APPENDIX B
ENVIRONMENTAL ASSESSMENT REPORT

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Lot 1665 Wanneroo Road, Sinagra

Environmental Assessment Report

Prepared for
Stockland Property Group
by Strategen

September 2019

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Lot 1665 Wanneroo Road, Sinagra

Environmental Assessment Report

Strategen is a trading name of
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September 2019

Limitations

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Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Stockland Property Group

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	A	Client review	C Turner & J Hyatt / D Newsome	Electronic	14 February 2019
Final Report	B	For submission	C Turner & J Hyatt / D Newsome	Electronic	15 March 2019
Final Report	0	For submission	C O'Brien & J Hyatt / D Newsome	Electronic	18 September 2019

Filename: STO18073.01 R005 Rev 0 - 18 September 2019

Executive Summary

Stockland Property Group (Stockland) proposes to develop Lot 1665 Wanneroo Road, Sinagra (the site; Figure 1), located in the City of Wanneroo, for residential purposes. The site comprises an area of approximately 40 ha and supports poultry operations.

The proposed Structure Plan (Figure 2) identifies:

- residential land uses
- areas of Public Open Space (POS) and drainage
- a primary school
- internal road network

The Environmental Assessment Report (EAR) ensures that environmental values and potential impacts associated with the proposed development can be managed in accordance with legislative and policy requirements, and have been adequately considered in the development design. The EAR addresses the following factors:

- topography, geology and soils
- acid sulfate soils
- contamination
- hydrology
- vegetation and flora
- fauna and habitat
- conservation areas
- bushfire risk
- heritage

The EAR demonstrates that the site is relatively unconstrained and is suitable for urban development, based on the assessment of existing environmental factors and values. A summary of the key environmental factors and values are listed below, along with management measures, where relevant:

- the soil mapped within the site comprise Spearwood sand derived from Tamala Limestone, and is considered as compatible with urbanisation and construction of roads. A geotechnical survey conducted for the site indicates that limestone pinnacles are present at the ground surface and below sands, which may require additional investigation to satisfy the requirements of the City of Wanneroo LPP 4.13: *Caves and Karstic Features* as part of the subdivision process
- no risk of acid sulfate soils has been identified for the site
- no widespread or gross soil or groundwater contamination is present across the site, and the detection of minor petroleum hydrocarbons and PCB is likely reflective of localised minor spills / releases from point sources, which are not considered to require remedial action
- Asbestos Containing Material (ACM) and asbestos fibres have been identified at four sample locations across the site, and further testing may be required following demolition works to inform contamination risk in areas of the site which were previously not accessible during the Detailed Site Investigation (DSI). A remediation and validation program will be implemented following further investigation to ensure that all identified contamination is remediated to Western Australian legislative standards prior to residential development
- no surface water, geomorphic wetlands or Public Drinking Water Source areas are mapped within the site
- no Commonwealth listed Threatened Ecological Communities (TEC) or State listed Priority Ecological Communities (PECs) were identified from the flora and vegetation surveys, and much of the vegetation on the site is considered to be in a Degraded to Completely Degraded condition
- no Threatened flora species pursuant to the EPBC Act or BC Act were recorded during the field survey

- Habitat for EPBC listed Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) was recorded during the fauna survey conducted by 360 Environmental (2017) and it is possible that Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) may also utilise habitat within the site. Given the presence of habitat, the project is subject to assessment under the *Environment Biodiversity Conservation Act 1999* and this assessment is anticipated to conclude in March 2019. High quality vegetation and significant trees will be retained in areas of Public Open Space (POS) and in road reserves where possible within the development design to ensure that impacts to these species are managed to an acceptable level. Additional management actions outlined in the Construction Environmental Management Plan (CEMP) will also be implemented.
- a large population of resident Western Grey Kangaroos are present within the site which will be translocated to a location that is agreed by the Department of Biodiversity, Conservation and Attractions (DBCA)
- no Conservation Areas, including Bush Forever, Environmentally Sensitive Areas, Local Natural Areas or Ecological Linkages are mapped within the site
- the site is mapped within a bushfire prone area due to the presence of classified vegetation within 150 m of the proposed development. A Bushfire Management Plan (BMP) has been prepared to address the requirements of *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7), namely Policy Measure 6.3.
- no Indigenous heritage or European heritage sites are mapped within the site

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1. Introduction

1.1 Project overview

Stockland Development Pty Ltd (Stockland) proposes to develop Lot 1665 Wanneroo Rd, Sinagra (the site; Figure 1), located in the City of Wanneroo, for residential purposes. The proposed Structure Plan is provided in Figure 2 and shows:

- residential land uses
- areas of Public Open Space (POS) and drainage
- a primary school
- internal road network

The site is approximately 40 ha and is located in the East Wanneroo Cell 2 Structure Plan. The site is currently zoned Urban Deferred under the Metropolitan Region Scheme (MRS) and Urban Development under the Wanneroo Local Planning Scheme 2. The Urban Deferred status under the MRS is related to the Ingham Poultry operations on site, and the relocation of this facility is required to enable development of the proposal area.

1.2 Purpose and scope of this document

This Environmental Assessment Report (EAR) has been prepared to support the Structure Plan application and to demonstrate that all environmental values and potential impacts associated with future land use can be managed in accordance with legislative and policy requirements, and have been adequately considered in the design of the development.

Figure 1: Site location

Scale 1:8,000 at A4

0 100 200 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 20/12/2018
Author: CThatcher
Source: Existing cadastre: Landgate July 2018, Imagery SLIP Public Services Locate 2018; Roads: MRWA 2017

Legend

- Subject site
- Cadastre
- Roads

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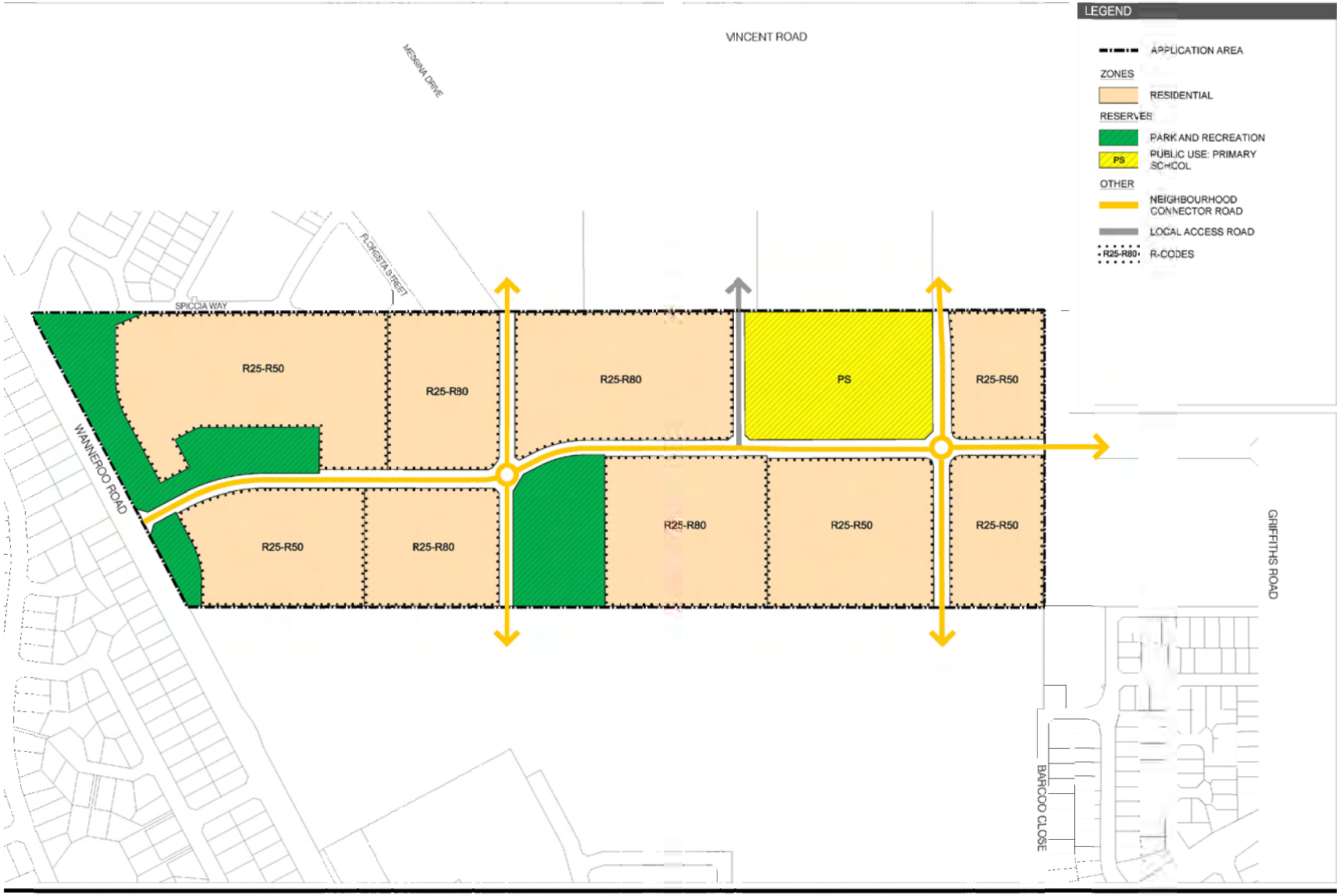

Figure 2: Draft Structure Plan

N

Coordinate System: GDA 1994 MGA Zone 50

Date: 8/03/2019

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2. Legislation, policies and guidelines

The key statutory and policy documents are listed below, and where specifically relevant to the Project, are described in detail in the following sections.

2.1 Federal

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Department of the Environment and Energy (DEE). The EPBC Act aims to protect and manage nine Matters of National Environmental Significance (MNES) throughout Australia including:

- World Heritage Properties
- National Heritage Places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth Marine Areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines).

The proposed development will necessitate clearing of up to 14.5 ha of native vegetation within the site that potentially provides habitat for listed threatened species, namely the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii*). As such, the project was referred to the DEE under the EPBC Act in May 2017 (EPBC 2017/7921), who determined the proposal to be a controlled action and assessed by preliminary documentation.

Preliminary documentation was prepared and released for public comment in November 2018. An assessment report is currently being prepared by the DEE to inform the Minister's decision, and the project's assessment phase is expected to conclude in March 2019.

The measures proposed to mitigate and manage impacts to Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii*) have been determined in consultation with DEE and are discussed in Section 4.5 of this report.

2.2 State government legislation

2.2.1 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) is administered by the Environmental Protection Authority (EPA). The Act provides 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 foregoing.

Part IV of the EP Act makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes. The EPA uses environmental principles, factors and associated objectives as the basis for assessing whether a proposal or land use planning scheme's impact on the environment is acceptable.

2.2.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* will replace the WC. On 3 December 2016, several parts of the new Act were enacted by the State Governor. The remaining parts of the Act and the associated Regulations will come into effect on 1 January 2019.

In addition to providing for the protection of flora and fauna, the *Biodiversity Conservation Act 2016* includes provisions for threatened ecological communities, threatening processes, critical habitats and environmental pests.

2.3 State Planning Policies

State Planning Policies (SPPs) are prepared and adopted by the WAPC under statutory procedures set out in part 3 of the *Planning and Development Act 2005*. The SPPs relevant to the proposed development are listed below:

- State Planning Policy 2.9: *Water Resources* (SPP 2.9)
  - *Better Urban Water Management guidelines* (WAPC 2008)
- State Planning Policy 3.7: *Planning in Bushfire Prone Areas* (SPP 3.7)

2.3.1 State Planning Policy 2.9: *Water Resources* (SPP 2.9) and *Better Urban Water Management Guidelines*

State Planning Policy 2.9: Water Resources (SPP 2.9) provides guidance on the planning, protection and management of surface and groundwater catchments, and the implementation of total water cycle management principles in the land use planning system. The Better Urban Water Management guidelines facilitates the implementation of SPP 2.9.

In accordance with policy measures set out in SPP 2.9 and the *Better Urban Water Management guidelines*, a Local Water Management Strategy (LWMS) has been prepared for the site. An Urban Water Management Plan (UWMP) will be subsequently required at the subdivision stage.

2.3.2 State Planning Policy 3.7: *Planning in Bushfire Prone Areas* (SPP 3.7)

State Planning Policy 3.7: Planning in Bushfire Prone Areas (SPP 3.7) requires all land which has been designated as bushfire prone by the Fire and Emergency Services (FES) Commissioner to address bushfire risk management. Development within a bushfire prone area is required to address the relevant policy provisions, for the particular stage of the planning process relevant to the development.

In accordance with Policy Measure 6.3 of SPP 3.7, a Bushfire Management Plan has been prepared for the site which includes:

- a bushfire hazard level (BHL) assessment
- identification of bushfire hazard issues arising from the above assessment
- assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance can be achieved in subsequent planning stages.

2.4 City of Wanneroo local policies, strategies and guidance

The City has developed numerous local planning polices (LPPs), strategies and guidelines relevant to planning and the environment, as listed below. Reference to these documents has been made throughout the report where applicable to a specific environmental factor.

- *Environmental Management Plan Guidelines (2018)*
- *Local Environmental Plan (2009-2014)*
- *Local Biodiversity Plan 2018/19 – 2023/24*
- LPP 4.13: *Caves and Karstic Features*
- LPP 3.3: *Fauna Management*
- LPP 4.3: *Public Open Space*
- LPP 4.8: *Tree Preservation*
- LPP 4.4: *Urban Water Management*

The City of Wanneroo has also developed and adopted East Wanneroo Cell 2 (Sinagra) Agreed Structure Plan 4. This Structure Plan has been reviewed and considered in the development of the environmental advice.

3. Overview of existing environment

3.1 Land use

3.1.1 Current and adjacent land use

Currently the site supports poultry operations. Cessation and relocation of the Ingham Chicken operations will occur prior to development of the site. An application to lift the Urban Deferred status is currently in preparation.

The Benara Nurseries landholding adjacent to the east of the site is proposed to be developed for residential purposes, however is currently constrained by the Inghams' operations and associated odour implications. Given that Benara Nursery operations are expected to cease concurrently with the Inghams operations, a buffer is not considered necessary to nursery operations. Regardless, the Benara Nursery operations that currently remain are limited and do not represent a risk to development and will not require a buffer.

3.1.2 Previous land use

The subject site has supported poultry operations, inclusive of a feed lot since 1960. The aerial imagery of 1965 is the earliest available and indicates a built form present on the site which is indicative of poultry operations. Poultry operations have been continuous on the site since that time.

3.2 Topography, Geology and Soils

Regional topographic contour mapping (DAFWA 2001) indicates that the site elevation ranges between 28 m AHD in the west to 78 m AHD in the east (Figure 3).

The subject site comprises Spearwood sand derived from Tamala Limestone. Regional geological mapping (Gozzard 1986) identifies the site as comprising; SAND – pale and olive yellow, medium to coarse-grained, sub-angular quartz and a trace of feldspar, moderately sorted, of residual origin (Figure 4). Gozzard (1986) identifies this geological unit as compatible with urbanisation and the construction of roads.

Mapping of karstic features risk zones in the City of Wanneroo (CoW 2018a) identifies the Sinagra locality as having a low risk of karstic features. A geotechnical survey conducted by Galt Geotechnics (2017) indicates that limestone pinnacles are present at the ground surface and below the sand within the site which may require more detailed investigation at a later stage to determine the strength of the material and excavatability.

3.2.1 Acid sulfate soils

Acid sulfate soils (ASS) are naturally occurring, iron-sulfide rich soils, sediments or organic substrates, formed under waterlogged conditions. If exposed to air, these sulfides can oxidise and release sulfuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

ASS risk mapping (DWER 2018) did not identify any risk of ASS occurring within the site.

3.3 Contamination

A Basic Summary of Records (BSR) request dated 27 June 2017 confirms that the site has not been reported to DWER as a known or suspected contaminated site.

Following the completion of a Preliminary Site Investigation (PSI) in June 2017 (360 Environmental 2017), Strategen were commissioned to undertake a Detailed Site Investigation (DSI) at the site and developed a soil and groundwater investigation program. A total of 65 soil bores / test pits (SB1 to SB65) were investigated to a maximum depth of 1.5 metres below ground level (mbgl). Soil and groundwater was tested for the presence of contaminants, and the results of the soil and groundwater investigations are detailed below in Table 1 and Table 2 respectively.

The DSI report will assist with the planning approval process to facilitate development of the land. It is also understood that the DSI report will provide a baseline condition report for the purpose the lease arrangement between Stockland and Inghams which will be in operation until Inghams vacates the site.

The DSI assessment, inclusive of supplementary sampling, has been undertaken, and summarised results of the first round of sampling is provided below.

Table 1 : Soil sampling results from DSI

PCOC	Discussion
Organochlorine / Organophosphate Pesticides (OCP/OPP)	Pesticide compounds including p,p-DDE, p,p-DDT, dieldrin, aldrin or bipenthrin were detected at one or more sample locations. No concentration exceeding the applicable residential or commercial / industrial assessment criteria have been identified. The detections of pesticides correspond to the locations of former and current poultry sheds.
Petroleum hydrocarbons	Total recoverable hydrocarbons (TRH) were detected in four (4) out of 27 samples. No concentration exceeding applicable residential or commercial / industrial assessment criteria have been identified. TRH was detected at sample locations adjacent to diesel storage and workshop areas. Polycyclic aromatic hydrocarbons (PAHs) were detected in one soil sample location situated in a vacant, cleared area north of the present-day poultry sheds.
Metals	All results satisfied the adopted assessment criteria with the exception of zinc, which was found to exceed the EIL value in three (3) out of 74 samples.
Polychlorinated biphenyls (PCB)	PCB was identified in a sample collected south of the main feed mill facility, adjacent to the weighbridge. The concentration of PCB was less than the applicable residential and commercial / industrial criteria.
Asbestos	Asbestos containing materials (ACM) such as fragments of fibre cement sheeting were identified at four sample locations. ACM was identified adjacent to the dangerous goods storage shed and the location of former site structures. As such, ACM may be more widespread at these locations as result of historical demolition / earthworks. Asbestos fibres were positively identified in soil samples collected concurrent to ACM fragments. The calculated %w/w asbestos for fibrous asbestos and asbestos fines adjacent to the dangerous goods storage shed (0.002% w/w) was greater than the Department of Health (DoH 2009) criterion for all site uses of 0.001% w/w. This finding suggests that some additional delineation / remediation works may be required at this location.

Table 2: Groundwater sampling results from DSI

PCOC	Discussion
Organochlorine / Organophosphate Pesticides (OCP/OPP)	No pesticide compounds were detected in groundwater samples GW1 and GW2.
Petroleum hydrocarbons	Petroleum hydrocarbon compounds (TRH and BTEN) were not detected in groundwater samples GW1 and GW2.
Metals	The concentration of copper and zinc in groundwater sample GW2 (upgradient) exceeded the adopted Fresh Water criteria.
Nutrients	The concentrations of total nitrogen, NOx as N, and total phosphorus in groundwater samples GW1 and GW2 exceeded the adopted Fresh Water criteria.

A summary of the preliminary DSI findings is provided below:

- the soil investigation suggests that no widespread or gross soil contamination is present across the site
- the detection of petroleum hydrocarbons and PCB is likely reflective of localised minor spills / releases from point sources
- elevated zinc concentrations (three sample locations) does not correlate with identified potential source areas, and the average concentration of zinc across the site is well within the adopted assessment criteria. On this basis, the concentration of zinc and metals are not considered a significant issue at the site
- the groundwater investigation suggests that no widespread or gross groundwater contamination is present beneath the site
- elevated concentrations of nutrients in groundwater (exceeding the adopted Fresh Water criteria) are broadly similar at both the upgradient and downgradient monitoring locations, indicating that historical operations at the site has not resulted in an increase in nutrient concentration in groundwater. The data suggests that elevated concentrations of nutrients in groundwater is reflective of regional groundwater conditions and or groundwater quality migrating onto the subject site

Minor areas of petroleum hydrocarbon and PCB impact within the site may represent a risk to development workers and future residents through exposure pathways such as vapour inhalation, however this risk is considered low. It is understood that the impacted areas are a result of minor localised spills in shallow soils. Remedial action is not considered necessary.

Asbestos Containing Material (ACM) and asbestos fibres in soil have been identified at four sample locations. ACM was identified adjacent to the dangerous goods storage shed and the location of former site structures. As such, ACM may be more widespread at these locations as result of historical demolition / earthworks. The calculated %w/w asbestos for fibrous asbestos and asbestos fines adjacent to the dangerous goods storage shed (0.002% w/w) was greater than the Department of Health (DoH 2009) criterion for all site uses of 0.001% w/w. This finding suggests that some additional delineation / remediation works may be required at this location.

3.4 Hydrology

3.4.1 Groundwater

The *Perth Groundwater Map* (DWER 2018) indicates that maximum groundwater levels range between 23 m AHD in the north-western corner of the subject site to 37 m AHD in the eastern portion (Figure 3). Based on regional topographic and groundwater contour mapping, depth to groundwater across the site ranges between approximately 5 m and 41 m with the majority of the site having a depth of 20 to 30 m, between the ground surface and the superficial aquifer.

