

# **Appendix C** – Flora, Fauna and Vegetation Assessment (October 2014)



Department of Treasury  
Hammond Park High School  
Flora Fauna and Vegetation Assessment

October 2014



# Executive summary

The Department of Treasury is undertaking site inspections and feasibility studies at a number of potential school sites. GHD was commissioned to undertake the flora, vegetation and fauna assessment for the proposed Hammond Park High School (the Study Area; 10.22 ha).

This Report will be used to assist the Department of Treasury in assessing the impact of clearing native vegetation at the site, to seek and comply with the appropriate environmental approvals and to enable works to be undertaken in an environmentally sensitive manner. This report provides recommendations and/or actions that need to be undertaken to assist in the continuation of the approval process.

## ***Federal Approvals***

Clearing for the Project will trigger referral to Department of the Environment due to potential impacts to 9.3 ha of Black Cockatoo foraging habitat and some potential breeding habitat. It is recommended that the Department of Treasury initiate consultation with DotE and/or refer the Project to DotE if development of the Study Area requires significant clearing of Black Cockatoo feeding habitat and/or potential breeding habitat.

## ***State Approvals***

It is not anticipated that this Project will require referral to the Environmental Protection Agency.

It is not anticipated that this Project will require permits under the WC Act for removal of Threatened flora.

An assessment against the Ten Clearing Principles, which inform impacts for a Native Vegetation Clearing Permit, determined that the Project is:

- Likely to be at variance with Clearing Principle (b) and Principle (f)
- May be at variance with Principle (a).

Any removal of native vegetation within the Study area will require a clearing permit from the Department of Environment Regulation.

## ***Recommendations***

It is recommended that the Department of Treasury considers a layout of the school that minimises impacts to Black Cockatoo foraging and potential breeding habitat.

Clearing of the Study Area will trigger referral to the Department of the Environment as clearing will result in the removal of approximately 9.3 ha of Black Cockatoo foraging habitat and potential breeding habitat (13 trees) identified within the Study Area. It is recommended the project be discussed with Department of the Environment before a final decision to refer is made. If the foraging habitat and potential breeding trees are not cleared then referral under the EPBC act will not be required.

Significant impacts associated with the Project are likely to be largely restricted to the construction phase, and should be mitigated through design as much as possible. It is recommended that DoE develop a Construction Environmental Management Plan (CEMP) to manage the potential construction impacts including a general fauna clearance program by qualified fauna relocation personnel.

Table 1 Summary of Environmental Issues and Recommendations

Aspect	Description	Issue	Recommendation	Indicative time to secure approvals and additional technical studies/next step
Presence of Cockatoo habitat	Approximately 9.3 ha of Black Cockatoo foraging habitat is present within the Study Area. Potential breeding habitat occurs within the Study Area (13 trees).	Clearing of vegetation that comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia at variance with Principle (b) and trigger referral of the project under the EPBC Act.	The design of the school should minimise clearing of the Black Cockatoo foraging habitat and retain the 13 potential breeding trees where possible.	If foraging habitat and potential breeding habitat cannot be avoided, timeline will depend on Department of Treasury's consultation with the Federal Department of the Environment.
Clearing of native vegetation	A Clearing Permit from Department of Environmental Regulation is required. Clearing of the Study Area is likely to be at variance with Clearing Principle (b) and Principle (f), and may be at variance with Principle (a).	Clearing of the Study Area is likely to be at variance with some of the Clearing Principles.	Department of Treasury should make an application for an 'Area Permit' through Department of Environment Regulation.	Dependent on the outcome of the assessment of the Native Vegetation Clearing Permit application and any offset conditions.
Potential construction impacts	Construction may cause adverse environmental impacts.		The Department of Treasury should develop a Construction Environmental Management Plan (CEMP) to manage potential environmental impacts during construction phase. It should include a general fauna clearance program by qualified relocation personnel.	

# Table of contents

1.	Introduction .....	1
1.1	Project background .....	1
1.2	Purpose of this report .....	1
1.3	Study Area .....	1
1.4	Scope of works.....	1
1.5	Relevant legislation, conservation codes and background information .....	2
1.6	Limitations.....	2
1.7	Assumptions.....	3
2.	Methodology .....	4
2.1	Desktop assessment .....	4
2.2	Field survey.....	4
2.3	Limitations.....	7
3.	Results and discussion.....	11
3.1	Climate.....	11
3.2	Bioregion.....	11
3.3	Environmentally Sensitive Areas.....	11
3.4	Conservation estates and reserves.....	11
3.5	Geomorphology and soils.....	12
3.6	Hydrology.....	12
3.7	Wetlands.....	13
3.8	Vegetation and flora .....	14
3.9	Fauna.....	25
3.1	Acid Sulphate Soils (ASS) .....	29
4.	Environmental approvals.....	30
4.1	Commonwealth .....	30
4.2	State .....	32
5.	Conclusions and recommendations.....	42
5.1	Conclusions .....	42
5.2	Recommendations .....	43
6.	References .....	44

# Table index

Table 1	Summary of Environmental Issues and Recommendations .....	ii
Table 2	Data collected during the field survey .....	4
Table 3	Vegetation condition rating scale .....	6
Table 4	Field survey limitations .....	9

Table 5	Department of Water Geographic Data Atlas queries (DoW 2014) .....	12
Table 6	Geomorphic wetlands occurring within approximately 2 km of the Study Area.....	13
Table 7	Extent of Beard vegetation association within the Study Area .....	16
Table 8	Extent of Hedde <i>et al</i> vegetation complex within the Study Area on the Swan Coastal Plain .....	16
Table 9	Vegetation types within the Study Area.....	18
Table 10	Summary of conservation significant flora species identified as likely to occur or possibly occurring within the Study Area.....	23
Table 11	Locations of Declared Pests and Weeds of National Significance .....	24
Table 12	Black Cockatoo habitat recorded in the Study Area.....	27
Table 13	Conservation significant species determined as present, likely to occur within the Study Area. ....	28
Table 14	Assessment of the Project against Matters of National Environmental Significance.....	30
Table 15	Department of the Environment risk referral table for Black Cockatoos .....	31
Table 16	Assessment against the Ten Clearing Principles.....	34

## Figure index

Figure 1	Locality.....	48
Figure 2	Environmental context.....	48
Figure 3	Vegetation types.....	48
Figure 4	Vegetation condition and weeds .....	48
Figure 5	Fauna habitat types & conservation significant fauna records .....	48

## Appendices

Appendix A – Figures

Appendix B – Background information

Appendix C – Desktop searches

Appendix D – Flora results

Appendix E – Fauna results

# 1. Introduction

## 1.1 Project background

As part of the Department of Treasury's strategic planning, site inspections and feasibility studies are being undertaken at a number of potential school sites. Flora, vegetation and fauna surveys are required to assess these sites for any potential environmental constraints prior to development progressing.

The proposed Hammond Park High School site is 10.22 hectares (ha) in size and would require clearing prior to commencement of any infrastructure works. As such, the Department of Treasury has commissioned GHD Pty Ltd (GHD) to conduct a flora, vegetation and fauna assessment for the proposed Hammond Park High School (the Study Area).

## 1.2 Purpose of this report

The purpose of the survey is to assess the environmental sensitivity of the Study Area and define all flora and fauna values associated with the site, in particular their spatial location and conservation significance. The report will document the potential impacts on flora and fauna from the proposed works, detail any potential environmental constraints and provide management recommendations to address these potential impacts.

This report will be used to assist the Department of Treasury in assessing the proposed impact of the clearing of native vegetation at the site to enable works to be undertaken in an environmentally sensitive manner.

## 1.3 Study Area

The Study Area is located in Hammond Park, approximately 26 kilometres (km) south of Perth, Western Australia. The Study Area occurs within an area bounded by Irvine Parade and Bellingham Road on the north-east, Atkins Parade to the north, Barfield Road to the east, Rowley Road to the south and Hammond Park Catholic Primary School to the west. The Study Area is 10.22 ha in area and is shown in Figure 1, Appendix A.

## 1.4 Scope of works

The general scope of the Project is to conduct a flora, vegetation and fauna assessment within the Study Area.

The scope of works as per the Project brief and GHD proposal was to:

- Undertake a desktop assessment
- Undertake a Level 1 vegetation and flora survey to provide:
  - Description and mapping of vegetation units and vegetation condition
  - Location and counts of any conservation significant flora (Threatened and Priority Flora) and Declared taxa
  - Inventory of vascular flora taxa (including weed species)
  - Preliminary identification and mapping of any Threatened or Priority Ecological Communities (TEC and/or PEC)
- Undertake a Level 1 fauna survey to provide:
  - Description and mapping of fauna habitat
  - Inventory of terrestrial fauna taxa



- Detail the presence or likelihood of occurrence of conservation significant fauna occurring within the Study Area
- Review of the presence of pest, declared or feral animals
- A Black Cockatoo habitat assessment
- Prepare a flora and fauna report including the results of the desktop assessment and field surveys

## 1.5 Relevant legislation, conservation codes and background information

In Western Australia, significant communities, flora and fauna are protected under both Australian Government and State legislation. In addition regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation, conservation codes and background information relevant to this Project is provided in Appendix B.

## 1.6 Limitations

*This report: has been prepared by GHD for Department of Treasury - Strategic Projects and may only be used and relied on by Department of Treasury - Strategic Projects for the purpose agreed between GHD and the Department of Treasury - Strategic Projects as set out in and as defined in the this report, letters of appointment and letters of aggregate liability dated 25 August 2014.*

*GHD otherwise disclaims responsibility to any person other than Department of Treasury - Strategic Projects arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible and as defined in the letters of appointment and letters of aggregate liability dated 25 August 2014.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.*

*GHD has prepared this report on the basis of information provided by Department of Treasury - Strategic Projects and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.*

*GHD has not been involved in the preparation of the EOI, RFP, Development Application or other documents beyond this report and has had no contribution to, or review of these documents. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of these other documents.*

*The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.*

*Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.*

*Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.*

*GHD excludes and disclaims all liability for all claims, expenses, losses, damages and costs, including indirect, incidental or consequential loss, legal costs, special or exemplary damages and loss of profits, savings or economic benefit, Department of Treasury - Strategic Projects may incur as a direct or indirect result of the PPP Schools Site Investigations Library, for any reason being inaccurate, incomplete or incapable of being processed on Department of Treasury - Strategic Projects's equipment or systems or failing to achieve any particular purpose. To the extent permitted by law, GHD excludes any warranty, condition, undertaking or term, whether express or implied, statutory or otherwise, as to the condition, quality, performance, merchantability or fitness for purpose of the PPP Schools Site Investigations Library.*

*GHD does not guarantee that the PPP Schools Site Investigations Library is free of computer viruses or other conditions that may damage or interfere with data, hardware or software with which it might be used. Department of Treasury - Strategic Projects absolves GHD from any consequence of Department of Treasury - Strategic Projects's or other person's use of or reliance on, PPP Schools Site Investigations Library.*

## 1.7 Assumptions

This report has assessed the flora, vegetation and fauna associated with the Study Area (Figure 1, Appendix A). Should the Study Area change, further assessment would be required.

## 2. Methodology

### 2.1 Desktop assessment

A desktop review was conducted prior to the commencement of field surveys. This included:

- A review of the Department of the Environment (DotE) Protected Matters database to identify species and communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within a 5 km buffer of the Study Area (DotE, 2013a)
- A review of the Department of Parks and Wildlife (DPaW) Threatened Ecological Community (TEC) and Priority Ecological Community (PEC) databases to determine the potential for TECs or PECs to be present within a 5 km buffer of the Study Area
- A review of DPaW's Threatened and Priority Flora database (TPFL) and Western Australian Herbarium database (WAHERB) for Threatened and Priority flora species listed under *Wildlife Conservation Act 1950* (WC Act) and listed by DPaW, previously recorded within a 5 km buffer the Study Area.
- A review of the DPaW NatureMap database for flora and fauna species previously recorded within a 5 km buffer of the Study Area (DPaW, 2007–)
- A review of the DPaW database of known records of Black Cockatoo roosting and nesting sites on the Swan Coastal Plain
- A review of existing datasets including: previous vegetation mapping of the Study Area (Beard, 1979; Hedde et al. 1980), aerial photography, geology/soils and hydrology information to provide background information on the variability of the environment
- Review of previous flora and fauna assessments undertaken in the general area

### 2.2 Field survey

#### 2.2.1 Flora and vegetation

GHD undertook a Level 1 flora and vegetation assessment of the Study Area on 11<sup>th</sup> October 2013. The survey was undertaken in accordance with the Environmental Protection Authority (EPA) Guidance Statement No. 51 (EPA, 2004a) and EPA Position Statement No. 3 (EPA, 2002). The survey was undertaken to provide identify and describe the dominant vegetation units present, assess vegetation condition and record vascular flora species present at the time of the survey. Additionally, opportunistic searching for conservation significant or other significant ecological communities and flora taxa were undertaken.

Field assessment methodology for the Level 1 survey involved sampling using a minimum of two 10 m x 10 m quadrats located in representative vegetation units. Field data at each quadrat was recorded on a pro-forma data sheet and included the parameters detailed in Table 2. The survey also included meandering transects of the Study Area on foot to record plant species present (visible) at the time of the survey.

Table 2 Data collected during the field survey

Aspect	Measurement
Physical features	Aspect, soil attributes. Percentage surface cover by: rocks, logs and branches, leaf litter, bare ground.
Location of important features	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately $\pm 5$ m.

Aspect	Measurement
Vegetation condition	Vegetation condition was assessed using the condition rating scale devised by Keighery (1994).
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, exploration activities).
Flora	List of dominant flora from each structural layer.

### Vegetation units

Vegetation units were described based on structure, dominant taxa and cover characteristics as defined by field observations and quadrat data. The unit descriptions follow Keighery's (1994) vegetation structural classification, adapted from Muir (1977) and Aplin (1979). Vegetation units were identified and boundaries delineated using a combination of aerial photography interpretation, topographical features, previous mapping (Beard, 1979; Heddle et al., 1980) and field observations.

Vegetation units were also qualitatively compared against Floristic Community Types (FCT) identified by Gibson et al. (1994) as present on the Swan Coastal Plain. The Gibson et al. (1994) "analysis of plant communities on the Swan Coastal Plain ... is the most recent regional floristic work on public lands, ... [and considers] the patterning of plant distribution on the Plain and relates to the total flora of the Plain" (Government of Western Australia, 2000). FCT are based on the results of multivariate analysis conducted on 1,122 quadrats. Comparison of vegetation identified at the Study Area against FCT identified by Gibson et al. (1994) can assist in determining the presence of TEC or PEC, although clarification with DPaW is recommended for certainty. In addition, FCT cannot be definitively determined when the remaining vegetation has been too disturbed to sample adequately or not enough information about the vegetation can be obtained (Government of Western Australia, 2000).

### Species identification and nomenclature

Species that were well known to the survey botanists were identified in the field, while species that were unknown were collected and assigned a unique collection number to facilitate tracking. Plant species were identified by the use of local and regional flora keys and by comparison with the named species held at the Western Australian Herbarium (WA Herbarium). When necessary, plant taxonomists considered to be authorities on particular plant groups were consulted.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium, 1998–) and the EPBC Act Threatened species database provided by DotE (2013c).

Nomenclature used in the report follows that used by the WA Herbarium as reported on *FloraBase* (WA Herbarium, 1998–).

### Vegetation condition

The vegetation condition of the Study Area was assessed using the vegetation condition rating scale developed by Keighery (1994) that recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels
- Extent of weed invasion
- Historical disturbance from tracks and other clearing or dumping
- The potential for natural or assisted regeneration

The scale consists of six rating levels as outlined in Table 3.

Table 3 Vegetation condition rating scale

Vegetation condition rating	Vegetation condition	Description
1	Pristine or Nearly So	No obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

### 2.2.2 Fauna

The fauna assessment was consistent with a Level 1 assessment (reconnaissance survey) in accordance with the EPA Guidance Statement No. 56 (EPA, 2004b). Nomenclature follows that used by the Western Australian Museum and the DPaW NatureMap database, as it is deemed to contain the most up-to-date species information for Western Australia, with the exception of birds, which uses Christidis and Boles (2008).

GHD ecologists conducted a reconnaissance fauna survey of the Study Area on foot on 11<sup>th</sup> October 2013. A fauna habitat assessment was undertaken which assessed:

- Habitat structure (e.g. vegetation type, presence/absence of overstorey, midstorey, understorey, ground cover)
- Presence/absence of refugia including: fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/boulder piles, and the type and extent of each refuge
- Presence/absence of waterways including type, extent and habitat quality within waterways
- Land use or disturbance history
- Location of habitat within the surrounding landscape and habitat connectivity
- Identification of wildlife corridors within and immediately adjacent Study Area
- Evaluation of the likelihood of occurrence of listed fauna occurring within the habitat (based on presence of suitable habitat)

Opportunistic fauna searches were also conducted across the Study Area. Opportunistic searches involved:

- Searching through microhabitats including turning over logs or rocks, turning over leaf litter and examining tree hollows and hollow logs
- Visual and aural surveys. This accounted for many bird species potentially utilising the Study Area
- Searching the Study Area for tracks, scats, bones, diggings and feeding areas for both native and feral fauna

A general assessment of the potential for Black Cockatoo habitat within the Study Area was also conducted. The Black Cockatoo assessment was undertaken with regard to the EPBC Act

Referral Guidelines for three threatened Black Cockatoo species: Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso*) (the Black Cockatoo Referral Guidelines) (DSEWPaC, 2012). Information collected during the field survey included:

- Identification of foraging habitat: the location and extent of suitable Black Cockatoo foraging habitat was identified and mapped for the Study Area, based on the vegetation associations and presence/absence of known foraging species. During the field surveys any direct or indirect evidence of foraging by cockatoos was recorded.
- Identification of potential breeding and roosting habitat: suitable breeding habitat for Black Cockatoos is defined by DSEWPaC (2012) as trees of species known to support breeding within the range\* of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm (DSEWPaC, 2012). The location of all suitable breeding trees was recorded in the Study Area and the suitable breeding trees are referred to as 'Significant Trees'. Additionally, details of tree species, size and number of hollows observed, evidence of use and any other significant observations were recorded for each tree.
- Opportunistic observations (both visual and aural) for the presence of Black Cockatoos within the Study Area and surrounding region were also noted during the survey.

The above information was used to map and calculate the amount of foraging habitat, potential breeding habitat and roost sites within the Study Area.

\*The Black Cockatoo Referral Guidelines (DSEWPaC, 2012) provide maps of the breeding areas and extent of occurrence for all three Cockatoo species, however consideration to the inaccuracy of the modelled distributions has been considered during this study. These considerations have included;;

- The maps presented in Black Cockatoo Referral Guidelines are modelled based on the best available information at the time of publication (2009). These maps are designed to provide an indicative location only and have been compiled from various sources. Species and ecology distributions are indicative only and are not to be used for localised assessment (DSEWPaC, 2012).
- Known breeding areas identified in the referral guidelines represent locations known to be used by the birds for breeding as December 2009. As habitat has been lost in traditional breeding areas the Cockatoos have begun breeding at new locations outside of the range indicated (DSEWPaC, 2012)..
- There are still a number of uncertainties in the understanding of Carnaby's Cockatoo ecology (Cockerill *et al* 2013).

## 2.3 Limitations

### 2.3.1 Desktop investigation limitations

Queries of the DotE Protected Matters database (using the Protected Matters Search Tool – PMST) are used to identify species listed under the EPBC Act and draw on various sources to report on the potential of the species occurrence within an area. The database is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. Additionally, it is broad-scale in its reporting and often the specific habitat requirements of the species do not occur, or are unlikely to occur, within a Study Area. For this reason not all species reported by the search tool need to be considered in management decisions. The DPaW NatureMap database reports on actual

records of the species within the designated area and can provide more accurate information of the likelihood of species presence. However, some records of collections, sightings or trappings can be dated and often misrepresent the current range of threatened species. Neither database can be considered exhaustive. Species of conservation significance may be found during surveys that are not listed in the databases.

### 2.3.2 Field survey limitations

The limitations surrounding the flora and fauna survey are provided in Table 4.

Table 4 Field survey limitations

Limitation	Constraint	Impact on survey outcomes
Sources of information and availability of contextual information	Nil	Adequate information is available for the Study Area, this includes: <ul style="list-style-type: none"> <li>• Broad scale (1:250,000) mapping by Beard (1979) and Shepherd et al. (2002)</li> <li>• Broad scale (1:250,000) mapping by Heddle et al. (1980)</li> <li>• Regional biogeography (Mitchell et al 2002)</li> </ul>
Scope (i.e. what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna taxa were sampled during the survey. Non-vascular flora taxa, invertebrate and aquatic fauna were not assessed as part of the survey.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The flora recorded from the field survey is detailed in Section 3.8.3 and a full flora species list provided in Appendix D. A total of 113 taxa representing 37 families and 87 genera were recorded during the survey. Due to the absence of adequate flowering parts and/or fruiting bodies required for identification, 13 taxa could be identified to genus only. The Level 1 survey was conducted mid-October 2013, which is within the optimal spring survey season. . It is considered that many of the taxa identifiable at the time of the survey would have been observed. The fauna assessment conducted was a reconnaissance (Level 1) survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic and nocturnal species would not have been identified during a reconnaissance survey and seasonal variation within species often requires targeted surveys at a particular time of the year. The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna using the Study Area. No sampling for invertebrates or aquatic species occurred. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than that of vertebrate species.
Flora determination	Nil	Flora determination was undertaken by GHD ecologists in the field. The taxonomy and conservation status of the Western Australian flora is dynamic. This report was prepared with reliance on taxonomy and conservation current at the time issuing, but it should be noted this may change.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed?)	Minor	Lot 14 was not accessible at the time of the field survey, lot 14 is 0.87 ha or 8% of the total Study Area. The remainder of the Study Area was fully surveyed during the Level 1 flora, vegetation and fauna assessment.
Mapping reliability	Nil	The vegetation of the Study Area was mapped at a scale of 1:2,500, using aerial photography captured in 2013 (Landgate: Metro Central 2013 Mosaic – 20130821). As the majority of the Study Area had not been burnt for over five years, fire is not considered to have an impact upon the vegetation type or condition identified during the survey.



Limitation	Constraint	Impact on survey outcomes
Timing, weather, season	Minor	<p>The field survey was conducted during spring, on 11<sup>th</sup> October 2013.</p> <p>In the period June–August, 2013, the Medina Bureau of Meteorology weather station (No. 9194) (located approximately 6.9 km from the Study Area) recorded 312 millimetres (mm) of rainfall (BoM, 2013). This is 23.4% percent lower than the long term average (407.4 mm) for the same period (BoM, 2013).</p> <p>There was no rainfall recorded during the survey.</p> <p>Climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to the aforementioned factors.</p> <p>Flora composition changes over time, with flora species having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two).</p> <p>Therefore, the results of future botanical surveys in this location may differ from the results of this survey.</p> <p>Complete flora and fauna surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.</p>
Disturbances (fire, flood, accidental human intervention etc)	Nil	As the Study Area is within the Perth metropolitan region, humans and domestic animals (especially dogs and cats) are a frequent occurrence. It is not considered that these disturbances impacted the survey.
Intensity (in retrospect, was the intensity adequate?)	Nil	The Study Area was sufficiently covered by GHD ecologists for Level 1 surveys with a total of 5 quadrats within the Study Area.
Resources	Nil	Adequate resources were employed during the survey. Two people days were spent conducting the flora and fauna survey.
Access problems	Minor	Lot 14 was not accessible during the survey, lot 14 is 0.87 ha or 8% of the total Study Area.
Experience levels	Nil	The ecologists who executed the survey were practitioners suitably qualified in their respective fields.

## 3. Results and discussion

### 3.1 Climate

The Study Area experiences a Mediterranean climate, with mild, wet winters and hot, dry summers. The closest Bureau of Meteorology (BoM) weather station to the Study Area is located approximately 6.9 km from the Study Area at the Medina weather station (station number 9194). A summary of the climatic data (BoM, 2013) for this weather station (1994–2013) is below:

- Mean maximum temperature: 18.3 °C (July) to 31.5 °C (February)
- Mean minimum temperature: 8.0 °C (July) to 17.6 °C (February)
- Mean annual rainfall: 763.9 mm
- Mean number of days of rain  $\geq$  1 mm: 90.1

### 3.2 Bioregion

The Study Area is located within the Swan Coastal Plain Interim Biogeographic Regionalisation of Australia (IBRA) Bioregion, Perth Sub-Region (SWA02). This sub-region is dominated by woodlands of *Banksia* and Tuart (*Eucalyptus gomphocephala*) on sandy soils, sheoak on outwash plains, and paperbark in swampy areas. The colluvial and aeolian sand areas represent three phases of Quaternary marine sand dune development (which provide relief), and include a complex series of seasonal fresh water wetlands, alluvial river flats, coastal limestone and several off-shore islands. Younger sandy areas and limestone are dominated by heath and/or Tuart woodlands, while *Banksia* and Jarrah (*E. marginata*)–*Banksia* woodlands are found on the older dune systems (Mitchell et al., 2002).

### 3.3 Environmentally Sensitive Areas

There are no Environmentally Sensitive Areas (ESAs) within the Study Area, however, there are four ESAs are within 2 km of the Study Area (Figure 2, Appendix A).

### 3.4 Conservation estates and reserves

There are no DPaW-managed estates or reserves within the Study Area, however, there are a number of reserves and conservation areas within the vicinity of the Study Area (Figure 2, Appendix A). These include:

- Harry Waring Marsupial Reserve (0.74 km west of the Study Area) – This is a Class A Reserve (R 29241) managed by DPaW and vested with the Conservation Commission of WA for the purpose of flora and fauna research and conservation.
- Thomsons Lake Nature Reserve (1.38 km north-west of the Study Area) – This is a Class A Reserve (R 15556) managed by DPaW and vested with the Conservation Commission of WA for the purpose of fauna conservation, research and drainage.
- Unnamed Conservation Park (1.9 km north-west of the Study Area) – Adjacent to Harry Waring Marsupial Reserve, this Conservation Park (R 48291) is vested with the Conservation Commission of WA.

A search of the EPBC Protected Matters database identified a further two reserves occurring within 5 km of the Study Area:

- Wandi Nature Reserve (3.0 km south-east of the Study Area) – This is a Class C Reserve (R 36110) vested with the Conservation Commission of WA for the purpose of flora and fauna conservation, water and likely Aboriginal cultural values.
- Unamed Conservation Park (3.0 km north-west of the Study Area) – Adjacent to Thomsons Lake Nature Reserve, this Conservation Park (R 49561) is vested with the Conservation Commission of WA.

