to Perth, east to Northam and south to Bremer bay (Johnstone & Storr, 1998). This subspecies is disjunct from populations in the Pilbara and Kimberley. It inhabits dense vegetation particularly forests and thickets where it feeds on large insects and small mammals (Johnstone & Storr, 1998). This species breeds in hollow tree trunks.	The study area is situated within the north-eastern distribution of the species. Although the study area contains hollows suitable for nesting of the species, the vast areas of openness are not ideal for the species. There are no records of the species within close proximity to the study area.	Unlikely
Pacific Swift (*Apus pacificus*)	Mi; S3	The Fork-tailed Swift is a summer migrant (October-April) to Australia, that has not been recorded breeding in Australia (Barrett *et al*. 2003). The Fork-tailed Swift is an aerial species, which forages high above the tree canopy and rarely lower so is independent of terrestrial habitats in Australia	As this species forages high in the airspace it is independent of terrestrial habitats. This species may overfly the study area occasionally.	Possible

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
		(Johnstone & Storr, 1998). It usually occurs in flocks of up to 2000 and is often seen accompanying Tree Martins and Masked Woodswallows (Johnstone & Storr, 1998).		
Rainbow Bee-eater (*Merops ornatus*)	Mi; S3	The Rainbow Bee-eater is a common breeding migrant that occurs in Western Australia in the Kimberley, and Pilbara through to the South-west (Johnstone & Storr, 1998). It generally breeds in summer in the greater south-west and occurs as a passage migrant or visitor in the northern part of its range throughout the rest of the year (Johnstone & Storr, 1998; Barrett *et al.* 2003). It occurs in lightly wooded, often sandy country, preferring areas near water. The Rainbow Bee-eater feeds on airborne insects, and nests in burrows excavated in sandy ground or banks (Johnstone & Storr, 1998).	All the habitat types in the survey area provides habitat for the Rainbow Bee-eater. In particular the soft substrates found near dams, drainage lines and tracks provide nesting sites. There are numerous recent records of this species in the vicinity of the survey area (DEC, 2012a). This species is not however dependent on the habitat found within the area.	Likely
Shy Heathwren (*Hylacola cauta whitlocki*)	P4	The Shy Heathwren inhabits shrublands including the understory of Mallee Woodlands and scrubs, post fire regeneration, uncleared road verges and remnants in farmlands (Garnett & Crowley, 2000). This species feeds mainly on small insects foraging on the ground and occasionally in low branches and foliage (Johnstone & Storr, 1998). The Shy Heathwren is documented as declining in the Wheatbelt (Garnett & Crowley, 2000) with significant loss of habitat in the south-west Wheatbelt.	The distribution of this species incorporates a large proportion of the semiarid interior, north-east of Wubin, south to the Stirling ranges and east to Buraminya. The study area is therefore situated east of the known distribution.	Unlikely
White-browed Babbler (*Pomatostomus superciliosus ashbyi*)	P4	The Western Wheatbelt White browed Babbler occurs in dense eucalypt forests, woodlands and scrub/thickets in south-west Western Australia. Clearance for agriculture has removed most of the White-browed Babbler's habitat in the Wheatbelt of Western Australia (Saunders and Ingram, 1995).	The cleared cropland and minor creekline habitat are too open and do not provide suitable habitat for the species. The species has been recorded recently (2006) from within the vicinity of the study area from St Ronan's reserve, ~2km N of the study area (DEC, 2012b).	Possible