As part of the DSI, Strategen installed two groundwater monitoring bores and sampled for depth and water quality in September 2017. The results of this sampling indicated that depth ranged from approximately 35 m below ground level (bgl) in the east to approximately 10 m bgl in the west of the site. Concentrations of total nitrogen, NOx and total phosphorus exceeded ANZECC and ARMCANZ (2000) guidelines for slightly disturbed freshwater ecosystems at the tested locations. The groundwater analytical data indicates that groundwater entering the site is broadly similar with groundwater quality migrating offsite (Strategen 2017). This finding indicates that historical poultry farm operations have not adversely impacted the quality of groundwater, and it can be argued that concentrations of nutrients in groundwater exceeding the adopted fresh water guidelines are reflective of regional groundwater quality, or attributable to upgradient land uses (i.e. large-scale nursery operations immediately upgradient of the site) (Strategen 2017).

Groundwater quality is considered generally suitable for irrigation purposes. Use of groundwater for irrigation of POS allows for vegetation uptake of nutrients in the irrigated groundwater, thus improving water quality.

3.4.2 Surface water and wetlands

Surface water

Regional hydrography mapping (Landgate 2004) does not identify any surface water features within the site.

Geomorphic Wetlands

Geomorphic wetland mapping (DBCA 2015) did not identify any wetlands within the site. The closest wetlands of conservation significance are Lake Joondalup (Conservation Category Wetland; UFI 7954) and Mariginup Lake (Conservation Category Wetland; UFI 7953) located 400 m west and 1.3 km north-east of the site respectively, as shown in Figure 5.

3.4.3 Public drinking water source area

The *Metropolitan Water Supply, Sewerage and Drainage Act 1909* (MWSSD Act) and the *Country Areas Water Supply Act 1947* (CAWS Act) identify and categorise public drinking water source areas (PDWSAs) as catchment areas, water reserves, or underground water pollution control areas.

The PDWSA dataset (DWER 2013) is used in policy decision-making and for providing advice about protecting drinking water quality when land uses and activities are proposed in PDWSAs.

The PDWSA dataset (DWER 2013) does not identify any PDWSAs within the site boundary. The nearest PDWSA is located to the west of Wanneroo Road and is a Priority 3 PDWSA.

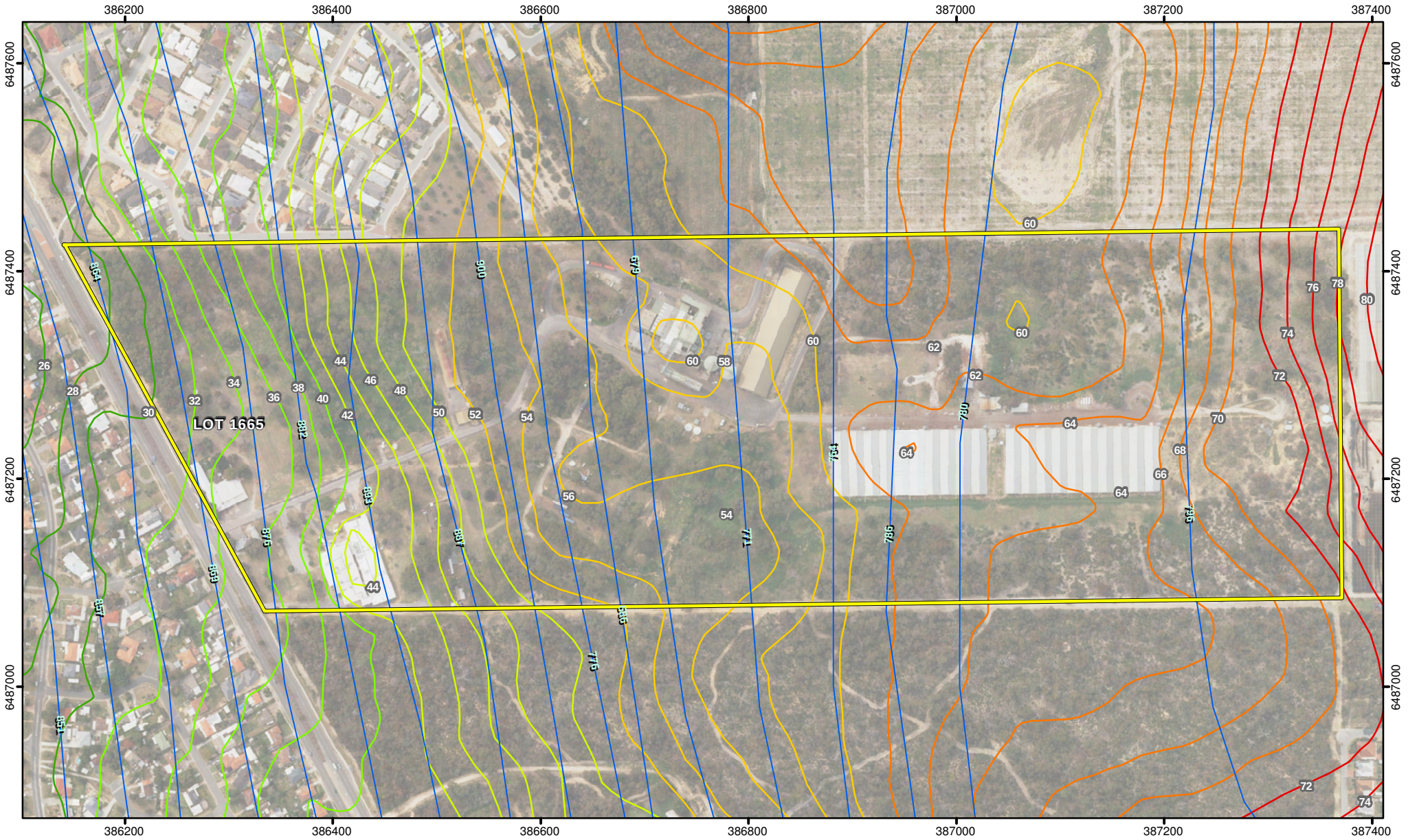

Figure 3: Topographic and groundwater contours

Data source: SLIP Public Service Locate 2018
Coordinate System: GDA 94 zone 50
Date: 20/12/2018

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Legend

- Subject site
- Groundwater contours
- Topographic contours (mAHD)
  - 20 - 30
  - 31 - 40
  - 41 - 50
  - 51 - 60
  - 61 - 70
  - 71 - 80

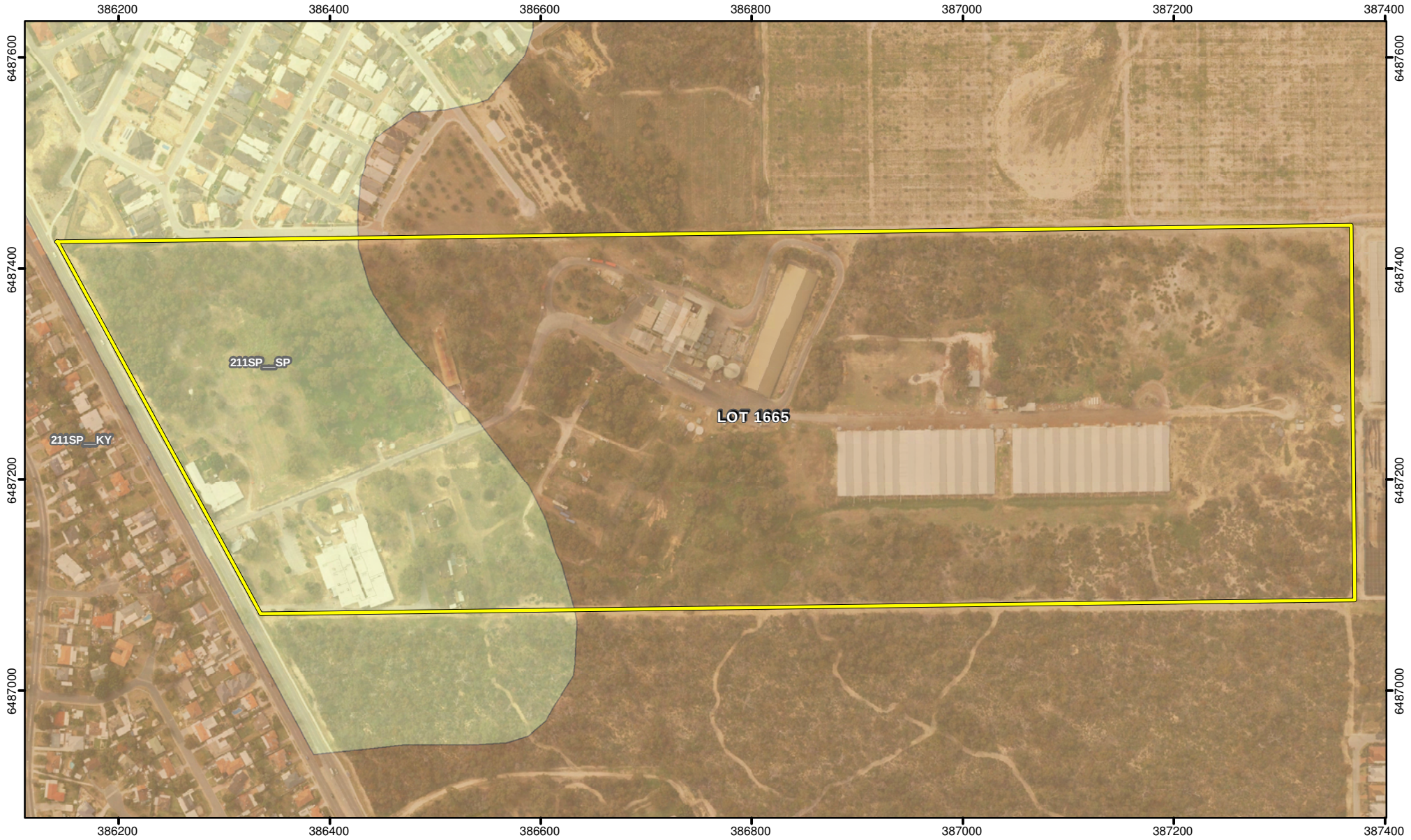

Figure 4: Soil type

Data source: SLIP Public Service Locate 2018
Coordinate System: GDA 94 zone 50
Date: 20/12/2018

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Legend

- Subject site

Soil landscape

- 211Sp__Ky-Karrakatta Sand Yellow Phase
- 211Sp__Sp-Spearwood Sand Phase

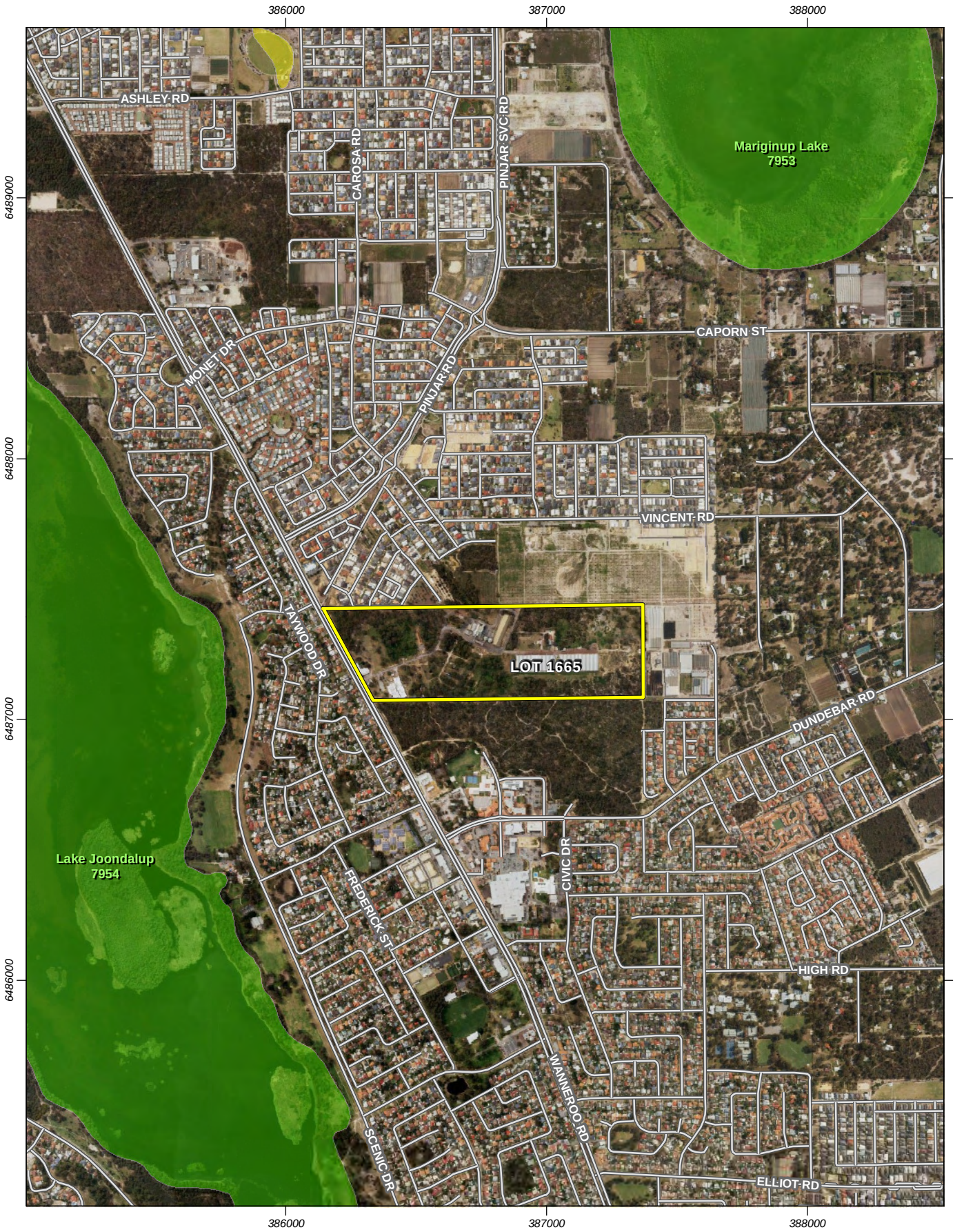

Figure 5: Geomorphic wetlands

Scale 1:20,000 at A4

0 250 500 m

N

Legend

- Subject site
- Cadastre
- Roads

Geomorphic Wetlands (DBCA)

- Conservation
- Multiple Use

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 20/12/2018
Author: CThatcher
Source: Existing cadastre: Landgate July 2018, Imagery SLIP Public Services Locate 2018; Roads: MRWA 2017

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3.5 Vegetation and flora

A flora and vegetation survey consistent with State and Commonwealth survey guidelines was undertaken by 360 Environmental (2017; Appendix 1).

3.5.1 Desktop assessment

The desktop assessment included searches of the DBCA database records to identify conservation significant flora and vegetation occurring within 5 km of the site and DEE's Protected Matters Search Tool (PMST) using a 5 km search buffer. The database records identified 28 conservation significant flora species occurring in the vicinity of the site including; 11 Threatened, three Priority 1, five Priority 2, seven Priority 3 and two Priority 4. The likelihood of these 28 conservation significant flora occurring within the site was assessed based on habitat suitability and the distance to the nearest recorded occurrence of a particular species. The following species were considered likely to occur within the site:

- *Conostylis bracteata* (Priority 3)
- *Lasiopetalum membranaceum* (Priority 3)
- *Jacksonia sericea* (Priority 4)

The database results identified one State listed threatened ecological community (TEC) and two Priority ecological communities (PECs) occurring in the vicinity of the site, comprising the below Floristic Community Types (FCTs):

- FCT SCP20a – *Banksia attenuata* woodlands over species rich shrublands (Endangered)
- FCT SCP24 – Northern Spearwood shrublands and woodlands (Priority 3)
- FCT SCP25 – Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands (Priority 3)

The EPBC listed Banksia Woodlands of the Swan Coastal Plain is comprised of a number of sub-communities, including the above FCT SCP20a. Although this FCT was identified in the database search conducted by 360 Environmental (2017; Appendix 1) as occurring within the vicinity of the site, the field survey confirmed that the vegetation present did not exhibit affiliation with this FCT.

3.5.2 Site survey

A flora and vegetation field survey was conducted by 360 Environmental in September 2016 and November 2016 (Appendix 1).

360 Environmental (2017) identified three natural vegetation associations within the site, as well as 12 vegetation units, as listed in Table 3 and shown in Figure 6.

Table 3: Vegetation types surveyed within the site (adapted from 360 Environmental 2017)

Vegetation type	Description	Area within site (ha)
EmCc	*Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana* and *Banksia attenuata* woodland over *Xanthorrhoea preissii* and *Macrozamia riedlei*.	5.18
BmBa	*Banksia menziesii* and *B. attenuata* woodland over *X. preissii*.	0.46
CcEmAf	Mature trees of *C. calophylla, E. marginata, A. fraseriana, Eucalyptus gomphocephala* and *X. preissii* over weeds.	1.42
JsJf	Tall shrubland of *Jacksonia sternbergiana* and *Jacksonia furcellata* over *X. preissii* and *Hakea prostrata* with occasional *B. attenuata*.	0.29

Vegetation type	Description	Area within site (ha)
CcXp	Closed Forest of *C. calophylla* over *X. preissii* and *M. riedlei*.	1.19
AfXp	Open woodland of *A. fraseriana* and *E. gomphocephala* over non-endemic species and weeds	0.41
Eg	*E. gomphocephala*	3.07
Cc	*C. calophylla*	
Em	*E. marginata*	
Af	*A. fraseriana*	
Bm	*B. menziesii*	
Xp	*X. preissii*	
Js	*J. sternbergiana*	
Pp	**Pinus pinaster*	0.02
Ne	Garden/non-endemic species	2.16

The vegetation condition recorded by 360 Environmental (2017) ranged from Good to Completely degraded, with the greatest extent of vegetation being Degraded to Completely Degraded. Vegetation condition and extent is described in Table 4 and shown in Figure 7. Much of the intact vegetation within the site is extremely fragmented, with a significant portion consisting of large isolated trees with no native understorey and non-endemic and weed species. The intact vegetation occurs at the site boundary, and has been rated as Good-Degraded due to the low species diversity, weed infestation, and grazing impacts of kangaroos.

Table 4: Vegetation Condition and Extent in the site (adapted from 360 Environmental 2017)

Condition	Extent (ha)
Good-degraded	4.14
Degraded	2.44
Degraded – Completely Degraded	4.53
Completely Degraded vegetation/Roads/paths/buildings/paving etc	29.01

The survey conducted by 360 Environmental (2017) found vegetation associations having a high affiliation with FCT SCP28, which is a listed sub-community of 'Banksia Woodlands of the Swan Coastal Plain'. These associations include EmCc, BmBa, CcXp and JsJf. While FCT SCP28 is not listed as a TEC or a Priority community, it is considered to form part of the 'Banksia dominated woodlands of the Swan Coastal Plain' ecological community which is listed as Priority 3.

Strategen conducted further analysis on the Banksia woodlands within the site and determined that the vegetation condition was too disturbed to meet the diagnostic criteria for the TEC. The absence of the Banksia Woodland TEC has been confirmed by the Commonwealth.

No Threatened species pursuant to the EPBC Act or the BC Act were recorded during the survey. Additionally, no Priority listed species were recorded.