#### 3.4.1 Bush Forever

Four Bush Forever sites occur within 2 km of the Study Area (Government of Western Australia, 2014), these include:

- Bush Forever Site No. 268 (1.75 km south-west of the Study Area) – Mandogalup Road Bushland
- Bush Forever Site No. 392 (0.74 km west of the Study Area) – Harry Waring Marsupial Reserve
- Bush Forever Site No. 391 (1.38 km north-west of the Study Area) – Thomsons Lake Nature Reserve and Adjacent Bushland
- Bush Forever Site No. 492 (1.3 km north-east of the Study Area) – Lyon Road Bushland

### 3.5 Geomorphology and soils

The Study Area lies on the Swan Coastal Plain, which consists of a series of distinct landforms including the Darling and Dandaragan Plateaus, Pinjarra Plain, and Bassendean, Spearwood and Quindalup Dune Systems that run sub-parallel to the present coastline. The Study Area occurs on the Bassendean Dune System, which is a gently undulating aeolian sand plain over sedimentary rock.

The sands of the Bassendean Dunes are described leached and infertile, they contain little silt or clay, and very low levels of nutrient elements, with any nutrient element content being associated with organic matter. Broad scale soil mapping by Tille (1996) indicates the following soil sub-units or phases of the Bassendean system occur within the Study Area:

- 212Bs\_B1 – Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
- 212Bs\_B2 – Flat to very gently undulating sandplain with well to moderately well-drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.

### 3.6 Hydrology

Groundwater in Western Australia is protected under the *Rights in Water and Irrigation Act 1914* (RIWI Act). A search of the DoW Geographic Data Atlas (DoW 2014) was undertaken for the Study Area. A summary of the Geographic Data Atlas queries for the Study Area is provided in Table 5.

Table 5 Department of Water Geographic Data Atlas queries (DoW 2014)

Aspect	Details	Results
RIWI Groundwater Areas	Groundwater areas proclaimed under the RIWI Act	None present
RIWI Surface Water Areas	Surface water areas proclaimed under the RIWI Act	None present

Aspect	Details	Results
RIWI Irrigation District	Irrigation Districts proclaimed under the RIWI Act	None present
RIWI Rivers	Rivers proclaimed under the RIWI Act	None present
Public Drinking Water Source Areas (PDWSA)	PDWSAs is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the <i>Metropolitan Water Supply, Sewage and Drainage Act 1909</i> (MWSSD) or the <i>Country Area Water Supply Act 1947</i> (CAWS).	None present
Waterway Management Areas	Areas proclaimed under the <i>Waterway Conservation Act 1976</i> .	None present

### 3.7 Wetlands

#### 3.7.1 Ramsar wetlands

A search of the EPBC Protected Matters database identified two Wetlands of International Importance (Ramsar) within 5 km of the Study Area (Figure 2, Appendix A).

- Forrestdale and Thomsons lakes (within Ramsar site).
- Peel-Yalgorup system (upstream from Ramsar).

#### 3.7.2 Lakes covered under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*

No Lakes covered under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) occur within the Study Area. Thirty six EPP Lakes occur within 5 km of the Study Area (Figure 2, Appendix A).

#### 3.7.3 Geomorphic wetlands

No geomorphic wetlands occur within the Study Area. Twenty three geomorphic wetlands occur within approximately 2 km of the Study Area (Table 6 and Figure 2, Appendix A).

Table 6 Geomorphic wetlands occurring within approximately 2 km of the Study Area

UFI	Conservation Category	Classification	Name
1638	Resource Enhancement	Sumpland	Unknown
6529	Conservation	Lake	Thomson Lake
6530	Multiple Use	Dampland	Mandogalup Swamp North
6533	Resource Enhancement	Sumpland	Copulup Lake
6534	Conservation	Dampland	Unknown
6611	Conservation	Sumpland	Banganup Swamp
6665	Resource Enhancement	Dampland	Unknown

UFI	Conservation Category	Classification	Name
6719	Resource Enhancement	Sumpland	Mandogalup Swamp North
6724	Resource Enhancement	Sumpland	Mandogalup Swamp North
6725	Conservation	Sumpland	Mandogalup Swamp North
6726	Resource Enhancement	Sumpland	Mandogalup Swamp North
6886	Resource Enhancement	Dampland	Unknown
6888	Resource Enhancement	Dampland	Unknown
6889	Resource Enhancement	Dampland	Unknown
6893	Conservation	Sumpland	Unknown
14104	Conservation	Dampland	Unknown
14662	Multiple Use	Sumpland	Mandogalup Swamp North
15406	Multiple Use	Sumpland	Unknown
15408	Multiple Use	Sumpland	Unknown
15412	Conservation	Sumpland	Unknown
15520	Resource Enhancement	Dampland	Baler Court
15521	Multiple Use	Dampland	Baler Court
15886	Multiple Use	Dampland	Unknown

(Government of Western Australia, 2012)

### 3.8 Vegetation and flora

#### 3.8.1 Broad vegetation associations and extent

Broad scale vegetation mapping of the Perth area was completed by Beard (1979) at an association level. Beard (1979) mapping indicates that one vegetation association is present within the Study Area (Government of Western Australia, 2012):

- Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina (association 1001, Bassendean)

Regional vegetation has been mapped by Heddle *et al.* (1980) based on major geomorphic units on the Swan Coastal Plain. Heddle *et al.* (1980) mapping indicates that one vegetation complex is present within the Study Area (Figure 2, Appendix A):

- Bassendean complex – Central and south: Vegetation ranges from woodland of *E. marginata* – *C. fraseriana* – *Banksia* spp. to low woodland of Melaleuca species, and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. totiana* in the vicinity of Perth.

The extent of remnant native vegetation has been assessed by Shepherd *et al.* (2002) and maintained by DPaW (latest update 2012 – Government of Western Australia, 2013), based on broad scale vegetation association mapping by Beard (1979). As shown in Table 7, the extent remaining of Beard (1979) vegetation association 1001 is less than 30 % at the State, IBRA Bioregion and IBRA Sub-region level, which is below the threshold level. The extent remaining at the Local Government Area (LGA) level is greater than 30 %. Although the extent remaining of vegetation association 1001 is below the threshold level at the State, IBRA bioregion and

IBRA sub-region level, the Study Area is located within an area of urban development on the Swan Coastal Plain. Therefore as there is greater than 10 percent of the vegetation association remaining, vegetation association 1001 is not considered to be a critical asset.

The Local Biodiversity Program (2013) and Perth Biodiversity Project (2010) have assessed the extent of Heddle et al. (1980) vegetation complexes against presumed pre-European extents for the Swan Coastal Plain and City of Cockburn. As shown in Table 8 and , the Bassendean complex – central and south is regarded as being below the threshold level on the Swan Coastal Plain, but above the threshold level in the City of Cockburn. At both levels the Bassendean complex – central and south, has greater than 10 % remaining and therefore is not considered to be a critical asset.

Table 7 Extent of Beard vegetation association within the Study Area

Vegetation association and description	Region	Pre-European extent (ha)	Current extent (ha)	Percentage remaining <sup>1</sup>	Current extent in all DPaW managed lands (%)
Vegetation association 1001: Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina	State	57,410.23	14,151.90	24.65	5.66
	IBRA bioregion Swan Coastal Plain	57,410.23	14,151.90	24.65	5.66
	IBRA sub-region Perth	57,410.23	14,151.90	24.65	5.66
	LGA City of Cockburn	7,328.40	2,474.19	33.76	12.14

(Beard, 1979; Government of Western Australia, 2013; Shepherd et al., 2002).

<sup>1</sup>When present at >10% of pre-European extents not considered a critical asset.

Table 8 Extent of Heddle *et al* vegetation complex within the Study Area on the Swan Coastal Plain

Vegetation complex description	Pre-European extent (ha)	2013 extent (ha)	% of pre-European extent	Total with informal protection (% of pre-European extent)
Bassendean complex – Central and south. Vegetation ranges from woodland of <i>E. marginata</i> – <i>C. fraseriana</i> – <i>Banksia</i> spp. to low woodland of <i>Melaleuca</i> species, and sedgelands on the moister sites. This area includes the transition of <i>E. marginata</i> to <i>E. todtiana</i> in the vicinity of Perth.	87,392.73	24,206.24	27.70	8.56

(Heddle et al., 1980; Local Biodiversity Program, 2013)

### 3.8.2 Vegetation types

Three vegetation types were recorded within the Study Area (Table 9 and Figure 3, Appendix A); these types are described as:

- VT1: Low Open Forest of *Banksia* spp. and *Allocasuarina fraseriana*
- VT2: Low Woodland of *Banksia* spp. over Open Low Heath of *Scholtzia involucreta*
- VT3: Low Open Woodland of *Melaleuca raphiophylla*

VT1: Low Open Forest of *Banksia* spp. and *Allocasuarina fraseriana* was the most dominant vegetation type within the Study Area. As a result of previous disturbances there were differences in species diversity between quadrats within VT1. Species diversity in one area had been impacted by sheep grazing and as a result there was almost no understory remaining except for the most unpalatable species. While VT1 overstorey was dominated by a variety of *Banksia* spp. and *Allocasuarina fraseriana* there were scattered Jarrah and Marri trees present. Comparison with FCTs indicates VT1 shows strong similarities with SCP23a – Central *Banksia attenuata* – *B. menziesii* woodlands.



VT2: Low Woodland of *Banksia* spp. over Open Low Heath of *Scholtzia involucreta* was very similar in species composition to VT1, however, differed in having a more open *Banksia* overstorey, general reduction in species presence and having a midstorey dominated by *Scholtzia involucreta*, which was only very sparsely present within the remainder of the Study Area. VT2 covers a small area within the Study Area and while it shows differences with VT1, these differences may have been caused by small changes in soil properties or various anthropogenic factors. As such VT2 also shows similarities with SCP23a – Central *Banksia attenuata* – *B. menziesii* woodlands.


The third vegetation type present within the Study Area was a highly degraded Low Open Woodland of *Melaleuca raphiophylla*. Areas representing VT3 have been largely cleared and subsequently invaded by weed species which has altered nature of this vegetation,

As noted in section 2.3.2, access to Lot 14 was not available during the survey. Assessment of the vegetation type is limited to an inferred assessment based on visual assessment from the property boundaries while surveying Lots 31 and 47 and from assessment of aerial photography.



Table 9 Vegetation types within the Study Area

Vegetation type and description	Area of Study Area (ha)	Potential corresponding Gibson et al. (1994) Floristic Community Type	Photograph
<p><b>VT1: Low Open Forest of <i>Banksia</i> spp. and <i>Allocasuarina fraseriana</i>.</b>                      Low Open Forest of <i>Banksia attenuata</i>, <i>Banksia menziesii</i> and <i>Allocasuarina fraseriana</i> over Tall Shrubland of <i>Kunzea glabrescens</i> and <i>Xanthorrhoea preissii</i> over Shrubland of <i>Xanthorrhoea preissii</i> and <i>Eremaea pauciflora</i> var. <i>pauciflora</i> over Open Low Heath of <i>Hibbertia racemosa</i>, <i>Calytrix fraseri</i> and <i>Leucopogon polymorphus</i> over Sedgeland of <i>Lepidosperma pubisquameum</i> and <i>Schoenus curvifolius</i> over a Herbland of <i>Phlebocarya ciliata</i>, <i>Desmocladius flexuosus</i> and <i>Dasypogon bromeliifolius</i> and assorted herbs and weedy grass spp.</p>	<p>7.49 ha (additional 0.87 ha inferred)</p>	<p>SCP23a – Central <i>Banksia attenuata</i> – <i>B. menziesii</i> woodlands.</p>	
<p><b>VT2: Low Woodland of <i>Banksia</i> spp. over Open Low Heath of <i>Scholtzia involucreta</i>.</b>                      Low Woodland of <i>Banksia menziesii</i> and <i>Banksia illicifolia</i> over Tall Open Shrubland of <i>Kunzea glabrescens</i> over Open Low Heath of <i>Scholtzia involucreta</i>, <i>Conostephium pendulum</i> and <i>Calytrix fraseri</i> over Open Herbland of <i>Dasypogon bromeliifolius</i>, <i>Phlebocarya ciliata</i> and <i>Desmocladius flexuosus</i>.</p>	<p>0.94 ha</p>	<p>SCP23a – Central <i>Banksia attenuata</i> – <i>B. menziesii</i> woodlands.</p>	

Vegetation type and description	Area of Study Area (ha)	Potential corresponding Gibson et al. (1994) Floristic Community Type	Photograph
<p><b>VT3: Low Open Woodland of <i>Melaleuca raphiophylla</i>.</b>            Low Open Woodland of <i>Melaleuca raphiophylla</i> over Tall Open Scrub of <i>Kunzea glabrescens</i> and <i>Astartea scoparia</i> over Open Low Heath of <i>Hypocalymma angustifolium</i> over Grassland of *<i>Ehrharta calycina</i> and herbaceous weed species</p>	0.92 ha	SCP4 – <i>Melaleuca preissiana</i> damplands.	

### 3.8.1 Vegetation condition

The Study Area consists of six residential/semi-rural properties, five of the properties have been developed and the sixth shows signs of use. As a result, the remnant vegetation in all six properties shows signs of disturbance. The vegetation condition of the Study Area ranged from *Excellent* (2) to *Degraded* (5) (Figure 4, Appendix A), with:

- 2.5 ha rated as *Excellent* (2)
- 2.17 ha rated as *Excellent* (2) – *Very Good* (3)
- 3.15 ha rated as *Good* (4)
- 2.14 ha rated as *Degraded* (5)
- 0.26 ha rated as *Completely Degraded* (6)

Condition within Lot 31 ranges from *Good* (4) to *Degraded* (5), only a small portion of the lot has been cleared for a shed and yards (Plate 1, A) while the remainder is remnant vegetation. Severe overgrazing has resulted in significant impacts to the mid and understorey species, with only the least palatable native species remaining. Current overgrazing has resulted in a ground level vegetation cover of 2-10 %, but it is likely that with cessation of grazing, weed species would dominate the understorey. Old farm infrastructure and some rubbish is scattered throughout the Lot (Plate 1, B).

The upper section of Lot 32 has been subject to partial clearing and has been badly affected by weed species such as *\*Ehrharta calycina* and *\*Eragrostis curvula* (Plate 1, C), with condition considered to range from *Good* (4) to *Degraded* (5). The remainder of the lot is in an *Excellent* (2) to *Very Good* (3) condition and shows very few signs of disturbance but does have a small amount of rubbish dumped on the property (Plate 1, D).

Within the Study Area a small section of Lot 47 has been partially cleared, with the understorey now dominated by weed species such as *\*Ehrharta calycina*. This partially cleared area is *Good* (4) in condition. The remainder of the lot is in *Excellent* (2) condition with few weeds present and minimal signs of previous disturbances.

Lot 33 is also in *Excellent* (2) condition. While there is some evidence of damage as a result of rubbish dumping and wood cutting (Plate 1, E and F), the portion of the property within the Study Area shows minimal signs of disturbance.

As noted in section 2.3.2, access to Lot 14 was not available during the survey. Assessment of the vegetation condition is limited to an inferred assessment based on visual assessment from the property boundaries while surveying Lots 31 and 47 and from assessment of aerial photography. As such condition in the vegetated areas is considered to range from *Excellent* (2) to *Very Good* (3) while the cleared areas are *Completely Degraded* (6).



Plate 1 Vegetation condition, Left to right A, B, C, D, E and F.

### 3.8.2 Threatened and Priority Ecological Communities

Desktop investigations identified three PECs within 5 km of the Study Area. These are:

- SCP21c – Low lying *Banksia attenuata* woodlands or shrublands (Priority 3), three occurrences
- SCP22 – *Banksia ilicifolia* woodlands (Priority 3), two occurrences
- SCP24 – Northern Spearwood shrublands and woodlands (Priority 3), one occurrence

The three vegetation types identified within the Study Area are considered unlikely to align with any of the PECs described above.

A new Priority 3 PEC was added to the PEC list by DPaW after the completion of this field survey:

- *Banksia dominated woodlands of the Swan Coastal Plain IBRA region.* The main feature of these Banksia woodlands is the presence of *Banksia attenuata* and/or *B. menziesii* occurring on deep sands.

It is likely that vegetation type 1 (VT1: Low Open Forest of *Banksia* spp. and *Allocasuarina fraseriana* – 7.49 ha) and vegetation type 2 (VT2: Low Woodland of *Banksia* spp. over Open Low Heath of *Scholtzia involucrate* – 0.94 ha) represent this PEC.

### 3.8.3 Flora diversity

The desktop assessment (DPaW, 2007–) identified 360 plant taxa (including subspecies and varieties), representing 70 families and 211 genera, previously been recorded within 5 km of the Study Area. This total comprised 285 native species and 75 introduced (exotic) species. Dominant families recorded within 5 km of the Study Area include:

- Myrtaceae: 41 taxa
- Fabaceae: 39 taxa
- Poaceae: 27 taxa

The GHD survey identified a total of 113 flora species from 37 families and 87 genera within the Study Area (Appendix D). This total included 94 native species and 19 introduced/planted species. Dominant families recorded during the survey of the Study Area were:

- Myrtaceae: 13 taxa
- Fabaceae: 11 taxa
- Poaceae: 11 taxa (9 weed species)
- Orchidaceae: 9 taxa

### 3.8.4 Conservation significant flora

Searches of the DPaW TPFL and WAHERB databases, EPBC Act PMST (DotE, 2013a) and DPaW NatureMap records (DPaW, 2007–) identified the presence/potential presence of 16 conservation significant flora species previously recorded within 5 km of the Study Area ((Figure 2, Appendix A and Appendix C). These included:

- Eight species listed under both the EPBC Act and WC Act
- One species listed under the EPBC Act and by DPaW
- Seven species listed by DPaW

No species listed under the EPBC Act or WC Act were recorded during the survey. In addition, no DPaW Priority species were identified during the survey.

#### **Likelihood of occurrence assessment**

A likelihood of occurrence assessment of conservation significant species (based on the range, habitat requirements and previous records of the species as well as taking into account the intensity of field survey and season) was undertaken for all conservation significant species identified in the desktop assessment (Appendix D). The likelihood of occurrence assessment determined three species may occur within the Study Area; this is summarised in Table 10.

Table 10 Summary of conservation significant flora species identified as likely to occur or possibly occurring within the Study Area


Family	Taxon	Status	
		State (WC Act/ DPaW listing)	Australian Government (EPBC Act listing)
Orchidaceae	<i>Caladenia huegelii</i>	T	E
Myrtaceae	<i>Eremaea asterocarpa</i> subsp. <i>brachyclada</i>	P1	
Fabaceae	<i>Jacksonia gracillima</i>	P3	

### 3.8.5 Introduced flora

A total of 19 introduced (exotic) species were recorded within the Study Area. This included one species, \**Asparagus asparagoides* (Bridal Creeper), which is listed as a Declared Pest under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and as a Weed of National Significance (WoNS) (Australian Weeds Committee, 2010).

*Asparagus asparagoides* is listed under C3 Management which means it is a Prohibited species for the whole of the State. One plant was identified within the Study Area and one plant was identified approximately 20 m to the east of the Study Area (Table 11 and Figure 4, Appendix D).

Table 11 Locations of Declared Pests and Weeds of National Significance

Species	Common name	Status	Description (WA Herbarium 1998–)	Indicative photograph (WA Herbarium 1998–)	Presence within the Study Area
* <i>Asparagus asparagoides</i>	Bridal Creeper	Declared Pest C3 Management for the Whole of the State	Rhizomatous and tuberous, perennial, herb and climber, 1-5 m high. Fl. white, Aug to Sep. Sand, loam, clay, granite.	 <p data-bbox="1124 858 1384 887"><i>Asparagus asparagoides</i></p> <p data-bbox="1599 863 1827 887">Photos: J.P. Pigott &amp; R. Randall</p>	<p data-bbox="1861 362 2056 448">One plant was within the Study Area</p> <p data-bbox="1861 459 1989 483">E 391780</p> <p data-bbox="1861 494 1995 518">N 6439911</p> <p data-bbox="1861 568 2069 687">One plant was approximately 20 m outside of the Study Area</p> <p data-bbox="1861 699 1989 722">E 391799</p> <p data-bbox="1861 734 1995 758">N 6439920</p>

## 3.9 Fauna

### 3.9.1 Fauna habitat

Two broad fauna habitat types have been identified in the Study Area based on the predominant landforms, soil and vegetation structure in the area. These habitat types closely correspond to the vegetation types outlined above:

- *Banksia* woodland
- *Melaleuca* dampland

#### ***Banksia* woodland**

The *Banksia* woodland habitat type is relatively intact and is dominated by *Banksia* species (*Banksia attenuata* and *Banksia menziesii*) and Sheoak (*Allocasuarina fraseriana*). The overstorey consists of scattered Jarrah trees and *Banksia* and *Allocasuarina* shrubs, tall *Kunzea* and *Xanthorrhoea* shrubs, and a relatively sparse understorey of low shrubs, sedges and herbs. This habitat type was generally in *Good* condition, however, in some areas there was evidence of disturbance from previous clearing, dumped rubbish and weed encroachment. In areas where there is less evidence of disturbance, the understorey vegetation is relatively dense, with leaf litter up to 5 cm.

This woodland habitat type would be expected to support a high diversity of bird species and would provide feeding and potential breeding habitat for the conservation significant Black Cockatoo species. The presence of Jarrah, *Banksia* sp. as well as other proteaceous species provides suitable foraging habitat for Black Cockatoo species (approximately 9.3 ha), and some of the larger Jarrah trees provide potential breeding habitat (Figure 5, Appendix E).

Across this woodland there are also areas of loose sands that are particularly suitable for burrowing reptiles such as the Priority 3 listed fossorial Black-striped Burrowing Snake (*Neelaps calonotos*) and the Priority 3 listed Perth Lined Skink (*Lerista lineata*). Where the understorey is densely vegetated, this would provide foraging opportunities and refuge areas for ground-dwelling mammals such as the Echidna and Southern Brown Bandicoot (Priority 5) and reptiles such as goannas and skinks. Micro-habitat features such as tree hollows and cavities also provide habitat for a number of birds, reptiles and small mammal species.

#### ***Melaleuca* dampland**

The *Melaleuca* dampland habitat type is highly degraded, with a large proportion that has previously been cleared and has been invaded by weeds species. This habitat consists of scattered *Melaleuca raphiophylla* and denser areas of *Kunzea glabrescens* and *Astarea scoparia*. The understorey is dominated by introduced weed species. This habitat type covers only a small portion of the Study Area (north-eastern corner, Figure 5, Appendix E) and provides foraging habitat for small birds and may potentially provide refuge areas for ground-dwelling mammals such as the Southern Brown Bandicoot (Priority 5) and reptiles such as snakes and skinks. Overall the value of this habitat type is limited due to its small size.

### 3.9.2 Fauna habitat connectivity

Habitat linkages are important to allow animals to move between areas of resource availability. They are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction. Fragmentation of habitat limits the resources available to species, particularly sedentary species, which means they may be more vulnerable to natural disasters or habitat changes over time. Fragmentation of habitat can also lead to edge effects, leading to degradation of the habitat. Where the distance between habitat fragments is small,



species may still be able to move between these habitat areas, but may be more exposed to predation pressures in the cleared areas.

The area surrounding the Study Area has been highly fragmented with native vegetation remnants surrounded by a mosaic of other land uses, including roads, industry, parklands and urban development and infrastructure (Figure 1, Appendix A). Locally, the Study Area is connected to remnant vegetation occurring within a larger block, approximately 47 ha in size, of semi-rural residential properties. This block is bound by Barfield Road, Rowley Road, Frankland Avenue, Hammond Park Catholic Primary School and Atkins Parade. The Study area also has limited connectivity a Conservation category wetland (UFI 14104) located approximately 450 m north-west of the Study Area. These areas provide habitat corridors for fauna movement within the local area.

Regionally, the Study Area has some connectivity to larger areas of remnant vegetation, which would provide valuable corridors for movement of fauna (Figure 1, Appendix A). The Study Area has limited connectivity to the west to the DPaW managed Harry Waring Marsupial Reserve (Class A, R 29241), which is part of Bush Forever Site 392 (271.6 ha). This reserve is connected to adjacent bushland to the north (Site 391, across the road), south (Site 393), east and west, and forms part of a regionally significant contiguous bushland/wetland linkage (Government of Western Australia 2000). The Study Area also has some connectivity, albeit fragmented, to Bush Forever Site 268 (Mandogallup Road Bushland, 95.9 ha).

The remnant vegetation remaining within the Study Area and surrounds provide shelter, food resources and habitat corridors to allow movement of fauna between these sites, particularly to the larger areas of contiguous vegetation and associated wetlands. Evidence of fauna movement was recorded in Western Grey Kangaroos where droppings were recorded over both sites, but no animals were recorded. This suggests the species is persisting locally and moving through the area in search of food.

### 3.9.3 Fauna diversity

A NatureMap search (DPaW, 2007–) identified 194 fauna species as previously recorded within 5 km of the Study Area, of which 186 species are native and eight are pest (introduced) or naturalised species (Appendix E). These results consisted of 123 birds, 16 mammals, 31 reptiles, seven amphibians, and 17 invertebrate species.

During the field surveys, a total of 26 fauna species, consisting of 22 birds and four mammals were recorded within the Study Area. Of these, three were introduced (feral) mammal species. The list of fauna species recorded during the survey is provided in Appendix E.

### 3.9.4 Conservation significant fauna

Searches of the EPBC Act PMST (DotE, 2013a) and Western Australian Museum/DPaW NatureMap records (DPaW, 2007–) identified the presence or potential presence of 27 conservation significant species:

In addition to these, the desktop searches identified a number of marine and/or wetland bird species. These species have been excluded from this assessment as no marine or wetland habitat is present within the Study Area or will be impacted as a result of the proposed Project. The list of conservation significant fauna species identified in the desktop review is provided in Appendix E.

During the field survey, one conservation significant fauna species was recorded, the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*). Two birds were seen flying over the Study Area during the survey. Carnaby's Black Cockatoo habitat is discussed further below.