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Crested Shriketit (*Falcunculus frontatus leucogaster*)	P4	This species occurs from Moora to Esperance and is an uncommon inhabitant of semi-arid woodlands and open forests of Eucalyptus (Johnstone & Storr, 2004). This subspecies is disjunct from the Kimberley. The Crested Shike-tit feeds primarily on insects prised from under bark or crevices (Crowley & Garnett, 2000). The species is generally scarce and uncommon and locally extinct for most of the Swan Coastal Plain and much of the wheatbelt (Recher, 2006).	Habitats of the study area provide potential habitat for habitat for this species. The area is already severely degraded and unexpected to inhabit the species. There is however a relatively recent record (2006), from Wambyn Nature Reserve which is situated ~3 km from the study area (DEC, 2012f)	Possible
Crested Bellbird (*Oreoica gutturalis*)	P4	This subspecies of the Crested Bellbird lives in the shrub layer of eucalypt woodlands, mallee and *Acacia* shrublands. This species has declined due to land clearing, and is particularly susceptible to habitat fragmentation. It feeds mainly on insects as well as some grass seeds (Johnstone & Storr, 2004).	The cleared cropland and minor creekline of the study area provide unsuitable habitat for this species. This species is particularly susceptible to clearing and therefore unlikely to inhabit the study area (Johnstone & Storr, 2004). This species has not been previously recorded in the vicinity of the survey area.	Unlikely
MAMMALS				
Chuditch/Western Quoll (*Dasyurus geoffroii*)	VU; S1	The Chuditch (Western Quoll) previously occurred over 70% of Australia, but now only occurs in the south-west of Western Australia. Being a relatively large predator, it occurs at low densities. Adult females inhabit a core area of 55-200 hectares around their den, while the corresponding figure for males is 400 hectares or more (van Dyck & Strahan, 2008). The Chuditch is now only found in sclerophyll forest, woodland and mallee shrubland (van Dyck & Strahan, 2008, Menkhorst & Knight, 2004). It is highly mobile, and appears able to utilise bush remnants and corridors.	The lack of suitable habitat suggests this species should not occur within the survey area. The Chuditch needs large logs as den sites which are not found in this area and is highly unlikely to occur in the survey area. There is a recent record from 2005 from Wambyn Rd, situated ~5km from the study area (DEC, 2012b)	Possible

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Red-tailed Phascogale (*Phascogale calura*)	EN; S1	Prior to agricultural expansion in the 1800s, the Red-tailed Phascogale was widespread throughout WA extending eastward to the Murray Darling basin (Van Dyck & Strahan, 2008). The species is now restricted to remnant vegetation of the southern wheatbelt (Kitchener, 1981). The Red-tailed Phascogale can persist in small bush remnants, as small as 67 ha (van Dyck & Strahan, 2008). The red-tailed phascogale is arboreal preferring habitat of dense, tall climax vegetation communities of wandoo (*Eucalyptus wandoo*) and rock oak (*Allocasuarina huegeliana*) where it feeds on insects and spiders (van Dyck & Strahan, 2008). The species primary threatening processes are clearing, fragmentation and introduced species.	Cropland and the minor drainage habitats of the study area provide unsuitable habitat for this species. This species in now confined to remnant vegetation in the southern wheatbelt and as such has not been recorded from within the vicinity of the study area.	Highly Unlikely
Numbat (*Myrmecobius fasciatus*)	VU; S1	The Numbat is a small, diurnal marsupial, endemic to WA. This species once ranged widely but due to predation by foxes and cats, loss of habitat due to clearing for agriculture and changes in fire regimes has contracted substantially (van Dyck & Strahan, 2008). Its current distribution is limited to east of Manjimup in upland Jarrah forests, open eucalypt woodlands, *Banksia* woodlands and tall closed shrublands, where it shelters in hollow logs and branches and feeds almost exclusively on termites (van Dyck & Strahan, 2008).	The current distribution of this species is far outside of the survey area. There are two previous records for this species within the study area, ~ 3 km at Wambyn Nature Reserve. These are however old records (1979 and 1983) and no longer relevant.	Highly Unlikely
Western Brush Wallaby (*Macropus Irma*)	P4	The Western Brush Wallaby occurs in open forest or woodland, particularly where areas with grassy understorey and scrubby thickets are present (van Dyck & Strahan, 2008). It is found only in south-western Western Australia, where it appears to be in decline, probably as a result of an increase in the numbers of foxes.	The degraded habitats of the study area are not suited for this species. Remnant vegetation in the surrounding areas does however provide habitat. There are eight records of the species from the study area, four at St Ronans Nature Reserve and four from Wambyn Nature Reserve, records range from 1970-1996 (DEC, 2012b).	Possible