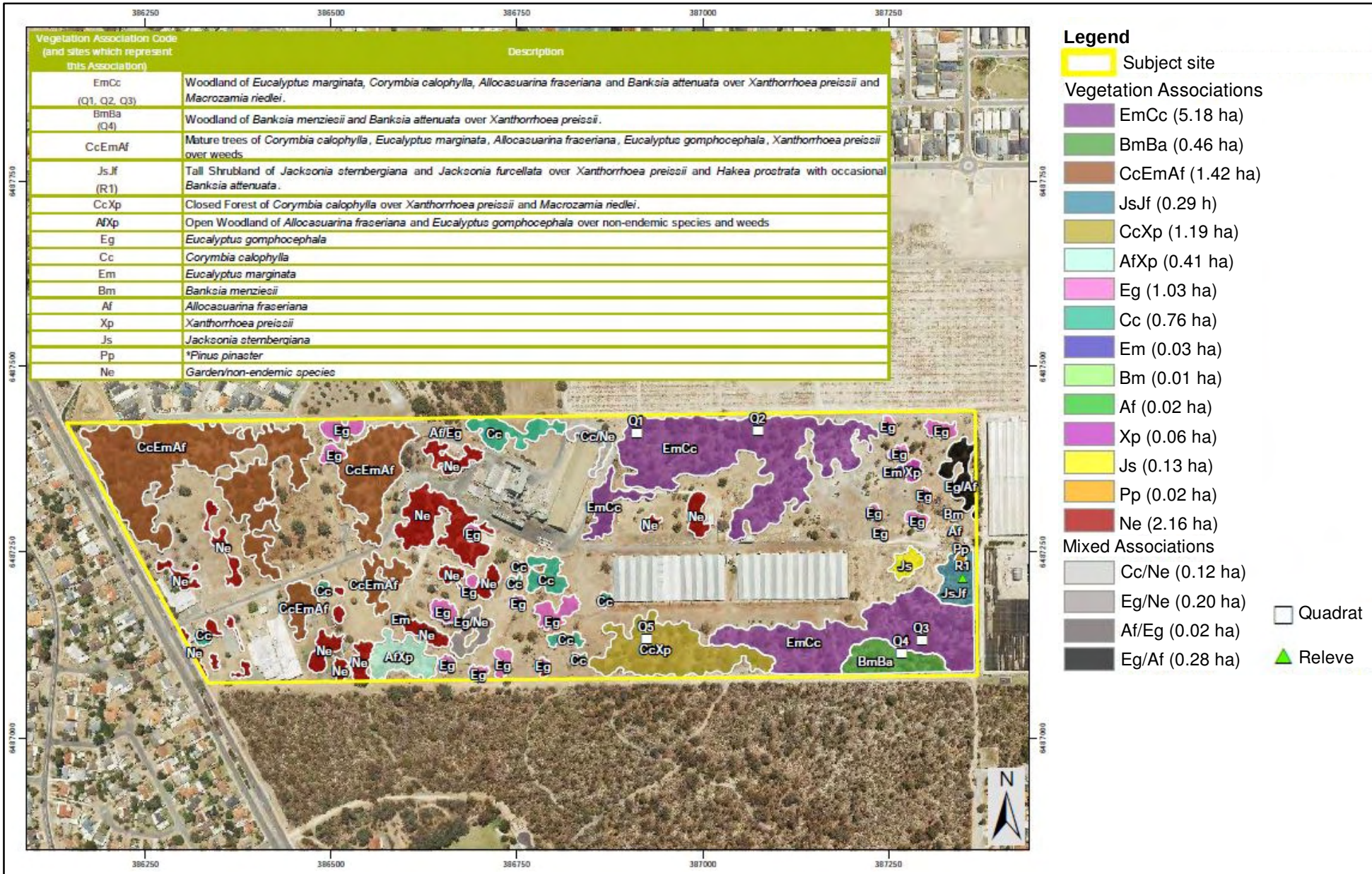

Figure 6: Vegetation associations

Data source: **360 Environmental 2017**
Coordinate System: GDA 94 zone 50
Date: 20/12/2018

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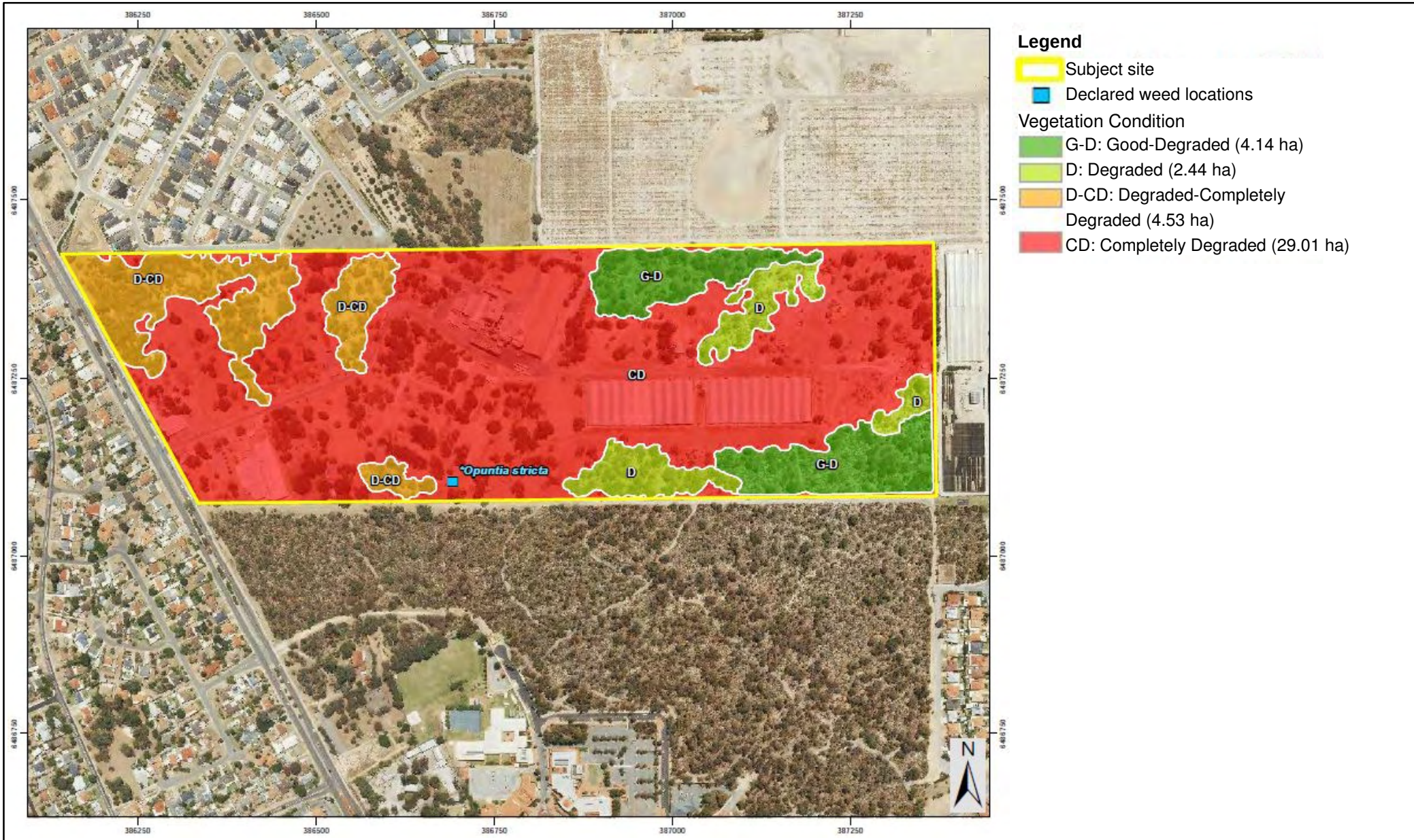

Figure 7: Vegetation condition

Data source: **360 Environmental 2017**

Coordinate System: GDA 94 zone 50

Date: 20/12/2018

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3.6 Fauna and habitat

3.6.1 Desktop assessment

360 Environmental (2017; Appendix 1) conducted a search of the Parks and Wildlife Threatened Fauna database, NatureMap and DEE's PMST to identify conservation significant fauna occurring within 4 km of the site. The database searches returned a total of eight conservation significant and Priority species. 360 Environmental (2017) assessed the likelihood of each species occurring on the site against the below criteria:

- Recorded: Recorded during the field assessment
- Likely: Suitable habitat is present within the site and the site is in the species' known distribution range
- Possible: Limited or no suitable habitat is present within the site but there is suitable habitat nearby. The species has good dispersal abilities and is known from the general area
- Unlikely: No suitable habitat is present within the site but is nearby, the species has poor dispersal ability but is known from the general area; or suitable habitat is present within the site but is outside of the species' known distribution range

A number of species returned from the database searches were discounted due to the lack of suitable habitat being present within the site. The Rainbow Bee-eater was included in the eight species and was assessed as 'Likely' to occur at the site by 360 Environmental (2017). This species was removed from the list of Migratory species in 2016 and is now listed only as a Marine species under the EPBC Act (Commonwealth of Australia 2016). Given that the site is not within a marine environment the Rainbow Bee-eater has been removed from this report. The remaining seven conservation significant and Priority species and their likelihood of occurrence at the site are listed in Table 5.

Table 5: Conservation significant and Priority species identified from desktop database searches and their likelihood of occurrence on the site (Adapted from 360 Environmental 2017)

Species	Conservation status		Likelihood of occurrence
	State	Federal	
Black-striped Snake *Neelaps calonotos*	Priority 3	Not listed	Unlikely
Fork-tailed Swift *Apus pacificus*	Protected under international agreement	Listed Migratory; Listed Marine	Unlikely
Peregrine Falcon *Falco peregrinus*	Other specially protected fauna	Not listed	Unlikely
Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*	Not listed	Vulnerable	Possible
Baudin's Black Cockatoo *Calyptorhynchus baudinii*	Not listed	Endangered	Possible
Carnaby's Black Cockatoo *Calyptorhynchus latirostris*	Threatened	Endangered	Recorded
Southern Brown Bandicoot *Isoodon obesulus fusciventer*	Priority 4	Not listed	Likely

3.6.2 Site survey

360 Environmental (2017; Appendix 1) conducted a fauna and habitat assessment survey in September 2016.

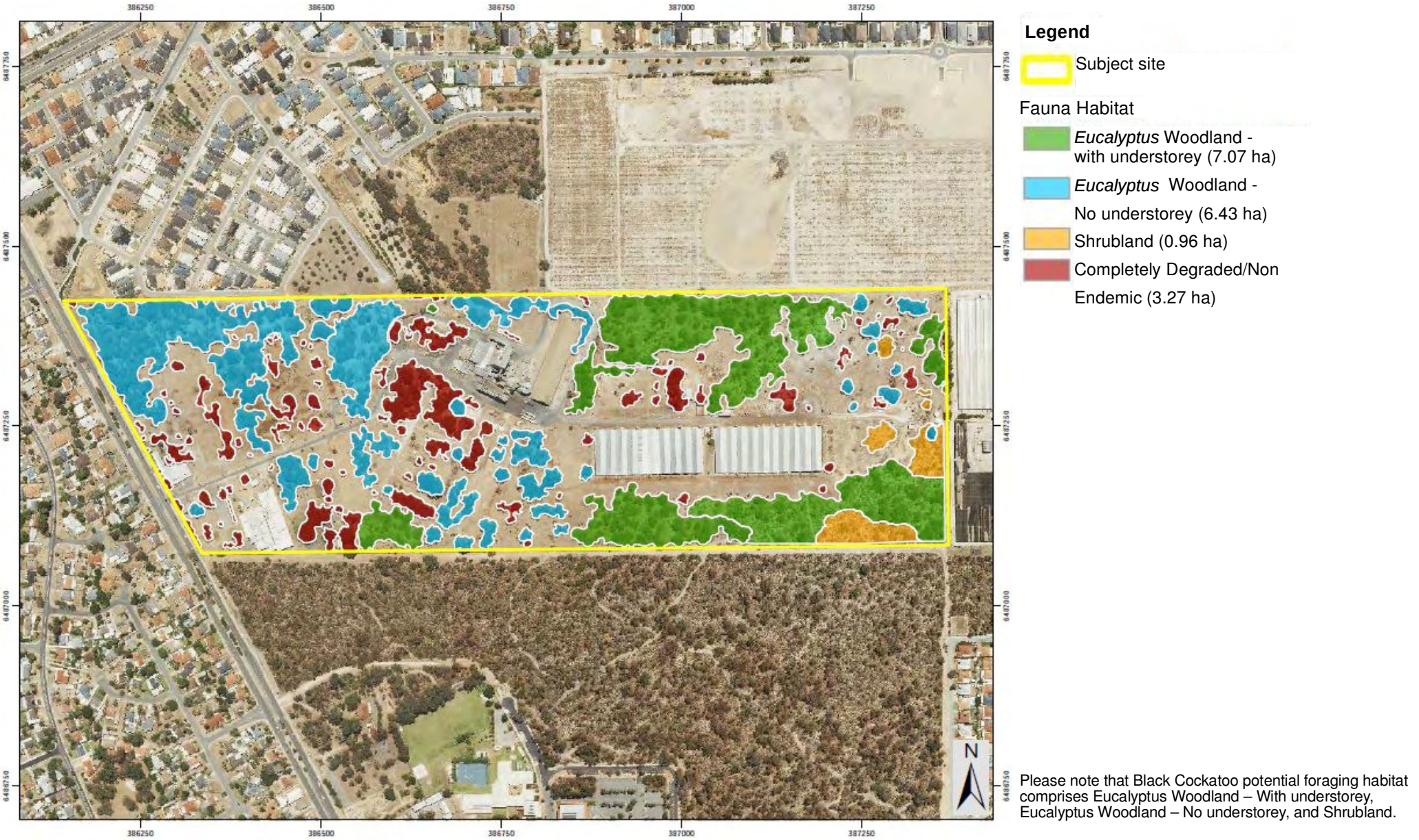
During the site survey, approximately six Carnaby's Black Cockatoos were observed flying over the site. No other species listed in Table 5 were recorded during the survey and no other species pursuant to the EPBC Act or the WC Act were recorded, apart from Carnaby's Black Cockatoo.

As seen in Table 5, the Forest Red-tailed Black Cockatoo and Baudin's Cockatoo were assessed as having a 'Possible' likelihood of occurring on the site. Although the site is situated at the northern extent of both species' distribution ranges, the habitat recorded during the survey is consistent with their foraging and breeding habitat requirements. This gives justification for the 'Possible' likelihood of occurrence on the site as assessed by 360 Environmental (2017).

360 Environmental (2017) recorded four habitat types during the site survey. Two of the four habitat types identified provide foraging and breeding habitat for the Carnaby's Cockatoo, Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo. The first habitat type consists of Eucalyptus trees (Marri, Jarrah, Tuart and Powderbark Wandoo) with understorey of *Allocasuarina, Banksia* and *Xanthorrhoea*. The second type consists of Eucalyptus trees but there is an absence of understorey species.

A total of 14.5 ha of Black Cockatoo foraging and potential breeding habitat was identified within the site, comprising *Eucalyptus* Woodland with understorey, *Eucalyptus* Woodland without understorey and Shrubland (Figure 8). 264 potential breeding trees were recorded during the survey (Figure 9), however, no tree hollows were identified.

A large population of Western Grey Kangaroos were also observed during the site survey and will require consideration during clearing and development.



Please note that Black Cockatoo potential foraging habitat comprises Eucalyptus Woodland – With understorey, Eucalyptus Woodland – No understorey, and Shrubland.

Figure 8: Black Cockatoo habitat

Data source: **360 Environmental 2017**
Coordinate System: GDA 94 zone 50
Date: 20/12/2018

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Figure 9: Black Cockatoo potential breeding trees

Data source: **360 Environmental 2017**

Coordinate System: GDA 94 zone 50

Date: 20/12/2018

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3.7 Conservation Areas

3.7.1 Bush Forever sites

Bush Forever is a 10-year strategic plan that aims to protect and retain at least 10% of each of the original 26 vegetation complexes that have been identified on the Swan Coastal Plain. Bush Forever sites are the specific localities that have been recognised as containing regionally significant vegetation and are endorsed for protection and retention under Bush Forever.

A search of the Western Australian Local Government Association Administrative Planning Categories mapping tool (WALGA 2018) found no Bush Forever sites within the site.

3.7.2 Environmentally sensitive areas

Environmentally Sensitive Areas (ESAs) are areas containing vegetation which has been identified to have high conservation value and cannot be cleared.

A search of the Department of Biodiversity, Conservation and Attractions Environmentally Sensitive Areas mapping tool (DBCA 2005) found no ESAs within the site.

3.7.3 Local natural areas

Local Natural Areas (LNAs) are areas of bushland, forest, water courses or granite outcrops, for example, which are not protected under the public conservation estate, proclaimed water catchments or Bush Forever sites. LNAs are afforded consideration through local planning strategies.

Given that the site falls within an area under an approved Structure Plan (ASP 4), no Priority Local Natural Areas have been identified within the site by the City of Wanneroo in the *Local Biodiversity Plan* (CoW 2018b).

3.7.4 Ecological linkages

Regional Ecological Linkages are a network of protected Regionally Significant Natural Areas which act as corridors to maintain habitat connectivity for flora and fauna species. The protection of these linkages is not mandated by legislation, but it is expected that consideration will be given where the linkage may be impacted by an action.

A search of the Western Australian Local Government Association Regional Ecological Linkages for the Perth Metropolitan Region mapping tool (WALGA 2008) found no ecological linkages occurring within the site.

3.8 Bushfire risk

A search of the Office of Bushfire Risk Management Bushfire Prone Areas mapping tool found the majority of the site is within the mapped bushfire prone area (DFES 2018; see Plate 1).

Plate 1 : Bush Fire Prone Area mapping

Strategen assessed the bushfire risk to the site through an on-ground assessment of classified vegetation and exclusions within 150 m of proposed development in accordance with *AS 3959—2009 Construction of Buildings in Bushfire-Prone Areas* (AS 3959; SA 2009). The bushfire assessment identified classified vegetation within 150 m of proposed development.

As such, a Bushfire Management Plan (BMP) has been prepared to support the Structure Plan and address the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7), namely Policy Measure 6.3.

3.9 Heritage

3.9.1 Indigenous heritage

The *Aboriginal Heritage Act 1972* (AHA Act) aims to protect Aboriginal heritage by registering Aboriginal sites (places and/or objects) that are of cultural importance to Aboriginal people. Any proposal to use or alter an area of land, for purposes such as research or development, must first determine if Aboriginal sites occur within the proposed area. If an Aboriginal site is found to occur, permission must be sought from the Minister for Aboriginal Affairs before that land can be used or altered in any way.

A search of the Department of Planning, Lands and Heritage Aboriginal Heritage Places mapping tool (DPLH 2017) found that there are no Aboriginal Heritage sites within the site. The closest listed Aboriginal Heritage site is Lake Joondalup (Place ID: 3740).

3.9.2 European heritage

A search of the Heritage Council of Western Australia *inherit* database did not identify any European heritage places within the site (HCWA & SHO 2017). The nearest listed European heritage place is 'St Anthony's Catholic Church (Heritage Place No. 9498), which is located approximately 500m south of the site.

4. Potential impacts and proposed management

4.1 Topography, Geology and Soils

Karst Features

4.1.1 Potential impacts

Without appropriate identification and assessment as per LPP 4.13: *Caves and Karstic Features*, the development has the potential to damage or destroy the natural caves and karstic features of the region. In addition, if present, caves and karstic features are a potential hazard to people and property.

4.1.2 Proposed management

While the site is mapped within a low risk zone for containing karstic features, a detailed geotechnical survey may be recommended by the CoW as a condition of subdivision to ensure that the requirements of LPP 4.13: *Caves and Karstic Features* are addressed.

A geotechnical survey undertaken by Galt Geotechnics (2017) indicates that limestone pinnacles are present at and below the ground surface on the site and it is likely that limestone is present across the site. During the survey, no samples of limestone were taken and the strength of the limestone was not characterised, and it was suggested that this may need to be addressed with a detailed investigation at a later stage. Given that this is an infill development and the surrounding land to the west, north and south has been developed, it is unlikely that karst features represent a risk to the site.

4.2 Contamination

4.2.1 Potential impacts

Asbestos fibres and ACM have been identified within the site which represents a potential risk to human health. Site users such as development workers and future residents may be exposed to this risk through pathways such as inhalation of airborne particles or direct contact / ingestion of contaminated soil. With the appropriate management measures, it is not anticipated that asbestos contamination will adversely impact development.

While a DSI has been undertaken in accessible areas of the site, there are areas which were inaccessible and the contamination risk is not known. Further testing for contaminants will be required following the demolition of structures that were not tested previously, to determine the nature and extent of contaminants that may be present.

4.2.2 Proposed management

An asbestos / hazardous building materials survey will be undertaken across the existing infrastructure on site, along with further investigation to determine the extent of asbestos fibres in soil and ACM within buried fill / waste material. The additional investigation will inform the requirements of an asbestos removal control plan (ARCP), which would be implemented prior to commencement of demolition and development works. If significant additional contaminants are detected during further testing following demolition works, the necessary action will be taken to remove the contaminants or remediate if it is considered necessary. The works conducted will be validated and reported on in accordance with the relevant procedures and guidelines relating to contaminated sites, namely the *Guidelines for the Assessment, Remediation and Management of Asbestos-contaminated sites in Western Australia* (DoH 2009).

4.3 Hydrology

4.3.1 Potential impacts

Without appropriate consideration and management, the development has the potential to impact upon the pre-development hydrological cycle and water quality, including:

- groundwater recharge and aquifer levels
- surface water characteristics

Development design must also take into consideration separation to groundwater to avoid flood damage in developed areas and to prevent erosion of waterways, slopes and banks.

4.3.2 Proposed management

Drainage management for the development will be influenced by the following factors:

- depth to groundwater
- high infiltration rates of the Spearwood sand
- gradient of the site
- proximity to Lake Joondalup

A Local Water Management Strategy (LWMS) has been prepared to support the Structure Plan, which details the proposed hydrological management. The LWMS is consistent with the requirements of *Better Urban Water Management* (WAPC 2008) and the City of Wanneroo LPP 4.4: *Urban Water Management*. An Urban Water Management Plan (UWMP) will be prepared to support each subdivision application area.

Given the characteristics identified for the site, it is expected that stormwater will be readily infiltrated on the site. Given the proximity of Lake Joondalup, stormwater may be required to be treated through biofiltration by a system incorporating vegetated swales, although an assessment of development to the north and to the south-east of the site indicates that drainage basins are an acceptable means of stormwater management in the area. As shown in the preliminary Structure Plan, POS areas and drainage points have been located in the low-point of the site to facilitate and optimise drainage/ urban water management.

4.4 Vegetation and flora

4.4.1 Potential impacts

The proposed development will necessitate the clearing of up to 14.5 ha of vegetation, much of which (35.98 ha) has been assessed to be in an already Degraded-Completely Degraded condition. If the appropriate construction management procedures are not implemented, there is potential for clearing practices to result in the accidental clearing of vegetation and trees that have been proposed for retention.

4.4.2 Proposed management

The City of Wanneroo has developed LPP 4.3: *Public Open Space,* LPP 4.8: *Tree Preservation* and *Environmental Management Plan Guidelines (2018)* which address the required actions for managing vegetation and POS in urban development.

The Structure Plan for the development indicates that vegetation will be retained in POS and drainage within the western portion of the site and a portion along the southern boundary towards the centre. Areas of vegetation retention in POS have been informed by the on-site flora and vegetation investigations and the BMP which has been prepared for the site. Opportunities for retention have also been informed by the site engineering (earthworks) requirements and geotechnical values. While the POS areas identified in the preliminary Structure Plan differ slightly from the current East Wanneroo Cell 2 (Sinagra) Approved Structure Plan 4, the placement and configuration of POS areas in the preliminary Structure Plan have been informed by the on-site flora, fauna and vegetation investigations and better reflect the environmental values within the site, namely Eucalyptus woodland vegetation and high volumes of significant trees for Black Cockatoos. The areas of POS areas identified in East Wanneroo Cell 2 (Sinagra) Approved Structure Plan 4 did not specify the retention of trees or the establishment of Conservation Public Open Space. Bushfire management requirements and associated setbacks would render the retention of in-tact vegetation within the ASP 4 POS areas impossible.