While only Carnaby's Black Cockatoo was observed during the field survey, there is also foraging habitat for the Forest Red-tailed Black Cockatoo within the Study Area. Baudin's Black Cockatoo is also known to occur on the southern Swan Coastal Plain, and may opportunistically use the habitat within the Study Area for foraging. Potential breeding habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo is also present, as the Study Area is located within the breeding range of both of these species (DSEWPaC 2012). This habitat includes 13 potential breeding trees and 9.3 ha of high quality *Banksia* woodland foraging habitat (Figure 5). Of the 13 trees identified as potential breeding trees one was just on the boundary of the Study Area and another was just out of the Study Area. It was decided to include these trees within the potential breeding tree tally for several reasons, GPS devices can be inaccurate ( $\pm 5$  m), branches from these trees may overhang into the Study Area and construction within the Study Area may damage these trees. Details of the significant habitat/potential breeding trees are provided in Appendix E and Black Cockatoo habitat types are detailed in Table 12.

Table 12 Black Cockatoo habitat recorded in the Study Area

Habitat type	Presence
Actual breeding	No breeding events were recorded for Black Cockatoos.
Potential breeding (trees with hollows currently suitable for breeding)	One dead stag currently able to support Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo breeding was recorded. This stag contained at least two hollows suitable for Black Cockatoo breeding.
Tree diameter at breast height (DBH) greater than 500 mm	13 trees were recorded with a DBH >500 mm and potentially may be used by Carnaby's and Forest Red-tailed Black Cockatoos for breeding in the future.
Foraging	9.3 ha of suitable <i>Banksia</i> woodland foraging habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo. May be opportunistically used by Baudin's Black Cockatoo.
Roosting	No roosting sites used by Black Cockatoos were recorded. The closest known roosting sites are approximately 5 kms north of the Study Area (Department of Planning Western Australia 2011)

### Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

The Carnaby's Black Cockatoo is listed as Endangered under the EPBC Act and Threatened (Schedule 1) under the WC Act. It is distributed across the south-west of Western Australia in uncleared or remnant areas of *Eucalyptus* woodland and shrubland of kwongan heath.

The Study Area provides suitable foraging habitat for the Carnaby's Black Cockatoo (as shown in Figure 5). The 9.3 ha *Banksia* woodland contains foraging habitat for the species, which provide suitable foraging species including Jarrah (*Eucalyptus marginata*), *Banksia attenuata*, *B. menziesii*, *B. grandis*, and *B. ilicifolia*. No evidence of Black Cockatoo foraging was recorded during the field survey. The Study Area is located in proximity to the known breeding range for the Carnaby's Black Cockatoo (DSEWPaC 2012) and as habitat has been lost in traditional breeding areas all three species of Cockatoos have begun breeding at new locations outside of the area previously considered to be the breeding range (DSEWPaC, 2012).

The species nests in hollows in live or dead trees of Jarrah, Marri (*Corymbia calophylla*), Salmon Gum (*E. salmonophloia*), Wandoo (*E. wandoo*), Tuart (*E. gomphocephala*), Flooded Gum (*E. rudis*), York gum (*E. loxophleba* subsp. *loxophleba*), Powderbark (*E. accedens*, and Karri (*E. diversicolor*). A total of 13 potential breeding trees with a (DBH) greater than 500 mm were recorded in the Study Area (Appendix E). One of these trees was a dead stag with hollows

currently able to support nesting; however no actual breeding was recorded during the field survey. The closest known breeding site to the Study Area, as mapped by the Department of Planning (2011), is located approximately 27 km north of the Study Area.

No suitable roosting habitat or evidence of roosting was identified within the Study Area during the field survey. Suitable roosting habitat is identified based on the presence of suitable tall trees, stem clippings (with leaves), excessive droppings, branch chewing, feathers, proximity to known roosting sites (Department of Planning, 2011) and presence of suitable foraging habitat. The closest known roosting site, as mapped by the Department of Planning (2011), is located approximately 5 km north of the Study Area.

### Likelihood of occurrence assessment

In addition to the fauna species recorded during the field survey, a number of conservation significant fauna species were identified as potentially occurring within the Study Area during the desktop investigation. An assessment on the likelihood of these species occurring in the Study Area was undertaken. This assessment is based on species biology, habitat requirements, the quality and availability of suitable habitat and records of the species in the area. The assessment is provided in Appendix E.

The assessment concluded that one species is known to occur, five species are likely to occur, four species may potentially occur, and 17 species are considered unlikely to occur within the Study Area. The species determined as present, likely to occur or could possibly occur within the Study Area are listed in Table 13.

Table 13 Conservation significant species determined as present, likely to occur within the Study Area.

Taxa	Common name	Status		Likelihood of Occurrence
		State (WC Act/ DPaW listing)	Federal (EPBC Act listing)	
<b>Birds</b>				
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	Threatened	Vulnerable	Likely
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	Threatened	Vulnerable	Possible
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	Threatened	Endangered	Known
<i>Merops ornatus</i>	Rainbow Bee-eater	Schedule 3	Migratory	Likely
<i>Falco peregrinus</i>	Peregrine Falcon	Schedule 4		Possible
<b>Mammals</b>				
<i>Isoodon obesulus fusciventer</i>	Quenda / Southern Brown Bandicoot	Priority 5		Likely
<b>Reptiles</b>				
<i>Neelaps calonotos</i>	Black-striped Snake	Priority 3		Likely
<i>Lerista lineata</i>	Perth Lined Skink	Priority 3		Likely
<b>Invertebrates</b>				
<i>Synemon gratiosa</i>	Graceful Sun Moth	Priority 4		Possible
<i>Throscodectes xiphos</i>	Cricket	Priority 1		Possible

### 3.1 Acid Sulphate Soils (ASS)

The ASS Swan Coastal Plain indicates that the Study Area has a Moderate to Low risk of ASS. The ASRIS database indicates that the Study Area is classified as 'Low Probability of Occurrence' with a high degree of confidence (ASRIS 2014).

## 4. Environmental approvals

### 4.1 Commonwealth

Referral to DotE (formerly DSEWPaC) under the EPBC Act is triggered if a proposed action has/or potentially has a significant impact on Matter of National Environmental Significance (MNES).

MNES are factors that require legislated protection in order to conserve biodiversity, protect world and national heritage places, and comply with international treaties. An assessment of the Project against MNES is provided in Table 14.

Table 14 Assessment of the Project against Matters of National Environmental Significance

Matters of National Environmental Significance (MNES)	Present	Impact
World Heritage Places	No	None
National Heritage Places	No	None
Wetlands of International Significance	No	None
Threatened Species and Ecological Communities	Yes	Removal of suitable foraging habitat and potential breeding habitat for Black Cockatoo species.
Migratory Species	May be present	No significant impacts
Commonwealth Marine Areas	No	None
Great Barrier Reef Marine Park	No	None
Nuclear Actions	No	None
A Water Resource (in relation to coal seam gas development and large coal mining development)	No	None

The Study Area is located within the modelled distribution for the Carnaby's Black Cockatoo and the Forest Red-tailed Black Cockatoo and outside the modelled distribution of the Baudin's Black Cockatoo (DSEWPaC, 2012). It should be noted, however, that there have been recent records of Baudin's Black Cockatoo on the southern Swan Coastal Plain. During the fauna survey, two Carnaby's Black Cockatoos were observed flying over the Study Area, however, no evidence of use by Black Cockatoos was recorded within the Study Area. The potential impacts on Black Cockatoo species are discussed in further detail in Section 4.1.1.

#### 4.1.1 Risk referral table for threatened Black Cockatoos

In October 2012, DSEWPaC (now DotE) released the referral guidelines for the assessment of projects for potential impacts on Black Cockatoos (DSEWPaC, 2012). These guidelines are for all Black Cockatoo species, and do not provide information relative to particular areas of the State, but provide information to decide whether a project may trigger referral.

Within these guidelines, DSEWPaC provided a risk table that gives guidance on what it views as risks/impacts to Black Cockatoos that will trigger referral. Risk is broken into three categories, high, uncertain and low, and primarily focuses on breeding, feeding and roosting areas as well as indirect impacts. If there is uncertainty in regards to risks on Black Cockatoos then DSEWPaC recommended referring the project or contacting the Department to ensure legal certainty.

The risk referral table is shown in Table 15 with an assessment of the Project against each of the potential risks. As detailed in Table 15, based on the potential impact of the Project on Black Cockatoos, clearing for the Project may trigger referral to DotE due to the presence of potential breeding habitat and approximately 9.3 ha of quality foraging habitat. Therefore, it is recommended that the Department of Treasury refer the Project to the DotE.

Table 15 Department of the Environment risk referral table for Black Cockatoos

Risk type	Referral trigger
<b>High risk of significant impacts: referral to DotE recommended</b>	
Clearing of any known nesting tree.	Referral is not triggered. No currently known nesting trees occur within the Study Area.
Clearing of any part or degradation of breeding habitat in a woodland or forest within a species' known breeding range.	Referral is triggered. Potential breeding habitat was identified within the <i>Banksia</i> woodland habitat within Study Area which is within proximity of the known breeding range of the Carnaby's Black Cockatoo
Clearing of more than 1 ha of quality foraging habitat.	Referral is triggered. There is approximately 9.3 ha of high quality foraging habitat present within the Study Area ( <i>Banksia</i> woodland).
Creating a gap or greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting).	Referral is not triggered. The Study Area is connected to larger areas of remnant native vegetation which contain suitable Black Cockatoo habitat. Clearing of the foraging and potential breeding habitat will not create a gap greater than 4 km between patches of habitat in the surrounding area.
Clearing or degradation (including pruning of top canopy) of a known roosting site.	Referral is not triggered, no known roosting sites have been recorded within the Study Area.
<b>Uncertainty: referral recommended or contact the DotE</b>	
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.	Referral is unlikely to be triggered. Clearing of approximately 9.3 ha of quality foraging habitat within the Study Area is unlikely to significantly degrade the surrounding foraging habitat through altered hydrology.
Clearing or disturbance in areas surrounding Black Cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effect, hydrological changes, increase human visitation or fire.	Referral is not triggered. Portions of the Study Area and surrounding area are already highly modified due to various external impacts (such as introduced species, edge effects, clearing, human visitation, etc.). There are however areas of habitat within the Study Area, connected to habitat outside the Study Area which are considered to be in <i>Excellent</i> condition and may be impacted on by the Project.
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	Referral is unlikely to be triggered. The clearing of the single suitable nesting hollow would reduce the amount of available nesting habitat in area, however, this is unlikely to significantly increase competition for remaining hollows in the area.

Risk type	Referral trigger
Actions with the potential to introduce known plant diseases such as <i>Phytophthora</i> spp.	Referral is unlikely to be triggered. <i>Phytophthora</i> is known to occur widely in the region and may already be present at the site. Portions of the Study Area are already degraded. Management measures should be implemented to reduce the risk of introduction and spread of <i>Phytophthora</i> .
Low risk of significant impacts: referral may not be required but may refer to DotE for legal certainty	
Actions that do not affect Black Cockatoo habitat or individuals.	Not applicable
Actions whose impacts occur outside the modelled distribution of the three Black Cockatoos.	Not applicable

## 4.2 State

### 4.2.1 Environmental Protection Authority

Significant proposals (e.g. subdivision and development applications) must be referred to the EPA under Section 38 of the EP Act.

In deciding whether a proposal will be subject to the formal environmental impact assessment process, the EPA takes into account the environmental significance of any potential impacts that may result from the implementation of the scheme or proposal.

The EPA considers that environmental significance is a function of:

- The extent and consequence of impacts on biophysical aspects.
- The environmental values of the areas affected.
- The extent of emissions and their potential to unreasonably interfere with the health, welfare, convenience, comfort or amenity of people.
- The extent and rigour to which potential impacts have been investigated and described in the referral, and the confidence in the reliability of predicted impacts.
- The extent to which the proposal implements the principles of sustainability.
- The ability of decision-making authorities to place conditions on the proposals to ensure required environmental outcomes are achieved.
- The likely level of public interest and the extent to which the proponent has consulted with interested and affected people and responded to issues raised.

It is not anticipated that this Project will require referral to the EPA.

### 4.2.2 Department of Environment Regulation

Any clearing of native vegetation is regulated by the Department of Environment Regulation (DER) and requires a permit under Part V of the EP Act, except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, and not in an ESA.

### Assessment against the Ten Clearing Principles

An assessment of the Study Area against the “10 clearing principles” was undertaken to determine whether the Project is likely to be at variance to the Principles (Table 16). These

Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

The assessment against the Ten Clearing Principles determined that the Project is:

- Likely to be at variance with Clearing Principle (b)
- May be at variance with Principle (a) and (f)

Any removal of native vegetation within the Study area will require a State Native Vegetation Clearing Permit.



Table 16 Assessment against the Ten Clearing Principles

Principle	Assessment	Outcome	Data sources
<p>(a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.</p>	<p>The Study Area is located within the Swan Coastal Plain bioregion and the Perth sub-region as described by the Interim Biogeographic Regionalisation of Australia (IBRA). The flora of the Perth sub-region is diverse, with 3,332 recorded native vascular species (DPaW 2007–).</p> <p>Desktop assessments identified a total of 360 native flora taxa within 5 km of the Study Area (DPaW, 2007–). A field survey of the Study Area recorded a total of 94 native flora species. The Study Area is considered to have low to moderate level of flora biodiversity.</p> <p>Desktop assessments identified the presence/potential presence of 16 conservation significant flora species within 5 km of the Study Area. A likelihood of occurrence assessment (based on the range, habitat requirements and previous records of the species) identified that three conservation significant flora species likely to occur or may potentially occur within the Study Area. These included:</p> <ul style="list-style-type: none"> <li>• <i>Caladenia huegelii</i> (Endangered, Threatened)</li> <li>• <i>Eremaea asterocarpa</i> subsp. <i>brachyclada</i> (Priority 1)</li> <li>• <i>Jacksonia gracillima</i> (Priority 3)</li> </ul> <p>No EPBC Act, WC Act or Priority listed flora species were recorded within the Study area during the field survey.</p> <p>Broad-scale vegetation mapping of the Perth area undertaken by Beard (1979) identified the following vegetation association within the Study Area:</p> <ul style="list-style-type: none"> <li>• Medium very sparse woodland; jarrah, with low woodland; banksia &amp; casuarina (association 1001, Bassendean)</li> </ul> <p>Heddle et al. (1980) mapping indicates that one vegetation complex is present within the Study area:</p> <ul style="list-style-type: none"> <li>• Bassendean complex – Central and south: Vegetation ranges from woodland of <i>E. marginata</i> – <i>C. fraseriana</i> – <i>Banksia</i> spp. to low woodland of <i>Melaleuca</i> species, and sedgelands on the moister sites. This area includes the transition of <i>E. marginata</i> to <i>E. todtiana</i> in the vicinity of Perth. <p>Beard (1979) vegetation association 1001 and Heddle et al. (1980) Bassendean complex – Central and south are both below the threshold level at all levels (state,</p> </li></ul>	<p>Proposal may be at variance with this Principle.</p>	<p>Beard (1979) EPA (2006a) DPaW (2007–) DotE (2013a) GHD field survey Heddle et al. (1980)</p>

Principle	Assessment	Outcome	Data sources
	<p>IBRA bioregion and IBRA sub-region), except LGA (i.e. less than 30 % of their pre-European extents remaining). However, as the Study Area is located within an area of urban development on the Swan Coastal Plain, and as there is greater than 10 percent remaining of vegetation association 1001 and vegetation complex Bassendean complex – Central and south, they are not considered to be a critical asset (EPA, 2006a).</p> <p>The Study Area comprises largely remnant vegetation and consists of three vegetation types including:</p> <ul style="list-style-type: none"> <li>• VT1; Low Open Forest of <i>Banksia</i> ssp. and <i>Allocasuarina fraseriana</i></li> <li>• VT2; Low Woodland of <i>Banksia</i> ssp. over Open Low Heath of <i>Scholtzia involucreta</i></li> <li>• VT3; Low Open Woodland of <i>Melaleuca raphiophylla</i></li> </ul> <p>The vegetation condition of the Study Area ranged from <i>Excellent</i> (2) to <i>Degraded</i> (5), with 24.5 % rated as <i>Excellent</i> (2), 21.2 % rated as <i>Excellent</i> (2) – <i>Very Good</i> (3), 30.8 % rated as <i>Good</i> (4), 20.9 % rated as <i>Degraded</i> (5) and 2.6 % rated as <i>Completely Degraded</i> (6). Disturbances in the Study Area include grazing, weed incursion and dumping of rubbish.</p> <p>Three PECs were identified in the desktop searches occurring within 5 km of the Study Area. The three vegetation types identified within the Study Area are considered unlikely to align with any of these PECs. A new Priority 3 PEC was added to the PEC list by DPaW after the completion of this field survey and initial report, namely Banksia dominated woodlands of the Swan Coastal Plain IBRA region. It is likely that VT1: (7.49 ha, and additional 0.87 ha inferred) and VT2 (0.94 ha) represent this PEC.</p> <p>No reserves, conservation areas or other DPaW-managed estates are located within the Study Area. There are five state and territory reserves occurring within 5 km of the Study Area and four Bush Forever sites within 2 km of the Study Area.</p> <p>Desktop assessments identified a total of 194 native fauna species within 5 km of the Study area (DPaW, 2007–). A field survey of the Study Area recorded a total of 23 native fauna species. Desktop assessments identified the presence/potential presence of 27 conservation significant fauna species within 5 km of the Study area. A likelihood of occurrence assessment (based on the range, habitat requirements and previous records of the species) identified five conservation significant fauna</p>		

Principle	Assessment	Outcome	Data sources
	<p>species likely to occur within the Study Area.</p> <p>One conservation significant fauna species, Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>), was recorded during the field survey.</p> <p>Two broad fauna habitat types were described within the Study Area, including <i>Banksia</i> woodland and <i>Melaleuca</i> dampland. These habitats would provide a variety of habitat resources for fauna species, and given the local and regional connectivity to other larger areas of remnant bushland, the Study Area is likely to provide a habitat linkage for fauna.</p>		
<p>(b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.</p>	<p>Desktop assessments identified the presence/potential presence of 27 conservation significant fauna species within 5 km of the Study area. A likelihood of occurrence assessment (based on the range, habitat requirements and previous records of the species) identified five conservation significant fauna species likely to occur within the Study Area. These include:</p> <ul style="list-style-type: none"> <li>• <i>Calyptorhynchus banksii naso</i> (Forest Red-tailed Black Cockatoo): State Threatened, Federal Vulnerable</li> <li>• <i>Merops ornatus</i> (Rainbow Bee-eater): State Schedule 3, Federal Migratory</li> <li>• <i>Isodon obesulus fusciventer</i> (Quenda/ Southern Brown Bandicoot): State Priority 5</li> <li>• <i>Neelaps calonotos</i> (Black-striped Snake): Priority 3</li> <li>• <i>Lerista lineata</i> (Perth Lined Skink): Priority 3</li> </ul> <p>One conservation significant fauna species, Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>), was recorded during the field survey.</p> <p>The Study Area is within proximity of the known breeding range of the Carnaby's Black Cockatoo and the modelled distribution of the Forest Red-tailed Black Cockatoo. One potential breeding tree (dead stag with at least two hollows suitable for Black Cockatoo breeding) and 13 trees with DBH greater than 500 mm were recorded within the Study Area. Furthermore, 9.3 ha of high quality foraging habitat (<i>Banksia</i> Woodland) was also recorded within the Study Area.</p> <p>Locally, the Study Area is connected to remnant vegetation occurring within a larger block of semi-rural residential properties. Regionally, the Study Area retains some linkages to conservation reserves and Bush Forever sites, which form part of a regionally significant contiguous bushland/wetland linkage. The remnant vegetation within the Study Area would provide corridors for fauna movement, in particular for</p>	<p>Proposal is likely to be at variance with this Principle.</p>	<p>DPaW (2007–) DotE (2013a) GHD field survey Government of Western Australia (2000)</p>

Principle	Assessment	Outcome	Data sources
	the Quenda, as well as a considerable area of foraging habitat for Black Cockatoos.		
(c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	<p>Desktop assessments identified the presence/potential presence of nine EPBC Act and/or WC Act-listed within 5 km of the Study area. These taxa included:</p> <ul style="list-style-type: none"> <li>• <i>Andersonia gracilis</i> (Endangered, Threatened)</li> <li>• <i>Caladenia huegelii</i> (Endangered, Threatened)</li> <li>• <i>Centrolepis caespitosa</i> (Endangered, Priority 4)</li> <li>• <i>Darwinia foetida</i> (Critically Endangered, Threatened)</li> <li>• <i>Diuris micrantha</i> (Vulnerable, Threatened)</li> <li>• <i>Diuris purdiei</i> (Endangered, Threatened)</li> <li>• <i>Drakaea elastica</i> (Endangered, Threatened)</li> <li>• <i>Drakaea micrantha</i> (Vulnerable, Threatened)</li> <li>• <i>Lepidosperma rostratum</i> (Endangered, Threatened)</li> </ul> <p>A likelihood of occurrence assessment (based on the range, habitat requirements and previous records of the species) identified that one species, <i>Caladenia huegelii</i>, may possibly occur within the Study Area. The survey timing was considered optimal to record <i>Caladenia huegelii</i> and the Study area was well traversed to determine the presence of this species.</p> <p>No Threatened flora was recorded within the Study area during the field survey.</p>	Proposal not likely to be at variance with this Principle.	DPaW (2007–) DotE (2013a) GHD field survey
(d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	<p>Desktop searches did not identify any TECs within 5 km of the Study Area.</p> <p>No EPBC Act or State listed TECs were identified within the Study Area during the field survey.</p>	Proposal not likely to be at variance with this Principle.	DPaW TEC/PEC databases DotE (2013a) GHD field survey
(e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been	<p>The Project footprint is located within the Swan Coastal Plain IBRA bioregion. This IBRA bioregion has approximately 39 % of its pre-European extent remaining (GoWA 2013).</p> <p>The extent remaining of Beard (1979) vegetation association 1001 and Heddle et al. (1980) vegetation complex Bassendean complex – Central and south is less than 30 % at the State, IBRA Bioregion and IBRA Sub-region level. This is below the</p>	Proposal not likely to be at variance with this Principle.	Beard (1979) EPA (2006a) Heddle et al. (1980) Government of Western Australia

Principle	Assessment	Outcome	Data sources
extensively cleared.	<p>threshold level (of 30%) at which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia 2001). At the LGA level, both Beard (1979) vegetation association 1001 and Heddle et al. (1980) vegetation complex Bassendean complex – Central and south have greater than 30 % of their pre-European extents remaining. The Study Area is located within an area of urban development on the Swan Coastal Plain. As there is greater than 10 % of the vegetation association 1001 and vegetation complex Bassendean complex – Central and south remaining, they are not considered to be critical assets.</p> <p>Locally, the Study Area is connected to remnant vegetation occurring within a larger block of semi-rural residential properties. Regionally, the Study Area retains some linkages to conservation reserves and Bush Forever sites, which form part of a regionally significant contiguous bushland/wetland linkage. However, the Study Area does not provide any significant linkages to surrounding remnant vegetation or is considered a significant remnant.</p>		(2012)
(f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	<p>Desktop searches identified 23 geomorphic wetlands within 2 km of the Study Area and 36 EPP Lakes within 5 km of the Study Area. No wetlands, lakes or drainage channels were recorded within the Study Area during the field survey. However the Study Area contained vegetation associated with damp conditions including <i>Melaleuca raphiophylla</i>, <i>Kunzea glabrescens</i> and <i>Hypocalymma angustifolium</i>. These species were recorded in VT3 which occurs in the eastern part of the Study Area (0.92 ha). This vegetation type was highly degraded due to extensive clearing and weed invasion.</p> <p>Vegetation that grows in or in association with a dampland occurs within the Study area.</p>	Proposal may be at variance with this Principle.	DPaW (2007–) GHD field survey Government of Western Australia (2012)
(g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>The groundwater salinity in Study Area is relatively fresh, ranging from typically 500 to 1000 mg/L TDS. The Natural Resource Management Shared Land Information Platform (SLIP) has mapped the salinity risk as '30-50% high to extreme hazard of salinity risk' (GoWA 2014). Native vegetation clearing in the Study Area is unlikely to increase salinity in the Study Area and surrounding areas, especially as the vegetation mainly comprises <i>Banksia</i> woodland and not deep-rooted trees.</p> <p>The Natural Resource Management SLIP has mapped the waterlogging risk as '3-10% moderate to very high hazard' and flooding risk as '0-2% Moderate to high hazard' (GoWA 2014). It is unlikely that clearing of native vegetation in the project area will increase waterlogging and flooding within and surrounding the project area.</p>	Proposal is not likely to be at variance with this Principle.	GHD field survey Government of Western Australia (2014) ASRIS (2014)

Principle	Assessment	Outcome	Data sources
	<p>The risk of water erosion was mapped as ‘3-10% and 10-30% high to extreme hazard’ for the majority of project area.</p> <p>The Study Area occurs on the Bassendean Dune System and the following soil sub-units or phases of the Bassendean system occur within the Study Area:</p> <ul style="list-style-type: none"> <li>• 212Bs_B1 – Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m.</li> <li>• 212Bs_B2 – Flat to very gently undulating sandplain with well to moderately well-drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.</li> </ul> <p>The sands within the Study Area are relatively porous and well drained, therefore there is little overland surface water flow, which minimises the risk of water erosion.</p> <p>The Natural Resource Management SLIP has mapped wind erosion risk as ‘&gt;70% high to extreme hazard’ for the Study Area (GoWA 2014). The high sand content of the soils and ease with which these materials can be transported by the wind means there is a high risk of wind erosion in this area.</p> <p>The ASS Swan Coastal Plain indicates that the Study Area has a Moderate to Low risk of ASS and the ASRIS database indicates that the Study Area is classified as ‘Low Probability of Occurrence’ with a high degree of confidence (ASRIS 2014).</p> <p>The Study Area is largely adjacent to existing cleared areas. This indicates that the Study Area exists within land which is capable of withstanding the intended use and is not considered likely to increase ground water recharge, surface water runoff, soil erosion or nutrient export.</p> <p>Given the small size of vegetation clearing (10.22 ha) required for the project, the project is unlikely to cause significant land degradation.</p>		
(h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values	<p>There are no DPaW-managed estates or reserves within the Study Area, however, there are a number of reserves and conservation areas within the vicinity of the Study Area (Government of Western Australia, 2014). These include:</p> <ul style="list-style-type: none"> <li>• Harry Waring Marsupial Reserve (Bush Forever Site No. 392) (0.74 km west of the Study Area)</li> </ul>	Proposal is not likely to be at variance with this Principle.	Bush Forever (GoWA 2000) DotE (2013a) DPaW database (DPaW managed)