Key:	
En	Listed as Endangered under the *EBPC Act 1999*.
Vu	Listed as Vulnerable under the *EBPC Act 1999*.
Mi	Listed as Migratory under the *EBPC Act 1999*.
S	Scheduled under the *WC Act 1950*. Schedule 1 and 2 fauna are also protected by the *EBPC Act 1999*.
P	Listed as Priority by the DEC.
Recorded	Recorded during the field survey or site reconnaissance.
Likely	Suitable habitat is present in the study area and the study area is in the species' known distribution.
Possible	Limited or no suitable habitat is present in study area but is nearby. The species has good dispersal abilities and is known from the general area.
Unlikely	No suitable habitat is present in study area but is nearby, the species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however the study area is outside of the species' known distribution.
Highly Unlikely	The species has poor dispersal abilities, no suitable habitat is present, and the species is uncommon; or the species is thought to be locally extinct.

APPENDIX E
POTENTIAL BLACK COCKATOO BREEDING TREES

APPENDIX E

POTENTIAL BLACK COCKATOO BREEDING TREES

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
1	*Corymbia calophylla*	Marri	462450	6469315	990	19	Y	-	-	-
2	*Corymbia calophylla*	Marri	462779	6469488	900	19	-	-	-	-
3	*Corymbia calophylla*	Marri	462880	6469506	820	17	Y	-	-	-
4	-	Dead Stag	462802	6469360	540	15	-	-	-	-
5	*Eucalyptus wandoo*	Wandoo	462707	6469358	590	16	-	-	-	-
6	*Corymbia calophylla*	Marri	462700	6469353	600	12	-	-	-	-
7	*Corymbia calophylla*	Marri	462702	6469356	750	18	Y	-	-	-
8	*Corymbia calophylla*	Marri	462581	6469300	1600	16	Y	-	-	-
9	*Corymbia calophylla*	Marri	462468	6469255	1120	20	Y	-	-	-
10	*Corymbia calophylla*	Marri	462450	6469280	860	20	-	-	-	-
11	*Eucalyptus wandoo*	Wandoo	462398	6469190	760	20	-	-	-	-
12	*Eucalyptus wandoo*	Wandoo	462429	6469185	610	18	-	-	-	-
13	*Eucalyptus wandoo*	Wandoo	462434	6469185	550	14	-	-	-	-
14	*Eucalyptus wandoo*	Wandoo	462445	6469172	90	20	-	-	-	-
15	*Eucalyptus wandoo*	Wandoo	462474	6469192	60	18	-	-	-	-
16	*Eucalyptus wandoo*	Wandoo	462474	6469192	70	18	-	-	-	-
17	*Eucalyptus wandoo*	Wandoo	462474	6469192	560	18	-	-	-	-
18	*Eucalyptus wandoo*	Wandoo	462495	6469163	510	18	-	-	-	-