The placement of POS within the Structure Plan has sought to retain significant trees, whilst additional significant trees will be retained within the road reserve through the central boulevard.

A Construction Environmental Management Plan (CEMP) has been prepared and vegetation clearing will be subject to management measures including:

- install temporary fencing or flagging to delineate areas/trees for retention, including root zone areas
- provide GPS co-ordinates of areas approved to be cleared and retained to the contractor to ensure no unapproved clearing is undertaken
- install appropriate temporary signage to restrict unauthorised access to retention areas (once defined)
- install and maintain appropriate separation between the retention area boundaries and development area boundaries and development area interface to control access (for example fencing, bollards, footpaths and garden beds)

4.5 Fauna and habitat

4.5.1 Potential impacts

It is assumed that 14.5 ha of foraging and potential breeding habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo will be cleared for the development which will reduce the available habitat within the site. Tree retention in POS in the western and southern central portions of the site will occur and has been recognised within the Structure Plan, as well as within road reserve through the central boulevard where possible, which will reduce the total amount of habitat that may potentially be lost. Areas of vegetation proposed for retention have been informed by on-site investigations and comprise Eucalyptus woodland vegetation and high volumes of significant trees for Black Cockatoos.

There is a population of Western Grey Kangaroos within the site which will require consideration and management during clearing and development.

4.5.2 Proposed management

The City of Wanneroo outline principles and requirements for fauna management in urban development within LPP 3.3: *Fauna Management* and *Environmental Management Plan Guidelines (2018)*. Fauna management measures that may be required at subsequent planning stages will be developed in accordance with these policies and guidelines. As noted in Section 4.4.2 above, there is provision for the retention of significant trees in accordance with LPP 4.8: *Tree Preservation*.

Management measures to minimise the impact to fauna and habitat have been identified in the CEMP and include actions such as:

- a significant tree and viability assessment to determine which trees can be retained in POS areas and road reserves, prior to each clearing stage

- conduct site inductions to inform personnel working on site of:
  - trees identified for retention
  - procedures to minimise impacts to retained trees e.g. minimise compaction and disturbance around retained vegetation, employing directional drilling or manually excavated trenches (includes pneumatic and hydraulic tools) where possible around retained vegetation to minimise impacts to roots
- provide map and GPS co-ordinates of trees to be retained to the contractor to ensure no unapproved clearing is undertaken
- clearly mark trees identified for retention with flagging tape and numbered tags
- inspection of potential breeding trees during Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo breeding season (July to November) within 7 days prior to the commencement of each clearing stage of the development. If a Black Cockatoo is detected using a hollow in a tree or trees the following will occur:
  - clearly identify the tree or trees with flagging/fencing
  - demarcate (with flagging or fencing) a 10 m buffer zone around the tree or trees – no earthworks/clearing will occur within the buffer zone until the hollow is no longer being used
  - a qualified fauna specialist will determine the hollow activities and confirm that the tree or tree hollows are vacant, prior to earthworks/clearing within the buffer zone
- prohibit the feeding of fauna during construction
- enforce a maximum speed limit of 20 km/hr during construction to minimise collisions with Black Cockatoos
- minimise planting of Black Cockatoo primary feeding species in areas that are expected to experience high volumes of traffic and/or have a maximum speed limit greater than 50 km/hr
- contact the DBCA Wildcare Helpline 24 hour emergency hotline if sick or injured animals are encountered

A requirement for an offset may result from the DEE assessment of the proposed development.

The population of Western Grey Kangaroos on the site will be managed in consultation with the City of Wanneroo and DBCA, and in accordance with *Fauna Management* LPP 3.3. Translocation of individual kangaroos will be undertaken prior to clearing to a location as agreed through consultation with DBCA.

4.6 Bushfire risk

4.6.1 Potential impacts

Vegetation occurring within and surrounding the site represents a bushfire risk to future residents if not appropriately managed. The majority of the site has been designated as bushfire prone, and has been identified to have a combination of 'Extreme' and 'Moderate' bushfire hazard level (BHL) attributed to the presence of Class A forest and Class G grassland. Vegetation clearing and modification proposed for the development will lower the overall BHL for the site.

4.6.2 Proposed management

As a result of bushfire hazard and management constraints, vegetation to be retained within POS will largely be limited to an overstorey of mature trees, potentially with some managed/ small pockets of vegetation. A Bushfire Management Plan (BMP) has been prepared to support the Structure Plan and address the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7), namely Policy Measure 6.3.

5. Conclusion

The EAR determined that the site is relatively unconstrained and is suitable for urban development, based on the assessment of existing environmental conditions. The topography, soil and hydrological features of the site do not represent a constraint to development. Limestone pinnacles are known to occur within the site and the geotechnical survey suggested that a detailed investigation may be required to determine the strength of the limestone material and how this may affect the excavatability of the site.

Contamination in the form of ACM will require further assessment to inform the requirements of an asbestos removal control plan. Additional investigation will be required following the demolition of structures in areas which were not accessible at the time that the DSI was undertaken, to determine if further remedial works are required before commencement of development. It is expected that contamination can be appropriately managed and will not adversely impact the development.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) have been identified as MNES which may be impacted by the development as a result of the removal of foraging and potential breeding habitat. A requirement for an offset may result from the DEE assessment of the proposed development. Through the implementation of management measures in Section 4, it is considered that the impacts to Black Cockatoos can be managed to an acceptable level.

A resident population of Western Grey Kangaroos present within the site will be translocated from the site in accordance with the relevant local policies to a suitable location to be determined in consultation with DBCA.

Bushfire risk will be managed through the implementation of the Bushfire Management Plan which has been prepared in accordance with the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7), namely Policy Measure 6.3.

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Appendix 1
360 Environmental Flora and Fauna Survey

360 environmental

Lot 1665 Wanneroo Road, Sinagra

Flora and Fauna Survey

Prepared for:

Ingham's Enterprises

April 2017

people planet professional

Document Reference	Revision	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
1833 AB	A INTERNAL DRAFT	NW/LS	RF	1 Electronic (email)	30/11/16
1833 AB	B CLIENT DRAFT	NW/LS		1 Electronic (email)	6/4/17
1833 AB	C CLIENT FINAL	NW	KC	1 Electronic (CD)	6/4/17

Executive Summary

360 Environmental Pty Ltd (360 Environmental) was commissioned by Ingham's Enterprises to undertake a flora, vegetation, fauna survey and Black Cockatoo habitat assessment in September 2016 of Lot 1665 Wanneroo Road, Sinagra (the Survey Area). The Survey Area is approximately 40 ha in size and is located approximately 30 km north of Perth, in the Swan Coastal Plain (SCP) biogeographic region of Western Australia. The purpose of the survey was to provide supporting documentation for the future development of the Survey Area.

The flora field survey was undertaken on the 13th of September 2016, the quadrats were resampled on the 1st November 2016. A total of 73 taxa (including species, subspecies, varieties and forms) from 62 genera and 38 families were recorded in the Survey Area, of these 22 were introduced species.

The database searches identified 46 conservation significant flora species as potentially occurring in the vicinity of the Survey Area. Of these, 16 are classed as Threatened, three as Priority 1, three as Priority 2, twelve as Priority 3 and 12 as Priority 4. A search of the DPaW TEC and PEC database and EPBC PMST identified one State listed TEC as occurring within 5 km of the Survey Area and two Priority communities, none of these are listed under the EPBC Act.

No Threatened species pursuant to the Environment Protection and Biodiversity Act (EPBC Act) and/or gazetted as Declared Rare Flora (DRF) pursuant to the Wildlife Conservation Act (WC Act) were recorded during the survey. No Priority species were recorded during the survey.

Vegetation condition ranged from Good to Completely Degraded with the majority of the Survey Area considered to be in a Degraded to Completely Degraded (35.9 ha) condition. Historical vegetation clearing, weeds, large kangaroo population, road infrastructure, residential development and the chicken farm within the Survey Area were the most frequently observed impacts on native vegetation.

The vegetation in the Survey Area is extremely fragmented and a large portion of the Survey Area consists of large isolated trees with no native understorey as well as non-endemic and weed species. A total of 22 introduced species were recorded during the survey. One species, One species, **Opuntia stricta,* is listed as Declared under the Biosecurity and Agriculture Management Act (BAM Act) and listed as a Weeds of National Significance (WONS).

Vegetation associations EmCc, BmBa, CcXp and JsJf, has been determined to have the highest affiliation with FCT SCP28, which is listed as a sub-community of 'Banksia woodlands of the Swan Coastal Plain'. As of 2016, Banksia woodlands of the Swan Coastal Plain have been listed as Endangered under the EPBC Act.

Based on this information, and the survey results, there is approximately 4.14 ha of FCT SCP28 rated as Good to Degraded condition. Based on the vegetation being in less than

Good condition, consideration of whether the vegetation in the Survey Area is a good representation of *Banksia woodlands of the Swan Coastal Plain* needs to be deliberated. The vegetation has been historically disturbed, is weed infested and has low species diversity. It should also be noted, that the density of Banksia in the Survey Area is very low and occurs only sporadically across the property, the dominating tree species are *Eucalyptus marginata*, *Corymbia calophylla* and *Eucalyptus gomphocephala*. Based on these attributes it is unlikely that the vegetation in the Survey Area would be favourable for national protection.

Under the State legislation FCT SCP28 is considered to form part of the Priority 3 Ecological community *Banksia dominated woodlands of the Swan Coastal Plain IBRA region*.

The Survey Area is not identified as an Environmentally Sensitive area (ESA).

The DPaW Geomorphic Wetlands Dataset did not identify any Conservation Category Wetlands (CCW), Resource Enhancement Wetlands, (REW) or Multiple Use Wetlands (MUW) within the Survey Area.

A total of eight fauna species of conservation significance (including Priority species) were returned in the database searches; comprised of one reptile species, seven bird species and one mammal species. One species was recorded during the field survey, two species are considered Likely to occur in the Survey Area, two are considered as Possible and three species are considered Unlikely to occur in the Survey Area.

The fauna survey was undertaken on 27th September 2016. One species of conservation significance was recorded during the field assessment, approximately six Carnaby's Black Cockatoo were observed flying over the Survey Area.

During the Black Cockatoo habitat assessment, 264 potential breeding trees were recorded. These were comprised of Marri, Jarrah, Tuart and Powderbark Wandoo. These trees also provided foraging habitat for Black Cockatoos. A total of 14.5 ha of Black Cockatoo breeding and foraging habitat was recorded in the Survey Area.

Four fauna habitats were recorded during the field survey; Eucalyptus Woodland with Understorey, Eucalyptus Woodland no Understorey, Shrubland and Degraded Habitat.

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1 Introduction

1.1 The Project

360 Environmental Pty Ltd (360 Environmental) was commissioned by Ingham's Enterprises to undertake a flora, vegetation and fauna survey and Black Cockatoo habitat assessment in September 2016 at Lot 1665 Wanneroo Road, Sinagra (the Survey Area) (Figure 1). The Survey Area is approximately 40 ha in size and is located approximately 30 km north of Perth, within the Swan Coastal Plain (SCP) biogeographic region of Western Australia (WA). The purpose of the survey was to provide supporting documentation for the future development of the Survey Area.

1.1.1 Objectives

The objectives of the flora and vegetation survey were to:

- Conduct a desktop assessment of relevant literature, databases and spatial datasets to determine the environmental values and any potential issues, such as Threatened/Rare and significant species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), that may be present in the Survey Area and surrounds;
- Produce a list of plant species;
- Document and map the location of any Declared Rare Flora (DRF), Priority flora and any other flora of local or taxonomic significance;
- Identify, map and discuss the significance of any suspected TECs, PECs and any other areas of ecological importance (e.g. National Parks, wetlands and Environmentally Sensitive Areas [ESAs]);
- Assess and map vegetation condition; and
- Document, describe and map the vegetation associations present.

The objectives of the fauna survey were to:

- Conduct a desktop assessment of fauna databases and any relevant literature;
- Document and describe the vertebrate fauna habitats present;
- Identify fauna of conservation significance that may potentially occur in the Survey Area; and
- Record opportunistic fauna sightings.

The objective of the Black Cockatoo habitat assessment was to:

- Identify and determine the type and extent of habitat (breeding and foraging) suitable for Black Cockatoos in the Survey Area with reference to the

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) referral guidelines for three threatened Black Cockatoo species (DSEWPaC 2011).

Legend

Survey Area (40.13 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- GEOMORPHIC WETLANDS SOURCED DPAW 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE OCT 2015
(© Western Australian Land Information Authority 2015)

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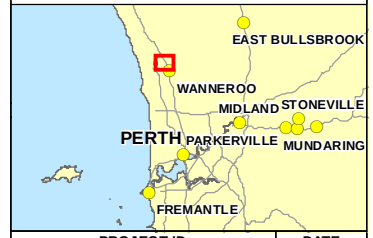
0 200 400 600 800
Meters
1:20,000 @ A4

LOCALITY MAP



PROJECT ID	DATE
1833	1/12/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	NW	RF	0

Ingham Enterprises
Lot 1665 Wanneroo Road, Sinagra

Flora and Fauna Survey

Figure 1 -
Survey Area Location

K:\Projects\1.0 EBS\1833 Ingham Enterprises\Figures\1833 Figure 1 - Survey Area Location.mxd

1.2 Background to the Protection of Flora, Vegetation and Fauna

Western Australian (WA) flora and fauna is protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative measures:

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- Wildlife Conservation Act 1950 (WC Act);
- Environmental Protection Act 1986 (EP Act); and
- Biosecurity and Agriculture Management Act 2007 (BAM Act).

Non-legislative measures:

- Western Australian Department of Parks and Wildlife (DPaW) Priority lists for flora, ecological communities and fauna;
- Weeds of National Significance (WONS); and
- Recognition of locally significant populations by the DPaW.

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

1.2.1 EPBC Act

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

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered under the EPBC Act. Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (FRTBC [*Calyptorhynchus banksii naso*]) are classified as Vulnerable.

Projects likely to cause a significant impact on MNES should be referred to the DEE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DPaW lists flora and fauna under the provisions of the WC Act as protected according to their need for protection (Appendix A & B).

Flora is given Declared Rare status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the WA Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes,

bryophytes and thallophytes) is protected throughout the State. Fauna are classified as Schedule 1 to Schedule 7 according to their need for protection.

Under the WC Act both Carnaby's Black Cockatoo and Baudin's Black Cockatoo are listed as Endangered and the FRTBC is listed as Vulnerable.

1.2.3 EP Act

Declared Rare Flora (DRF) and TECs are given special consideration in environmental impact assessments, and have special status as Environmentally Sensitive Areas (ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Exemptions for a clearing permit do not apply in an ESA. In addition, habitat necessary for the maintenance of indigenous fauna is considered in the clearing principles and assessed during consideration of applications for a clearing permit.

1.2.4 BAM Act

Plants may be 'Declared' by the Agriculture Protection Board (APB) under the BAM Act 2007 (WA). Declared Plants are gazetted under three categories (C1-C3), which define the action required. Details of the definitions of these categories are provided in Appendix C. A declaration may apply to the whole State, to districts, individual properties or even to single paddocks. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food Western Australia [DAFWA] 2014).

1.2.5 Weeds of National Significance

The Australian Government along with the State and Territory governments has endorsed 32 WONS. Four major criteria were used in determining WONS:

- The invasiveness of a weed species;
- A weed's impacts;
- The potential for spread of a weed; and
- Socio-economic and environmental values.

Each WONS has a national strategy and a national coordinator, responsible for implementing the strategy. WONS are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts (Thorp & Lynch 2000).

1.2.6 DPAW Priority Lists

The DPaW lists 'Priority' flora and fauna that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as DRF or 'Scheduled' fauna. Flora and fauna assessed as Priority 1-3 are considered to be in urgent need of further survey. Priority 4 flora and

fauna require monitoring every 5-10 years and Priority 5 flora and fauna are subject to a specific conservation programme (Appendix A).

The DPaW maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the WA Minister of Environment becomes a TEC, and protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Appendix B).

1.2.7 Informal Recognition of Flora and Fauna

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

1.3 Background to Black Cockatoos

Three species of Black Cockatoo are found in south-west WA; Carnaby's Black Cockatoo, Baudin's Black Cockatoo and FRTBC. All three Black Cockatoos have suffered a substantial decline in numbers and breeding distribution in the past 50 years (Johnstone & Storr 1998). Direct causes of population decline include the large numbers shot by orchardists (mainly associated with Baudin's Black Cockatoo), clearing and fragmentation of habitat (especially the loss of breeding hollows), the impact of hollow competitors including the Galah (*Cacatua roseicapilla*), corellas including Butler's Corella (*Cacatua pastinator butleri*), Australian Shelduck (*Tadorna tadornoides*), Australian Wood Duck (*Chenonetta jubata*), the feral European honey bee (*Apis mellifera*), and also vehicle strikes. Around 60% of the original vegetation on the Swan Coastal Plain has been cleared and up to 85% in other parts of the south-west region for agriculture (crops), meat production, dairying, farms, orchards, vineyards, pine plantations, mining, timber and wood chipping, cities and towns. At present, extensive tracts of uncleared land only remain in State forest and conservation reserves and what is left of remnant vegetation (in roadside verges etc.) is often disturbed to a varying degree (Johnstone & Kirkby 2011).

The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, and alterations in the landscape led to significant changes in forest structure. Almost every part of the Jarrah-Marri forest has been logged in the past, and most present day trees are too young to form hollows, and competition with exotic species, exacerbate the future

conservation of Carnaby's Black Cockatoo, FRTBC's and Baudin's Black Cockatoo (Johnstone & Kirkby 2011).

The distribution of all three Black Cockatoo species can be seen in the 2014 DEE distribution maps in Appendix D. The Survey Area is within the known distribution of Carnaby's Black Cockatoo; however, it is on the northern extremity of Baudin's Cockatoo and FRTBCs distribution. Nevertheless, all three species of Black Cockatoo were returned in the three database searches and have therefore been included for consideration in this document, particularly given that they are all highly mobile and the DEE distribution maps are indicative only. In addition there is some difficulty in distinguishing between Carnaby's Black Cockatoo and Baudin's Black Cockatoo, particularly when on the wing, therefore it advisable to include both species.

2 Biophysical Environment

2.1 Climate

The closest official Bureau of Meteorology (BoM) weather station currently operating near to the Survey Area is the Perth Weather Station (Station number 009225), approximately 26 km south of the Survey Area. The climate for Wanneroo is described as warm Mediterranean (Mitchell *et al.* 2002), with a mean minimum temperature of approximately 12.8 °C and a mean maximum of 24.8°C. Average annual rainfall is 728.1 mm (Figure 2) (BoM 2016).

Perth recorded 691.6 mm of rain in the 12 months prior to the survey (Sept 2015 – August 2016) which is 36.5 mm below the long term average rainfall of 728.1 mm for the same period (BoM 2016). The three months prior to survey (June 2016 – August 2016), Perth recorded 372.2 mm of rainfall, 5.27% below the 392.9 mm average rainfall for the same period (BoM 2016).

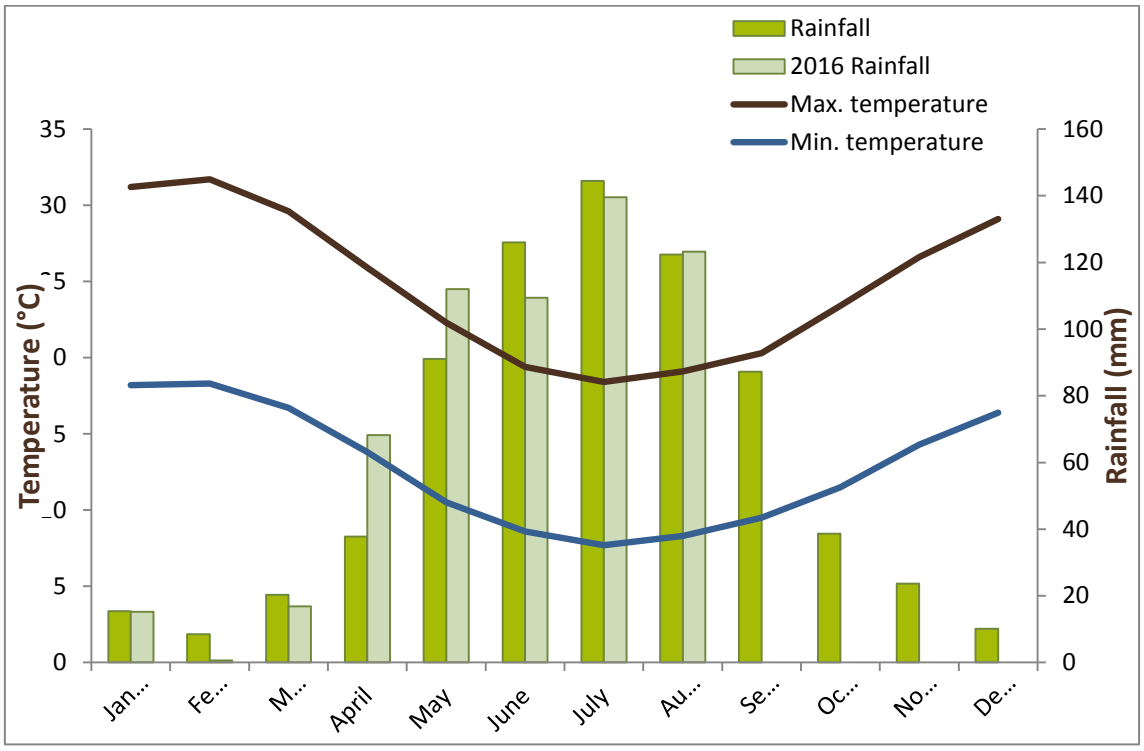


Figure 2: 2016 rainfall and mean rainfall for Perth Weather Station (009225) from 1993 to 2016 (BoM 2016).