Principle	Assessment	Outcome	Data sources
<p>of any adjacent or nearby conservation area.</p>	<ul style="list-style-type: none"> <li>• Thomsons Lake Nature Reserve (Bush Forever Site No. 391) (1.38 km north-west of the Study Area)</li> <li>• Unamed Conservation Park (1.9 km north-west of the Study Area)</li> <li>• Wandi Nature Reserve (3.0 km south-east of the Study Area)</li> <li>• Unamed Conservation Park (3.0 km north-west of the Study Area)</li> </ul> <p>Additionally a further two bush Forever sites occur within 2 km of the Study Area:</p> <ul style="list-style-type: none"> <li>• Bush Forever Site No. 268 (Mandogalup Road Bushland) (1.75 km south-west of the Study Area)</li> <li>• Bush Forever Site No. 492 (Lyon Road Bushland) (1.3 km north-east of the Study Area)</li> </ul> <p>Furthermore, there are 23 geomorphic wetlands within 2 km of the Study Area, and 36 EPP lakes, and two Wetlands of International Importance within 5 km of the Study Area.</p> <p>Locally, the Study Area is connected to remnant vegetation occurring within a larger block of semi-rural residential properties. Regionally, the Study Area retains some linkages to conservation reserves and Bush Forever sites, which form part of a regionally significant contiguous bushland/wetland linkage. These linkages provide corridors for fauna movement. However, the Study Area does not provide any significant linkages to surrounding remnant vegetation or is considered a significant remnant.</p> <p>Any clearing of the Study Area is not considered to significantly impact or further fragment these conservation area or result in a significant loss of connectivity function between local and region linkages. However, clearing of the Study Area will result in a direct loss of native vegetation (albeit small) in a highly fragmented landscape.</p>		<p>lands and waters)</p> <p>GHD field survey</p> <p>Government of Western Australia, 2012</p>
<p>(i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.</p>	<p>No rivers or surface water bodies listed under the RIWI Act were identified within the Study Area (DoW 2014a). There are no drainage lines or lakes in the Study Area (DoW 2014a). It is unlikely that the proposed works will disturb or interrupt any natural drainage and surface run-off patterns due to the deep sandy soils present in the area.</p> <p>A search of the DoW Perth Groundwater Atlas and DAFWA WetlandBase indicates that there are no wetlands in the Study Area (DAFWA 2014). The nearest wetland is located approximately 450 m north-west of the Study Area (Unnamed Dampland). It is unlikely that the proposed works will impact any wetlands in the vicinity of the</p>	<p>Proposal is not likely to be at variance with this Principle.</p>	<p>GHD field survey</p> <p>Government of Western Australia, 2012</p>

Principle	Assessment	Outcome	Data sources
	<p>project area.</p> <p>There are no EPP Lakes protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 within the Study Area. There are however 36 EPP Lakes located within 5 km to the Study Area. The nearest EPP lake is located approximately 1.6 km north-west of the Study Area (Unnamed Lake) and therefore no direct impacts are expected to occur to any EPP lakes as a result of the proposed project.</p> <p>The ASS Swan Coastal Plain indicates that the Study Area has a Moderate to Low risk of ASS and the ASRIS database indicates that the Study Area is classified as 'Low Probability of Occurrence' with a high degree of confidence (ASRIS 2014). Native vegetation clearing in the Study Area is unlikely to result in ASS. There are also no known contaminated sites are present within or immediately adjacent to the Study Area.</p> <p>The NRM SLIP has mapped the salinity risk as '30-50% high to extreme hazard of salinity risk' (GoWA 2014). Native vegetation clearing in the Study Area is unlikely to increase salinity in the Study Area and surrounding areas, especially as the vegetation mainly comprises <i>Banksia</i> woodland and not deep-rooted trees.</p> <p>The project is not likely to be at variance to this principle as clearing of the 10.22 ha of vegetation is unlikely to cause deterioration in the quality of surface or underground water.</p>		
(j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	<p>The Study Area is within a generally low lying area, as shown by the number of wetlands and EPP lakes in the broader area. However, the Study Area comprises largely upland vegetation on sandy porous soils.</p> <p>The Natural Resource Management SLIP has mapped the waterlogging risk for the Study Area as '3-10% moderate to very high hazard' and flooding risk as '0-2% Moderate to high hazard' (GoWA 2014).</p> <p>It is unlikely that the removal of vegetation (10.22 ha) proposed for this project would cause or exacerbate the incidence or intensity of flooding in the local or regional area.</p>	Proposal is not likely to be at variance with this Principle.	GHD field survey Natural Resource Management SLIP (GoWA 2014)



# 5. Conclusions and recommendations

## 5.1 Conclusions

### 5.1.1 Flora and vegetation

The assessment identified the following key vegetation and flora constraints:

- Three vegetation types were identified within the Study Area. It is likely that VT1 (7.49 ha and additional 0.87 ha inferred) and VT2 (0.94 ha) align with Priority 3 PEC: *Banksia dominated woodlands of the Swan Coastal Plain IBRA region*. This PEC was added to the PEC list by DPaW after the completion of this field survey.
- A likelihood of occurrence assessment determined that three conservation significant species are likely to or may possibly occur within the Study Area:
  - *Caladenia huegelii*, State Threatened, Federal Endangered;
  - *Eremaea asterocarpa* subsp. *brachyclada*, State Priority 1
  - *Jacksonia gracillima*, State Priority 3

Whilst targeted searching for *Caladenia huegelii* and other conservation significant species was not undertaken during the field survey, the survey timing was considered optimal and the Study Area was well traversed. No conservation significant flora species were recorded during the survey.

- One individual of *\*Asparagus asparagoides* (Bridal Creeper), which is listed as a Declared Pest under the BAM Act and as a WoNS was identified within the Study Area during the field survey.

### 5.1.2 Fauna

The assessment identified the following key fauna constraints:

- Habitat for two species of threatened Black Cockatoo including
  - A total of 9.3 ha of Black Cockatoo foraging habitat within the Study Area.
  - Potential breeding habitat (13 trees) within the Study Area, which is within proximity of the known breeding range of the Carnaby's Black Cockatoo and the modelled distribution of the Forest Red-tailed Black Cockatoo.
- During the survey, one conservation significant fauna species was recorded, Carnaby's Black Cockatoo. Two individuals were observed flying over the Study Area.
- A likelihood of occurrence assessment determined that 10 conservation significant species are known, likely to or may possibly occur within the Study Area:

### 5.1.3 Environmental Approvals

Based on the potential impact of the Project on Black Cockatoos, clearing for the Project may trigger referral to DotE due to the presence of potential breeding habitat and 9.3 ha of quality foraging habitat.

It is not anticipated that this Project will require referral to the EPA.

It is not anticipated that this Project will require permits under the WC Act.

The assessment against the Ten Clearing Principles determined that the Project is:

- Likely to be at variance with Clearing Principle (b) and Principle (f)

- May be at variance with Principle (a)

Any removal of native vegetation within the Study area will most likely require a clearing permit from the DER.

## 5.2 Recommendations

It is recommended that the Department of Treasury initiate consultation with DotE and refer the Project to DotE if development of the Study Area requires clearing of Black Cockatoo feeding habitat and/or potential breeding habitat.

Significant impacts associated with the Project are likely to be largely restricted to the construction phase, and should be mitigated through design as much as possible. It is recommended that DoE develop a Construction Environmental Management Plan (CEMP) to manage the potential construction impacts including a general fauna clearance program by qualified fauna relocation personnel.

## 6. References

- Aplin, TEH 1979, '*The Flora*', *Environment and Science*, Perth, University of WA Press.
- Australia New Zealand Environment and Conservation Council (ANZECC) 2000, *Core Environmental Indicators for Reporting on the State of Environment*, ANZECC State of the Environment Reporting Task Force.
- Australian Government 2012, *Weeds in Australia*, retrieved April 2013, from <http://www.environment.gov.au/biodiversity/invasive/weeds/index.html>.
- Australian Weeds Committee 2010, *Weeds of National Significance: Update 2010*, Launceston, Commonwealth of Australia.
- Beard, JS 1979, *Vegetation Survey of Western Australia: Perth Map and Explanatory Memoir 1:250,000 series*, Perth, Vegmap Publications.
- Bureau of Meteorology 2013, *Climate Data Online*, retrieved September 11, 2013, from <http://www.bom.gov.au/climate/data/?ref=fr>.
- Christidis, L & Boles, WE 2008, *Systematics and Taxonomy of Australian Birds*, Melbourne, CSIRO Publishing.
- Cockerill, A., Lambert, T, Conole, L. and Pickett, E. (2013). Carnaby's Cockatoo Population Viability Analysis Model Report. Report funded by the Department of Sustainability, Environment, Water, Population, and Communities through the Sustainable Regional Development Program. Parsons Brinckerhoff, Perth
- Commonwealth Conservation Advice on Darwinia sp. Muehea (B.J. Keighery 2458) (Muehea Bell) (Threatened Species Scientific Committee (TSSC), 2009ab) [Conservation Advice].
- Commonwealth Conservation Advice on Diuris purdiei (Purdie's Donkey-orchid) (Threatened Species Scientific Committee, 2008j) [Conservation Advice].
- Commonwealth Conservation Advice on Lepidosperma rostratum (Threatened Species Scientific Committee, 2008rh) [Conservation Advice].
- Commonwealth of Australia 2001, *National Targets and Objectives for Biodiversity Conservation 2001–2005*, Canberra, AGPS.
- Department of Environment and Conservation (2006). Slender Andersonia (*Andersonia gracilis*) Interim Recovery Plan 2006-2011. Interim Recovery Plan No. 228.
- Department of Environment and Conservation (2009). National recovery plan for the Glossy-leafed Hammer Orchid (*Drakaea elastica*) (Department of Environment and Conservation, 2009I)
- Commonwealth Conservation Advice on Drakaea micrantha Hopper & A.P. Brown nom. inval. (Dwarf Hammer-orchid) (Threatened Species Scientific Committee, 2008k) [Conservation Advice].
- Department of Parks and Wildlife (DPAW) 2007–, *NatureMap: Mapping Western Australia's Biodiversity*, retrieved September 11, 2013, from <http://NatureMap.dec.wa.gov.au/>.
- Department of Parks and Wildlife (DPAW) 2012, *Department of Environment and Conservation Threatened Flora (Rare Flora Notice 2012(2))*, updated 6 November, 2012.
- Department of Parks and Wildlife (DPAW) 2013a, *Priority ecological communities for Western Australia*, 26 March 2013.

- Department of Parks and Wildlife (DPAW) 2013b, *Threatened ecological communities endorsed by the Minister for the Environment*, May 2013.
- Department of Planning Western Australia 2011, *Metropolitan Region Scheme (MRS) South West – Potential habitat for the Carnaby's Black Cockatoo which may require further assessment*, Perth, Department of Planning WA on behalf of Western Australian Planning Commission.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012, *Environmental Protection and Biodiversity Conservation Act 1999 referral guidelines for three threatened Black Cockatoo species*, Canberra, DSEWPaC.
- Department of the Environment (DotE) 2013a, *Protected Matters Search Tool Results*, retrieved September 11, 2013, from <http://www.environment.gov.au/epbc/pmst/index.html>.
- Department of the Environment (DotE) 2013b, *The Ramsar Convention on Wetlands*, retrieved June 4, 2013, from <http://www.environment.gov.au/water/topics/wetlands/ramsar-convention/index.html>.
- Department of the Environment (DotE) 2013c, *Threatened species & ecological communities*, retrieved July, 2013, from <http://www.environment.gov.au/biodiversity/threatened/index.html>.
- Environmental Protection Authority (EPA) 2000, *Environmental Protection of Native Vegetation in Western Australia. Clearing of native vegetation, with particular reference to the agricultural area. Position Statement No. 2*, Perth, Environmental Protection Authority.
- Environmental Protection Authority (EPA) 2002, *Terrestrial Biological Surveys as an Element of Biodiversity Protection: Position Statement No. 3*, Perth, EPA.
- Environmental Protection Authority (EPA) 2004a, *Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Impact Assessment in Western Australia*, Perth, EPA.
- Environmental Protection Authority (EPA) 2004b, *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, Perth, Environmental Protection Authority.
- Environmental Protection Authority (EPA) 2006a, *Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986): Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region (No. 10)*, Perth, Environmental Protection Authority.
- Environmental Protection Authority (EPA) 2006b, *Position Statement No. 9: Environmental Offsets*, Perth, Environmental Protection Authority.
- Gibson, N, Keighery, BJ, Keighery, GJ, Burbidge, AH & Lyons, MN 1994, *A Floristic Survey of the Southern Swan Coastal Plain*, unpublished report prepared for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and The Conservation Council of Western Australia (Inc.).
- Government of Western Australia 2000, *Bush Forever – Keeping the Bush in the City. Volumes 1 (Policies, Principals and Processes) & 2 (Directory of Bush Forever Sites)*, Perth, Government of Western Australia.
- Government of Western Australia 2013, *2012 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report): current as of October 2012*, retrieved July 20, 2013, from <https://www2.landgate.wa.gov.au/web/guest/downloader>.

- Government of Western Australia 2014, *Natural Resource Management Shared Land Information Platform*, retrieved June, 2014, from <http://spatial.agric.wa.gov.au/slip/>.
- Hedde, EM, Loneragan, OW, & Havel, JJ 1980, 'Vegetation Complexes of the Darling System, Western Australia', In Atlas of Natural Resources, Darling System, Western Australia, Perth, Department of Conservation and Environment.
- Keighery, B 1994, *Bushland Plant Survey: a Guide to Plant Community Survey for the Community*, Nedlands, Wildflower Society of WA (Inc.).
- Local Biodiversity Program 2013, *2013 Native vegetation by vegetation complex dataset for the South West of Western Australia*, retrieved July, 2013, from <http://pbp.walga.asn.au/Publications.aspx>
- Mitchell, D, Williams, K & Desmond, A 2002, 'Swan Coastal Plain 2 (SWA2 — Swan Coastal Plain subregion)', In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, Perth, Department of Conservation and Land Management.
- Muir, BG 1977, 'Biological Survey of the Western Australian Wheatbelt Part II', Perth, Records of the Western Australian Museum, Supplement No. 3.
- Perth Biodiversity Project 2010, *Native vegetation extent by vegetation complexes for each Local Government in Perth and Peel*, retrieved July, 2013, from <http://pbp.walga.asn.au/Publications.aspx>.
- Shepherd, DP, Beeston, GR, & Hopkins, AJM 2002, *Native Vegetation in Western Australia – Extent, Type and Status, Resource Management Technical Report 249*, Perth, Department of Agriculture.
- Western Australian (WA) Herbarium 1998–, *FloraBase—the Western Australian Flora*, retrieved July, 2013, from <http://florabase.dpaw.wa.gov.au/>.

# Appendices

# Appendix A – Figures

Figure 1 Locality

Figure 2 Environmental context

Figure 3 Vegetation types

Figure 4 Vegetation condition and weeds

Figure 5 Fauna habitat types & conservation significant fauna records

# Appendix B – Background information



## B.1 Legislation

### B.1.1 Federal *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as matters of national environmental significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities.
- Migratory species.

A person must not take an action that has, will have, or is likely to have a significant impact MNES, without approval from the Federal Minister for the Environment.

### B.1.2 State *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. It provides for an Environmental Protection Authority (EPA), for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the above.

Clearing of native vegetation in Western Australia requires a permit from the Department of Parks and Wildlife (DPaW) (formerly the Department of Environment and Conservation – DEC), unless exemptions apply. Native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native, but not vegetation planted in a plantation or planted with commercial intent.

In the EP Act Section 51A, clearing is defined as the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage of some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above.

When making a decision to grant or refuse a permit to clear native vegetation the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

- a. Native vegetation should not be cleared if it comprises a high level of biodiversity.
- b. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance habitat for fauna indigenous to Western Australia.
- c. Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.
- d. Native vegetation should not be cleared if it comprises the whole or part of native vegetation in an area that has been extensively cleared.
- e. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
- f. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

- g. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.
- h. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
- i. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.
- j. Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

There are a number of Environmentally Sensitive Areas (ESA) within Western Australia where exemptions in regulations do not apply. ESA include locations of threatened communities and species.

### B.1.3 State *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

ESA are declared by a notice under Section 51B of the EP Act. Table B.1 outlines the aspects of areas declared as ESA (under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* – Reg 6).

**Table B.1 Aspects of Environmentally Sensitive Areas**

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).
An area that is registered on the Register of the National Estate (RNE), because of its natural values, under the <i>Australian Heritage Commission Act 1975</i> of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community (TEC).
A Bush Forever Site.
The areas covered by the following policies:
a. The <i>Environmental Protection (Gnangara Mound Crown Land) Policy 1992</i> .
b. The <i>Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002</i> .
The areas covered by the lakes to which the <i>Environmental Protection (Swan Coastal Plain Lakes) Policy 1992</i> (SCPL) (EPP Lakes) applies.
Protected wetlands as defined in the <i>Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998</i> .
Areas of fringing native vegetation in the policy area as defined in the <i>Environmental Protection (Swan and Canning Rivers) Policy 1997</i> .

### B.1.4 State *Wildlife Conservation Act 1950*

The *Wildlife Conservation Act 1950* (WC Act) provides for the conservation and protection of wildlife. It is administered by the DPaW and applies to both flora and fauna. Any person wanting to capture, collect, disturb or study fauna requires a permit to do so. A permit is required under the WC Act if removal of threatened species is required.

### B.1.5 State *Biosecurity and Agriculture Management Act 2007*

Under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), a Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) is in force. The Department of Agriculture and Food Western Australia (DAFWA) maintains a list of Declared Pests for Western Australia. If a Pest is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the specific category of control. Declared plants are gazetted under categories, which define the action required. The category may apply to the whole of the State, districts, individual properties or even paddocks. Categories of control are defined in Table B.2. Among the factors considered in categorising Declared Pests are:

- The impact of the plant on individuals, agricultural production and the community in general
- Whether it is already established in the area
- The feasibility and cost of possible control measures

The BAM Act replaces the repealed *Agriculture and Related Resources Protection Act 1976*.

**Table B.2 Department of Agriculture and Food (Western Australia) Categories for Declared Pests under the *Biosecurity and Agriculture Management Act 2007***

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

## B.2 Background information

### B.2.1 Reserves & conservation areas

Bush Forever, which was released in December 2000 and proclaimed in 2010, is a Government initiative aimed to retain and protect regionally significant bushland on the Swan Coastal Plain within the Perth Metropolitan Region. Bush Forever aims to protect more than 51,000 hectares of regionally significant bushland within 287 sites across the metropolitan portion of the Swan Coastal Plain (Government of Western Australia, 2000).

### B.2.2 Vegetation extent & status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia, 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia's

Biological Diversity (ANZECC, 2000) and in EPA Position Statement No. 2 on environmental protection of native vegetation in Western Australia (EPA, 2000).

From a purely biodiversity perspective and taking no account of any other land degradation issues, there are a number of key criteria now being applied to the clearing of native vegetation in Western Australia (EPA, 2000c).

- The “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30 percent of the pre-European extent of the vegetation type.
- A level of 10 percent of the original extent is regarded as being a level representing Endangered.
- Clearing which would put the threat level into the class below should be avoided.
- From a biodiversity perspective, stream reserves should generally be in the order of at least 200 metres (m) wide.

Within the Swan Coastal Plain, EPA Position Statement No. 9 (EPA, 2006b) identifies vegetation complexes with 30 percent or less of their pre-clearing extent remaining in a bioregion, or 10 percent or less of their pre-clearing extent remaining in constrained areas (i.e. areas of urban development in cities and major town) on the Swan Coastal Plain, to be critical assets.

The extent of remnant native vegetation has been assessed by Shepherd et al. (2002) and the Government of Western Australia (2013), based on broadscale vegetation association mapping by Beard (1979).

The EPA Guidance Statement No. 10 (EPA, 2006a) assesses the extent of Heddle et al. (1980) vegetation complexes currently present against presumed pre-European extents. It is important to note that the “*remnant native vegetation mapping used in the Region is derived from dated aerial photography (in this case 1998) with limited ground-truthing. As a consequence, the percentages of ecological communities remaining are generally an overestimate of the native vegetation remaining at present and at the date of this Guidance (2006). The principal factors contributing to this overestimation are:*

- *The preferential mapping of treed landscapes, leading to some mapping of areas that are parkland cleared or completely degraded*
- *The inclusion of areas that are approved for clearing through development approvals and/or clearing permits*
- *Some areas that have been cleared since the time of the aerial photography*

*It is therefore important to bear these issues in mind when the percentage of the vegetation complexes remaining is approaching 30 percent”* (EPA, 2006a). Furthermore, as a result of the clearing of the Swan Coastal Plain since 1998, it is likely that the actual percentage remaining of each vegetation type is less.

### B.3 Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State WC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

### B.3.1 Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth, 1997). Federally listed Threatened Ecological Communities (TEC) are protected under the EPBC Act administered by the Department of the Environment (DotE – formerly the Department of Sustainability, Environment, Water, Population and Communities DSEWPaC). The DPaW also maintains a list of TEC for Western Australia; some of which are also protected under the EPBC Act. TEC are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable (Table B.3).

Possible TEC that do not meet survey criteria are added to the DPaW Priority Ecological Community (PEC) List under Priorities 1, 2 and 3 (Table B.4). These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PEC that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PEC are not listed under any formal Federal or State legislation.

**Table B.3 Conservation codes & definitions for Threatened Ecological Communities (TEC) endorsed by the Western Australian Minister for the Environment & listed under the EPBC Act**

Western Australia conservation categories		Federal Government Conservation Categories (EPBC Act)	
Presumed Totally Destroyed (PD)	The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.	Critically Endangered (CR)	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated	Endangered (EN)	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.	Vulnerable (VU)	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future

Western Australia conservation categories		Federal Government Conservation Categories (EPBC Act)	
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.		

Table B.4 Conservation categories & definitions for Priority Ecological Communities (PEC) as listed by the DPaW

Category	Description
Priority 1	<p><b>Poorly known ecological communities.</b></p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally <math>\leq 5</math> occurrences or a total area of <math>\leq 100</math>ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority 2	<p><b>Poorly known ecological communities.</b></p> <p>Communities that are known from few occurrences with a restricted distribution (generally <math>\leq 10</math> occurrences or a total area of <math>\leq 200</math>ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority 3	<p><b>Poorly known ecological communities.</b></p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>

Category	Description
Priority 4	<p><b>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</b></p> <p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority 5	<p><b>Conservation Dependent ecological communities.</b></p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

### B.3.2 Other significant vegetation

Vegetation may be significant for a range of reasons, other than a statutory listing as TEC or because the extent is below a threshold level. The EPA (2004a) states that significant vegetation may include vegetation that includes the following:

- Scarcity
- Unusual species
- Novel combinations of species
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of the range of a unit (particularly, a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- A restricted distribution

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

### B.3.3 Conservation significant flora & fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the WC Act can warrant referral to the DoE and/or the EPA. According to the DPaW (WA Herbarium, 1998–): "Threatened flora are plants which have been assessed as being at risk of extinction. In Western Australia the term Declared Rare Flora (DRF) is applied to Threatened flora due to the laws regarding threatened flora conservation. The WC Act is the primary wildlife conservation legislation in the State and the Minister for the Environment can declare taxa (species, subspecies or variety) as "Rare Flora" if they are considered to be in danger of extinction, rare or otherwise in need of special protection." For the purposes of this report, flora listed by the WC Act as DRF is described as Threatened.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act (Table B.5). The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN).

The State conservation level of fauna species and their significance status is assessed under the State WC Act (*Wildlife Conservation (Specially Protected Fauna) Notice 2010(2)*). This Act uses a set of Schedules (Table B.6) but also classifies species using some of the IUCN categories. Schedule 3 fauna species are those which are “subject to an agreement between the Government of Australia and the Governments of Japan, China and the Republic of Korea relating to the protection of migratory birds, are declared to be fauna that is in need of special protection”.

In Western Australia, the DPaW also maintains a list of Priority listed flora species. Conservation codes for Priority species are assigned by the DPaW to define the level of conservation significance (Table B.6). Priority species are not currently protected under the WC Act.

In addition to conservation significant species flora and fauna can be considered important if they are significant either on the Swan Coastal Plain or in the Perth metropolitan region. This includes species discussed in Government of Western Australia (2000) as being rare, poorly known, restricted in distribution or with some other distinctive feature.

For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DPaW Priority species are considered conservation significant.

**Table B.5 Conservation categories & definitions for *Environment Protection and Biodiversity Conservation Act 1999* listed flora & fauna species**

Conservation category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened



Table B.6 Conservation codes and descriptions for Western Australian flora & fauna

Code	Conservation category	Description
<b>Wildlife Conservation Act 1950</b>		
T	Schedule 1 under the WC Act	<p><b>Threatened Fauna (Fauna that is rare or is likely to become extinct)</b>  <b>Threatened Flora (Declared Rare Flora – Extant)</b>            Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.  <b>CR: Critically Endangered</b> – considered to be facing an extremely high risk of extinction in the wild.  <b>EN: Endangered</b> – considered to be facing a very high risk of extinction in the wild.  <b>VU: Vulnerable</b> – considered to be facing a high risk of extinction in the wild.</p>
X	Schedule 2 under the WC Act	<p><b>Presumed Extinct Fauna</b>  <b>Presumed Extinct Flora (Declared Rare Flora – Extinct)</b>            Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.</p>
IA	Schedule 3 under the WC Act	<p><b>Birds protected under an international agreement.</b>            Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.</p>
S	Schedule 4 under the WC Act	<p><b>Other specially protected fauna.</b>            Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.</p>
<b>DPaW Priority Listed</b>		
1	Priority One: Poorly-known taxa	<p>Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.</p>
2	Priority Two: Poorly-known taxa	<p>Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.</p>
3	Priority Three: Poorly-known taxa	<p>Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.</p>

Code	Conservation category	Description
4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring	(a) Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5	Priority 5: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

### Migratory species listed under the EPBC Act

The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

#### B.3.4 Introduced plants (weeds)

##### Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012 (Australian Government, 2012).

Information on species considered to be Declared Pests is provided in B.1.5.