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
19	*Eucalyptus wandoo*	Wandoo	462507	6469173	600	17	-	-	-	-
20	*Corymbia calophylla*	Marri	462647	6469265	1170	20	-	1	12 cm	10
21	*Corymbia calophylla*	Marri	462693	6469303	710	17	Y	-	-	-
22	*Corymbia calophylla*	Marri	462695	6469293	620	16	-	-	-	-
23	*Corymbia calophylla*	Marri	462695	6469293	540	13	Y	-	-	-
24	*Eucalyptus wandoo*	Wandoo	462981	6469334	650	10	-	-	-	-
25	*Eucalyptus wandoo*	Wandoo	462893	6469289	620	18	-	-	-	-
26	*Eucalyptus wandoo*	Wandoo	462891	6469290	540	18	-	-	-	-
27	*Eucalyptus wandoo*	Wandoo	462886	6469288	500	18	-	-	-	-
28	*Eucalyptus wandoo*	Wandoo	462890	6469283	550	18	-	-	-	-
29	*Eucalyptus wandoo*	Wandoo	462734	6469260	710	20	-	-	-	-
30	*Corymbia calophylla*	Marri	462596	6469190	510	13	-	-	-	-
31	*Corymbia calophylla*	Marri	462575	6469191	710	13	-	-	-	-
32	*Corymbia calophylla*	Marri	462546	6469167	650	13	-	-	-	-
33	*Eucalyptus wandoo*	Wandoo	462504	6469143	590	13	-	-	-	-
34	*Eucalyptus wandoo*	Wandoo	462393	6469067	720	17	-	-	-	-
35	*Eucalyptus wandoo*	Wandoo	462389	6469060	950	20	-	-	-	-
36	*Eucalyptus wandoo*	Wandoo	462387	6469058	760	26	-	-	-	-
37	*Eucalyptus wandoo*	Wandoo	462478	6469012	640	18	-	-	-	-
38	*Corymbia calophylla*	Marri	462536	6468994	660	15	-	-	-	-
39	*Corymbia calophylla*	Marri	462539	6469004	700	17	Y	-	-	-
40	*Corymbia calophylla*	Marri	462539	6469008	900	17	-	-	-	-

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
41	*Corymbia calophylla*	Marri	462581	6469039	710	16	-	-	-	-
42	*Corymbia calophylla*	Marri	462619	6469082	760	17	-	-	-	-
43	*Corymbia calophylla*	Marri	462655	6469111	910	20	-	-	-	-
44	*Corymbia calophylla*	Marri	462662	6469159	900	20	-	-	-	-
45	-	Dead Stag	462655	6469160	730	15	-	-	-	-
46	*Corymbia calophylla*	Marri	462686	6469088	860	18	-	-	-	-
47	*Corymbia calophylla*	Marri	462697	6469068	780	17	-	-	-	-
48	*Corymbia calophylla*	Marri	462723	6469083	870	19	-	-	-	-
49	*Corymbia calophylla*	Marri	462728	6469085	820	18	-	-	-	-
50	*Corymbia calophylla*	Marri	462835	6469133	1100	15	-	-	-	-
51	*Eucalyptus wandoo*	Wandoo	462872	6469129	870	20	-	-	-	-
52	-	Dead Stag	462928	6469162	580	12	-	-	-	-
53	-	Dead Stag	462974	6469158	1320	15	-	10	8 - 30	6 - 16
54	*Eucalyptus wandoo*	Wandoo	463017	6469231	580	18	-	-	-	-
55	*Eucalyptus wandoo*	Wandoo	463017	6469232	600	17	-	-	-	-
56	*Eucalyptus wandoo*	Wandoo	463048	6469264	620	13	-	-	-	-
57	*Corymbia calophylla*	Marri	463092	6469266	630	17	-	-	-	-
58	-	Dead Stag	463074	6469246	910	15	-	-	-	-
59	*Eucalyptus wandoo*	Wandoo	463069	6469222	620	17	-	-	-	-
60	*Eucalyptus wandoo*	Wandoo	463067	6469222	520	18	-	-	-	-
61	*Eucalyptus wandoo*	Wandoo	463074	6469210	840	17	-	-	-	-
62	*Corymbia calophylla*	Marri	463145	6469165	1300	15	-	-	-	-