2.2 Geology and Soils

Soil-landscape mapping of South West WA has been captured at scales ranging from 1:20,000 to 1:250,000. Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales.

The Survey Area contains the following two geological units:

- Spearwood Sand Phase: Irregular banks of karst depressions. Some limestone outcrop. Shallow brown sands; and
- Karrakatta Sand Yellow Phase: Low hilly to gently undulating terrain. Yellow sand over limestone.

2.3 Hydrology

The Geomorphic Wetlands dataset is identified and utilised by the Environmental Protection Authority (EPA), Department of Environment Regulation (DER) and the Department of Planning as a basis for planning and decision making.

The DPaW Geomorphic Wetlands Dataset didn't identify any Conservation Category Wetlands (CCW), Resource Enhancement Wetlands (REW) or Multiple-Use Wetlands in the Survey Area. Lake Joondalup is a wetland with the unique identification number (UFI7954) which is approximately 400 m east of the Survey Area. A second CCW, Mariginiup Lake, is located approximately 1.4 km north east of the site (UFI7953) (Figure 3).

2.4 Bush Forever

Bush Forever is a State Government Policy and programme that identifies 51,200 ha of regionally significant vegetation for protection, covering 26 vegetation complexes. This amounts to approximately 18% of the original vegetation on the SCP biogeographic region of the Perth metropolitan area.

Regionally significant vegetation has been identified based on criteria relating to its conservation value. Important criteria in the identification process include the achievement, where possible, of a comprehensive representation of all the ecological communities originally occurring in the region, principally through protecting a target of at least 10% of each vegetation complex in the Bush Forever project boundary (Government of WA 2000). The site does not contain any Bush Forever sites.

2.5 Ecological Linkages

The purpose of the Regional Ecological Linkages was to link protected natural areas with other areas of mapped native vegetation. Priority was given to identifying linkages through those areas having the greatest assumed protection and to those areas that maximised opportunities to form continuous corridors of native vegetation. The Survey

Area does not form part of the Perth Biodiversity Project's Draft Regional Ecological linkage network presented in Figure 4.A Perth Regional Linkage (ID24) runs east-west approximately 740 m north of the site at its closest point. Another runs north-south through Lake Joondalup, approximately 930 m west of the site. A third Linkage exists approximately 943 m north-east of the site.

Ecological linkages are not legislatively protected, however, the EPA expects that in preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of an ecological linkage.

2.6 Environmentally Sensitive Areas

The site is not classified as an Environmentally Sensitive Area (ESA). The site does not contain any Managed Land sites or Regional Parks. Lake Joondalup Regional Park is the closest conservation area; approximately 400 m west of the site and an unnamed DPaW Managed Lands site is located approximately 330 m south of the site (Figure 4).

2.7 Broad Vegetation Types

Vegetation across the State has been mapped at different scales by various people. The Survey Area has been mapped by both Beard (1979) which was later reassessed by Shepherd *et al*. (2001). Heddle *et al.* (1980) also undertook vegetation mapping for the region and therefore both these studies have been used to demonstrate the broad vegetation types in the Survey Area (Tables 1 and 2).

The Shepherd *et al.* (2001) and Heddle *et al.* 1980) studies have been used to estimate how much vegetation is currently present in comparison to the pre-European extent of the same vegetation types. From these comparisons, it can be determined what vegetation types have been extensively cleared and therefore in need of protection. This is later discussed in Section 5.5.

Mapping of the vegetation of the Perth region of WA was completed on a broad scale (1:250,000) by Beard (1979). These vegetation units were re-assessed by Shepherd *et al*. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There are one Beard / Shepherd vegetation units in the Survey Area. The Shepherd *et al.* (2001) vegetation types (along with the corresponding Beard [1979] type in brackets), are described below, and their representation within the Survey Area, subregion, region and State is shown in Table 1.

- Spearwood_6 (e2,4Mi)– Medium woodland, Tuart and Jarrah

Table 1: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of Western Australia 2015).

	Pre-European area (ha)	Current extent (ha) 1	Remaining (%)	Current extent % in IUCN Class I-IV Reserves1
Vegetation Types (Beard 1979/ Shepherd *et al.* 2001) in the state				
6	56,343	13,411.19	23.80	13.88
Vegetation Types (Beard 1979/ Shepherd *et al.* 2001) in the Swan Coastal Bioregion				
6	56,343	13,411.19	23.80	13.88
Vegetation Types (Beard 1979/ Shepherd *et al.* 2001) in the Perth Subregion				
6	56,343	13,411.19	23.80	13.88

Mapping by Heddle *et al.* (1980) based in relation to the landform-soil units determined by Churchward and McArthur (1978) identified two vegetation complexes occurring in the Survey Area which are summarised in Table 2. The delineation of vegetation complexes is based on the concept of series of plant communities forming regularly repeating complexes associated with a particular soil unit. The Heddle *et al.* (1980) vegetation complexes that occur across the Survey Area are described below:

- Karrakatta Complex – Central and South.

Table 2: Vegetation Complexes within the Survey Area and its State and Regional Representation.

	Pre-European area (ha)	Current extent (ha)	Remaining (%)	Current extent % Secure Tenure Reserves
Vegetation Complex (Heddle *et al.* 1980) in the System 6/part System 1 area (EPA 2006)				
Karrakatta Complex – Central and South	49,912	14, 729	29.5	2.5
Vegetation (Heddle *et al*. 1980) in the Swan Coastal Bioregion (PBP 2013)				
Karrakatta Complex – Central and South	49786.04	11905.85	23.91	4.69

3 Methods

3.1 Background

The flora survey was consistent with a Level 2 survey as per the EPA requirements for environmental surveying and reporting for flora and vegetation in Western Australia, where possible and as set out in the following documents:

- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004a); and
- EPA Guidance for the Level of Assessment for Proposals affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 region. Guidance Statement No. 10 (EPA 2006); and
- Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (EPA-DPaW 2015).

The fauna survey was compliant with the EPA requirements for the environmental surveying and reporting of fauna in Western Australia where practical and relevant, and as set out in the following documents:

- Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA 2002);
- Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA 2004b);
- Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA-DEC 2010); and
- EPBC Act referral guidelines for three threatened black cockatoo species (DSEWPaC 2012).

3.2 Flora and Vegetation Survey Methods

3.2.1 Flora and Vegetation Database Review

The desktop study provided background information on the flora and vegetation of the Survey Area. This involved a search of the following sources:

- DPaW Threatened and Priority Flora database (DPaW 2016a);
- DPaW Threatened and Priority Ecological Communities database (DPaW 2016b); and
- DEE Protected Matters Search Tool (PMST) (DEE 2016a).

A request for a database search was submitted to the DPaW on the 19th August (5 km radial search around the Survey Area [Appendix F]) to obtain a list of Declared Rare Flora/Threatened or Priority flora, and TECs and PECs in and near the Survey Area (Figure 5). These sources were used to compile a list of expected DRF or Priority species and TECs and PECs that may occur based on the landforms and previous studies in the Survey Area.

3.2.2 Flora and Vegetation Field Survey

The field survey was undertaken on the 13th of September 2016 and again on the 1st November 2016.

The survey included the assessment of five quadrats and one relevé and vegetation mapping notes. The quadrats were rescored a second time at the end of spring. Quadrats are vegetation survey plots which are accurately measured out as 10 x 10 m (or an area equivalent to 100 m^2) and marked at the NW corner using a handheld Garmin GPS unit. Relevés are unbounded vegetation survey plots with information recorded including landscape features, surface soil colour and texture, bare ground, litter cover, disturbance, fire age, aspect and vegetation condition. Each species of dominant plant at each relevé was recorded, including information on height and percentage cover.

Permits

This flora survey was conducted under the following licences issued by DPaW; Licence to take flora for scientific or other prescribed purposes SL011541 and Permit to take Declared Rare Flora 44-1516 issued to Narelle Whittington.

3.2.3 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification utilising resources of the WA Herbarium (WAH).

The species list was checked against FloraBase (WAH 2015) to determine the species conservation status. Threatened and Priority Flora were verified against the EPBC Act listing of threatened species to determine Commonwealth listing.

Introduced species were checked against the DPaW Weed Prioritisation Process (WPP) (DPaW 2013) to determine their ranking in terms of environmental impact. The BAM Act Declared Plants list was consulted to determine if any are Declared Plants, and the WONS list to determine the presence of any WONS (Thorp & Lynch 2000).

3.2.4 Vegetation Mapping

The vegetation mapping units were described based on their structure and species composition, as defined by quadrat data and field observations. Vegetation types and condition was mapped in the field using handheld GPS (Garmin) units and high-resolution aerial photographs (1:2,000 scale), which in the office were digitised using GIS software.

Vegetation condition was assessed based on Bush Forever (Government of WA 2000) (Appendix E).

3.2.5 Statistical Analysis

All statistics were carried out using Primer-E version 6.1.5 (Clarke & Gorley 2006). Quadrats were classified on the basis of similarity in species composition. Quadrat cover data was pre-treated with square root transformation. The purpose of the similarity analysis was to help clarify the assignment of Floristic Community type (FCT) to the quadrat sites recorded during the current survey.

3.3 Fauna Survey Methods

3.3.1 Fauna Database Review

A 4 km radial search of the EPBC PMST, DPaW threatened fauna database and NatureMap were undertaken (Appendix G). The searches were undertaken to identify fauna species of conservation significance potentially occurring in the Survey Area (DEE 2016b; DPaW 2016c and DPaW 2016d,).

Collectively, these sources were used to compile a list of species that have been previously recorded in the vicinity of the Survey Area (Appendix K). This list invariably includes some species that do not occur as some fauna have a limited or patchy distribution or a high level of habitat specificity for habitats which are not located in the Survey Area e.g. waders/shorebirds that require coastal shores for habitat. Some fauna may also have become locally extinct or were erroneously identified in previous surveys. These fauna were examined and then excluded from the list where relevant.

3.3.2 Field Assessment

The field assessment was undertaken on 27th September 2016. The survey was consistent with standard protocols for the region and relevant EPA Guidance Statements and EPBC Act Survey Guidelines as outlined above in section 3.1 (where relevant and practical).

The purpose of the field assessment was to verify the accuracy of the desktop assessment and to further delineate and characterise the fauna assemblages and fauna habitat in the Survey Area.

3.3.3 Opportunistic Observation

Fauna were opportunistically observed and recorded during the assessment. The assessment included looking through leaf litter, overturning rocks, looking under decorticating bark and searches for scats, tracks, burrows and other traces of animals throughout the Survey Area (when the habitat supported such features). If conservation significant species were located, the coordinates were recorded with a GPS.

3.3.4 Taxonomy

For species identified in the desktop assessment, where there is doubt as to their true taxonomy (through subsequent name changes or taxonomic reviews), an effort was made to determine the current scientific name for each taxon. In some cases, old scientific names may be presented where correct nomenclature could not be determined due to name changes. Some taxon names may be followed by 'sp.', meaning that the species name was not given in the data source or the identification is in doubt. Where there are previously recorded taxa such as this that have the potential to be a conservation significant species, they are discussed specifically in the results and discussion section.

Taxonomy and nomenclature in this report follows the accepted listing of published terrestrial vertebrate species. The listing for amphibians and reptiles follows Cogger (2014), birds follows Christidis & Boles (2008) and mammals Van Dyck & Strahan (2008).

3.4 Black Cockatoo Habitat Assessment Methods

The Black Cockatoo habitat assessment was undertaken on 27th September 2016 and involved traversing the Survey Area by foot. Any trees meeting each of the following criteria for potential breeding were recorded and electronically logged using a hand held Global Positioning System (GPS) unit:

- Native trees (e.g. Marri [*Corymbia calophylla*], Jarrah [*Eucalyptus marginata*], Tuart [*Eucalyptus gomphocephala*], etc.);
- Diameter at breast height (DBH) > 500 mm (300 mm for Wandoo [*Eucalyptus wandoo*] and Salmon Gum [*Eucalyptus salmonophloia*]) regardless of the presence or absence of hollows;
- Hollows > 120 mm diameter.

The Black Cockatoo habitat assessment involved assessing the habitat for tree and shrub species known to be important dietary items e.g. Marri and *Banksia sp.* It also included looking for:

- Evidence of feeding (chewed cones, seed and nut material); and
- Opportunistic observations of Black Cockatoos in the Survey Area.

4 Results

4.1 Flora, Vegetation and Fauna Survey Limitations and Constraints

It is important to note the specific constraints imposed on surveys. Constraints are often difficult to predict, as is the extent to which they influence survey effort. Survey constraints of the flora and fauna survey are detailed in Table 3.

Table 3: Limitations and Constraints Associated with the Survey Area.

VARIABLE	IMPACT ON SURVEY OUTCOMES
Access	The entire Survey Area was accessed and traversed. Particular focus was given to areas with relatively intact native vegetation expected to be impacted and that may have species of conservation significance.
Experience	The personnel who executed these surveys were practitioners suitably qualified in their respective fields: ● Field Staff: Narelle Whittington (Botanist) and Laura Stevens (Zoologists); ● Data Interpretation and Reporting: Narelle Whittington and Laura Stevens ● Report Review: Dr Ron Firth.
Timing, weather, season	The survey was conducted during September and November after three months of slightly below average rainfall (refer to section 2.1). The climate for Wanneroo is described as warm Mediterranean (Mitchell *et al.* 2002), with a mean minimum of 12.8 °C and a mean maximum of 24.8°C. Rainfall totals, on average, 728.1 mm per annum (Figure 2) (BoM 2016). Flora composition changes with time, particularly seasonally as a result of seasonal conditions. Therefore, botanical surveys completed at different times will have varying results. Fauna were opportunistically observed throughout the day, but especially in the first few hours following dawn, when birds in particular are most active.
Scope: Life forms sampled	The scope of this project included the detailed surveying of flora and vegetation and searching for conservation significant species or communities.

	The fauna survey was primarily a habitat assessment, many species that occur in the Survey Area would not have been observed, particularly small ground-dwelling fauna that are normally captured by methods such as trapping. All conservation significant species previously recorded in the area have been considered. Based on the habitat present, those species deemed to potentially occur in the Survey Area have been addressed in this report. The scope of this project also included the surveying of potential Black Cockatoo habitat.
Sources of information	The desktop analysis used several sources to produce a list of flora and fauna species previously recorded in the vicinity of the project area. This includes records from the EPBC Protected Matters Search Tool (DEE 2016a&b), DPaW Threatened flora and fauna database (DPaW 2016a & d), TECs and PECs (DPaW 2016b) and NatureMap (DPaW 2016c). Field guides and other scientific literature was also examined.
Completeness	The entire Survey Area was accessible; all vegetation associations were sufficiently surveyed; with five quadrats, 1 relevé and additional vegetation mapping notes recorded. Three fauna habitat assessments were carried out and all trees considered to be potential Black Cockatoo breeding trees were measured.
Disturbances	The Survey Area has been altered by the construction of Ingham's poultry farm and associated infrastructure, as well as historical vegetation clearing.

4.2 Flora Results

4.2.1 Database Results

The review of the database searches identified 28 conservation significant flora potentially occurring in the vicinity of the Survey Area. Of these, 11 are classed as Threatened, three as Priority 1, five as Priority 2, seven as Priority 3 and two as Priority 4.

The likelihood of these 28 conservation significant flora occurring in the Survey Area is shown in Appendix H.

A search of the DPaW TEC and PEC database and EPBC PMST identified one State listed TEC as occurring within 5 km of the Survey Area and two Priority communities (Figure 5), none of these are listed under the EPBC Act. The TEC and PEC communities are:

- FCT SCP24 – Northern Spearwood shrublands and woodlands (Priority 3 [DPaW]);
- FCT SCP20a – *Banksia attenuata* woodlands over species rich shrublands (Endangered [DPaW]); and
- FCT SCP25 – Southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands (Priority 3 [DPaW]).

4.2.2 Overview of Flora

A total of 73 taxa (including species, subspecies, varieties and forms) from 62 genera and 38 families were recorded in the Survey Area, of these 22 were introduced species. The commonly occurring families were; Poaceae (6 species), Asteraceae (5 species and Myrtaceae, Iridaceae, Orchidaceae and Proteaceae (all with 4 species). The flora inventory is provided in Appendix I and the Survey Area data sheets in Appendix J.

4.2.3 Flora of Conservation Significance

No Threatened species pursuant to the EPBC Act and/or gazetted as DRF under the WC Act or Priority listed species were recorded during the survey.

4.2.4 Introduced Flora

A total of 22 introduced species were recorded during the survey (Table 4). One species, **Opuntia stricta*, is listed as Declared under the BAM Act and is a WONS listed species.

Table 4: Introduced Flora Recorded in the Survey Area.

TAXON	(COMMON NAME)	DECLARED BAM ACT	WONS
**Arctotheca calendula*	Cape Weed	No	No
**Avena barbata*	Bearded oat	No	No
**Briza maxima*	Blowfly Grass	No	No
**Bromus diandrus*	Great Brome	No	No
**Ehrharta calycina*	Perennial Veldt Grass	No	No
**Ehrharta longifolia*	Annual Veldt Grass	No	No
*Disa bracteata	-	No	No
*Euphorbia peplus	Petty Spurge	No	No
*Euphorbia terracina	Geraldton Carnation weed	No	No
**Gladiolus caryophyllaceus*	Wild Gladiolus	No	No

Taxon	(Common Name)	Declared BAM Act	WONS
**Hypochaeris glabra*	Smooth Catsear	No	No
**Lupinus angustifolius*	Lupin	No	No
**Lysimachia arvensis*	Pimpernel	No	No
**Opuntia stricta*	Prickly pear	Yes	Yes
**Oxalis sp.*	-	No	No
**Pelargonium capitatum*	Rose Pelargonium	No	No
**Ricinus communis*	Castor oil plant	No	No
**Romulea rosea*	Guildford Grass	No	No
**Silene gallica*	French catchfly	No	No
**Sonchus oleraceus*	Common Sowthistle	No	No
**Ursinia anthemoides*	Ursinia	No	No
*Wahlenbergia capensis	Cape Bluebell	No	No

4.2.5 Vegetation Associations

Three natural vegetation associations were described for the Survey Area. In addition to the associations, 12 vegetation units were also mapped, which included isolated mature trees and trees over gardens and weeds. Descriptions of these are provided in Table 5 and Figure 6.

Table 5: Vegetation Association and unit Descriptions and their Extent in the Survey Area.

Vegetation Association Code (and sites which represent this Association)	Description	Area (ha)
EmCc (Q1, Q2, Q3)	Woodland of *Eucalyptus marginata*, *Corymbia calophylla*, *Allocasuarina fraseriana* and *Banksia attenuata* over *Xanthorrhoea preissii* and *Macrozamia riedlei*.	5.18
BmBa (Q4)	Woodland of *Banksia menziesii and Banksia attenuata* over *Xanthorrhoea preissii*.	0.46

Vegetation Association Code (and sites which represent this Association)	Description	Area (ha)
CcEmAf	Mature trees of *Corymbia calophylla*, *Eucalyptus marginata*, *Allocasuarina fraseriana*, *Eucalyptus gomphocephala*, *Xanthorrhoea preissii* over weeds	1.42
JsJf (R1)	Tall Shrubland of *Jacksonia sternbergiana* and *Jacksonia furcellata* over *Xanthorrhoea preissii* and *Hakea prostrata* with occasional *Banksia attenuata*.	0.29
CcXp	Closed Forest of *Corymbia calophylla* over *Xanthorrhoea preissii* and *Macrozamia riedlei*.	1.19
AfXp	Open woodland of *Allocasuarina fraseriana* and *Eucalyptus gomphocephala* over non-endemic species and weeds	0.41
Eg	*Eucalyptus gomphocephala*	3.07
Cc	*Corymbia calophylla*	
Em	*Eucalyptus marginata*	
Af	*Allocasuarina fraseriana*	
Bm	*Banksia menziesii*	
Xp	*Xanthorrhoea preissii*	
Js	*Jacksonia sternbergiana*	
Pp	**Pinus pinaster*	0.02
Ne	*Garden/non-endemic species*	2.16

4.2.6 Vegetation Condition

Vegetation condition ranged from Good to Completely Degraded with the majority of the Survey Area considered to be in a Degraded to Completely Degraded (35.9 ha) condition (Table 6 and Figures 7). Historical vegetation clearing, weeds, roads, residential development and the chicken farm within the Survey Area were the most frequently observed impacts on native vegetation.

The vegetation in the Survey Area is extremely fragmented and a large portion consists of large isolated trees with no native understorey as well as non-endemic and weed species.

Land use in the Survey Area has caused fragmentation of the native vegetation. The intact vegetation occurs in pockets around the Lot's boundary line with the interior of the lot currently being used for the chicken farm.

The intact native vegetation has a condition rating of Good to Degraded due to low species diversity and weed infestation. The condition of the vegetation has also been impacted by the grazing of many kangaroos.

Table 6: Vegetation Condition and Extent in the Survey Area.