# Appendix C – Desktop searches

Environment Protection and Biodiversity Conservation Act 1999 Protected Matters Search

NatureMap flora search

NatureMap fauna search



# EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 15/10/13 18:42:07

[Summary](#)

[Details](#)

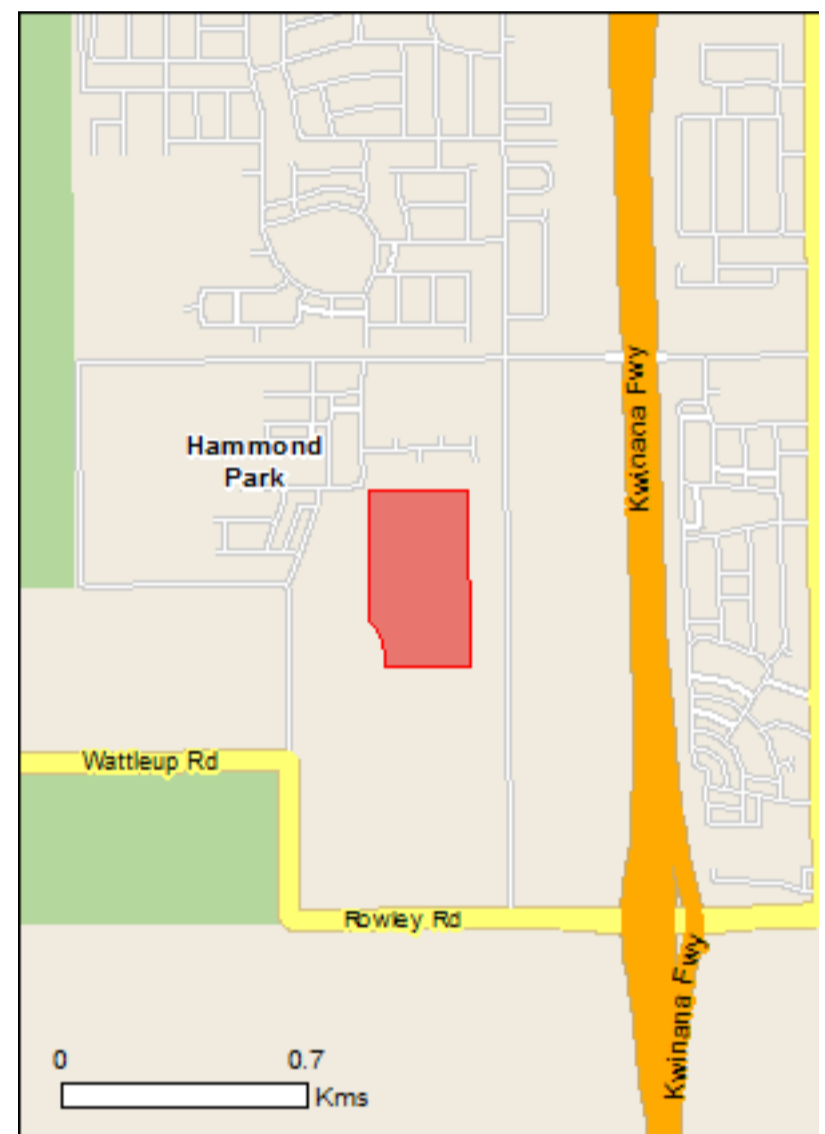
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

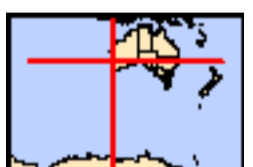
[Acknowledgements](#)



This map may contain data which are  
©Commonwealth of Australia  
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 5.0Km



# Summary

## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	2
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Areas:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	19
<a href="#">Listed Migratory Species:</a>	15

## Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As [heritage values](#) of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

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

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	23
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine</a>	None

## Extra Information

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

<a href="#">Place on the RNE:</a>	5
<a href="#">State and Territory Reserves:</a>	5
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	41
<a href="#">Nationally Important Wetlands:</a>	3
<a href="#">Key Ecological Features (Marine)</a>	None

## Details

### Matters of National Environmental Significance

Wetlands of International Importance (RAMSAR)	[ Resource Information ]
Name	Proximity
<a href="#">Forrestdale &amp; thomsons lakes</a>	Within Ramsar site
<a href="#">Peel-yalgorup system</a>	Upstream from Ramsar

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo [67034]	Vulnerable	Species or species habitat may occur within area
<a href="#">Calyptorhynchus baudinii</a> Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<a href="#">Sternula nereis nereis</a> Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Pseudocheirus occidentalis</a> Western Ringtail Possum [25911]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Setonix brachyurus</a> Quokka [229]	Vulnerable	Species or species habitat may occur within area
<b>Plants</b>		
<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
<a href="#">Centrolepis caespitosa</a> [6393]	Endangered	Species or species habitat likely to occur within area
<a href="#">Darwinia foetida</a> Muceha Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea elastica</a> Glossy-leaved Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Lepidosperma rostratum</a> Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
<b>Listed Migratory Species</b>		<b>[ <a href="#">Resource Information</a> ]</b>
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Breeding known to occur within area

Name	Threatened	Type of Presence
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat likely to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]		Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]		Species or species habitat known to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Species or species habitat known to occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Species or species habitat known to occur within area
<a href="#">Tringa stagnatilis</a> Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

## Other Matters Protected by the EPBC Act

### Commonwealth Land [\[ Resource Information \]](#)

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

Name
Commonwealth Land -

### Listed Marine Species [\[ Resource Information \]](#)

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

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Breeding known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat likely to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area



Name	Threatened	Type of Presence
<a href="#">Calidris canutus</a> Red Knot, Knot [855]		within area  Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]		Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Species or species habitat known to occur within area
<a href="#">Calidris subminuta</a> Long-toed Stint [861]		Species or species habitat known to occur within area
<a href="#">Charadrius dubius</a> Little Ringed Plover [896]		Species or species habitat known to occur within area
<a href="#">Charadrius ruficapillus</a> Red-capped Plover [881]		Species or species habitat known to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Himantopus himantopus</a> Black-winged Stilt [870]		Species or species habitat known to occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Species or species habitat known to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Philomachus pugnax</a> Ruff (Reeve) [850]		Species or species habitat known to occur within area
<a href="#">Recurvirostra novaehollandiae</a> Red-necked Avocet [871]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat known to occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
<a href="#">Tringa stagnatilis</a> Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

## Extra Information

### Places on the RNE [\[ Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
<b>Natural</b>		
<a href="#">Gibbs Road Wetland System</a>	WA	Indicative Place
<a href="#">Beeliar Regional Park and Adjacent Areas Reserve 7756 (March 1978 Boundary)</a>	WA	Interim List
<a href="#">Thomson Lake Reserve</a>	WA	Registered
<a href="#">Wandi Nature Reserve</a>	WA	Registered

### State and Territory Reserves [\[ Resource Information \]](#)

Name	State
Harry Waring Marsupial Reserve	WA
Thomsons Lake	WA
Unnamed WA48291	WA
Unnamed WA49561	WA
Wandi	WA

### Invasive Species [\[ Resource Information \]](#)

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

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Acridotheres tristis</a> Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
<a href="#">Anas platyrhynchos</a> Mallard [974]		Species or species habitat likely to occur within area
<a href="#">Carduelis carduelis</a> European Goldfinch [403]		Species or species habitat likely to occur within area
<a href="#">Columba livia</a> Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
<a href="#">Passer domesticus</a> House Sparrow [405]		Species or species habitat likely to occur within area
<a href="#">Passer montanus</a> Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area

Name	Status	Type of Presence within area
<a href="#">Streptopelia chinensis</a> Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
<a href="#">Streptopelia senegalensis</a> Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
<a href="#">Sturnus vulgaris</a> Common Starling [389]		Species or species habitat likely to occur within area
<a href="#">Turdus merula</a> Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
<b>Mammals</b>		
<a href="#">Bos taurus</a> Domestic Cattle [16]		Species or species habitat likely to occur within area
<a href="#">Canis lupus familiaris</a> Domestic Dog [82654]		Species or species habitat likely to occur within area
<a href="#">Felis catus</a> Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
<a href="#">Funambulus pennantii</a> Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
<a href="#">Mus musculus</a> House Mouse [120]		Species or species habitat likely to occur within area
<a href="#">Oryctolagus cuniculus</a> Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
<a href="#">Rattus norvegicus</a> Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
<a href="#">Rattus rattus</a> Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
<a href="#">Vulpes vulpes</a> Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
<a href="#">Anredera cordifolia</a> Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
<a href="#">Asparagus aethiopicus</a> Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
<a href="#">Asparagus asparagoides</a> Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
<a href="#">Asparagus plumosus</a> Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
<a href="#">Brachiaria mutica</a> Para Grass [5879]		Species or species

Name	Status	Type of Presence
<a href="#">Cenchrus ciliaris</a>		habitat may occur within area
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
<a href="#">Chrysanthemoides monilifera</a>		Species or species habitat may occur within area
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
<a href="#">Chrysanthemoides monilifera subsp. monilifera</a>		Species or species habitat likely to occur within area
Boneseed [16905]		Species or species habitat likely to occur within area
<a href="#">Genista linifolia</a>		Species or species habitat likely to occur within area
Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
<a href="#">Genista sp. X Genista monspessulana</a>		Species or species habitat may occur within area
Broom [67538]		Species or species habitat may occur within area
<a href="#">Lantana camara</a>		Species or species habitat likely to occur within area
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
<a href="#">Lycium ferocissimum</a>		Species or species habitat likely to occur within area
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
<a href="#">Olea europaea</a>		Species or species habitat may occur within area
Olive, Common Olive [9160]		Species or species habitat may occur within area
<a href="#">Opuntia spp.</a>		Species or species habitat likely to occur within area
Prickly Pears [82753]		Species or species habitat likely to occur within area
<a href="#">Pinus radiata</a>		Species or species habitat may occur within area
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
<a href="#">Protasparagus plumosus</a>		Species or species habitat likely to occur within area
Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
<a href="#">Rubus fruticosus aggregate</a>		Species or species habitat likely to occur within area
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
<a href="#">Sagittaria platyphylla</a>		Species or species habitat likely to occur within area
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
<a href="#">Salix spp. except S.babylonica, S.x calodendron &amp; S.x reichardtii</a>		Species or species habitat likely to occur within area
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
<a href="#">Salvinia molesta</a>		Species or species habitat likely to occur within area
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
<a href="#">Tamarix aphylla</a>		Species or species habitat likely to occur within area
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
<b>Reptiles</b>		
<a href="#">Hemidactylus frenatus</a>		Species or species habitat likely to occur within area
Asian House Gecko [1708]		Species or species habitat likely to occur within area

## Nationally Important Wetlands

[\[ Resource Information \]](#)

Name	State
<a href="#">Gibbs Road Swamp System</a>	WA
<a href="#">Spectacles Swamp</a>	WA
<a href="#">Thomsons Lake</a>	WA

## Coordinates

-32.171341 115.852176,-32.171359 115.852154,-32.175155 115.852219,-32.175174  
115.850051,-32.174901 115.850073,-32.174611 115.85003,-32.174356 115.849837,  
-32.174156 115.849687,-32.171323 115.849687,-32.171341 115.852176

## Caveat

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

# Acknowledgements

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

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

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

Please feel free to provide feedback via the [Contact Us](#) page.

© Commonwealth of Australia

Department of Sustainability, Environment, Water, Population and Communities

GPO Box 787

Canberra ACT 2601 Australia

+61 2 6274 1111

# NatureMap Flora Hammond 11\_09\_2013

Created By Guest user on 11/09/2013

**Kingdom** Plantae  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 115°51' 02" E,32°09' 34" S  
**Buffer** 5km  
**Group By** Family

Family	Species	Records
Aizoaceae	2	6
Anarthriaceae	2	9
Apiaceae	6	11
Apocynaceae	1	1
Araceae	1	1
Araliaceae	1	7
Asparagaceae	19	32
Asteraceae	24	62
Boraginaceae	1	1
Campanulaceae	3	6
Caryophyllaceae	3	5
Casuarinaceae	2	4
Celastraceae	2	4
Centrolepidaceae	2	7
Colchicaceae	1	1
Commelinaceae	1	3
Convolvulaceae	1	1
Crassulaceae	3	4
Cupressaceae	1	1
Cyperaceae	21	41
Dasygongonaceae	2	8
Dilleniaceae	4	25
Droseraceae	7	10
Elaeocarpaceae	1	2
Ericaceae	14	37
Euphorbiaceae	2	2
Fabaceae	39	78
Gentianaceae	1	2
Geraniaceae	1	2
Goodeniaceae	4	9
Haemodoraceae	9	26
Haloragaceae	4	9
Hemerocallidaceae	6	8
Iridaceae	6	13
Juncaceae	4	6
Juncaginaceae	1	1
Lamiaceae	3	6
Lauraceae	2	3
Loganiaceae	1	1
Lythraceae	1	1
Menyanthaceae	1	1
Molluginaceae	1	2
Moraceae	1	1
Myrtaceae	41	89
Onagraceae	4	4
Orchidaceae	9	31
Orobanchaceae	1	2
Papaveraceae	1	1
Phyllanthaceae	2	4
Phytolaccaceae	1	1
Plantaginaceae	3	3
Poaceae	27	60
Polygalaceae	1	3
Portulacaceae	2	2
Primulaceae	1	1
Proteaceae	21	43
Restionaceae	5	15
Rhamnaceae	1	1
Rutaceae	4	7
Salviniaceae	1	1
Santalaceae	3	8
Sapindaceae	1	14
Solanaceae	2	2
Stylidiaceae	9	28
Thymelaeaceae	3	4
Tropaeolaceae	1	1
Violaceae	1	1
Xanthorrhoeaceae	1	6
Zamiaceae	1	4
Zygophyllaceae	1	1
<b>TOTAL</b>	<b>360</b>	<b>797</b>



Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Aizoaceae</b>				
1.	2794 <i>Carpobrotus aequilaterus</i> (Angular Pigface)	Y		
2.	2795 <i>Carpobrotus edulis</i> (Hottentot Fig)	Y		
<b>Anarthriaceae</b>				
3.	1097 <i>Lyginia barbata</i>			
4.	18049 <i>Lyginia imberbis</i>			
<b>Apiaceae</b>				
5.	6214 <i>Centella asiatica</i>			
6.	15446 <i>Eryngium pinnatifidum</i> subsp. <i>pinnatifidum</i>			
7.	6222 <i>Homalosciadium homalocarpum</i>			
8.	6249 <i>Platysace compressa</i> (Tapeworm Plant)			
9.	6253 <i>Platysace filiformis</i>			
10.	6289 <i>Xanthosia huegelii</i>			
<b>Apocynaceae</b>				
11.	6587 <i>Gomphocarpus fruticosus</i> (Narrowleaf Cottonbush)	Y		
<b>Araceae</b>				
12.	1049 <i>Zantedeschia aethiopica</i> (Arum Lily)	Y		
<b>Araliaceae</b>				
13.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
<b>Asparagaceae</b>				
14.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
15.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
16.	1287 <i>Dichopogon capillipes</i>			
17.	1307 <i>Laxmannia ramosa</i> (Branching Lily)			
18.	11911 <i>Laxmannia ramosa</i> subsp. <i>ramosa</i>			
19.	11464 <i>Laxmannia sessiliflora</i> subsp. <i>australis</i>			
20.	1309 <i>Laxmannia squarrosa</i>			
21.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
22.	1228 <i>Lomandra hermaphrodita</i>			
23.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
24.	1246 <i>Lomandra suaveolens</i>			
25.	1312 <i>Sowerbaea laxiflora</i> (Purple Tassels)			
26.	1318 <i>Thysanotus arbuscula</i>			
27.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
28.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
29.	1343 <i>Thysanotus patersonii</i>			
30.	1351 <i>Thysanotus sparteus</i>			
31.	1357 <i>Thysanotus thyrsoides</i>			
32.	1358 <i>Thysanotus triandrus</i>			
<b>Asteraceae</b>				
33.	7833 <i>Angianthus preissianus</i>			
34.	7851 <i>Asteridea pulverulenta</i> (Common Bristle Daisy)			
35.	7937 <i>Cirsium vulgare</i> (Spear Thistle)	Y		
36.	20074 <i>Conyza sumatrensis</i>	Y		
37.	7945 <i>Cotula coronopifolia</i> (Waterbuttons)	Y		
38.	29594 <i>Helichrysum luteoalbum</i> (Jersey Cudweed)			
39.	12741 <i>Hyalosperma cotula</i>			
40.	8086 <i>Hypochoeris glabra</i> (Smooth Catsear)	Y		
41.	9352 <i>Hypochoeris radicata</i> (Flat Weed)	Y		
42.	18585 <i>Lagenophora huegelii</i>			
43.	8099 <i>Leontodon saxatilis</i> (Hairy Hawkbit)	Y		
44.	42281 <i>Pithocarpa cordata</i>			
45.	8175 <i>Podolepis gracilis</i> (Slender Podolepis)			
46.	8182 <i>Podotheca angustifolia</i> (Sticky Longheads)			
47.	8183 <i>Podotheca chrysantha</i> (Yellow Podotheca)			
48.	8184 <i>Podotheca gnaphalioides</i> (Golden Long-heads)			
49.	8195 <i>Quinetia urvillei</i>			
50.	13300 <i>Rhodanthe citrina</i>			
51.	8225 <i>Siloxerus humifusus</i> (Procumbent Siloxerus)			
52.	9367 <i>Sonchus hydrophilus</i> (Native Sowthistle)			
53.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
54.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
55.	38388 <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	Y		
56.	8282 <i>Waitzia suaveolens</i> (Fragrant Waitzia)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Boraginaceae</b>				
57.	6710 <i>Heliotropium europaeum</i> (Common Heliotrope)	Y		
<b>Campanulaceae</b>				
58.	9289 <i>Lobelia anceps</i> (Angled Lobelia)			
59.	7384 <i>Wahlenbergia capensis</i> (Cape Bluebell)	Y		
60.	7389 <i>Wahlenbergia preissii</i>			
<b>Caryophyllaceae</b>				
61.	2889 <i>Cerastium glomeratum</i> (Mouse Ear Chickweed)	Y		
62.	19825 <i>Petrorhagia dubia</i>	Y		
63.	2918 <i>Stellaria media</i> (Chickweed)	Y		
<b>Casuarinaceae</b>				
64.	1728 <i>Allocasuarina fraseriana</i> (Sheoak, Kondii)			
65.	1732 <i>Allocasuarina humilis</i> (Dwarf Sheoak)			
<b>Celastraceae</b>				
66.	4733 <i>Stackhousia monogyna</i>			
67.	16998 <i>Tripterococcus paniculatus</i>		P4	
<b>Centrolepidaceae</b>				
68.	1125 <i>Centrolepis drummondiana</i>			
69.	1134 <i>Centrolepis polygyna</i> (Wiry Centrolepis)			
<b>Colchicaceae</b>				
70.	12770 <i>Burchardia congesta</i>			
<b>Commelinaceae</b>				
71.	1162 <i>Cartonema philydroides</i>			
<b>Convolvulaceae</b>				
72.	6663 <i>Cuscuta epithymum</i> (Lesser Dodder, Greater Dodder)	Y		
<b>Crassulaceae</b>				
73.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
74.	3139 <i>Crassula exserta</i>			
75.	3140 <i>Crassula glomerata</i>	Y		
<b>Cupressaceae</b>				
76.	36600 <i>Callitris pyramidalis</i> (Swamp Cypress)			
<b>Cyperaceae</b>				
77.	741 <i>Baumea articulata</i> (Jointed Rush)			
78.	743 <i>Baumea juncea</i> (Bare Twigrush)			
79.	15837 <i>Baumea preissii</i> subsp. <i>laxa</i>			
80.	749 <i>Bolboschoenus caldwellii</i> (Marsh Club-rush)			
81.	16245 <i>Cyathochaeta teretifolia</i>		P3	
82.	816 <i>Cyperus tenuiflorus</i> (Scaly Sedge)	Y		
83.	20200 <i>Isolepis cernua</i> var. <i>setiformis</i>			
84.	917 <i>Isolepis marginata</i> (Coarse Club-rush)	Y		
85.	925 <i>Lepidosperma angustatum</i>			
86.	937 <i>Lepidosperma longitudinale</i> (Pithy Sword-sedge)			
87.	940 <i>Lepidosperma pubisquamatum</i>			
88.	945 <i>Lepidosperma squamatum</i>			
89.	955 <i>Mesomelaena pseudostygia</i>			
90.	957 <i>Mesomelaena tetragona</i> (Semaphore Sedge)			
91.	978 <i>Schoenus brevisetis</i>			
92.	982 <i>Schoenus clandestinus</i>			
93.	984 <i>Schoenus curvifolius</i>			
94.	986 <i>Schoenus efoliatus</i>			
95.	992 <i>Schoenus grandiflorus</i> (Large Flowered Bogrush)			
96.	1017 <i>Schoenus subbulbosus</i>			
97.	12048 <i>Tricostularia neesii</i> var. <i>neesii</i>			
<b>Dasypogonaceae</b>				
98.	19309 <i>Calectasia narragara</i>			
99.	1218 <i>Dasypogon bromeliifolius</i> (Pineapple Bush)			
<b>Dilleniaceae</b>				
100.	5134 <i>Hibbertia huegelii</i>			
101.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
102.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
103.	5173 <i>Hibbertia subvaginata</i>			
<b>Droseraceae</b>				
104.	3095 <i>Drosera erythrorhiza</i> (Red Ink Sundew)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
105.	3106 <i>Drosera macrantha</i> (Bridal Rainbow)			
106.	14298 <i>Drosera macrantha</i> subsp. <i>macrantha</i>			
107.	3109 <i>Drosera menziesii</i> (Pink Rainbow)			
108.	3117 <i>Drosera paleacea</i> (Dwarf Sundew)			
109.	13188 <i>Drosera paleacea</i> subsp. <i>paleacea</i>			
110.	3135 <i>Drosera zonaria</i> (Painted Sundew)			

#### Elaeocarpaceae

111.	4524 <i>Platytheca galioides</i>			
------	----------------------------------	--	--	--

#### Ericaceae

112.	6334 <i>Astroloma pallidum</i> (Kick Bush)			
113.	6339 <i>Astroloma xerophyllum</i>			
114.	30142 <i>Brachyloma preissii</i> subsp. <i>obtusifolium</i>			
115.	30136 <i>Brachyloma preissii</i> subsp. <i>preissii</i>			
116.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
117.	6349 <i>Conostephium preissii</i>			
118.	13527 <i>Croninia kingiana</i>			
119.	6360 <i>Leucopogon australis</i> (Spiked Beard-heath)			
120.	6374 <i>Leucopogon conostephioides</i>			
121.	6425 <i>Leucopogon oxycedrus</i>			
122.	6434 <i>Leucopogon polymorphus</i>			
123.	6436 <i>Leucopogon propinquus</i>			
124.	6456 <i>Lysinema ciliatum</i> (Curry Flower)			
125.	34736 <i>Lysinema pentapetalum</i>			

#### Euphorbiaceae

126.	20014 <i>Euphorbia hyssopifolia</i>	Y		
127.	4648 <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	Y		

#### Fabaceae

128.	11731 <i>Acacia browniana</i> var. <i>browniana</i>			
129.	3262 <i>Acacia cochlearis</i> (Rigid Wattle)			
130.	3282 <i>Acacia cyclops</i> (Coastal Wattle)			
131.	3374 <i>Acacia huegelii</i>			
132.	3502 <i>Acacia pulchella</i> (Prickly Moses)			
133.	30032 <i>Acacia saligna</i> subsp. <i>saligna</i>			
134.	3557 <i>Acacia stenoptera</i> (Narrow Winged Wattle)			
135.	3686 <i>Aotus cordifolia</i>			
136.	3688 <i>Aotus gracillima</i>			
137.	3692 <i>Aotus procumbens</i>			
138.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
139.	18156 <i>Chamaecytisus palmensis</i> (Tagasaste)	Y		
140.	3832 <i>Daviesia physodes</i>			
141.	3845 <i>Daviesia triflora</i>			
142.	3872 <i>Euchilopsis linearis</i> (Swamp Pea)			
143.	3880 <i>Eutaxia virgata</i>			
144.	20475 <i>Gastrolobium capitatum</i>			
145.	20483 <i>Gastrolobium linearifolium</i>			
146.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
147.	3961 <i>Hardenbergia comptoniana</i> (Native Wisteria)			
148.	3968 <i>Hovea trisperma</i> (Common Hovea)			
149.	12859 <i>Hovea trisperma</i> var. <i>trisperma</i>			
150.	4012 <i>Jacksonia furcellata</i> (Grey Stinkwood)			
151.	20462 <i>Jacksonia gracillima</i>		P3	
152.	4029 <i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			
153.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
154.	8564 <i>Lotus subbiflorus</i>	Y		
155.	4065 <i>Lupinus angustifolius</i> (Narrowleaf Lupin)	Y		
156.	4079 <i>Medicago polymorpha</i> (Burr Medic)	Y		
157.	4085 <i>Melilotus indicus</i>	Y		
158.	4113 <i>Ornithopus compressus</i> (Yellow Serradella)	Y		
159.	4141 <i>Phyllota gracilis</i>			
160.	4181 <i>Pultenaea reticulata</i>			
161.	4211 <i>Sphaerolobium vimineum</i> (Leafless Globe Pea)			
162.	17145 <i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Y		
163.	14738 <i>Trifolium resupinatum</i> var. <i>resupinatum</i>	Y		
164.	4320 <i>Vicia hirsuta</i> (Hairy Vetch)	Y		
165.	11474 <i>Vicia sativa</i> subsp. <i>nigra</i>	Y		
166.	4325 <i>Viminaria juncea</i> (Swishbush, Koweda)			

#### Gentianaceae

167.	6542 <i>Centaurium tenuiflorum</i>			
------	------------------------------------	--	--	--