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
63	-	Dead Stag	463095	6469144	930	11	-	3	13 - 20	5 - 7
64	*Eucalyptus wandoo*	Wandoo	463080	6469119	570	18	-	-	-	-
65	*Eucalyptus wandoo*	Wandoo	463069	6469134	750	16	-	-	-	-
66	*Eucalyptus wandoo*	Wandoo	463075	6469162	960	18	-	-	-	-
67	-	Dead Stag	463047	6469171	870	16	-	-	-	-
68	-	Dead Stag	463033	6469139	680	14	-	-	-	-
69	*Eucalyptus wandoo*	Wandoo	463023	6469145	850	14	-	-	-	-
70	-	Dead Stag	462996	6469106	680	18	-	-	-	-
71	*Eucalyptus wandoo*	Wandoo	462996	6469106	650	14	-	1	16	8
72	*Eucalyptus wandoo*	Wandoo	462944	6469119	900	18	-	1	11	10
73	*Eucalyptus wandoo*	Wandoo	462947	6469094	920	16	-	-	-	-
74	-	Dead Stag	462931	6469066	760	17	-	-	-	-
75	*Eucalyptus wandoo*	Wandoo	462933	6469042	700	15	-	-	-	-
76	*Eucalyptus wandoo*	Wandoo	462926	6469036	650	17	-	-	-	-
77	*Eucalyptus wandoo*	Wandoo	462921	6469033	790	17	-	-	-	-
78	*Corymbia calophylla*	Marri	462794	6468969	700	17	-	-	-	-
79	*Corymbia calophylla*	Marri	462786	6468970	730	16	-	-	-	-
80	-	Dead Stag	462542	6468814	1190	17	-	-	-	-
81	-	Dead Stag	462543	6468817	1090	17	-	-	-	-
82	*Eucalyptus wandoo*	Wandoo	462557	6468847	1600	20	-	8	10 - 25	8 - 17
83	-	Dead Stag	462578	6468844	690	11	-	-	-	-
84	*Eucalyptus wandoo*	Wandoo	462582	6468848	500	17	-	-	-	-

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
85	-	Dead Stag	462581	6468847	860	19	-	2	10 - 16	11 - 12
86	*Eucalyptus wandoo*	Wandoo	462581	6468873	750	17	-	2	10 - 15	13 -16
87	-	Dead Stag	462651	6468907	890	16	-	1	10	10
88	*Eucalyptus wandoo*	Wandoo	462676	6468872	680	18	-	-	-	-
89	*Eucalyptus wandoo*	Wandoo	462683	6468872	570	18	-	-	-	-
90	-	Dead Stag	462688	6468883	550	13	-	-	-	-
91	*Eucalyptus wandoo*	Wandoo	462711	6468874	780	17	-	-	-	-
92	*Eucalyptus wandoo*	Wandoo	462729	6468903	780	16	-	-	-	-
93	-	Dead Stag	462729	6468903	780	16	-	-	-	-
94	-	Dead Stag	462809	6468905	1230	10	-	-	-	-
95	*Eucalyptus wandoo*	Wandoo	462837	6468918	930	20	-	-	-	-
96	-	Dead Stag	462870	6468907	630	12	-	2	10 - 15	7 - 8
97	*Eucalyptus wandoo*	Wandoo	462870	6468907	820	17	-	-	-	-
98	*Eucalyptus wandoo*	Wandoo	462955	6468922	640	19	-	-	-	-
99	*Eucalyptus wandoo*	Wandoo	462963	6468899	630	18	-	-	-	-
100	-	Dead Stag	462965	6468897	720	18	-	1	18	10
101	*Eucalyptus wandoo*	Wandoo	462965	6468897	680	17	-	-	-	-
102	-	Dead Stag	462965	6468897	550	16	-	-	-	-
103	-	Dead Stag	462965	6468897	670	14	-	-	-	-
104	*Eucalyptus wandoo*	Wandoo	462983	6468886	620	17	-	-	-	-
105	*Corymbia calophylla*	Marri	463092	6469047	630	17	-	-	-	-
106	-	Dead Stag	463254	6468958	680	17	-	-	-	-