CONDITION	EXTENT (HA)
Good-Degraded	4.14
Degraded	2.44
Degraded - Completely Degraded	4.53
Completely Degraded vegetation/Roads/paths/buildings/paving etc.	29.01

4.2.7 Floristic Community Types

Statistical analysis (Primer-E version 6.1.5 multivariate analysis) and data interpretation, as shown in Table 7 was undertaken to help determine the FCTs represented by the vegetation in the Survey Area. This involves reviewing site data for other factors that are diagnostic for FCTs, including the presence of indicator species, soil types and landform position. The quadrat data was tested for similarity against each of Gibson *et al. (1994)* FCT's that were determined and mapped as part of a regional study to describe the vegetation types present on the Swan Coastal Plain in 1994. Results from the statistical analysis and the site information, identified one FCT as occurring in the Survey Area.

Table 7: Floristic Community Type Analysis

VEGETATION ASSOCIATION	GIBSON *ET AL.* QUADRAT & FCT	SIMILARITY BASED ON STATISTICAL ANALYSIS	COMMENTS	INFERRED FLORISTIC COMMUNITY TYPE
EmCc (Q1, Q2, Q3)	FCT SCP30c – other mallees or scrubs	20.45	Typically FCT SCP30c contains Quindalup species which are absent in the Survey Area.	FCT SCP28 – Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus*
	FCT SCP25 –	18.91	Even though there	

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
	Southern Eucalyptus gomphocephala – Agonis flexuosa woodlands		were scattered occurrences of *Eucalyptus gomphocephala* they were not in association with naturally occurring *Agonis flexuosa*. Given the dominance of the other tree species it is unlikely to occur within the Survey Area.	**woodlands This is based on the several dominant tree species present in the Survey Area and the occurrence of the FCT in nearby vegetation remnants**
	FCT SCP20c - Eastern shrublands and woodlands	16.03	FCT SCP20c occurs on the Ridgehill/Pinjarra plains and typically at the base of the scarp with high species diversity.	
BmBa (Q4)	FCT SCP6 – Weed dominated wetlands on heavy clays	20.48	FCT SCP6 occurs on the heavy soils of the Pinjarra Plain	
	FCT SCP20c- Eastern shrublandsand woodlands	20.19	FCT SCP20c occurs on the Ridgehill/Pinjarra plains and typically at the base of the scarp with high species diversity.	
	FCT SCP20a – Banksia attenuata woodlands over species rich dense shrublands	18.26	FCT SCP20a is the most species rich of any of the Banksia communities from the Gibson *et al. (1994)* study. The woodlands	

Vegetation Association	Gibson *et al.* Quadrat & FCT	Similarity Based on Statistical analysis	Comments	Inferred Floristic Community Type
			in the Survey Area are dominated by other tree species.	
CcXp (Q5)	FCT SCP30c - other mallees or scrubs	12.12	Typically FCT SCP30c contains species on the Quindalup dunes which are absent in the Survey Area.	
	FCT SCP16 – Highly saline seasonal wetlands	8.16	There are no wetlands in the Survey Area.	
	FCT SCP19 – Sedgelands in Holocene dune swales	6.77	FCT SCP19 is known to occur on the linear features and swales of the Quindalup dune system.	

The size and condition of one vegetation remnant meant establishing a quadrat in this area was not possible, therefore a relevé was used to collect information. Statistical analysis was not undertaken for this site and therefore a FCT was referred (Table 8).

Table 8: Inferred Floristic Community Type Analysis.

Vegetation Association	Comments	Inferred Floristic Community Type
JsJf (R1)	The altered landscape and minimal species present made it difficult to infer a FCT, however, Based on the dominant species present and the location it is likely to be FCT SCP28.	**FCT SCP28** - Spearwood *Banksia attenuata* or *B. attenuata* – *Eucalyptus* woodlands

4.2.8 Threatened and Priority Ecological Communities

Vegetation associations EmCc, BmBa, CcXp and JsJf, has been determined to have the highest affiliation with FCT SCP28, which is listed as a sub-community of 'Banksia woodlands of the Swan Coastal Plain'. As of 2016, *Banksia woodlands of the Swan*

Coastal Plain have been listed as an Endangered ecological community under the EPBC Act. TECs and their associated buffers are regarded as ESAs. FCT SCP28 is not listed as a TEC under state legislation or as a Priority community.

FCT SCP28 is not listed as TEC under state legislation, however, it is considered to form part of the Priority 3 ecological community '*Banksia dominated woodlands of the Swan Coastal Plain'* IBRA region", and all vegetation that has an over storey that includes *Banksia* are listed as a Priority 3 ecological community. The key feature of these *Banksia* woodlands is the presence of *Banksia attenuata* and/or *B. menziesii* occurring on deep sands. With this taken into consideration, vegetation associations EmCc, BmBa, CcXp and JsJf may be considered the Priority 3 ecological community.

4.2.9 Regional Representation

Vegetation mapping units described in the Survey Area were correlated with the Beard (1978) and Shepherd *et al*. (2001) broad vegetation types as much as possible by examining similarities in vegetation descriptions (Table 9). Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, and the different spatial scale of the analysis (i.e. region vs. local scale).

Table 9: Representation of broad Vegetation Types and corresponding Vegetation Associations.

Vegetation Type and Description (Shepherd *et al.* 2001/Beard 1978)	Corresponding Vegetation Association (Current Survey)	Vegetation Association Extent in Survey Area (ha)
6 (e2,4Mi)	EmCc	5.18

4.3 Fauna Results

4.3.1 Database Searches

Database searches returned 232 vertebrate species from 75 families as potentially occurring in the vicinity of the Survey Area. Of these, seven species were amphibians from four families, 44 were reptile species from nine families, 165 were bird species from 49 families and 16 were mammal species from 13 families.

A total of 35 conservation significant vertebrate species (including Priority species) from 19 families were identified during the desktop review of the database searches (Appendix K). These were comprised of one reptile species, 31 bird species from 15 families, and three mammals from three families.

4.3.2 Conservation Significant Fauna

The 4 km DPaW threatened fauna database, NatureMap database and EPBC PMST search returned a number of wetland species, in particular birds (i.e. marine birds and waders), as well as the Water Rat, that require specific habitats (i.e. oceans, shorelines, wetlands and waterways) that are not present in the Survey Area. The Survey Area is approximately 1 km to the east of Lake Joondalup and approximately 7 km from the coast. Many of these wetland, marine and coastal species in the databases may occur nearby, however, given the absence of suitable habitat in the Survey Area these species have been omitted from any further discussion.

A number of species returned in the databases are also known to be historical records of species now extinct (e.g. Malleefowl) in the local area and more broadly in the region. These species have been omitted from any further discussion.

It is important to note, that the EPBC PMST is not entirely based on point records, but also on broader information, for example bioclimatic distribution models. Whereas DPaWs threatened fauna database and NatureMap is based on point records, consequently, the results of the EPBC PMST are in some cases less accurate, particularly at a local scale. Consequently, the EPBC PMST will include species that do not occur in the search area, because for example there is no habitat or they are now known to be locally extinct.

In addition, many fauna are not distributed evenly across the landscape, are more abundant in some places than others are, and consequently more detectable (Currie 2007). Furthermore, some small, common ground-dwelling reptile and mammal species tend to be habitat specific, and many bird species can occur as regular migrants, occasional visitors or vagrants. Therefore all these species have been omitted from any further discussion regarding fauna results.

With the afore mentioned marine species removed, a total of eight conservation significant species (including Priority species) from the database searches are potentially considered to either be likely, possibly or unlikely to occur in the Survey Area. These eight species comprise of one reptile, six bird and one mammal species.

Of these eight conservation significant species, one species was recorded during the field assessment, two species are considered as 'Likely' to occur, two species are considered 'Possible' and three species are considered 'Unlikely' to occur within the Survey Area (Table 10).

The Likelihood of each species is based on the following criteria:

- Recorded: Recorded during the field assessment;
- Likely: Suitable habitat is present in the Survey Area and the Survey Area is in the species' known distribution;

- Possible: Limited or no suitable habitat is present in Survey Area, but is nearby. The species has good dispersal abilities and is known from the general area; and
- Unlikely: No suitable habitat is present in Survey Area but is nearby, the species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however the Survey Area is outside of the species' known distribution.

Table 10: Conservation significant fauna potentially occurring in the Survey Area.
En = Listed as Endangered under the EBPC Act, Vu = Listed as Vulnerable under the EBPC Act, Mi = Listed as Migratory under the EBPC Act, Ma = Listed as Marine under the EBPC Act, S = Scheduled under the WC Act, and P = Listed as Priority by the DPaW.

TAXA	CONSERVATION STATUS	LIKELIHOOD
Reptiles		
Black-striped Snake (*Neelaps calonotos*)	P3	Unlikely
Birds		
Fork-tailed Swift (*Apus pacificus*)	MiMa	Unlikely
Peregrine Falcon (*Falco peregrinus*)	S7	Unlikely
Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)	Vu	Possible
Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)	Vu	Possible
Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)	En	Recorded
Rainbow Bee-eater (*Merops ornatus*)	Ma, S5	Likely
Mammals		
Southern Brown Bandicoot (*Isoodon obesulus fusciventer*)	P5	Likely

4.3.3 Field assessment Results

During the field assessment 18 species from 12 families were recorded. This consisted of two reptile species from two families, 15 bird species from nine families and one mammal species.

4.3.3.1 Amphibians

From the database searches, seven amphibian species have been previously recorded from the following four families in the surrounding area: Cheluidae, Limnodynastidae, Myobatrachidae and Hylidae (Appendix K). During the survey, no amphibians were recorded.

4.3.3.2 Reptiles

From the database searches, a total of 44 reptile species have been previously recorded from the following nine families in the surrounding area; Diplodactylidae, Pygopodidae,

Gekkonidae, Scincidae, Agamidae, Varanidae, Typhlopidae, Boidae and Elapidae. Two reptile species were recorded during the field assessment The Tree Dtella (*Gehyra variagata)* and Buchanans Snake-eyed Skink (*Cryptoblepharus buchananii*) (Appendix K).

4.3.3.3 Birds

From the database searches, a total of 165 bird species from 49 families have been previously recorded in the surrounding area. During the field assessment 15 bird species were recorded from the following nine families: Anatidae, Columbidae, Psittacidae, Acanthizidae, Meliphagidae, Pachycephalidae, Dicruridae, Cracticidae and Corvidae (Appendix K).

4.3.3.4 Mammals

From the database searches, a total of 16 mammal species from 13 families have been previously recorded in the surrounding area. During the field assessment one mammal species was recorded; the Western Grey Kangaroo (*Macropus fuliginosus*) (Appendix K).

4.3.4 Black Cockatoo Results

The DPaW threatened fauna database, NatureMap and EPBC PMST databases all had records of all three Black Cockatoo species (Appendix K).

During the survey, a small group (six individuals) of Carnaby's Black Cockatoos were observed flying over the Survey Area. No evidence of foraging (for example chewed Marri nuts) was observed in the Survey Area.

4.3.4.1 Black Cockatoo Foraging Habitat

There is a total of 14.5 ha of foraging habitat in the Survey Area (Figure 9).

Four species of Eucalypts recorded in the Survey Area, Marri, Jarrah, Tuart and Powderbark Wandoo are considered Black Cockatoo foraging habitat. Other foraging species present in the Survey Area included *Banksia menziesii*, *Allocasuarina fraseriana* and *Xanthorrhoea preissii*. All these species provide important foraging habitat for all three species of Black Cockatoo.

4.3.4.2 Black Cockatoo Potential Breeding Trees

Four species of Eucalypts - Marri, Jarrah, Tuart and Powderbark Wandoo recorded in the Survey Area are also considered Black Cockatoo potential breeding habitat.

The Survey Area contains 264 potential breeding trees with a DBH of more than 500 mm (Marri (136), Jarrah (113) Tuart (14) and one Powderbark Wandoo with a DBH of more than 300 mm. The locations of the potential breeding trees are displayed in Appendix L and Figure 8. No hollows were observed from the ground during the survey.

4.3.5 Fauna Habitat

Three fauna habitat assessments were undertaken during the survey (Appendix M) and four fauna habitats were identified in the Survey Area:

Eucalyptus Woodland with Understorey

This habitat has an overstorey that includes Marri, Jarrah and Tuart, a midstorey comprised of *Allocasuarina*, *Banksia* and *Xanthorrhoea*, over an understorey of mixed herbs and grasses.

The large Eucalypt trees provide foraging habitat and potential breeding habitat for Black Cockatoos, while the *Allocasuarina, Banksia* and *Xanthorrhoea* are foraging habitat for Black Cockatoos.

This habitat has vegetation in multiple strata (canopy, midstorey and understorey), limited woody debris and leaf litter that provides habitat for small reptile, bird and mammal species. However, as these patches are for the most part fragmented, fauna movement between them is probably limited, particularly for the less mobile groups such as small reptiles.

Eucalyptus Woodland no Understorey

This habitat includes large Marri, Jarrah, and Tuart trees which provide important foraging and breeding habitat for all three Black Cockatoo species, particularly Carnaby's Black Cockatoo. This habitat, however, is disturbed as a result of vegetation clearing and so lacks any understorey species. It therefore provides limited value to other fauna species due to a lack of vegetation structure that would provide cover.

Shrubland

This habitat consists of various tall shrubs including *Allocasuarina, Banksia, Jacksonia, Hakea and Xanthorrhoea* species over mixed herbs and mixed grasses.

This habitat has limited vegetation strata, but does contain some woody debris and leaf litter that provides habitat, particularly for small reptile and bird species.

Degraded Habitat

This habitat consists of degraded areas, garden and non-endemic species.

5 Discussion

5.1 Flora Context

The Survey Area is highly fragmented due to historical vegetation clearing, weeds, road infrastructure, residential development and the chicken farm. Due to historic and present land-use the quality and size of vegetation remnants varies greatly across the Survey Area. During the survey 73 taxa (including species, subspecies, varieties and forms) from 62 genera and 38 families were recorded, of these, 22 were introduced species. The majority of the original vegetation in the Survey Area has been cleared (26.34 ha) with intact vegetation remaining around the boundary of the Survey Area on the eastern side.

5.2 Flora of Conservation Significance

No Threatened species listed under the EPBC Act or gazetted as T/DRF (Threatened) pursuant to the WC Act were recorded during the survey.

The review of the database searches identified 11 T/DRF flora species potentially occurring in the vicinity of the Survey Area. Of these species, 10 are considered unlikely based on the habitat type present and one is considered Possible. The one potential species, *Caladenia huegelii*, is a perennial (tuberous) short-lived herb (orchid) that needs various conditions to flower and exhibits different flowering patterns. The survey was undertaken during the known flowering period of this species; however, none were recorded. *Caladenia huegelii* grows to 0.6 m high and is easily recognizable during its flowering period from September to October (WAH 2014). Outside of this period *C. huegelii* remains as an underground tuber and is difficult to detect. Throughout its range the species tends to favour areas of dense undergrowth with soil, usually deep grey-white sand associated with the Bassendean sand-dune system (DEC 2009). However on occasion it has been located on the Spearwood dune system. Due to the condition of the vegetation and the grazing by kangaroos, the vegetation that would have been considered suitable habitat for *Caladenia huegelii* no longer possesses the attributes favoured by the species, and therefore, it is unlikely that the species occurs in the Survey Area.

No Priority flora was recorded during the survey. Of the Priority flora (17 taxa) identified as potentially occurring within the Survey Area during the desktop assessment, four do not have ecological information available to determine whether they could occur i.e. habitat type and preference and their distribution. Nine are considered unlikely due to the absence of suitable habitat, one is considered possible (*Leucopogon* sp. Yanchep) and three are considered likely (*Conostylis bracteata* [P3], *Lasiopetalum membranaceum* [P3] and *Jacksonia sericea* [P4]). The survey was undertaken at the appropriate time to identify these four species and none were found at the time of the Survey.

5.3 Vegetation of Conservation Significance

A search of the DPaW database and EPBC PMST for TECs and PECs identified one State listed TEC and two PECs as occurring within 5 km of the Survey Area, none of these are listed under the EPBC Act. None of these are thought to occur in the Survey Area.

Banksia woodlands of the Swan Coastal Plain ecological community has only been recently listed (16 September 2016) as an Endangered ecological community under the EPBC Act. A key diagnostic feature is a prominent tree layer of *Banksia*, with scattered Eucalypts and other tree species often present among the *Banksia* canopy. To determine if the TEC is present in the Survey Area, the results of the statistical analysis were compared to the list of sub-communities which were drawn from the FCT descriptions outlined in Gibson *et al*. (1994), Government of WA (2000) and Keighery *et al*. (2008). Input into the sub-communities was obtained by DPaW.

The statistical analysis resulted in the EmCc, BmBa CcXp and JsJf vegetation community having the most affiliation with FCT SCP28 – Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands.

FCT SCP28 has been listed as a sub-community under the EPBC Act listed Banksia woodlands of the Swan Coastal Plain (DEE 2016). For vegetation remnants to be under full national protection the community has to meet key diagnostic characteristics. In regards to the presence of FCT SCP28, the Approved Conservation Advice for the thresholds state that for vegetation in Excellent Condition the minimum patch size should be 0.5 ha, while vegetation in Very Good condition should be a minimum of one hectare and vegetation in Good condition should be a minimum of two hectares. If a vegetation patch is considered Degraded or worse it is not considered favourable for national protection.

Based on this information, and the survey results, there is approximately 4.14 ha of FCT SCP28 rated as Good to Degraded condition. Based on the vegetation being in less than Good condition, consideration of whether the vegetation in the Survey Area is a good representation of *Banksia woodlands of the Swan Coastal Plain* needs to be deliberated. The vegetation has been historically disturbed, is weed infested and has low species diversity. It should also be noted, that the density of Banksia in the Survey Area is very low and occurs only sporadically across the property, the dominant tree species are *Eucalyptus marginata, Corymbia calophylla* and *Eucalyptus gomphocephala*. Based on these attributes it is unlikely that the vegetation in the Survey Area would be considered for national protection.

Under the State legislation FCT SCP28 is considered to form part of the Priority 3 Ecological community Banksia dominated woodlands of the Swan Coastal Plain IBRA region, all vegetation that has an over storey dominated by Banksia are all listed as a Priority 3 ecological community. There is no written policy on how to respond to the

presence of PECs within proposed development sites and the presence of these communities is dealt with by DPaW on a case by case basis.

5.4 Vegetation Condition and Introduced Flora

Vegetation condition ranged from Good to Completely Degraded with the majority of the Survey Area considered to be in a Degraded to Completely Degraded (35.9 ha) condition. Historical vegetation clearing, weeds, kangaroos, road infrastructure, residential development and the chicken farm within the Survey Area were the most frequently observed impacts on native vegetation.

Land use in the survey area has caused fragmentation of the native vegetation, with little to no native understorey occurring. In these instances the vegetation no longer has a natural structure and is mapped as Completely Degraded. The intact native vegetation has a condition rating of Good to Degraded based on the percentage of weed cover and low diversity of native species compared to that expected within vegetation in the surrounding region.

A total of 22 introduced species were recorded during the survey. One species, **Opuntia stricta (Prickly pear)*, is listed as Declared under the BAM Act and is a WONS. Land-use in the Survey Area has been a source of extensive weed infestations and therefore is a dominant feature of the Survey Area. Due to the scale of weed cover, a comprehensive weed list was not produced. Instead only weeds that were present within intact native vegetation were recorded. The majority of these weeds are common bushland and agricultural weeds (Hussey *et al.* 2007).

5.5 Regional Representation

The Perth Biodiversity Project (PBP 2013) has mapped native vegetation extent by vegetation complex on the Swan Coastal Plain. It is estimated that Karrakatta Complex – Central and South is estimated to have 23.8% native vegetation remaining based on the pre-European extent.

The EPA recognises vegetation complexes that are not well represented as being significant. Vegetation complexes which have 10%-30% remaining may be considered regionally significant. Proposals that would affect a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2006).

These levels may be modified for 'Constrained Areas'. Such areas include the Swan Coastal Plain portion of the Perth Metropolitan Region (in which the Survey Area lies), and may include urban, urban deferred and industrial zoned lands, and lands with development approvals.

The modified objective for Constrained Areas are to:

- Retain at least 10% of the pre-clearing extent of the ecological community where >10% of the ecological community remains, or
- Retain all remaining areas of each ecological community where <10% of this ecological community remains.

The remaining extent of the vegetation community is greater than the 10% threshold set by the EPA for protecting Australia's biological diversity in constrained areas.

5.6 Fauna of Conservation Significance

5.6.1 Species Recorded

During the field assessment, one conservation significant species was recorded; Carnaby's Black Cockatoo, which listed as Endangered under the EPBC Act.

As a Black Cockatoo habitat assessment forms part of this report, all three Black Cockatoo species will be discussed in detail in section 5.7.

5.6.2 Species Considered Likely to Occur

Two species are considered Likely to occur in the Survey Area; the Rainbow Bee-eater and the Southern Brown Bandicoot.

Rainbow Bee-eater

The Rainbow Bee-eater is listed as Marine under the EPBC Act and Schedule 5 under the WC Act. This species is one of the most common and widespread birds in Australia with a distribution that covers the majority of Australia (Barrett *et al.* 2003). It occurs in lightly wooded, often sandy country, preferring areas near water. It feeds on airborne insects, and nests throughout its range in WA in burrows excavated in sandy ground or banks, often at the margins of roads and tracks. In WA this species can occur as a 'resident, breeding visitor, postnuptial nomad, passage migrant and winter visitor' (Johnstone & Storr 2004). The Survey Area contains potential foraging habitat for this species.

The DPaW threatened fauna database returned 14 records of the Rainbow Bee-eater, (all from between 1999-2008), however, due to the species distribution and past survey experience, the Rainbow Bee-eater is considered Likely to occur in the Survey Area.