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
		Y		
<b>Geraniaceae</b>				
168.	4343 <i>Pelargonium capitatum</i> (Rose Pelargonium)	Y		
<b>Goodeniaceae</b>				
169.	12724 <i>Anthotium junciforme</i>			
170.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
171.	7572 <i>Lechenaultia expansa</i>			
172.	7574 <i>Lechenaultia floribunda</i> (Free-flowering Leschenaultia)			
<b>Haemodoraceae</b>				
173.	11434 <i>Anigozanthos humilis</i> subsp. <i>humilis</i>			
174.	1411 <i>Anigozanthos manglesii</i> (Mangles Kangaroo Paw, Kurulbrang)			
175.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
176.	11826 <i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
177.	1436 <i>Conostylis juncea</i>			
178.	1454 <i>Conostylis setigera</i> (Bristly Cottonhead)			
179.	11597 <i>Conostylis setigera</i> subsp. <i>setigera</i>			
180.	1475 <i>Haemodorum spicatum</i> (Mardja)			
181.	1478 <i>Phlebocarya ciliata</i>			
<b>Haloragaceae</b>				
182.	6161 <i>Gonocarpus pithyoides</i>			
183.	34676 <i>Meionectes brownii</i> (Swamp Raspwort)			
184.	6189 <i>Myriophyllum crispatum</i>			
185.	6199 <i>Myriophyllum tillaeoides</i>			
<b>Hemerocallidaceae</b>				
186.	1264 <i>Arnocrinum preissii</i>			
187.	1277 <i>Caesia occidentalis</i>			
188.	1285 <i>Corynotheca micrantha</i> (Sand Lily)			
189.	1259 <i>Dianella revoluta</i> (Blueberry Lily)			
190.	1260 <i>Stypandra glauca</i> (Blind Grass)			
191.	1363 <i>Tricoryne tenella</i>			
<b>Iridaceae</b>				
192.	1520 <i>Gladiolus caryophyllaceus</i> (Wild Gladiolus)	Y		
193.	1550 <i>Patersonia occidentalis</i> (Purple Flag, Koma)			
194.	30471 <i>Patersonia occidentalis</i> var. <i>angustifolia</i>			
195.	14485 <i>Romulea flava</i> var. <i>minor</i>	Y		
196.	1556 <i>Romulea rosea</i> (Guildford Grass)	Y		
197.	14924 <i>Romulea rosea</i> var. <i>communis</i>	Y		
<b>Juncaceae</b>				
198.	1178 <i>Juncus bufonius</i> (Toad Rush)	Y		
199.	1186 <i>Juncus microcephalus</i>	Y		
200.	1188 <i>Juncus pallidus</i> (Pale Rush)			
201.	1190 <i>Juncus planifolius</i> (Broadleaf Rush)			
<b>Juncaginaceae</b>				
202.	40660 <i>Cynogeton huegelii</i>			
<b>Lamiaceae</b>				
203.	6839 <i>Hemiandra pungens</i> (Snakebush)			
204.	38320 <i>Hemiandra</i> sp. <i>Jurien</i> (B.J. Conn & M.E. Tozer BJC 3885)			
205.	6777 <i>Lachnostachys albicans</i>			
<b>Lauraceae</b>				
206.	2951 <i>Cassytha flava</i> (Dodder Laurel)			
207.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
<b>Loganiaceae</b>				
208.	6515 <i>Logania vaginalis</i> (White Spray)			
<b>Lythraceae</b>				
209.	5281 <i>Lythrum hyssopifolia</i> (Lesser Loosestrife)	Y		
<b>Menyanthaceae</b>				
210.	36177 <i>Ornduffia albiflora</i>			
<b>Molluginaceae</b>				
211.	2839 <i>Macarthuria australis</i>			
<b>Moraceae</b>				
212.	1747 <i>Ficus carica</i> (Common Fig)	Y		
<b>Myrtaceae</b>				

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
213.	17202 <i>Agonis flexuosa</i> var. <i>flexuosa</i>			
214.	20283 <i>Astartea scoparia</i>			
215.	36441 <i>Babingtonia camphorosmae</i> (Camphor Myrtle)			
216.	5382 <i>Beaufortia elegans</i>			
217.	5411 <i>Calothamnus hirsutus</i>			
218.	5415 <i>Calothamnus lateralis</i>			
219.	5439 <i>Calytrix angulata</i> (Yellow Starflower)			
220.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
221.	5460 <i>Calytrix fraseri</i> (Pink Summer Calytrix)			
222.	35618 <i>Darwinia</i> sp. <i>Karonie</i> (K. Newbey 8503)			
223.	14097 <i>Eremaea asterocarpa</i> subsp. <i>brachyclada</i>		P1	
224.	5541 <i>Eremaea pauciflora</i>			
225.	14104 <i>Eremaea pauciflora</i> var. <i>pauciflora</i>			
226.	13536 <i>Eucalyptus decipiens</i> subsp. <i>decipiens</i>			
227.	5708 <i>Eucalyptus marginata</i> (Jarrah, Djara)			
228.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
229.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
230.	13511 <i>Eucalyptus rudis</i> subsp. <i>rudis</i>			
231.	5790 <i>Eucalyptus todtiana</i> (Coastal Blackbutt)			
232.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
233.	35070 <i>Hypocalymma angustifolium</i> subsp. <i>Swan Coastal Plain</i> (G.J. Keighery 16777)			
234.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
235.	15498 <i>Kunzea glabrescens</i> (Spearwood)			
236.	5850 <i>Leptospermum laevigatum</i> (Coast Teatree)	Y		
237.	5900 <i>Melaleuca cuticularis</i> (Saltwater Paperbark)			
238.	13271 <i>Melaleuca huegelii</i> subsp. <i>huegelii</i>			
239.	13273 <i>Melaleuca incana</i> subsp. <i>incana</i>			
240.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
241.	5946 <i>Melaleuca pauciflora</i>			
242.	5952 <i>Melaleuca preissiana</i> (Moonah)			
243.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
244.	18598 <i>Melaleuca systema</i>			
245.	5978 <i>Melaleuca teretifolia</i> (Banbar)			
246.	5980 <i>Melaleuca thymoides</i>			
247.	5987 <i>Melaleuca viminea</i> (Mohan)			
248.	6006 <i>Pericalymma ellipticum</i> (Swamp Teatree)			
249.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
250.	6012 <i>Regelia ciliata</i>			
251.	6033 <i>Scholtzia involucreta</i> (Spiked Scholtzia)			
252.	15432 <i>Verticordia densiflora</i> var. <i>densiflora</i>			
253.	14714 <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4	
<b>Onagraceae</b>				
254.	6133 <i>Epilobium hirtigerum</i> (Hairy Willow Herb)			
255.	14293 <i>Oenothera indecora</i> subsp. <i>bonariensis</i>	Y		
256.	16347 <i>Oenothera laciniata</i>	Y		
257.	6140 <i>Oenothera mollissima</i>	Y		
<b>Orchidaceae</b>				
258.	1592 <i>Caladenia flava</i> (Cowslip Orchid)			
259.	15352 <i>Caladenia georgei</i>			
260.	1596 <i>Caladenia huegelii</i> (Grand Spider Orchid)		T	
261.	1599 <i>Caladenia latifolia</i> (Pink Fairy Orchid)			
262.	12938 <i>Diuris micrantha</i>		T	
263.	1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
264.	1645 <i>Epiblema grandiflorum</i> (Babe-in-a-cradle)			
265.	15419 <i>Microtis media</i> subsp. <i>media</i>			
266.	1716 <i>Thelymitra tigrina</i> (Tiger Orchid)			
<b>Orobanchaceae</b>				
267.	7090 <i>Parentucellia viscosa</i> (Sticky Bartsia)	Y		
<b>Papaveraceae</b>				
268.	2969 <i>Fumaria capreolata</i> (Whiteflower Fumitory)	Y		
<b>Phyllanthaceae</b>				
269.	4675 <i>Phyllanthus calycinus</i> (False Boronia)			
270.	4691 <i>Poranthera microphylla</i> (Small Poranthera)			
<b>Phytolaccaceae</b>				
271.	2793 <i>Phytolacca octandra</i> (Red Ink Plant)	Y		
<b>Plantaginaceae</b>				
272.	34942 <i>Callitriche brutia</i> subsp. <i>brutia</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
273.	19625 <i>Cymbalaria muralis</i> subsp. <i>muralis</i>	Y		
274.	14282 <i>Gratiola pubescens</i>			
<b>Poaceae</b>				
275.	184 <i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
276.	185 <i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
277.	198 <i>Amphipogon laguroides</i>			
278.	20184 <i>Amphipogon laguroides</i> subsp. <i>laguroides</i>			
279.	200 <i>Amphipogon turbinatus</i>			
280.	17234 <i>Austrostipa compressa</i>			
281.	17245 <i>Austrostipa mollis</i>			
282.	17253 <i>Austrostipa semibarbata</i>			
283.	37421 <i>Austrostipa</i> sp. <i>Marchagee</i> (B.R. Maslin 1407)			
284.	8661 <i>Brachypodium distachyon</i> (False Brome)	Y		
285.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
286.	245 <i>Briza minor</i> (Shivery Grass)	Y		
287.	249 <i>Bromus diandrus</i> (Great Brome)	Y		
288.	41568 <i>Cenchrus setaceus</i> (Fountain Grass)	Y		
289.	277 <i>Cortaderia selloana</i> (Pampas Grass)	Y		
290.	299 <i>Deyeuxia quadriseta</i> (Reed Bentgrass)			
291.	11105 <i>Echinochloa crus-galli</i>	Y		
292.	347 <i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
293.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
294.	444 <i>Holcus lanatus</i> (Yorkshire Fog)	Y		
295.	20019 <i>Lachnagrostis filiformis</i>			
296.	478 <i>Lolium rigidum</i> (Wimmera Ryegrass)	Y		
297.	485 <i>Microlaena stipoides</i> (Weeping Grass)			
298.	527 <i>Paspalum dilatatum</i>	Y		
299.	578 <i>Poa porphyroclados</i>			
300.	582 <i>Polypogon monspeliensis</i> (Annual Beardgrass)	Y		
301.	722 <i>Vulpia bromoides</i> (Squirrel Tail Fescue)	Y		
<b>Polygalaceae</b>				
302.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
<b>Portulacaceae</b>				
303.	2848 <i>Calandrinia corrigioloides</i> (Strap Purslane)			
304.	2856 <i>Calandrinia liniflora</i> (Parakeelya)			
<b>Primulaceae</b>				
305.	11647 <i>Samolus repens</i> var. <i>repens</i>			
<b>Proteaceae</b>				
306.	1775 <i>Adenanthos cygnorum</i> (Common Woollybush)			
307.	11837 <i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> (Common Woollybush)			
308.	1791 <i>Adenanthos obovatus</i> (Basket Flower)			
309.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
310.	32580 <i>Banksia dallanneyi</i> var. <i>dallanneyi</i>			
311.	1822 <i>Banksia ilicifolia</i> (Holly-leaved Banksia)			
312.	1830 <i>Banksia littoralis</i> (Swamp Banksia, Pungura)			
313.	1834 <i>Banksia menziesii</i> (Firewood Banksia)			
314.	32077 <i>Banksia sessilis</i> var. <i>cygnorum</i>			
315.	1852 <i>Banksia telmatiaea</i> (Swamp Fox Banksia)			
316.	1858 <i>Conospermum amoenum</i> (Blue Smokebush)			
317.	15611 <i>Conospermum stoechadis</i> subsp. <i>stoechadis</i> (Common Smokebush)			
318.	2032 <i>Grevillea leucopteris</i> (White Plume Grevillea)			
319.	2197 <i>Hakea prostrata</i> (Harsh Hakea)			
320.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
321.	2273 <i>Persoonia saccata</i> (Snottygobble)			
322.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
323.	2301 <i>Petrophile macrostachya</i>			
324.	2312 <i>Petrophile striata</i>			
325.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
326.	15532 <i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>			
<b>Restionaceae</b>				
327.	16595 <i>Desmocladus flexuosus</i>			
328.	17838 <i>Dielsia stenostachya</i>			
329.	1070 <i>Hypolaena exsulca</i>			
330.	17841 <i>Hypolaena pubescens</i>			
331.	17683 <i>Meeboldina cana</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Rhamnaceae</b>				
332.	4822 <i>Rhamnus alaternus</i> (Buckthorn)	Y		
<b>Rutaceae</b>				
333.	4413 <i>Boronia crenulata</i> (Aniseed Boronia)			
334.	16636 <i>Boronia crenulata</i> subsp. <i>viminea</i>			
335.	11503 <i>Boronia crenulata</i> var. <i>crenulata</i>			
336.	4417 <i>Boronia dichotoma</i>			
<b>Salviniaceae</b>				
337.	17737 <i>Azolla pinnata</i>			
<b>Santalaceae</b>				
338.	2342 <i>Leptomeria cunninghamii</i>			
339.	2344 <i>Leptomeria empetriformis</i>			
340.	2350 <i>Leptomeria pauciflora</i> (Sparse-flowered Currant Bush)			
<b>Sapindaceae</b>				
341.	4763 <i>Dodonaea hackettiana</i> (Hackett's Hopbush)		P4	
<b>Solanaceae</b>				
342.	6974 <i>Nicotiana glauca</i> (Tree Tobacco)	Y		
343.	7020 <i>Solanum linnaeanum</i> (Apple of Sodom)	Y		
<b>Stylidiaceae</b>				
344.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
345.	7677 <i>Levenhookia stipitata</i> (Common Stylewort)			
346.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
347.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
348.	25801 <i>Stylidium hesperium</i>			
349.	7774 <i>Stylidium piliferum</i> (Common Butterfly Triggerplant)			
350.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
351.	25806 <i>Stylidium scariosum</i>			
352.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
<b>Thymelaeaceae</b>				
353.	5237 <i>Pimelea calcicola</i>		P3	
354.	5243 <i>Pimelea ferruginea</i>			
355.	18117 <i>Pimelea rosea</i> subsp. <i>rosea</i>			
<b>Tropaeolaceae</b>				
356.	4360 <i>Tropaeolum majus</i> (Garden Nasturtium)	Y		
<b>Violaceae</b>				
357.	5216 <i>Hybanthus calycinus</i> (Wild Violet)			
<b>Xanthorrhoeaceae</b>				
358.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
<b>Zamiaceae</b>				
359.	85 <i>Macrozamia riedlei</i> (Zamia, Djiridji)			
<b>Zygophyllaceae</b>				
360.	4383 <i>Tribulus terrestris</i> (Caltrop)	Y		

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

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

# NatureMap Fauna Hammond 11\_09\_2013

Created By Guest user on 11/09/2013

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 115°51' 02" E,32°09' 34" S  
**Buffer** 5km  
**Group By** Family

Family	Species	Records
Acanthizidae	6	315
Accipitridae	6	244
Agamidae	3	45
Anatidae	13	753
Araneidae	3	4
Ardeidae	3	96
Artamidae	2	8
Barychelidae	1	1
Campephagidae	1	79
Castriidae	1	2
Charadriidae	4	48
Cheluidae	1	3
Columbidae	5	167
Corvidae	1	197
Cracticidae	3	290
Cuculidae	2	24
Dicaeidae	1	2
Dicruridae	2	296
Elapidae	9	18
Estrilidae	1	1
Falconidae	4	77
Gekkonidae	1	4
Halcyonidae	2	109
Hirundinidae	1	128
Hylidae	2	27
Leporidae	1	1
Limnodynastidae	2	114
Lycosidae	4	4
Macropodidae	1	1
Maluridae	2	151
Meliphagidae	8	404
Meropidae	1	51
Micropholcommatidae	1	1
Muridae	4	7
Myobatrachidae	3	66
Myrmecobiidae	1	2
Neosittidae	1	8
Pachycephalidae	3	136
Paradoxosomatidae	1	1
Pardalotidae	2	123
Pelecanidae	1	73
Peramelidae	3	27
Petroicidae	1	1
Phalacrocoracidae	3	24
Phalangeridae	1	4
Phasianidae	2	2
Podargidae	1	3
Podicipedidae	3	86
Psittacidae	10	125
Pygopodidae	4	53
Rallidae	7	316
Recurvirostridae	3	103
Scincidae	12	533
Scolopacidae	10	103
Scolopendridae	1	2
Sparassidae	1	6
Strigidae	1	1
Sylviidae	2	145
Tachyglossidae	1	1
Tarsipedidae	1	1
Tetragnathidae	1	1
Tettigoniidae	1	3
Theridiidae	1	1
Threskiornithidae	4	306
Typhlopidae	1	2
Urodacidae	1	1
Vespertilionidae	3	5
Zosteropidae	1	137
<b>TOTAL</b>	<b>194</b>	<b>6073</b>



Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Acanthizidae</b>				
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
4.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
5.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
6.	30948 <i>Smicronis brevirostris</i> (Weebill)			
<b>Accipitridae</b>				
7.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
8.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
9.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
10.	24288 <i>Circus approximans</i> (Swamp Harrier)			
11.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)		IA	
12.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
<b>Agamidae</b>				
13.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragon, Western Heath Dragon)			
14.	24905 <i>Pogona minor</i> subsp. <i>minima</i> (Dwarf Bearded Dragon (Houtman Abrolhos Is.), Dwarf Bearded Dragon)		T	
15.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
<b>Anatidae</b>				
16.	24310 <i>Anas castanea</i> (Chestnut Teal)			
17.	24312 <i>Anas gracilis</i> (Grey Teal)			
18.	24313 <i>Anas platyrhynchos</i> (Mallard)			
19.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
20.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
21.	24318 <i>Aythya australis</i> (Hardhead)			
22.	24319 <i>Biziura lobata</i> (Musk Duck)			
23.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
24.	24322 <i>Cygnus atratus</i> (Black Swan)			
25.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
26.	24328 <i>Oxyura australis</i> (Blue-billed Duck)			
27.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
28.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
<b>Araneidae</b>				
29.	-11836 <i>Austracantha minax</i>			
30.	-11830 <i>Cyrtophora parnasia</i>			
31.	-12821 <i>Eriophora biapicata</i>			
<b>Ardeidae</b>				
32.	41324 <i>Ardea modesta</i> (Eastern Great Egret)		IA	
33.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
34.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
<b>Artamidae</b>				
35.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
36.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
<b>Barychelidae</b>				
37.	-13273 <i>Idiomata blackwalli</i>			
<b>Campephagidae</b>				
38.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
<b>Castniidae</b>				
39.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		P4	
<b>Charadriidae</b>				
40.	25574 <i>Charadrius dubius</i> (Little Ringed Plover)		IA	
41.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
42.	24379 <i>Erythrogonys cinctus</i> (Red-kneed Dotterel)			
43.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
<b>Cheluidae</b>				
44.	25337 <i>Chelodina oblonga</i> (Oblong Turtle)			
<b>Columbidae</b>				
45.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
46.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
47.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
48.	25589	<i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
49.	25590	<i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
<b>Corvidae</b>					
50.	25592	<i>Corvus coronoides</i> (Australian Raven)			
<b>Cracticidae</b>					
51.	25595	<i>Cracticus tibicen</i> (Australian Magpie)			
52.	25596	<i>Cracticus torquatus</i> (Grey Butcherbird)			
53.	25597	<i>Strepera versicolor</i> (Grey Currawong)			
<b>Cuculidae</b>					
54.	25598	<i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
55.	42307	<i>Cacomantis pallidus</i> (Pallid Cuckoo)			
<b>Dicaeidae</b>					
56.	25607	<i>Dicaeum hirundinaceum</i> (Mistletoebird)			
<b>Dicruridae</b>					
57.	24443	<i>Grallina cyanoleuca</i> (Magpie-lark)			
58.	25614	<i>Rhipidura leucophrys</i> (Willie Wagtail)			
<b>Elapidae</b>					
59.	42381	<i>Brachyurophis semifasciatus</i>			
60.	25296	<i>Demansia psammophis</i> subsp. <i>reticulata</i> (Yellow-faced Whipsnake)			
61.	25250	<i>Elapognathus coronatus</i> (Crowned Snake)			
62.	25249	<i>Neelaps calonotos</i> (Black-striped Snake)		P3	
63.	25252	<i>Notechis scutatus</i> (Tiger Snake)			
64.	25253	<i>Parasuta gouldii</i>			
65.	25511	<i>Pseudonaja affinis</i> (Dugite)			
66.	25259	<i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
67.	25266	<i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
<b>Estrilidae</b>					
68.	25683	<i>Lonchura castaneothorax</i> (Chestnut-breasted Mannikin)			
<b>Falconidae</b>					
69.	25621	<i>Falco berigora</i> (Brown Falcon)			
70.	25622	<i>Falco cenchroides</i> (Australian Kestrel)			
71.	25623	<i>Falco longipennis</i> (Australian Hobby)			
72.	25624	<i>Falco peregrinus</i> (Peregrine Falcon)		S	
<b>Gekkonidae</b>					
73.	24980	<i>Christinus marmoratus</i> (Marbled Gecko)			
<b>Halcyonidae</b>					
74.	30901	<i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
75.	25549	<i>Todiramphus sanctus</i> (Sacred Kingfisher)			
<b>Hirundinidae</b>					
76.	24491	<i>Hirundo neoxena</i> (Welcome Swallow)			
<b>Hylidae</b>					
77.	25378	<i>Litoria adelaidensis</i> (Slender Tree Frog)			
78.	25388	<i>Litoria moorei</i> (Motorbike Frog)			
<b>Leporidae</b>					
79.	24085	<i>Oryctolagus cuniculus</i> (Rabbit)	Y		
<b>Limnodynastidae</b>					
80.	25410	<i>Heleioporus eyrei</i> (Moaning Frog)			
81.	25415	<i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
<b>Lycosidae</b>					
82.	-11630	<i>Arctoria flavimana</i>			
83.	-12841	<i>Kangarosa properipes</i>			
84.	-12809	<i>Lycosa ariadnae</i>			
85.	-11721	<i>Venator immansueta</i>			
<b>Macropodidae</b>					
86.	24131	<i>Macropus eugenii</i> subsp. <i>derbianus</i> (Tamar Wallaby (WA subsp))		P5	
<b>Maluridae</b>					
87.	25651	<i>Malurus lamberti</i> (Variegated Fairy-wren)			
88.	25654	<i>Malurus splendens</i> (Splendid Fairy-wren)			
<b>Meliphagidae</b>					
89.	24560	<i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
90.	24561	<i>Anthochaera carunculata</i> (Red Wattlebird)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
91.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
92.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
93.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
94.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
95.	24587 <i>Melithreptus chloropsis</i> (Western White-naped Honeyeater)			
96.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
<b>Meropidae</b>				
97.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
<b>Micropholcommatidae</b>				
98.	-11693 <i>Raveniella peckorum</i>			
<b>Muridae</b>				
99.	24215 <i>Hydromys chrysogaster</i> (Water-rat)		P4	
100.	24223 <i>Mus musculus</i> (House Mouse)	Y		
101.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
102.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
<b>Myobatrachidae</b>				
103.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
104.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
105.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
<b>Myrmecobiidae</b>				
106.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
<b>Neositidae</b>				
107.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
<b>Pachycephalidae</b>				
108.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
109.	25679 <i>Pachycephala pectoralis</i> (Golden Whistler)			
110.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
<b>Paradoxosomatidae</b>				
111.	-12101 <i>Antichiropus variabilis</i>			
<b>Pardalotidae</b>				
112.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
113.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
<b>Pelecanidae</b>				
114.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
<b>Peramelidae</b>				
115.	25478 <i>Isoodon obesulus</i> (Southern Brown Bandicoot)		P5	
116.	24153 <i>Isoodon obesulus</i> subsp. <i>fusciventer</i> (Quenda, Southern Brown Bandicoot)		P5	
117.	25504 <i>Perameles bougainville</i> (Western Barred Bandicoot, Marl)		T	
<b>Petroicidae</b>				
118.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
<b>Phalacrocoracidae</b>				
119.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
120.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
121.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
<b>Phalangeridae</b>				
122.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
<b>Phasianidae</b>				
123.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
124.	25701 <i>Coturnix ypsilophora</i> (Brown Quail)			
<b>Podargidae</b>				
125.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
<b>Podicipedidae</b>				
126.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
127.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
128.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
<b>Psittacidae</b>				
129.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
130.	24729 <i>Cacatua tenuirostris</i> (Eastern Long-billed Corella)	Y		
131.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
132.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black-Cockatoo)		T	
133.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo),			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
	<i>Carnaby's Cockatoo</i>		T	
134.	24735 <i>Glossopsitta porphyrocephala</i> (Purple-crowned Lorikeet)			
135.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
136.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
137.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
138.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
<b>Pygopodidae</b>				
139.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
140.	25005 <i>Lialis burtonis</i>			
141.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i> (Keeled Legless Lizard)			
142.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
<b>Rallidae</b>				
143.	25727 <i>Fulica atra</i> (Eurasian Coot)			
144.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
145.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
146.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
147.	24769 <i>Porzana fluminea</i> (Australian Spotted Crane)			
148.	25732 <i>Porzana pusilla</i> (Baillon's Crane)			
149.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
<b>Recurvirostridae</b>				
150.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
151.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
152.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
<b>Scincidae</b>				
153.	42368 <i>Acritoscincus trilineatus</i>			
154.	30893 <i>Cryptoblepharus buchananii</i>			
155.	25020 <i>Cryptoblepharus plagioccephalus</i>			
156.	25027 <i>Ctenotus australis</i>			
157.	25100 <i>Egernia napoleonis</i>			
158.	25119 <i>Hemiergis quadrilineata</i>			
159.	25133 <i>Lerista elegans</i>			
160.	25147 <i>Lerista lineata</i> (Perth Slider, Lined Skink)		P3	
161.	25184 <i>Menetia greyii</i>			
162.	25191 <i>Morethia lineocellata</i>			
163.	25519 <i>Tiliqua rugosa</i>			
164.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
<b>Scolopacidae</b>				
165.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
166.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
167.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
168.	24786 <i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
169.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
170.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
171.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
172.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
173.	24808 <i>Tringa nebularia</i> (Common Greenshank)		IA	
174.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper)		IA	
<b>Scolopendridae</b>				
175.	-11860 <i>Cormocephalus novaehollandiae</i>			
<b>Sparassidae</b>				
176.	-12192 <i>Isopeda leishmanni</i>			
<b>Strigidae</b>				
177.	25748 <i>Ninox novaeseelandiae</i> (Boobook Owl)			
<b>Sylviidae</b>				
178.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
179.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
<b>Tachyglossidae</b>				
180.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
<b>Tarsipedidae</b>				
181.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
<b>Tetragnathidae</b>				
182.	-13100 <i>Nanometa gentilis</i>			
<b>Tettigoniidae</b>				
183.	33994 <i>Throscodectes xiphos</i> (cricket)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
				P1
<b>Theridiidae</b>				
184.	-11913 <i>Crustulina bicrucata</i>			
<b>Threskiornithidae</b>				
185.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
186.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
187.	24844 <i>Threskiornis molucca</i> (Australian White Ibis)			
188.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
<b>Typhlopidae</b>				
189.	25271 <i>Ramphotyphlops australis</i>			
<b>Urodacidae</b>				
190.	-12778 <i>Urodacus novaehollandiae</i>			
<b>Vespertilionidae</b>				
191.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
192.	24189 <i>Falsistrellus mackenziei</i> (Western False Pipistrelle)		P4	
193.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
<b>Zosteropidae</b>				
194.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

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

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

# Appendix D – Flora results

Flora species list recorded within the Study Area during the survey

Likelihood of occurrence assessment of conservation significant flora identified in the desktop assessment as potentially occurring within the Study Area