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
107	*Eucalyptus wandoo*	Wandoo	463254	6468958	570	17	-	-	-	-
108	-	Dead Stag	463254	6468958	860	14	-	5	10 - 26	8 - 12
109	*Eucalyptus wandoo*	Wandoo	463334	6468855	590	14	-	-	-	-
110	-	Dead Stag	463328	6468852	590	12	-	2	16 – 22	8 - 12
111	*Corymbia calophylla*	Marri	463355	6468812	610	15	Y	-	-	-
112	*Eucalyptus wandoo*	Wandoo	463349	6468786	710	16	-	-	-	-
113	*Corymbia calophylla*	Marri	463315	6468788	980	19	-	-	-	-
114	*Corymbia calophylla*	Marri	463315	6468770	590	15	-	-	-	-
115	*Corymbia calophylla*	Marri	463299	6468774	870	17	-	-	-	-
116	*Corymbia calophylla*	Marri	463249	6468867	630	17	-	-	-	-
117	*Eucalyptus wandoo*	Wandoo	463245	6468852	750	18	-	-	-	-
118	-	Dead Stag	463140	6468858	1000	16	-	-	-	-
119	*Eucalyptus wandoo*	Wandoo	463082	6468817	500	14	-	-	-	-
120	*Eucalyptus wandoo*	Wandoo	463067	6468821	500	15	-	-	-	-
121	*Eucalyptus wandoo*	Wandoo	463054	6468820	600	15	-	-	-	-
122	*Corymbia calophylla*	Marri	463016	6468755	1200	20	-	-	-	-
123	*Corymbia calophylla*	Marri	463013	6468731	9300	21	-	-	-	-
124	*Eucalyptus wandoo*	Wandoo	462828	6468812	630	18	-	-	-	-
125	*Eucalyptus wandoo*	Wandoo	462828	6468812	650	18	-	-	-	-
126	*Eucalyptus wandoo*	Wandoo	462828	6468812	670	18	-	-	-	-
127	*Corymbia calophylla*	Marri	462783	6468695	1000	20	-	-	-	-
128	*Corymbia calophylla*	Marri	462760	6468756	890	21	Y	-	-	-

Tree No.	Species Name	Common Name	#Easting	#Northing	DBH (mm)	Height (m)	Foraging Evidence	No. of Hollows	Size of Hollows (cm)	Height Above Ground (m)
129	*Corymbia calophylla*	Marri	462760	6468756	750	20	-	-	-	-
130	*Eucalyptus wandoo*	Wandoo	462276	6469507	560	17	-	-	-	-
131	*Corymbia calophylla*	Marri	462276	6469507	740	18	-	-	-	-
132	*Corymbia calophylla*	Marri	462345	6469480	680	17	-	-	-	-
133	*Corymbia calophylla*	Marri	462328	6469561	660	16	-	-	-	-
134	*Corymbia calophylla*	Marri	462454	6469581	630	16	-	-	-	-
135	*Eucalyptus wandoo*	Wandoo	462576	6469677	520	17	-	-	-	-
136	*Eucalyptus wandoo*	Wandoo	462576	6469677	580	17	-	-	-	-
137	*Corymbia calophylla*	Marri	462087	6469356	670	21	-	-	-	-
138	*Corymbia calophylla*	Marri	462089	6469340	590	19	-	-	-	-
139	*Eucalyptus wandoo*	Wandoo	462112	6469267	560	16	-	-	-	-
140	*Corymbia calophylla*	Marri	462202	6469183	740	22	-	-	-	-
141	*Corymbia calophylla*	Marri	461565	6469096	570	16	-	-	-	-
142	*Corymbia calophylla*	Marri	461566	6469103	610	16	-	-	-	-
143	*Corymbia calophylla*	Marri	461575	6469102	1020	20	-	-	-	-
144	*Eucalyptus rudis*	Flooded Gum	461672	6469164	590	12	-	-	-	-

#Australian Geocentric 1994 (GDA94) Zone 50H

Definition of Hollow Size

Size	Entrance Diameter
Small	Under 10 cm diameter
Medium	10-20 cm diameter
Large	20 cm or more