Southern Brown Bandicoot

The Southern Brown Bandicoot is listed as Priority 5 under the DPaW Priority List. It once occurred throughout south-west WA; it now occurs from Guilderton southwards on the SCP, including the Perth Metropolitan area, in Jarrah and Karri (*Eucalyptus diversicolor*) forests and adjacent coastal vegetation complexes. The species inhabits scrubby, often swampy, vegetation with dense cover up to about 1m high. It 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. The Southern Brown Bandicoot is patchily

distributed in suitable habitat, with populations inhabiting Jarrah and Wandoo forests usually associated with watercourses. On the Swan Coastal Plain it is often associated with wetlands with dense vegetation where they feed on fruit, seeds, insects and fungi (Woinarski *et al.* 2012).

The DPaW threatened fauna database returned just ten records from a 4 km radial search. However, suitable habitat is present and based on past survey experience, the Bandicoot is quite common in Perth in semi-urban areas. The species is therefore considered Likely to occur in the Survey Area.

5.6.3 Species Considered as Possibly Occurring

Two species are considered as Possibly occurring in the Survey Area; Baudin's Black Cockatoo and FRTBC. As a Black Cockatoo habitat assessment forms part of this report, all three Black Cockatoo species will be discussed in detail in section 5.7.

5.6.4 Species Considered as Unlikely to Occur

A total of three species of conservation significance are considered Unlikely to occur in the Survey Area; the Black-striped Snake, the Fork-tailed Swift and the Peregrine Falcon.

Black-striped Snake

The Black-striped Snake is listed as Priority 3 under the DPaW Priority List. It is restricted to a narrow coastal and near-coastal strip of south-western WA, from about Lancelin to Rockingham and inland for about 90 km. It is a burrowing snake found in coastal heaths and low shrubland, where it feeds on lizards mostly of the burrowing skink genus *Lerista*.

The DPaW results returned four records (two undated and two from 1972) of the Black-striped Snake. The Survey Area lacks the heath habitat and low shrublands in which they typically occur, therefore the Black-striped Snake is considered Unlikely to occur.

Fork-tailed Swift

The Fork-tailed Swift is listed as migratory under the EPBC Act and as Schedule 4 under the WC Act. It is a non-breeding visitor to all states and territories of Australia (Higgins 1999). The Fork-tailed Swift is a summer migrant to Australia usually during the months of October-April. The Fork-tailed Swift is an aerial species which forages high above the tree canopy and is mostly independent of terrestrial habitats. It occurs in flocks of up to 2,000 birds and is often seen accompanying Tree Martins and Masked Wood swallows (Johnstone & Storr 1998).

As single record was returned from the DPaW threatened fauna database. This record was from Neil Hawkins Park, which is approximately 3 km to the west of the Survey Area. This bird may fly over but is unlikely to depend on the Survey Area. The Fork-tailed Swift is therefore considered Unlikely to occur in the Survey Area.

Peregrine Falcon

The Peregrine Falcon is listed as Schedule 7 under the WC Act and is an uncommon but a wide-ranging bird across Australia. It occurs mainly along rivers and ranges as well as wooded watercourses and lakes and nests primarily on cliffs, granite outcrops and quarries. The diet of the Peregrine Falcon has been well studied and includes primarily flocking species such as European Starlings (Olsen *et.al.* 2008).

The DPaW results returned eight records of the Peregrine Falcon, primarily from Lake Joondalup to the west of the Survey Area. The Survey Area lacks suitable habitat and as such the Peregrine Falcon is considered Unlikely to occur.

5.7 Black Cockatoo Habitat Assessment

5.7.1 Foraging Habitat

The total area of foraging habitat present in the Survey Area is 14.5 ha (Figure 9). This foraging habitat consisted primarily of Marri, Jarrah trees and to a lesser extent Tuart. Foraging habitat also consisted of species including Pine, *Allocasuarina*, *Banksia* and *Xanthorrhoea*, which are known dietary items of all three Black Cockatoo species, (Johnstone & Kirkby 2011).

Carnaby's Black Cockatoo is listed as Endangered under the EPBC Act. It was returned from the DPaW threatened fauna, NatureMap and EPBC PMST database searches and was observed during the Black Cockatoo habitat assessment. Carnaby's Black Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include Banksia, Pine trees (*Pinus* sp.), Marri, Jarrah and *Allocasuarina*, (Shah 2006). All these species were recorded in the Survey Area during the Black Cockatoo habitat assessment.

Baudin's Black Cockatoo is listed as Vulnerable under the EPBC Act. It was returned from the DPaW threatened fauna and NatureMap searches, however it was not returned from the EPBC PMST or recorded during the Black Cockatoo habitat assessment This species forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds of Eucalypt, Banksia, and Pines (*Pinus* sp.) (Johnstone & Kirkby 2008, Johnstone & Storr 1998a).

The FRTBC is listed as Vulnerable under the EPBC Act. It was returned from the DPaW threatened fauna and EPBC PMST database searches, however it was not returned from NatureMap or recorded during the Black Cockatoo habitat assessment. The FRTBC feeds primarily on Marri and Jarrah fruit (Johnstone & Kirkby 1999; Cooper *et al.* 2002) which make up 90% of the diet of the FRTBC.

The Survey Area contains species such as Marri and Jarrah which provide suitable foraging habitat for the Carnaby's Black Cockatoo, Baudin's and FRTBC. The Survey Area is within the distribution of Carnaby's Black Cockatoo, and was recorded during the

Black Cockatoo habitat assessment. The Survey Area however is on the northern extremity of distribution for both Baudin's Black Cockatoo and the FRTBC and as such these two species are considered as Possibly occurring in the Survey Area.

5.7.2 Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone *et al.* 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (SEWPaC, 2012).

The Black Cockatoo habitat assessment revealed that the Survey Area contains Marri, Jarrah and Tuart trees which have reached a size that are considered to be potential future hollow bearing trees, therefore potential breeding trees (>500 mm DBH [>300 mm for Wandoo]) according to the EPBC Act Black Cockatoo referral guidelines.

In total, 264 trees were recorded which met the criteria to be classed as a potential breeding trees. This suggests that these trees may develop hollows and have the potential to be use for breeding in the future. In order to be suitable for Black Cockatoos, the hollow entrances need to be greater than 120 mm diameter. No observable hollows were recorded in the Survey Area.

There were many other Marri, Jarrah and Tuart trees that have the potential to be foraging habitat, however, they were under the threshold of 500 mm to be considered as potential breeding trees.

5.8 Fauna Habitat Types

Eucalyptus Trees with Understorey

This habitat (7.07 ha) mainly constitutes the area of relatively intact bushland to the eastern end of the Survey Area. It is a mix of Marri, Jarrah, Tuart and Powderbark Wandoo with a midstorey consisting of *Allocasuarina*, *Banksia* and *Xanthorrhoea.* This habitat provides foraging and breeding habitat for Carnaby's Black Cockatoos, Baudin's Black Cockatoo and FRTBC.

This habitat has vegetation in multiple strata (canopy, midstorey and understorey), limited woody debris and an understorey that is comprised of mixed herbs and grasses which provides habitat for small reptile, bird and mammal species. However, as these patches are for the most part fragmented, fauna movement between them is limited, particularly for the less mobile groups such as small reptiles and mammals.

Eucalyptus Trees no Understorey

This habitat (6.43 ha) consists of large Eucalypt Trees comprised of Marri, Jarrah, Tuart and Powderbark Wandoo which provide important foraging and breeding habitat for all three Black Cockatoo species, particularly Carnaby's Black Cockatoo. This habitat, however, is disturbed as a result of vegetation clearing and so lacks any understorey. A lack of vegetation in the mid and lower strata results in limited cover for common reptile, bird and mammal species and so provides limited value to fauna.

Shrubland

This habitat (0.96 ha) consists of various tall shrubs including various *Allocasuarina, Banksia, Jacksonia, Hakea and Xanthorrhoea* species over herbland/grassland and scrubland.

This habitat has limited vegetation strata, but does contain woody debris and leaf litter that provides habitat for small reptile, bird and mammal species. However, as these patches are for the most part fragmented, fauna movement between them is limited, particularly for the less mobile groups such as small reptiles and mammals.

Degraded Habitat

This habitat consisted of degraded and cleared areas as well as garden species and non-endemic species. It provides little value to fauna.

6 Conclusions

The following conclusions can be drawn:

- No Threatened species or Priority species were recorded within the Survey Area;
- A total of 22 introduced species were recorded. One species, **Opuntia stricta,* is listed as Declared under the BAM Act and is a WONS;
- Vegetation association EmCc, BmBa, CcXp and JsJf, have been determined to have the highest affiliation with FCT SCP 28 - Spearwood *Banksia attenuata* or *Banksia attenuata - Eucalyptus* woodlands, which is listed as a sub-community of 'Banksia woodlands of the Swan Coastal Plain. Banksia woodlands of the Swan Coastal Plain have been recently listed as Endangered TEC under the EPBC Act;
- The vegetation complexes in the survey area are: Karrakatta Complex – Central and South which is estimated to have 23.8% native vegetation remaining based on the pre-European extent;
- The remaining extent of this vegetation community is greater than the 10% threshold set by the EPA for protecting Australia's biological diversity in constrained areas;
- No Bush Forever sites occur in the Survey Area;
- The Survey does not form part of the Draft Regional Ecological linkage network;
- No DPaW Geomorphic Wetlands have been identified; and
- The Survey Area is not identified as an ESA.

The fauna survey was undertaken at a time considered appropriate for the species of conservation significance considered likely to be present on site. The following conclusions can be made:

- During the desktop review of database searches, eight conservation significant species were identified;
- One species of conservation significance was recorded during the field assessment:
  - Carnaby's Black Cockatoo.
- 14.5 ha of Black Cockatoo breeding and foraging habitat was recorded in the Survey Area;
- 264 Black Cockatoo potential breeding trees were recorded;
- No hollows were observed from the ground; and
- Four fauna habitats were identified in the Survey Area.

7 Recommendations

In order to minimise the impact on native flora and fauna the following recommendations are provided:

- Avoid unnecessary clearing of vegetation beyond that strictly required for the proposed works;
- Woody debris (this includes trees felled and logs) and leaf litter formed during clearing should be retained, as they create good microhabitat for a large array of fauna, particularly small reptiles;

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It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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FIGURES

Legend

- Survey Area (40.13 ha)

Geomorphic Wetlands evaluation

- Conservation
- Resource Enhancement
- Multiple Use
- Not Assessed

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- ESA SOURCED DER 2016
- ECOLOGICAL LINKAGES SOURCED WALGA 2014
- GEOMORPHIC WETLANDS SOURCED DPAW 2015
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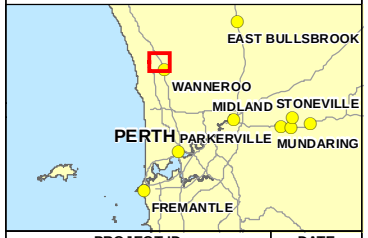

PROJECT ID	DATE
1833	1/12/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	NW	RF	0

Ingham Enterprises
Lot 1665 Wanneroo Road, Sinagra

Flora and Fauna Survey

Figure 3 - Geomorphic Wetlands

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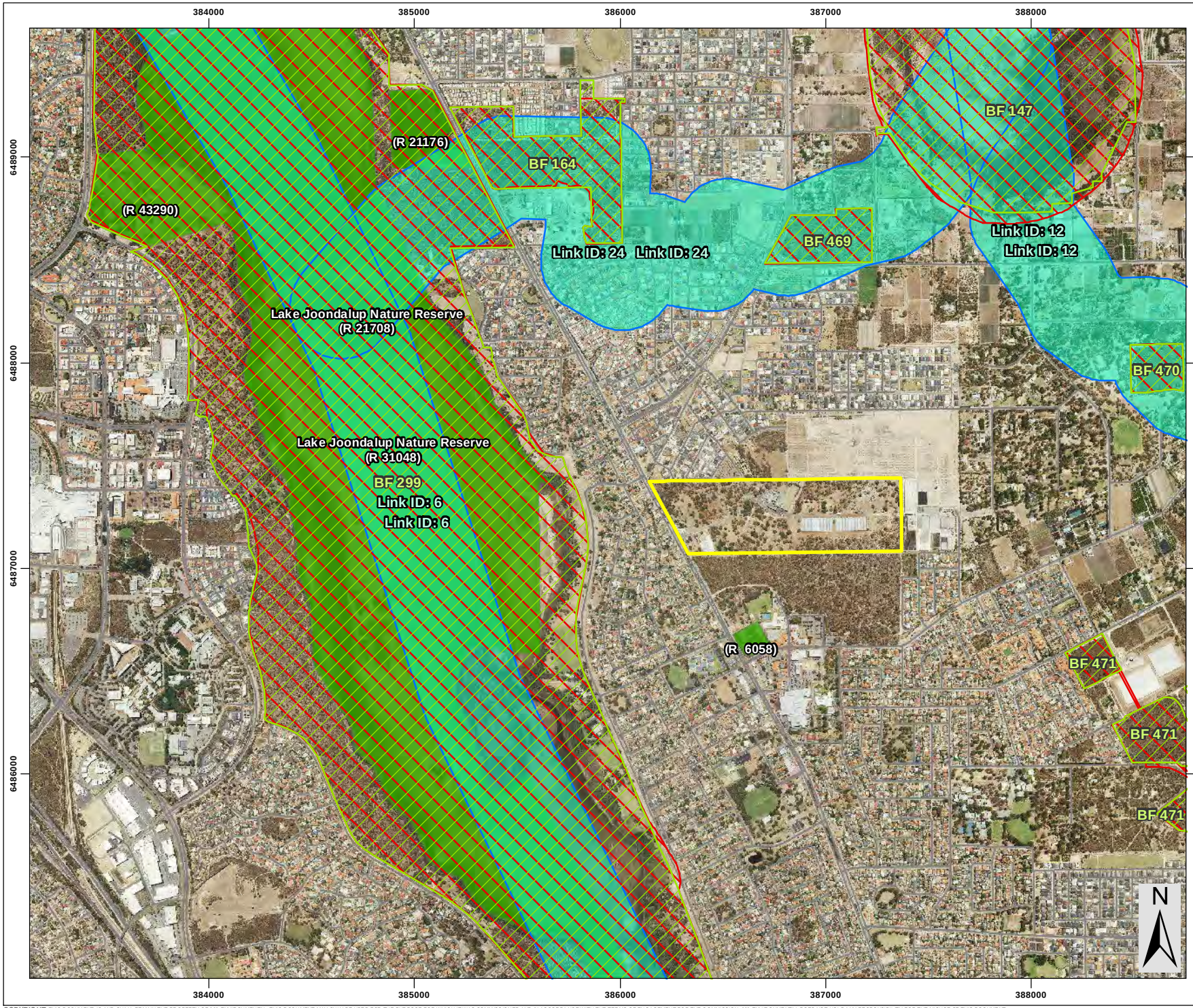

Legend

- Survey Area (40.13 ha)
- Bush Forever Sites
- DPaW Managed Lands
- Perth Regional Ecological Linkages
- Environmentally Sensitive Areas

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- ESA SOURCED DER 2016
- ECOLOGICAL LINKAGES SOURCED WALGA 2014
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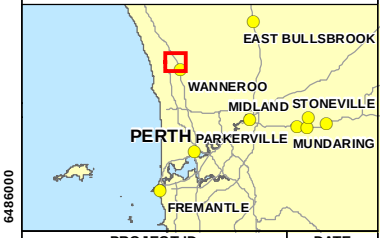

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Flora and Fauna Survey

Figure 4 - Conservation Areas

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Legend

Survey Area (40.13 ha)

Rare and Priority Flora

- Priority 4
- Priority 3
- Priority 2
- Priority 1
- Declared Rare

TECs/PECs

- Priority 3 (State Listed)
- Endangered (State Listed)

SCP24: Northern Spearwood shrublands and woodlands
SCP20a: *Banksia attenuata* woodlands over species rich dense shrublands
SCP25: Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
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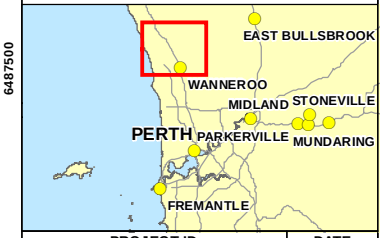

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Flora and Fauna Survey

Figure 5 -
Threatened and Priority Flora, TECs and PECs

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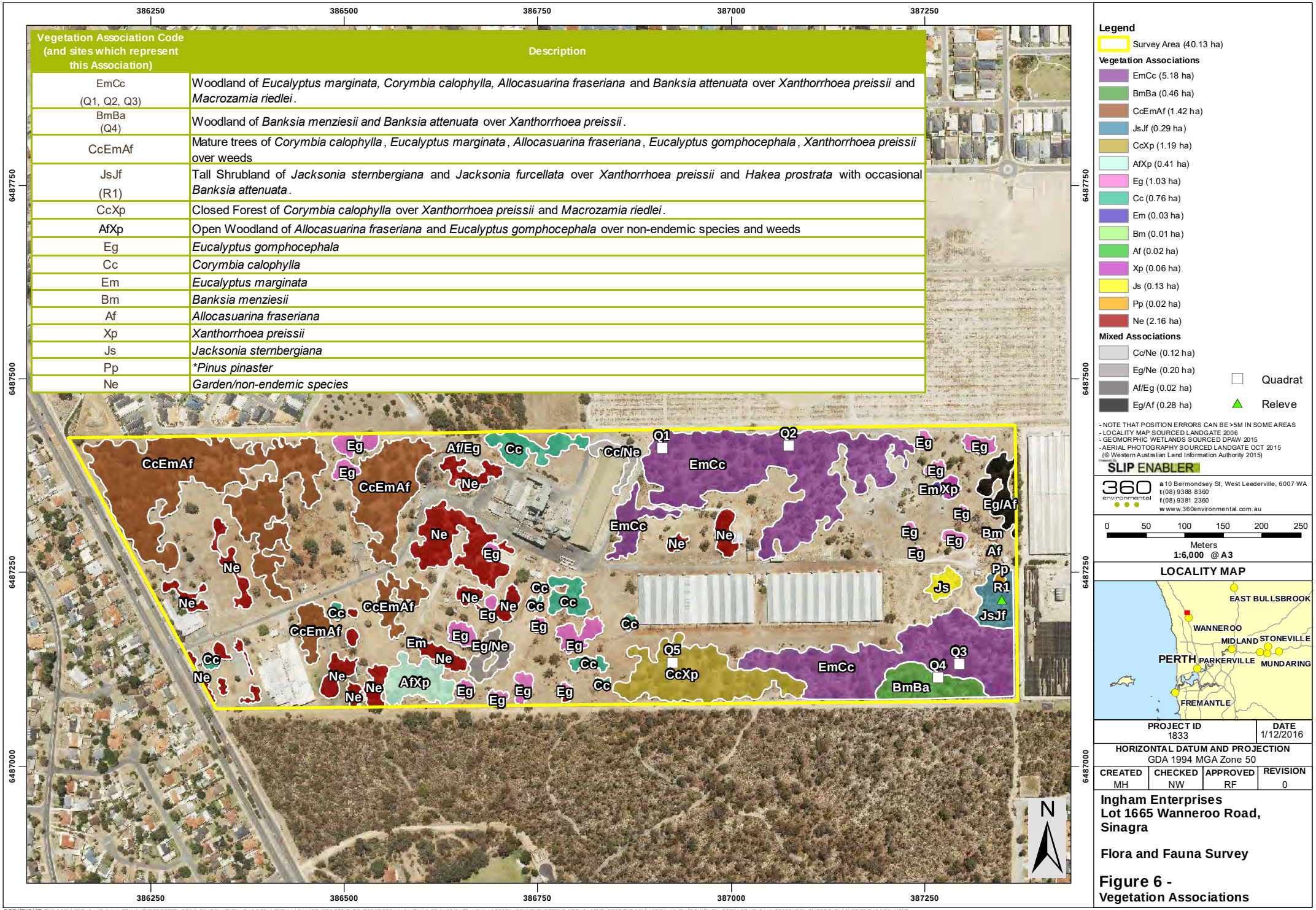

Vegetation Association Code (and sites which represent this Association)	Description
EmCc (Q1, Q2, Q3)	Woodland of *Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana* and *Banksia attenuata* over *Xanthorrhoea preissii* and *Macrozamia riedlei*.
BmBa (Q4)	Woodland of *Banksia menziesii and Banksia attenuata* over *Xanthorrhoea preissii*.
CcEmAf	Mature trees of *Corymbia calophylla*, *Eucalyptus marginata*, *Allocasuarina fraseriana*, *Eucalyptus gomphocephala*, *Xanthorrhoea preissii* over weeds
JsJf (R1)	Tall Shrubland of *Jacksonia sternbergiana* and *Jacksonia furcellata* over *Xanthorrhoea preissii* and *Hakea prostrata* with occasional *Banksia attenuata*.
CcXp	Closed Forest of *Corymbia calophylla* over *Xanthorrhoea preissii* and *Macrozamia riedlei*.
AfXp	Open Woodland of *Allocasuarina fraseriana* and *Eucalyptus gomphocephala* over non-endemic species and weeds
Eg	*Eucalyptus gomphocephala*
Cc	*Corymbia calophylla*
Em	*Eucalyptus marginata*
Bm	*Banksia menziesii*
Af	*Allocasuarina fraseriana*
Xp	*Xanthorrhoea preissii*
Js	*Jacksonia sternbergiana*
Pp	**Pinus pinaster*
Ne	*Garden/non-endemic species*

Legend

Survey Area (40.13 ha)