Quadrat data & photographs

## Flora species identified within the Study Area during the survey

Family	Taxon	EPBC ACT	WC Act	DPaW	Introduced
Aizoaceae	<i>Carpobrotus edulis</i>				*
Anarthriaceae	<i>Lyginia barbata</i>				
Anarthriaceae	<i>Lyginia imberbis</i>				
Araliaceae	<i>Trachymene pilosa</i>				
Asparagaceae	<i>Asparagus asparagoides</i>				* DP, WoNS
Asparagaceae	<i>Laxmannia squarrosa</i>				
Asparagaceae	<i>Lomandra caespitosa</i>				
Asparagaceae	<i>Lomandra preissii</i>				
Asparagaceae	<i>Thysanotus sp.</i>				
Asteraceae	<i>Arctotheca calendula</i>				*
Asteraceae	<i>Hypochaeris sp.</i>				*
Asteraceae	<i>Podolepis gracilis</i>				
Asteraceae	<i>Podotheca gnaphalioides</i>				
Asteraceae	<i>Ursinia anthemoides</i>				*
Casuarinaceae	<i>Allocasuarina fraseriana</i>				
Colchicaceae	<i>Burchardia congesta</i>				
Cyperaceae	<i>Baumea juncea</i>				
Cyperaceae	<i>Lepidosperma pubisquameum</i>				
Cyperaceae	<i>Mesomelaena pseudostygia</i>				
Cyperaceae	<i>Schoenus curvifolius</i>				
Dasyopogonaceae	<i>Dasyopogon bromeliifolius</i>				
Dilleniaceae	<i>Hibbertia hypericoides</i>				
Dilleniaceae	<i>Hibbertia racemosa</i>				
Droseraceae	<i>Drosera erythrorhiza</i>				
Droseraceae	<i>Drosera menziesii</i>				
Ericaceae	<i>Conostephium pendulum</i>				
Ericaceae	<i>Leucopogon polymorphus</i>				
Ericaceae	<i>Leucopogon sp.</i>				
Euphorbiaceae	<i>Euphorbia terracina</i>				*
Fabaceae	<i>Acacia alata</i>				
Fabaceae	<i>Acacia pulchella</i>				
Fabaceae	<i>Acacia saligna</i>				
Fabaceae	<i>Acacia sp.</i>				
Fabaceae	<i>Bossiaea eriocarpa</i>				
Fabaceae	<i>Daviesia triflora</i>				
Fabaceae	<i>Gompholobium tomentosum</i>				
Fabaceae	<i>Hovea pungens</i>				
Fabaceae	<i>Hovea trisperma</i>				
Fabaceae	<i>Jacksonia floribundum</i>				
Goodeniaceae	<i>Dampiera linearis</i>				
Goodeniaceae	<i>Scaevola sp.</i>				
Haemodoraceae	<i>Conostylis aculeata</i>				
Haemodoraceae	<i>Conostylis setigera</i>				
Haemodoraceae	<i>Phlebocarya ciliata</i>				
Haloragaceae	<i>Gonocarpus paniculatus</i>				
Hemerocallidaceae	<i>Agrostocrinum hirsutum</i>				
Hemerocallidaceae	<i>Caesia micrantha</i>				
Hemerocallidaceae	<i>Dianella revoluta</i>				
Hemerocallidaceae	<i>Tricoryne elatior</i>				
Iridaceae	<i>Gladiolus caryophyllaceus</i>				*
Iridaceae	<i>Patersonia occidentalis</i>				

Family	Taxon	EPBC ACT	WC Act	DPaW	Introduced
Lamiaceae	<i>Hemiandra pungens</i>				
Loranthaceae	<i>Nuytsia floribunda</i>				
Molluginaceae	<i>Macarthuria australis</i>				
Myrtaceae	<i>Astartea scoparia</i>				
Myrtaceae	<i>Calytrix fraseri</i>				
Myrtaceae	<i>Calytrix sp.</i>				
Myrtaceae	<i>Eremaea asterocarpa</i>				
Myrtaceae	<i>Eremaea pauciflora var. pauciflora</i>				
Myrtaceae	<i>Eucalyptus marginata</i>				
Myrtaceae	<i>Hypocalymma angustifolium</i>				
Myrtaceae	<i>Hypocalymma robustum</i>				
Myrtaceae	<i>Kennedia sp.</i>				
Myrtaceae	<i>Kunzea glabrescens</i>				
Myrtaceae	<i>Melaleuca raphiophylla</i>				
Myrtaceae	<i>Melaleuca thymoides</i>				
Myrtaceae	<i>Scholtzia involucrata</i>				
Orchidaceae	<i>Caladenia flava</i>				
Orchidaceae	<i>Caladenia paludosa</i>				
Orchidaceae	<i>Caladenia sp.</i>				
Orchidaceae	<i>Elythranthera brunonis</i>				
Orchidaceae	<i>Leptoceras menziesii</i>				
Orchidaceae	<i>Microtis media</i>				
Orchidaceae	<i>Pyrorchis nigricans</i>				
Orchidaceae	<i>Thelymitra crinita</i>				
Orchidaceae	<i>Thelymitra sp.</i>				
Orobanchaceae	<i>Orobanche minor</i>				*
Papaveraceae	<i>Fumaria sp.</i>				*
Poaceae	<i>Amphipogon turbinatus</i>				
Poaceae	<i>Austrostipa sp.</i>				
Poaceae	<i>Avena barbata</i>				*
Poaceae	<i>Briza maxima</i>				*
Poaceae	<i>Bromus diandrus</i>				*
Poaceae	<i>Bromus hordeaceus</i>				*
Poaceae	<i>Ehrharta calycina</i>				*
Poaceae	<i>Ehrharta sp.</i>				*
Poaceae	<i>Eragrostis curvula</i>				*
Poaceae	<i>Lolium sp.</i>				*
Poaceae	<i>Vulpia bromoides</i>				*
Proteaceae	<i>Adenanthos cygnorum</i>				
Proteaceae	<i>Banksia attenuata</i>				
Proteaceae	<i>Banksia illicifolia</i>				
Proteaceae	<i>Banksia littoralis</i>				
Proteaceae	<i>Banksia menziesii</i>				
Proteaceae	<i>Persoonia saccata</i>				
Proteaceae	<i>Petrophile linearis</i>				
Proteaceae	<i>Stirlingia latifolia</i>				
Restionaceae	<i>Desmocladius flexuosus</i>				
Restionaceae	<i>Hypolaena exsulca</i>				
Rubiaceae	<i>Opercularia vaginata</i>				
Rutaceae	<i>Boronia crenulata</i>				



## Flora species identified within the Study Area during the survey

Family	Taxon	EPBC ACT	WC Act	DPaW	Introduced
Rutaceae	<i>Philotheca spicata</i>				
Solanaceae	<i>Solanum nigrum</i>				*
Stylidiaceae	<i>Stylidium piliferum</i>				
Stylidiaceae	<i>Stylidium repens</i>				
Stylidiaceae	<i>Stylidium schoenoides</i>				
Stylidiaceae	<i>Stylidium sp.</i>				
Stylidiaceae	<i>Stylidium striatum</i>				
Thymelaeaceae	<i>Pimelea lehmanniana</i>				
Violaceae	<i>Hybanthus calycinus</i>				
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>				
Zamiaceae	<i>Macrozamia riedlei</i>				
	* <i>Introduced species</i>				

Likelihood of occurrence assessment of conservation significant flora identified in the desktop assessment as potentially occurring within the Study Area

Scientific name	Common name	Status		Source			Description and habitat requirements (Western Australian Herbarium, 1998-)	Likelihood of occurrence	References
		State	Federal	NatureMap search	WAHERB/TPFL	EPBC search			
<i>Andersonia gracilis</i>	Slender Andersonia	T	E			X	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps. Andersonia gracilis is currently known from the Badgingarra, Dandaragan and Kenwick areas where it is found on seasonally damp, black sandy clay flats near or on the margins of swamps, often on duplex soils supporting low open heath vegetation with species such as <i>Calothamnus hirsutus</i> , <i>Verticordia densiflora</i> and <i>Kunzea recurva</i> over sedges.	Very unlikely as preferred habitat is not present and possible habitat is very degraded	Department of Environment and Conservation (2006). Slender Andersonia ( <i>Andersonia gracilis</i> ) Interim Recovery Plan 2006-2011. Interim Recovery Plan No. 228.  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Caladenia huegelii</i>	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	T	E	X		X	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	Possible	Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Centrolepis caespitosa</i>		P4	E			X	Tufted annual, herb (forming a rounded cushion up to 25 mm across). Fl. Oct to Dec. White sand, clay. Salt flats, wet areas. Centrolepis caespitosa occurs in winter-wet clay pans dominated by low shrubs and sedges	Very unlikely as preferred habitat is not present	Department of Conservation and Land Management (2004). Matted centrolepis ( <i>Centrolepis caespitosa</i> ) 2004-2008 Interim Recovery Plan No 159 (Gilfillan, S. & S. Barrett, 2004)  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Cyathochaeta teretifolia</i>		P3		X	X		Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. Brown. Grey sand, sandy clay. Swamps, creek edges.	Very unlikely as preferred habitat is not present and possible habitat is very degraded	Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Darwinia foetida</i>	Muceha bell	T	CE			X	Erect, or spreading, shrub to 0.7 m high, often using other shrubs for support. Young branches are slender, green-brown with prominent, decurrent leaf bases, becoming grey and woody. Fl. Green, Oct to Nov. Grey or white sand, swampy, seasonally wet sites. The Muceha Bell is known from three populations in swampy, seasonally wet habitat in the Muceha area, approximately 70km north of Perth.	Very unlikely as preferred habitat is not present	Commonwealth Conservation Advice on <i>Darwinia</i> sp. <i>Muceha</i> (B.J.Keighery 2458) ( <i>Muceha</i> Bell) (Threatened Species Scientific Committee (TSSC), 2009ab) [Conservation Advice].  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Diuris micrantha</i>	Dwarf Bee-orchid	T	V	X	X	X	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water. Dwarf Bee-orchid is known from seven populations, from east of Kwinana and south towards the Frankland area, Western Australia. It is found in small populations, on dark, grey to blackish, sandy clay-loam substrates in winter wet depressions or swamps. The bases of the flowering plants are often covered with shallow water	Unlikely as preferred habitat is not present	Commonwealth Conservation Advice on <i>Diuris micrantha</i> (Threatened Species Scientific Committee, 2008mo) [Conservation Advice].  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Diuris purdiei</i>	Purdie's Donkey Orchid	T	E			X	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps. It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath and emergent trees	Very unlikely as preferred habitat is not present	Commonwealth Conservation Advice on <i>Diuris purdiei</i> (Purdie's Donkey-orchid) (Threatened Species Scientific Committee, 2008j) [Conservation Advice].  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Dodonaea hackettiana</i>	Hackett's Hopbush	P4		X	X		Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	Very unlikely as preferred habitat is not present	Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Drakaea elastica</i>	Glossy-leaved Hammer-orchid, Praying Virgin	T	E		X	X	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps. Preferred habitat is low-lying areas of deep sand supporting banksia woodland or spearwood thicket	Very unlikely as preferred habitat is not present and possible habitat is very degraded	Department of Environment and Conservation (2009). National recovery plan for the Glossy-leaved Hammer Orchid ( <i>Drakaea elastica</i> ) (Department of Environment and Conservation, 2009l)  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	T	V			X	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand. The species is usually found in cleared fire breaks or open sandy patches that have been disturbed, and where competition from other plants has been removed. It occurs in infertile grey sands, in Banksia, Jarrah and Common Sheoak woodl and thickets of Spearwood ( <i>Kunzea ericifolia</i> )	Very unlikely as preferred habitat is not present and possible habitat is very degraded	Commonwealth Conservation Advice on <i>Drakaea micrantha</i> Hopper & A.P.Brown nom. inval. (Dwarf Hammer-orchid) (Threatened Species Scientific Committee, 2008k) [Conservation Advice].  Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Eremaea asterocarpa</i> subsp. <i>brachyclada</i>		P1		X	X		Shrub, to 0.7 m high. Fl. orange. Deep grey sand. Local Government Areas (LGAs): Gosnells.	Possible	Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Jacksonia gracillima</i>		P3		X	X		Local Government Areas (LGAs): Armadale, Busselton, Capel, Cockburn, Murray, Serpentine-Jarrahdale.	Possible	Western Australian (WA) Herbarium 1998-, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .

Scientific name	Common name	Status		Source			Description and habitat requirements (Western Australian Herbarium, 1998-)	Likelihood of occurrence	References
		State	Federal	NatureMap search	WAHERB/ TPFL	EPBC search			
<i>Lepidosperma rostratum</i>	Beaked Lepidosperma	T	E			X	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay. Beaked Lepidosperma is associated with Marsh Banksia ( <i>Banksia telmatiaea</i> ) and Hairy Clawflower ( <i>Calothamnus hirsutus</i> ), and grows in sandy soil among low heath in a winter-wet swamp	Very unlikely as preferred habitat is not present and possible habitat is very degraded	Commonwealth Conservation Advice on <i>Lepidosperma rostratum</i> (Threatened Species Scientific Committee, 2008th) [Conservation Advice]. Western Australian (WA) Herbarium 1998–, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Pimelea calcicola</i>		P3		X	X		Erect to spreading shrub, 0.2-1 m high. Fl. pink, Sep to Nov. Sand. Coastal limestone ridges.	Very unlikely as preferred habitat is not present	Western Australian (WA) Herbarium 1998–, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Tripterococcus paniculatus</i>		P4		X	X		Perennial, herb, to 1 m high. Fl. yellow-green, Oct to Nov. Grey, black or peaty sand. Winter-wet flats.	Very unlikely as preferred habitat is not present and possible habitat is very degraded	Western Australian (WA) Herbarium 1998–, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4		X	X		Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.	Unlikely as preferred habitat is not present and possible habitat is very degraded	Western Australian (WA) Herbarium 1998–, FloraBase—the Western Australian Flora, retrieved November, 2013, from <a href="http://florabase.dpaw.wa.gov.au/">http://florabase.dpaw.wa.gov.au/</a> .

## Quadrat data & photographs

Site	Q01	Project	Hammond Park
<b>Type:</b>	Quadrat	<b>Size:</b>	10 x 10 m
<b>Date:</b>	11/10/2013	<b>Described by:</b>	CB & LZ
<b>Co-ordinates:</b>	MGA 50	mE 391650	mN 6439732
<b>Location:</b>	Hammond Park		
<b>Landform:</b>	Flat		
<b>Drainage:</b>	Good drainage		
<b>Soil colour &amp; type:</b>	White/grey sand		
<b>Vegetation type:</b>	<i>Banksia/Kunzea</i> woodland		
<b>Vegetation condition:</b>	Degraded (5)		
<b>Fire age &amp; intensity:</b>	Old (> 5 years), no damage		
<b>Disturbances:</b>	Clearing, exotic weeds, sheep grazing (completely degraded understorey), ?dieback		
<b>Bare ground (%):</b>	10-30	<b>Logs (%):</b>	10-30
<b>Twigs (%):</b>	30-70	<b>Leaves (%):</b>	30-70
<b>Rocks &lt;2 cm (%):</b>	0	<b>Rocks 2-30 cm (%):</b>	0
<b>Rocks &gt;30 cm (%):</b>	0	<b>Veg. ground layer (%):</b>	2-10



## Species list

Family	Species	Status	Stratum	Cover (%)	Height (m)
Casuarinaceae	<i>Allocasuarina fraseriana</i>		U1	10-30	4.5
Proteaceae	<i>Banksia attenuata</i>		U1	10-30	3.5
Proteaceae	<i>Banksia littoralis</i>		U1	2-10	4.0
Proteaceae	<i>Banksia menziesii</i>		U1	2-10	5.5
Myrtaceae	<i>Kunzea glabrescens</i>		M1	10-30	3.0
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M2	2-10	1.5
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M3	2-10	0.8
Cyperaceae	<i>Schoenus curvifolius</i>		G1	2-10	0.4
Restionaceae	<i>Desmodcladus flexuosus</i>		G2	2-10	0.2
Dasygogonaceae	<i>Dasygogon bromeliifolius</i>		G2	2-10	0.3
Dilleniaceae	<i>Hibbertia hypericoides</i>		G2	2-10	0.2
Araliaceae	<i>Trachymene pilosa</i>		G2	<2	0.5
Asparagaceae	<i>Lomandra caespitosa</i>		G2	<2	0.2
Asteraceae	<i>Arctotheca calendula</i>	*	G2	<2	0.1
Droseraceae	<i>Drosera menziesii</i>		G2	<2	0.05
Hemerocallidaceae	<i>Agrostocrinum hirsutum</i>		G2	<2	0.4
Orchidaceae	<i>Caladenia flava</i>		G2	<2	0.1
Orchidaceae	<i>Leptoceras menziesii</i>		G2	<2	0.1
Poaceae	<i>Bromus hordeaceus</i>	*	G2	<2	0.3
Poaceae	<i>Vulpia bromoides</i>	*	G2	<2	0.1

Site	Q02	Project	Hammond Park
<b>Type:</b>	Quadrat	<b>Size:</b>	10 × 10 m
<b>Date:</b>	11/10/2013	<b>Described by:</b>	CB & LZ
<b>Co-ordinates:</b>	MGA 50	mE 0391583	mN 6439854
<b>Location:</b>	Hammond Park		
<b>Landform:</b>	Flat		
<b>Drainage:</b>	Good drainage		
<b>Soil colour &amp; type:</b>	Grey sand		
<b>Vegetation type:</b>			
<b>Vegetation condition:</b>	Excellent (2) – Very Good (3)		
<b>Fire age &amp; intensity:</b>	Nil		
<b>Disturbances:</b>	Clearing, exotic weeds		
<b>Bare ground (%):</b>	10-30	<b>Logs (%):</b>	0
<b>Twigs (%):</b>	10-30	<b>Leaves (%):</b>	30-70
<b>Rocks &lt;2 cm (%):</b>	0	<b>Rocks 2-30 cm (%):</b>	0
<b>Rocks &gt;30 cm (%):</b>	0	<b>Veg. ground layer (%):</b>	30-70



## Species list

Family	Species	Status	Stratum	Cover (%)	Height (m)
Proteaceae	<i>Banksia attenuata</i>		U1	30-70	5.5
Proteaceae	<i>Banksia illicifolia</i>		U1	<2	2.5
Proteaceae	<i>Banksia menziesii</i>		U1	<2	2.5
Myrtaceae	<i>Kunzea glabrescens</i>		M1	2-10	3.5
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M1	<2	2.5
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M2	30-70	1.5
Myrtaceae	<i>Kunzea glabrescens</i>		M2	<2	2.5
Myrtaceae	<i>Melaleuca thymoides</i>		M2	<2	2.5
Dilleniaceae	<i>Hibbertia racemosa</i>		M3	30-70	0.8
Ericaceae	<i>Leucopogon sp.</i>		M3	30-70	0.2
Myrtaceae	<i>Calytrix sp.</i>		M3	10-30	0.4
Fabaceae	<i>Gompholobium tomentosum</i>		M3	2-10	0.7
Fabaceae	<i>Bossiaea eriocarpa</i>		M3	2-10	0.3
Ericaceae	<i>Leucopogon polymorphus</i>		M3	<2	0.4
Fabaceae	<i>Hovea trisperma</i>		M3	<2	0.5
Proteaceae	<i>Petrophile linearis</i>		M3	<2	0.6
Haemodoraceae	<i>Phlebocarya ciliata</i>		G1	30-70	0.5
Dasygogonaceae	<i>Dasygogon bromeliifolius</i>		G1	10-30	0.6
Asparagaceae	<i>Lomandra preissii</i>		G1	2-10	0.25
Hemerocallidaceae	<i>Caesia micrantha</i>		G1	2-10	0.20
Araliaceae	<i>Trachymene pilosa</i>		G1	<2	0.2
Asparagaceae	<i>Thysanotus sp.</i>		G1	<2	Creeper
Asteraceae	<i>Ursinia anthemoides</i>	*	G1	<2	0.15
Asteraceae	<i>Hypochaeris sp.</i>	*	G1	<2	0.05
Colchicaceae	<i>Burchardia congesta</i>		G1	<2	0.4
Droseraceae	<i>Drosera erythrorhiza</i>		G1	<2	0.05
Haemodoraceae	<i>Conostylis aculeata</i>		G1	<2	0.15
Haloragaceae	<i>Gonocarpus paniculatus</i>		G1	<2	0.4
Iridaceae	<i>Gladiolus caryophyllaceus</i>	*	G1	<2	0.7
Orchidaceae	<i>Caladenia sp.</i>		G1	<2	0.1
Orchidaceae	<i>Pyrorchis nigricans</i>		G1	<2	0.05
Orchidaceae	<i>Thelymitra sp.</i>		G1	<2	0.15
Orchidaceae	<i>Leptoceras menziesii</i>		G1	<2	0.05
Orobanchaceae	<i>Orobanche minor</i>	*	G1	<2	0.15
Poaceae	<i>Ehrharta sp.</i>	*	G1	<2	0.15
Poaceae	<i>Briza maxima</i>	*	G1	<2	0.3
Restionaceae	<i>Hypolaena exsulca</i>		G1	<2	0.6
Stylidiaceae	<i>Stylidium repens</i>		G1	<2	0.15
Stylidiaceae	<i>Stylidium schoenoides</i>		G1	<2	0.15

Site	Q03	Project	Hammond Park
<b>Type:</b>	Quadrat	<b>Size:</b>	10 × 10 m
<b>Date:</b>	11/10/2013	<b>Described by:</b>	CB & LZ
<b>Co-ordinates:</b>	MGA 50	mE 0393266	mN 6479456
<b>Location:</b>	Hammond Park		
<b>Landform:</b>	Flat		
<b>Drainage:</b>	Good drainage		
<b>Soil colour &amp; type:</b>	Grey sand		
<b>Vegetation type:</b>			
<b>Vegetation condition:</b>	Excellent (2) – Very Good (3)		
<b>Fire age &amp; intensity:</b>	Nil		
<b>Disturbances:</b>	Exotic weeds		
<b>Bare ground (%):</b>	10-30	<b>Logs (%):</b>	0
<b>Twigs (%):</b>	2-10	<b>Leaves (%):</b>	30-70
<b>Rocks &lt;2 cm (%):</b>	0	<b>Rocks 2-30 cm (%):</b>	0
<b>Rocks &gt;30 cm (%):</b>	0	<b>Veg. ground layer (%):</b>	30-70





## Species list

Family	Species	Status	Stratum	Cover (%)	Height (m)
Proteaceae	<i>Banksia menziesii</i>		U1	10-30	5.0
Proteaceae	<i>Banksia illicifolia</i>		U1	2-10	5.0
Proteaceae	<i>Banksia littoralis</i>		U1	<2	5.0
Myrtaceae	<i>Kunzea glabrescens</i>		M1	2-10	4.0
Fabaceae	<i>Jacksonia floribundum</i>		M1	<2	2.0
Myrtaceae	<i>Kunzea glabrescens</i>		M2	2-10	1.5
Myrtaceae	<i>Scholtzia involucrata</i>		M3	30-70	0.3
Ericaceae	<i>Conostephium pendulum</i>		M3	30-70	0.3
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M3	10-30	1.0
Myrtaceae	<i>Calytrix fraseri</i>		M3	10-30	0.4
Dilleniaceae	<i>Hibbertia racemosa</i>		M3	<2	0.25
Proteaceae	<i>Petrophile linearis</i>		M3	<2	0.15
Fabaceae	<i>Gompholobium tomentosum</i>		M3	<2	0.3
Fabaceae	<i>Bossiaea eriocarpa</i>		M3	<2	0.2
Anarthriaceae	<i>Lyginia imberbis</i>		G1	<2	0.5
Cyperaceae	<i>Schoenus curvifolius</i>		G1	<2	0.2
Cyperaceae	<i>Lepidosperma pubisquameum</i>		G1	<2	0.4
Dasypogonaceae	<i>Dasypogon bromeliifolius</i>		G2	10-30	0.6
Haemodoraceae	<i>Phlebocarya ciliata</i>		G2	10-30	0.5
Restionaceae	<i>Desmocladius flexuosus</i>		G2	2-10	0.2
Araliaceae	<i>Trachymene pilosa</i>		G2	<2	0.05
Asparagaceae	<i>Lomandra preissii</i>		G2	<2	0.15
Asteraceae	<i>Hypochaeris sp.</i>	*	G2	<2	0.05
Asteraceae	<i>Ursinia anthemoides</i>	*	G2	<2	0.05
Asteraceae	<i>Podotheca gnaphalioides</i>		G2	<2	0.2
Colchicaceae	<i>Burchardia congesta</i>		G2	<2	0.25
Goodeniaceae	<i>Dampiera linearis</i>		G2	<2	0.1
Iridaceae	<i>Gladiolus caryophyllaceus</i>	*	G2	<2	0.4
Iridaceae	<i>Patersonia occidentalis</i>		G2	<2	0.4
Orchidaceae	<i>Pyrorchis nigricans</i>		G2	<2	0.05
Poaceae	<i>Briza maxima</i>	*	G2	<2	0.15
Poaceae	<i>Ehrharta calycina</i>	*	G2	<2	0.4
Poaceae	<i>Vulpia bromoides</i>	*	G2	<2	0.15
Poaceae	<i>Austrostipa compressa</i>		G2	<2	0.20
Stylidiaceae	<i>Stylidium striatum</i>		G2	<2	0.3

Site	Q04	Project	Hammond Park
Type:	Quadrat	Size:	10 × 10 m
Date:	11/10/2013	Described by:	CB & LZ
Co-ordinates:	MGA 50	mE 0391703	mN 6439980
Location:	Hammond Park		
Landform:	Plain		
Drainage:	Good drainage		
Soil colour & type:	Brown silty sand		
Vegetation type:			
Vegetation condition:	Excellent (2)		
Fire age & intensity:	Old (>5 years)		
Disturbances:	Exotic weeds		
Bare ground (%):	0	Logs (%):	10-30
Twigs (%):	10-30	Leaves (%):	30-70
Rocks <2 cm (%):	0	Rocks 2-30 cm (%):	0
Rocks >30 cm (%):	0	Veg. ground layer (%):	30-70



## Species list

Family	Species	Status	Stratum	Cover (%)	Height (m)
Proteaceae	<i>Banksia menziesii</i>		U1	30-70	5
Proteaceae	<i>Banksia attenuata</i>		U1	30-70	5
Proteaceae	<i>Banksia ilicifolia</i>		U1	10-30	5
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M1	2-10	2
Myrtaceae	<i>Eremaea pauciflora</i> var. <i>pauciflora</i>		M1	2-10	1.5
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		M2	10-30	1
Fabaceae	<i>Bossiaea eriocarpa</i>		M3	<2	0.3
Myrtaceae	<i>Calytrix fraseri</i>		M3	<2	0.15
Cyperaceae	<i>Lepidosperma pubisquameum</i>		G1	30-70	0.5
Anarthriaceae	<i>Lyginia imberbis</i>		G1	10-30	0.4
Cyperaceae	<i>Schoenus curvifolius</i>		G1	<2	0.3
Iridaceae	<i>Patersonia occidentalis</i>		G2	2-10	0.4
Haemodoraceae	<i>Phlebocarya ciliata</i>		G2	30-70	0.2
Restionaceae	<i>Desmocladus flexuosus</i>		G2	30-70	0.15
Dasyopogonaceae	<i>Dasyopogon bromeliifolius</i>		G2	30-70	0.4
Araliaceae	<i>Trachymene pilosa</i>		G2	<2	0.1
Asparagaceae	<i>Lomandra caespitosa</i>		G2	2-10	0.4
Asparagaceae	<i>Asparagus asparagoides</i>	* DP, WoNS	G2	<2	0.8
Colchicaceae	<i>Burchardia congesta</i>		G2	<2	0.4
Droseraceae	<i>Drosera erythrorhiza</i>		G2	<2	0.05
Haemodoraceae	<i>Conostylis aculeata</i>		G2	<2	0.2
Hemerocallidaceae	<i>Caesia micrantha</i>		G2	<2	0.4
Hemerocallidaceae	<i>Tricoryne elatior</i>		G2	2-10	0.2
Iridaceae	<i>Gladiolus caryophyllaceus</i>	*	G2	<2	0.8
Iridaceae	<i>Patersonia occidentalis</i>		G2	<2	0.3
Orchidaceae	<i>Thelymitra</i> sp.		G2	<2	0.3
Orchidaceae	<i>Microtis media</i>		G2	<2	0.4
Orchidaceae	<i>Pyrorchis nigricans</i>		G2	<2	0.2
Poaceae	<i>Briza maxima</i>	*	G2	<2	0.15
Poaceae	<i>Ehrharta calycina</i>	*	G2	<2	0.8
Poaceae	<i>Avena barbata</i>	*	G2	<2	0.4
Restionaceae	<i>Hypolaena exsulca</i>		G2	<2	0.3
Rubiaceae	<i>Opercularia vaginata</i>		G2	2-10	0.2
Solanaceae	<i>Solanum nigrum</i>	*	G2	<2	0.3
Stylidiaceae	<i>Stylidium schoenoides</i>		G2	<2	0.3

Site	Q05	Project	Hammond Park
<b>Type:</b>	Quadrat	<b>Size:</b>	10 × 10 m
<b>Date:</b>	11/10/2013	<b>Described by:</b>	CB & LZ
<b>Co-ordinates:</b>	MGA 50	mE 0391719	mN 6439914
<b>Location:</b>	Hammond Park		
<b>Landform:</b>	Plain		
<b>Drainage:</b>	Seasonal wet		
<b>Soil colour &amp; type:</b>	Black/grey sand		
<b>Vegetation type:</b>			
<b>Vegetation condition:</b>	Good (4) – Degraded (5)		
<b>Fire age &amp; intensity:</b>	Old (>5 years)		
<b>Disturbances:</b>	Exotic weeds, clearing		
<b>Bare ground (%):</b>	2-10	<b>Logs (%):</b>	<2
<b>Twigs (%):</b>	10-30	<b>Leaves (%):</b>	30-70
<b>Rocks &lt;2 cm (%):</b>	0	<b>Rocks 2-30 cm (%):</b>	0
<b>Rocks &gt;30 cm (%):</b>	0	<b>Veg. ground layer (%):</b>	30-70



## Species list

Family	Species	Status	Stratum	Cover (%)	Height (m)
Myrtaceae	<i>Melaleuca raphiophylla</i>		U1	2-10	6
Myrtaceae	<i>Kunzea glabrescens</i>		M1	30-70	3
Myrtaceae	<i>Astartea scoparia</i>		M1	30-70	1.5
Myrtaceae	<i>Hypocalymma angustifolium</i>		M2	30-70	1
Poaceae	<i>Ehrharta calycina</i>	*	G1	30-70	1.4
Asteraceae	<i>Arctotheca calendula</i>	*	G1	10-30	0.15
Asparagaceae	<i>Lomandra caespitosa</i>		G1	<2	0.8
Asteraceae	<i>Hypochaeris sp.</i>	*	G1	<2	0.05
Iridaceae	<i>Gladiolus caryophyllaceus</i>	*	G1	<2	0.8
Iridaceae	<i>Patersonia occidentalis</i>		G1	<2	0.5
Poaceae	<i>Avena barbata</i>	*	G1	<2	0.5

# Appendix E – Fauna results

Fauna species recorded within the Study Area during the field survey

Fauna likelihood of occurrence assessment of conservation significant fauna identified in the desktop assessment as potentially occurring within the Study Area

Significant habitat trees (diameter at breast height >500 mm) recorded within the Study Area

## Fauna species identified within the Study Area during the survey

Family	Taxon	Common name	EPBC ACT	WC Act	DEC	Locally Significant	Introduced
<b>Birds</b>							
Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite				X	
Anatidae	<i>Tadorna tadornoides</i>	Australian Shelduck					
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck					
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah					
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu				X	
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon					
Corvidae	<i>Corvus coronoides perplexus</i>	Australian Raven					
Cracticidae	<i>Cracticus tiibicen dorsalis</i>	Australian Magpie					
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie-lark					
Dicruridae	<i>Rhipidura leucophrys leucophrys</i>	Willie Wagtail					
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow					
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren				X	
Motacillidae	<i>Anthus novaeseelandiae</i>	Richards Pipit					
Psittacidae	<i>Platycercus zonarius semitorquatus</i>	Twenty-eight Parrot					
<b>Mammals</b>							
Canidae	<i>Canis lupus*</i>	Domestic Dog					X
Bovidae	<i>Bos taurus*</i>	Cow					X
Felidae	<i>Felis catus*</i>	Cat					X
Leporidae	<i>Oryctolagus cuniculus*</i>	European Rabbit					X
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo					

\* Introduced species

Likelihood of occurrence assessment of conservation significant flora identified in the desktop assessment as potentially occurring within the Study Area

Scientific name	Common name	Status		Source		Description and habitat requirements (Western Australian Herbarium, 1998-)	Likelihood of occurrence	References
		State	Federal	NatureMap search	EPBC search			
<b>Birds</b>								
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	T	V	X	X	Forest Red-tailed Black Cockatoo typically occurs in dense Jarrah ( <i>Eucalyptus marginata</i> ), Karri ( <i>E. diversicolor</i> ) and Marri ( <i>Corymbia calophylla</i> ) forests, however the species also occurs in a range of other forest and woodland types, including Blackbutt ( <i>E. patens</i> ), Wandoo ( <i>E. wandoo</i> ), Tuart ( <i>E. gomphocephala</i> ), Albany Blackbutt, Yate ( <i>E. cornuta</i> ), and Flooded Gum ( <i>E. rudis</i> ) (DSEWPac, 2012). Habitats also tend to have an understorey of <i>Banksia</i> spp., <i>Persoonia</i> spp., <i>Allocasuarina</i> spp. The Forest red-tailed Black Cockatoo generally nests in hollows in live or dead trees of marri, karri, wandoo, bullich, blackbutt, tuart and jarrah (DSEWPac 2012).	Likely The Forest Red-tailed Black Cockatoo has been recorded within 5 km of the Study Area and there is suitable foraging and potential breeding habitat present.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) (2012). Environmental Protection and Biodiversity Conservation Act 1999 referral guidelines for three threatened black cockatoo species. Department of Sustainability, Environment, Water, Population and Communities. Australian Government Canberra
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	T	V		X	Baudin's Black Cockatoo occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by Marri ( <i>Corymbia calophylla</i> ) and Eucalyptus species, especially Karri ( <i>E. diversicolor</i> ) and Jarrah ( <i>E. marginata</i> ). The species also occurs in woodlands of Wandoo ( <i>E. wandoo</i> ), Blackbutt ( <i>E. patens</i> ), Flooded Gum ( <i>E. rudis</i> ), and Yate ( <i>E. cornuta</i> ). Baudin's Black Cockatoo breeds in the Jarrah, Marri and Karri forests of the deep south-west in areas averaging more than 750 mm of rainfall annually. The range of the species extends from Albany northward to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Boyup Brook. Preferred roosts are in areas with a dense canopy close to permanent sources of water, that provide the birds with protection from weather conditions (DSEWPac, 2012).	Possible The Study Area is located outside the modelled distribution of the Baudin's Black Cockatoo, however the species has been known to occur on the southern Swan Coastal Plain. This species typically is restricted to the Darling Range, however, sightings have been recorded within the Perth metropolitan area. There is suitable foraging and potential breeding habitat for the Baudin's Black Cockatoo present within the Study Area.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) (2012). Environmental Protection and Biodiversity Conservation Act 1999 referral guidelines for three threatened black cockatoo species. Department of Sustainability, Environment, Water, Population and Communities. Australian Government Canberra
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	T	E	X	X	This species mainly occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland dominated by Hakea, Dryandra, Banksia and Grevillea species. The species also occurs in forests containing Marri ( <i>Corymbia calophylla</i> ), Jarrah ( <i>Eucalyptus marginata</i> ) or Karri ( <i>E. diversicolor</i> ). Breeding usually occurs in the Wheatbelt region of Western Australia, with flocks moving to the higher rainfall coastal areas to forage after the breeding season. Feeds on the seeds of a variety of native plants, including <i>Allocasuarina</i> , Banksia, Dryandra, Eucalyptus, Grevillea and Hakea, and some introduced plants (DSEWPac, 2012).	Known Carnaby's Black Cockatoo was recorded flying over the Study Area during the field survey. This species has been recorded within 5 km of the Study Area and there is suitable foraging and potential breeding habitat present.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) (2012). Environmental Protection and Biodiversity Conservation Act 1999 referral guidelines for three threatened black cockatoo species. Department of Sustainability, Environment, Water, Population and Communities. Australian Government Canberra
<i>Botaurus poiciloptilus</i>	Australasian Bittern	T	E		X	The Australasian Bittern occurs mainly in densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands. The species favours foraging in tall, dense vegetation in shallow permanent or seasonal fresh water. In the southwest of Western Australia the Bittern is now largely confined to coastal areas especially along the south coast where it is found in beds of tall rush mixed with or near short fine sedge or open pools (Burbridge 2004). It also occurs around swamps, lakes, pools, rivers and channels fringed with lignum <i>Muehlenbeckia</i> , canegrass <i>Eragrostis</i> or other dense vegetation. It occasionally ventures into areas of open water or onto banks.	Unlikely There is no suitable habitat present for this species within the Study Area.	Burbridge, A.A (2004) Threatened Animals of Western Australia. Department of Conservation and Land Management, Perth.
<i>Sternula nereis nereis</i>	Australian Fairy Tern	T	V		X	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night (Garnett and Crowley 2000; Nevill, 2008)	Unlikely There is no suitable habitat present for this species within the Study Area.	Nevill S. (2008) Birds of the Greater South West Western Australia. Simon Nevill Publications. Perth Australia.  Garnett S.T. and Crowley G.M. (2000). The Action Plan for Australian Birds 2000. Environment Australia, Canberra
<i>Falco peregrinus</i>	Peregrine Falcon	S		X		The Peregrine Falcon is seen occasionally anywhere in the south-west of Western Australia. It is found everywhere from woodlands to open grasslands and coastal cliffs - though less frequently in desert regions. The species nests primarily on ledges of cliffs, shallow tree hollows, and ledges of building in cities. (Morcombe, 2004).	Possible The Peregrine Falcon is known to occur in the region and may utilise the Study Area opportunistically.	Morcombe M. (2004). Field Guide to Australian Birds. Steve Parish Publishing Archer Field Queensland Australia
<i>Calidris ferruginea</i>	Curlew Sandpiper	T	Mi	X		Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (DSEWPac 2013).	Unlikely There is no suitable habitat present for this species within the Study Area.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) 2013, <i>Species Profile and Threats Database (SPRAT)</i> , Department of Sustainability, Environment, Water, Population and Communities, Australian Government Canberra.
<b>Migratory Birds</b>								



Scientific name	Common name	Status		Source		Description and habitat requirements (Western Australian Herbarium, 1998-)	Likelihood of occurrence	References
		State	Federal	NatureMap search	EPBC search			
<i>Ardea modesta</i>	Great Egret	IA	Mi	X	X	The eastern Great Egret is widespread in Australia. They have been reported in a wide range of wetland habitats, include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pasture or agricultural lands; reservoirs; sewerage treatment ponds; drainage channels; salt pans; salt marshes; mangrove, and a range of coastal/marine habitats (DSEWPac 2013).	Unlikely There is no suitable habitat present for this species within the Study Area.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) 2013, <i>Species Profile and Threats Database (SPRAT)</i> , Department of Sustainability, Environment, Water, Population and Communities, Australian Government Canberra.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	IA	Mi	X	X	The White-bellied Sea-Eagle occurs in coastal habitats (especially those close to the sea-shore as well as any habitat characterized by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). It also occurs in the vicinity of estuaries, mangroves, swamps, lagoons and floodplains, often far inland along major rivers (Morcombe, 2004).	Unlikely There is no suitable habitat present for this species within the Study Area.	Morcombe M, (2004). Field Guide to Australian Birds. Steve Parish Publishing Archer Field Queensland Australia.
<i>Merops ornatus</i>	Rainbow Bee-eater	IA	Mi	X	X	Open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also inhabits sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe, 2004).	Likely The Study Area contains suitable habitat for this species. The Rainbow Bee-eater has previously been recorded in the area.	Morcombe M, (2004). Field Guide to Australian Birds. Steve Parish Publishing Archer Field Queensland Australia.
<i>Leipoa ocellata</i>	Malleefowl	T	V, Mi		X	The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to south east of the Eyre Bird Observatory (south-east Western Australia). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine <i>Callitris</i> woodlands, Acacia shrublands, Broombush <i>Melaleuca uncinata</i> vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (DSEWPac 2013).	Unlikely The Malleefowl has never been recorded on the Swan Coastal Plain.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) 2013, <i>Species Profile and Threats Database (SPRAT)</i> , Department of Sustainability, Environment, Water, Population and Communities, Australian Government Canberra.
<i>Plegadis falcinellus</i>	Glossy Ibis	IA	Mi	X		Within Australia, the Glossy Ibis is generally located east of the Kimberley. The species is also known to be patchily distributed in the rest of Western Australia. Its preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, floodplains, wet meadows, swamps, reservoirs, sewerage ponds, rice-fields and cultivated areas under irrigation (DSEWPac 2013). The Glossy Ibis is considered scarce to uncommon on the Swan Coastal Plain (Neville 2008).	Unlikely There is no suitable habitat present for this species within the Study Area.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) 2013, <i>Species Profile and Threats Database (SPRAT)</i> , Department of Sustainability, Environment, Water, Population and Communities, Australian Government Canberra.  Nevill S. (2008) Birds of the Greater South West Western Australia. Simon Nevill Publications. Perth Australia.
<i>Rostratula australis</i>	Australian Painted Snipe	T	E, Mi		X	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The species rarely occurs in south-western Australia, where it was once more common (DSEWPac 2013).	Unlikely There is no suitable habitat present for this species within the Study Area.	Department of Sustainability, Environment, Water, Population and Communities (DSEWPac) 2013, <i>Species Profile and Threats Database (SPRAT)</i> , Department of Sustainability, Environment, Water, Population and Communities, Australian Government Canberra.
<b>Mammals</b>								
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	T	V		X	The Chuditch inhabits eucalypt forest (especially Jarrah, <i>Eucalyptus marginata</i> ), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyke & Strahan, 2008). The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range.	Unlikely Historically the species was known to be wide spread on the Swan Coastal Plain. In recent years some records of individuals have been identified however these are associated with large tracks of remnant vegetation. Due to the fragmented nature of natural vegetation in the area this species is unlikely to occur.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	T	V		X	The Western Ringtail Possum occurs in and near coastal Peppermint Tree ( <i>Agonis flexuosa</i> ) forest and Tuart ( <i>Eucalyptus gomphocephala</i> ) dominated forest with a Peppermint Tree understorey from Bunbury to Albany. Also occurs in Jarrah ( <i>Eucalyptus marginata</i> ) forest and Jarrah-Marri ( <i>Corymbia calophylla</i> ) forest associated with Peppermint Tree (Van Dyck and Strahan, 2008).	Unlikely The Western Ringtail Possum is known to occur southern Swan Coastal Plain, however it doesn't not occur as far north as the Study Area.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<i>Isodon obesulus</i> subsp. <i>fusciventer</i>	Quenda, Southern Brown Bandicoot	P5		X		The Quenda prefers dense scrubby, often swampy, vegetation with dense cover up to one metre high. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Van Dyck and Strahan, 2008).	Likely There is suitable habitat present within Study Area, and the Quenda has previously been recorded in the Study Area and in surrounding areas of remnant vegetation.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<i>Hydromys chrysogaster</i>	Water-rat	P4		X		Water-rats live primarily in a wide variety of freshwater habitats, from sub-alpine streams and other inland waterways to lakes, swamps, farm dams and irrigation channels and are thought to be one of the few native species to have at least partially benefited from human encroachment (Van Dyck and Strahan, 2008).	Unlikely The Study Area does not contain any permanent water bodies which would provide habitat for the water-rat. The species has previously been recorded within 5 km of the Study Area, near Banganup Lake in 1973.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.

Scientific name	Common name	Status		Source		Description and habitat requirements (Western Australian Herbarium, 1998-)	Likelihood of occurrence	References
		State	Federal	NatureMap search	EPBC search			
<i>Setonix brachyurus</i>	Quokka	T	V		X	Dense forests and thickets, streamside vegetation, heaths and shrublands <i>Agonis linearifolia</i> -dominated swamps in the Jarrah ( <i>Eucalyptus marginata</i> ) forest. The northern extent of the current distribution on the mainland is in the Jarrah forest immediately south-east of the Perth metropolitan area, from where it extends southward through the southern Jarrah, Marri and Karri forests to the south coast, but largely confined throughout to areas receiving an annual rainfall of 1,000 millimetres or more (Van Dyck and Strahan, 2008).	Unlikely There is no suitable habitat for the Quokka within the Study Area, and the species has not been recorded within 5 km.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle	P4		X		The Western False Pipistrelle occurs in wet sclerophyll forest dominated by Karri ( <i>Eucalyptus diversicolor</i> ), and in the high rainfall zones of the Jarrah ( <i>E. marginata</i> ) and Tuart ( <i>E. gomphocephala</i> ) forests. The species is restricted to areas in or adjacent to stands of old growth forest. It has also been recorded in mixed Tuart-Jarrah tall woodlands on the adjacent coastal plain. Marri ( <i>E. calophylla</i> ), Sheoak ( <i>Casuarina heugeliana</i> ) and Peppermint ( <i>Agonis flexuosa</i> ) trees are often co-dominant at its collection localities (Churchill 2008).	Unlikely There is no suitable habitat for the Western False Pipistrelle within the Study Area, and the nearest record of the species is from Harry Waring Marsupial Reserve in 1993. This is the only record of the species on the northern Swan Coastal Plain.	Churchill, S (2008). Australian Bats. Second Edition. Allen and Unwin, NSW.
<i>Macropus eugenii subsp. derbianus</i>	Tammar Wallaby (WA subsp)	P5		X		The Tammar Wallaby inhabits dense, low vegetation for daytime shelter and open grassy areas for feeding. Inhabits coastal scrub, heath, dry sclerophyll (leafy) forest and thickets in mallee and woodland The tammar wallaby is currently known to inhabit three islands in the Houtman Abrolhos group, Garden Island near Perth, Middle and North Twin Peak Islands in the Archipelago of the Recherche, and at least nine sites on the mainland including, Dryandra, Boyagin, Tutanning Batalling (reintroduced) Perup, private property near Pingelly, Jaloran Road timber reserve near Wagin, Hopetown, Stirling Range National Park, and Fitzgerald River National Park (Van Dyck and Strahan 2008).	Unlikely The Tammar Wallaby is restricted to known populations on offshore islands and at only nine sites on the mainland.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<i>Myrmecobius fasciatus</i>	Numbat	T	V	X		The numbat's distribution once encompassed a number of habitat types, including eucalypt forest, eucalypt woodland, Acacia woodland and Triodia grasslands. Current populations occupy several different habitat types: upland Jarrah forest, open eucalypt woodland, banksia woodland and tall closed shrubland. There are currently two remnant native populations at Dryandra and Perup, WA and several reintroduced populations including Boyagin Nature Reserve, Tutanning Nature Reserve, Batalling block and Karroun Hill Nature Reserve. Habitats usually have an abundance of termites in the soil, hollow logs and branches for shelter. This species has been part of a recovery plan since the late 1980's and has been relocated into several areas of the south west (Van Dyck and Strahan, 2008).	Unlikely The Numbat is restricted to known populations at Dryandra and Perup, and several introduced populations in DPaW managed reserves.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<i>Perameles bougainville</i>	Western Barred Bandicoot	T	Extinct	X		Historically the Western Barred Bandicoot occupied a wide variety of landscapes and vegetation types, including the saltbush covered Nullarbor Plain, sand ridges with woodlands, bluebush plains, desert <i>Acacia</i> , shrublands and heath throughout southern Australia (Van Dyck and Strahan, 2008). The western subspecies is now restricted to Bernier and Dorre Islands in Shark Bay.	Unlikely The mainland sub-species of the Western Barred Bandicoot is extinct.	Van Dyke. S & Strahan. R. (2008). The Mammals of Australia. Third Edition. New Holland Publishing, Sydney Australia.
<b>Reptiles</b>								
<i>Neelaps calonotos</i>	Black-striped Burrowing Snake	P3		X		The Black-striped Burrowing Snake is restricted to the sandy coastal strip near Perth, between Mandurah and Lancelin. It occurs on dunes and sand-plains vegetated with heaths and eucalypt/banksia woodlands, where it shelters in the upper layers of loose soil beneath leaf litter at the base of trees and shrubs. This species is seriously threatened by increasing development within its restricted distribution (Wilson and Swan 2013).	Likely The Black-striped Burrowing Snake has been recorded within 5 km of the Study and there is suitable eucalypt/banksia woodland habitat for the species.	Wilson S and Swan G, (2013) A Complete Guide to Reptiles of Australia. 4th Edition New Holland Press. Sydney Australia.
<i>Lerista lineata</i>	Perth Lined Skink	P3		X		Locally restricted to the Swan Coastal Plain south of the Swan River including Rottnest and Garden Islands, where it inhabits coastal dunes, banksia/eucalypt woodlands and suburban gardens. The Perth lined <i>Lerista</i> shelters in leaf litter and upper layers of loose soil at the bases of shrubs, inside soil heaps and abandoned stick-ant nests. There are also isolated populations on the mid-west coast at Woodleigh Station and in Busselton (Wilson and Swan, 2013).	Likely There is suitable eucalypt/banksia woodland habitat for the Perth Lined Skink within the Study Area and the species has previously been recorded...	Wilson S and Swan G, (2013) A Complete Guide to Reptiles of Australia. 4th Edition New Holland Press. Sydney Australia
<i>Pogona minor subsp. minima</i>	Dwarf Bearded Dragon (Houtman Abrolhos Is.)	T		X		The Houtman Abrolhos Island subspecies of the Dwarf Bearded Dragon is restricted to the Houtman Abrolhos Island off the lower west coast of WA.	Unlikely The Houtman Abrolhos Island subspecies of the Dwarf Bearded Dragon is restricted to the Houtman Abrolhos Island off the lower west coast of WA. There are two NatureMap records in the vicinity of the Perth metropolitan area (both from 2013), and these are most likely mid-identifications.	Wilson S and Swan G, (2013) A Complete Guide to Reptiles of Australia. 4th Edition New Holland Press. Sydney Australia
<b>Invertebrates</b>								

Scientific name	Common name	Status		Source		Description and habitat requirements (Western Australian Herbarium, 1998-)	Likelihood of occurrence	References
		State	Federal	NatureMap search	EPBC search			
<i>Synemon gratiosa</i>	Graceful Sun Moth	P4		X		The Graceful Sun-moth is closely associated with Banksia woodland. The species is also dependent upon <i>Lomandra maritima</i> and <i>L. hermaphrodita</i> being present for breeding. In recent years the species has been found to be wide spread and not restricted to the Perth metropolitan area. In 2012 the species was down graded from Vulnerable both under the EPBC Act and WC Act, but now resides as a Priority 4 species under DPaW.	Possible The Graceful Sun-moth is known to occur in the region, and there is suitable Banksia woodland habitat present within the Study Area.	
<i>Throscodectes xiphos</i>	Cricket	P1				There are only four records of <i>Throscodectes xiphos</i> from one location at Jandokot between 1981-1999.	Possible This species has been recorded 6.5 km north east of Study Area, and there is potentially suitable habitat available.	

Significant habitat trees (diameter at breast height >500 mm) recorded within the Study Area

Tree species	Location	DBH	Hollows			Foraging	Comments
			S	M	L	Marri nuts	
Jarrah	Easting: 391720 Northing: 6439711	600	0	0	0		
Jarrah	Easting: 391586 Northing: 6439696	550	0	0	0		
Jarrah	Easting: 391583 Northing: 6439696	800	0	0	0		
Jarrah	Easting: 391569 Northing: 6439725	1000	0	0	0		
Jarrah	Easting: 391566 Northing: 6439719	700	0	0	0		
Stag	Easting: 391664 Northing: 6439792	1500	0	0	2		At least 2 suitable (1 with beehive)
Jarrah	Easting: 391596 Northing: 6439795	700	0	0	0		
Jarrah	Easting: 391594 Northing: 6439798	500	0	0	0		
Jarrah	Easting: 391580 Northing: 6439807	700	0	0	0		
Jarrah	Easting: 391600 Northing: 6439780	1000	0	0	0		
Jarrah	Easting: 391534 Northing: 6439895	1000	0	0	0		
Jarrah	Easting: 391611 Northing: 6439994	800	0	0	0		
Jarrah	Easting: 391565 Northing: 6439679	700	0	0	0		

GHD


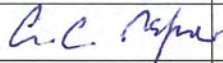
GHD House, 239 Adelaide Tce. Perth, WA 6004  
P.O. Box 3106, Perth WA 6832  
T: 61 8 6222 8222 F: 61 8 6222 8555 E: [permail@ghd.com.au](mailto:permail@ghd.com.au)

© GHD 2013

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

G:\61\2992303\WP\136686.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	C. Best D. Mullan	J. Reid C. Grabham		C. Grabham		
B	C. Best D. Mullan	A. Napier		A. Napier		1/10/2014

[www.ghd.com](http://www.ghd.com)