Vegetation Associations

- EmCc (5.18 ha)
- BmBa (0.46 ha)
- CcEmAf (1.42 ha)
- JsJf (0.29 ha)
- CcXp (1.19 ha)
- AfXp (0.41 ha)
- Eg (1.03 ha)
- Cc (0.76 ha)
- Em (0.03 ha)
- Bm (0.01 ha)
- Af (0.02 ha)
- Xp (0.06 ha)
- Js (0.13 ha)
- Pp (0.02 ha)
- Ne (2.16 ha)

Mixed Associations

- Cc/Ne (0.12 ha)
- Eg/Ne (0.20 ha)
- Af/Eg (0.02 ha)
- Eg/Af (0.28 ha)

Quadrat

Releve

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- GEOMORPHIC WETLANDS SOURCED DPAW 2015
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LOCALITY MAP

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1833	1/12/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

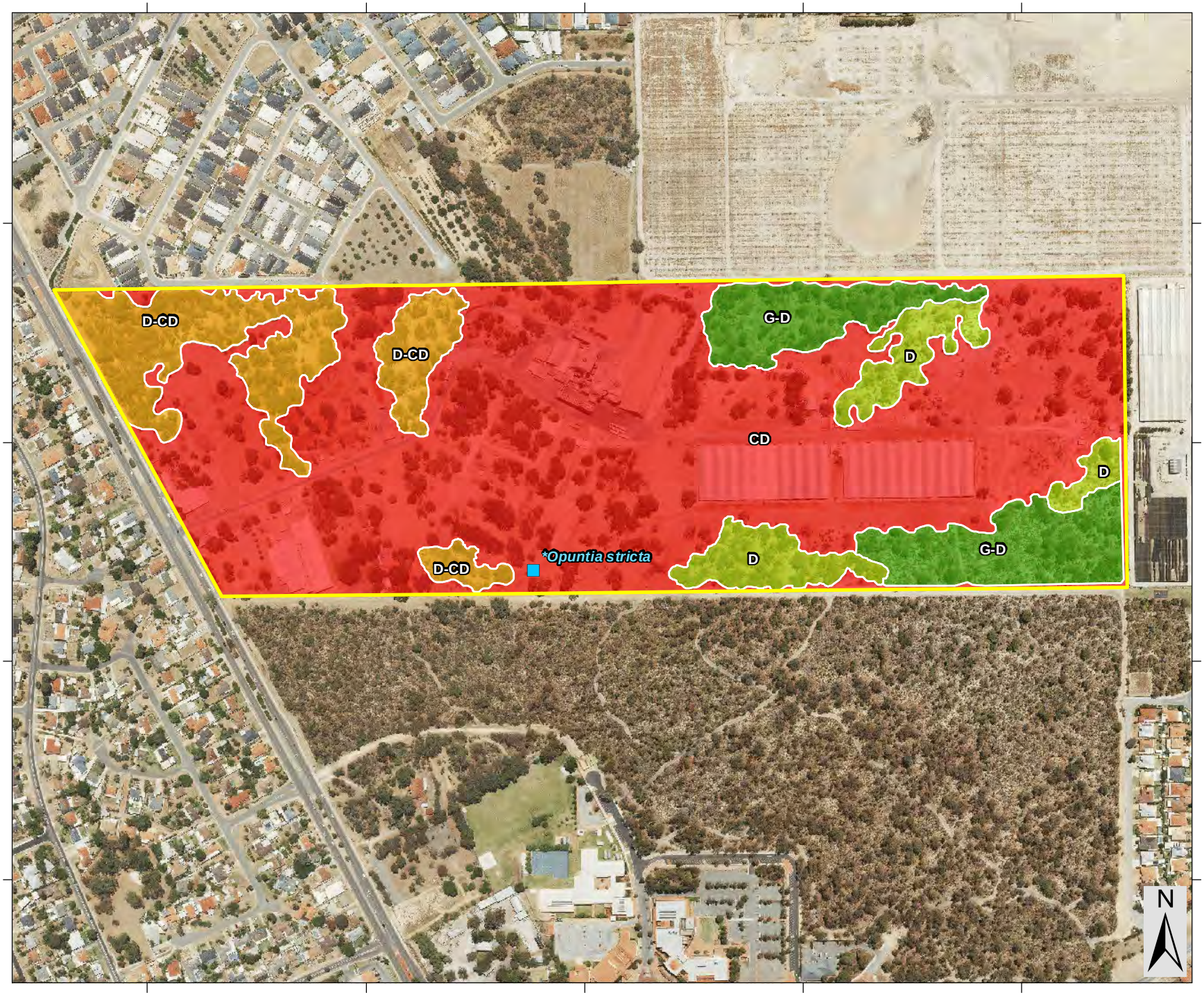
CREATED	CHECKED	APPROVED	REVISION
MH	NW	RF	0

Ingham Enterprises
Lot 1665 Wanneroo Road, Sinagra

Flora and Fauna Survey

Figure 6 - Vegetation Associations

K:\Projects\1.0 EBS\1833 Ingham Enterprises\Figures\1833 Figure 6 - Vegetation Associations.mxd



Legend

- Survey Area (40.13 ha)
- Declared Weed Locations

Vegetation Condition

- **G-D:** Good-Degraded (4.14 ha)
- **D:** Degraded (2.44 ha)
- **D-CD:** Degraded-Completely Degraded (4.53 ha)
- **CD:** Completely Degraded (29.01 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- GEOMORPHIC WETLANDS SOURCED DPAW 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE OCT 2015
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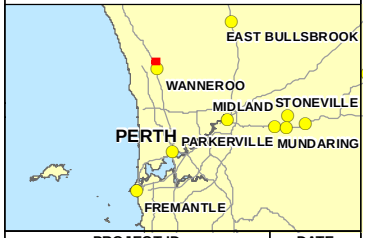
0 50 100 150 200 250
Meters
1:6,000 @ A3

LOCALITY MAP



PROJECT ID	DATE
1833	1/12/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	NW	RF	0

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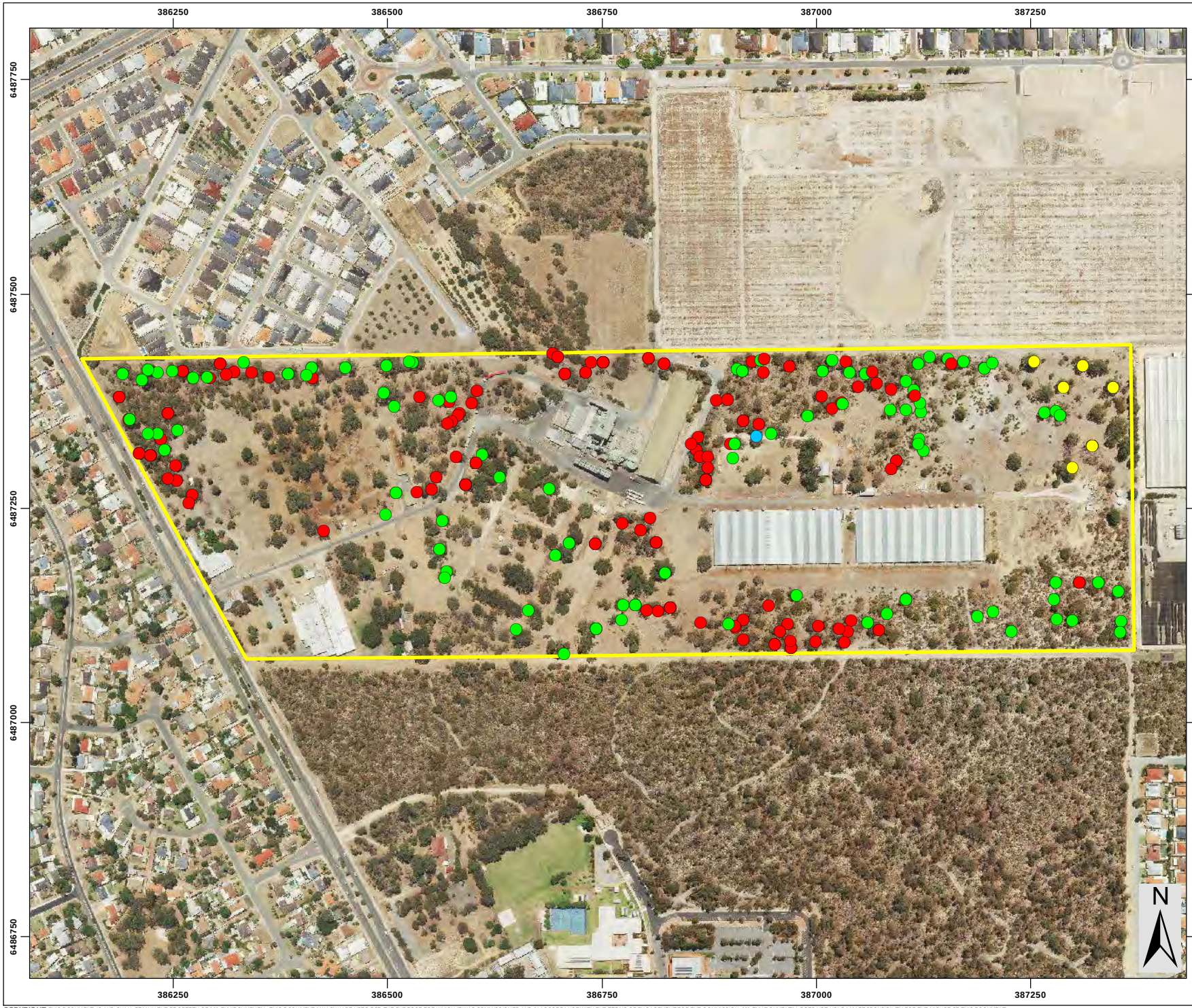
Flora and Fauna Survey

Figure 7 - Vegetation Condition

K:\Projects\1.0 EBS\1833 Ingham Enterprises\Figures\1833 Figure 7 - Vegetation Condition.mxd



Legend

Survey Area (40.13 ha)

Potential Black Cockatoo Breeding Trees

- *Corymbia calophylla*
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- *Eucalyptus wandoo*

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- GEOMORPHIC WETLANDS SOURCED DPAW 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE OCT 2015 (© Western Australian Land Information Authority 2015)

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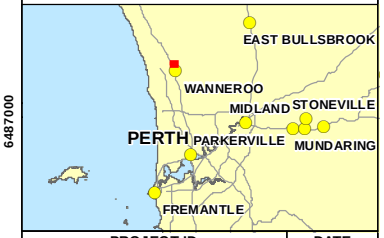
LOCALITY MAP



PROJECT ID	DATE
1833	1/12/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

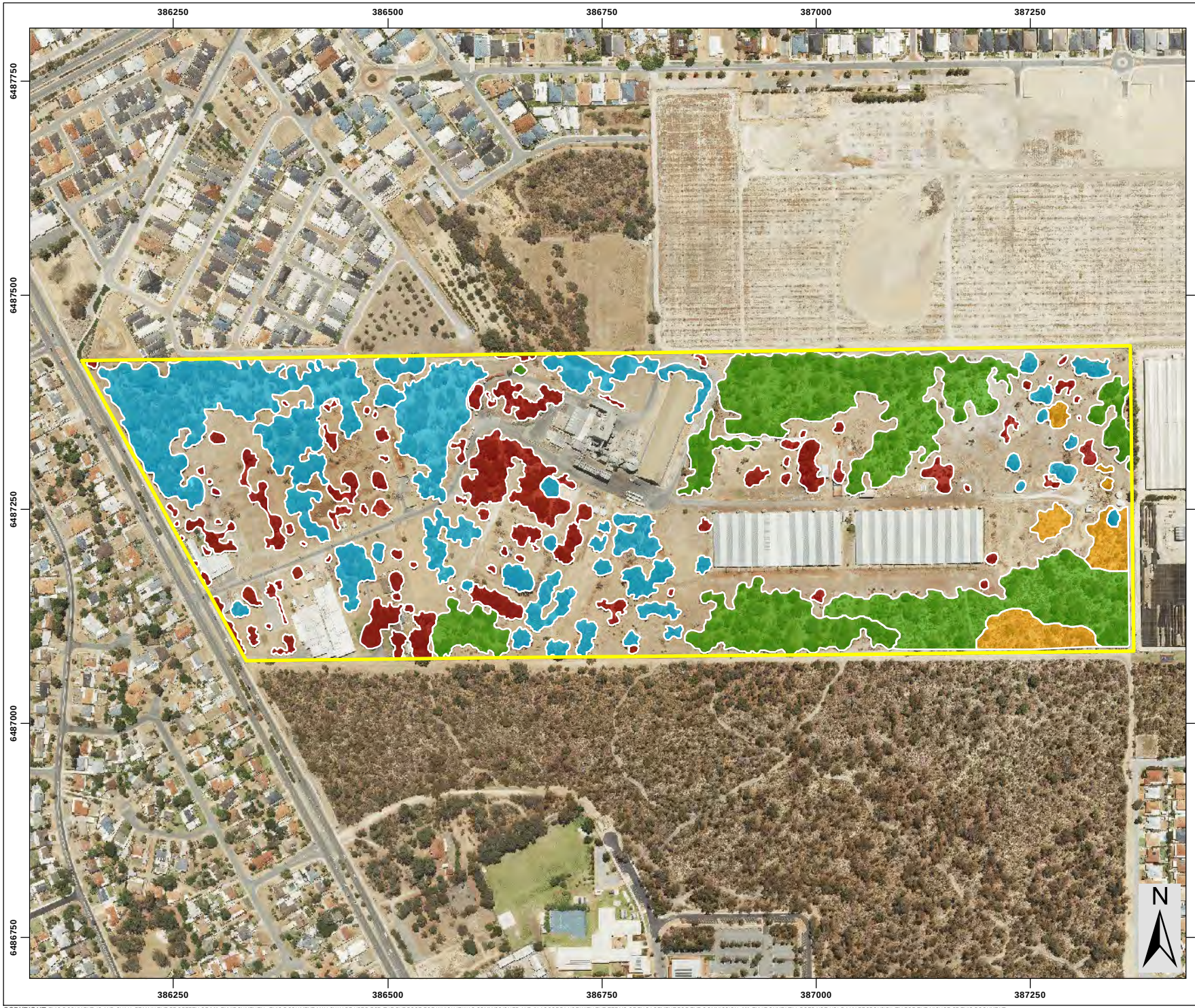
CREATED	CHECKED	APPROVED	REVISION
MH	LS	RF	0

Ingham Enterprises
Lot 1665 Wanneroo Road, Sinagra

Flora and Fauna Survey

Figure 8 -
Potential Back Cockatoo Breeding Trees

K:\Projects\1.0 EBS\1833 Ingham Enterprises\Figures\1833 Figure 8 - Potential BC Breeding Trees.mxd



Legend

Survey Area (40.13 ha)

Fauna Habitat

- *Eucalyptus* Woodland - With Understorey (7.07 ha)
- *Eucalyptus* Woodland - No Understorey (6.43 ha)
- Shrubland (0.96 ha)
- Degraded Habitat (3.27 ha)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- GEOMORPHIC WETLANDS SOURCED DPAW 2015
- AERIAL PHOTOGRAPHY SOURCED LANDGATE OCT 2015 (© Western Australian Land Information Authority 2015)

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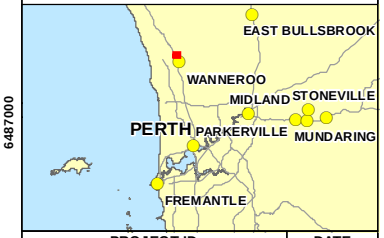
LOCALITY MAP



PROJECT ID	DATE
1833	1/12/2016

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
MH	NW	RF	0

Ingham Enterprises
Lot 1665 Wanneroo Road, Sinagra

Flora and Fauna Survey

Figure 9 - Fauna Habitat

K:\Projects\1.0 EBS\1833 Ingham Enterprises\Figures\1833 Figure 9 - Fauna Habitat.mxd

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	16
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	34
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		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
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Jandabup	WA
Lake Joondalup	WA
Unnamed WA21176	WA
Unnamed WA43290	WA
Woodvale Nature Reserve	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 Resouces Audit, 2001.

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

Name	Status	Type of Presence
		habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara 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
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Joondalup Lake	WA

APPENDIX H

Flora Likelihood Table

Assessment of the Likely Occurrence of DRF and Priority Flora (as per DPaW and EPBC Database Searches) in the Survey Area

[1]Closest record to Survey Area based on DPaW 2015.Likely = Suitable habitat present and records less than 5 km from the Survey Area, Possible = Suitable habitat present and records between 5 km and 10 km from the Survey Area, and Unlikely = No suitable habitat present and/or records greater than 10 km from the Survey Area. En = Listed as Endangered under the EBPC Act, Vu = Listed as Vulnerable under the EBPC, Ce= Critically Endangered under the EBPC Act, P = Listed as Priority by the DPaW DRF = Declared Rare Flora as listed by the State.

Source	Conservation Status		Species	Habitat Information	Distance to Nearest Record	Suitable Habitat Present	Likelihood of Occurrence in the Survey Area
	EPBC	DPaW					
EPBC PMST	Endangered	-	*Andersonia gracilis*	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps	29.6	No	Unlikely
EPBC PMST	Vulnerable	DRF/T	*Anigozanthos viridis subsp. terraspectans*	Grey sand, clay loam. Winter-wet depressions	72km	No	Unlikely
EPBC PMST	Endangered	DRF/T	*Caladenia huegelii*	Grey or brown sand, clay loam.	6.93 km	Yes	Possible
DPaW	Critically Endangered	DRF/T	*Dasymalla axillaris*	Information not available	120 km	Unknown	Unlikely
EPBC PMST	Vulnerable	DRF/T	*Diuris micrantha*	Brown loamy clay. Winter-wet swamps, in shallow water.	50 km	No	Unlikely
EPBC PMST	Endangered	DRF/T	*Diuris purdiei*	Grey-black sand, moist. Winter-wet swamps.	30 km	No	Unlikely
EPBC PMST	Endangered	DRF/T	*Drakaea elastica*	White or grey sand. Low-lying situations adjoining winter-wet swamps.	33 km	No	Unlikely
EPBC PMST	Vulnerable	DRF/T	*Drakaea micrantha*	White-grey sand.	40.7 km	Yes	Unlikely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
EPBC PMST	*Endangered*	DRF/T	*Lepidosperma rostratum*	Peaty sand, clay	34 km	No	Unlikely
DPaW	-	DRF/T	*Marianthus paralius*	White sand over limestone. Low coastal cliffs	2.5 km	No	Unlikely
EPBC PMST	*Endangered*	DRF/T	*Thelymitra dedmaniarum*	Granite	23 km	No	Unlikely
DPaW NatureMap	-	P1	*Baeckea sp. Limestone*	Unavailable	241.76m	Unknown	Unknown
DPaW	-	P1	*Drosera x sidjamesii*	Peaty sand. Along lake margins, close to winter high-water line	6.22 km	No	Unlikely
DPaW		P1	*Melaleuca sp. Wanneroo*	Unavailable	No data	Unknown	Unknown
DPaW NatureMap	-	P2	*Acacia benthamii*	Typically on limestone breakaways	425.56m	No	Unlikely
DPaW	-	P2	*Austrostipa mundula*	Unavailable	2.1km	Unknown	Unknown
DPaW	-	P2	*Calectasia elegans*	Unavailable	10.3 km	Unknown	Unknown
DPaW NatureMap	-	P2	*Tetraria sp. chandala*	Along edges of swamp. Black peaty sand	494 m	No	Unlikely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
DPaW NatureMap	-	P2	*Thelymitra variegata*	Sandy clay, sand, laterite.	241.76m	No	Unlikely
DPaW NatureMap	-	P3	*Conostylis bracteata*	Sand, limestone. Consolidated sand dunes	1.66 km	Yes	Likely
DPaW	-	P3	*Cyathochaeta teretifolia*	Grey sand, sandy clay. Swamps, creek edges.	6.6 km	No	Unlikely
NatureMap	-	P3	*Lasiopetalum membranaceum*	Sand over limestone	700 m	Yes	Likely
DPaW	-	P3	*Leucopogon sp. Yanchep*	Light grey-yellow sand, brown loam, limestone, laterite, granite. Coastal plain, breakaways, valley slopes, low hills.	No data	Yes	Possible
DPaW NatureMap	-	P3	*Pimelea calcicola*	Coastal limestone ridges	241.76 m	No	Unlikely
DPaW	-	P3	*Sarcozona bicarinata*	White sand	6 km	No	Unlikely
DPaW	-	P3	*Stylidium paludicola*	Peaty sand over clay. Winter-wet areas. Marri and *Melaleuca* woodland, *Melaleuca* shrubland.	2.5 km	No	Unlikely
DPaW	-	P4	*Jacksonia sericea*	Calcareous and sandy soils	600m	Yes	Likely

Source	Conservation Status		Species	Habitat information	Distance to nearest Record	Suitable Habitat present	Likelihood of occurrence in the Survey area
	EPBC	DPaW					
DPaW	-	P4	*Schoenus griffinianus*	White sand	12.7	No	Unlikely

APPENDIX I

Flora Inventory

Family	Name
Amaranthaceae	*Ptilotus manglesii*
	Ptilotus polystachyus
Araliaceae	*Trachymene pilosa*
Asparagaceae	*Lomandra ? caespitosa*
	Lomandra hermaphrodita
Asteraceae	**Arctotheca calendula*
	**Hypochaeris glabra*
	Podotheca gnaphalioides
	**Sonchus oleraceus*
	**Ursinia anthemoides*
Brassicaceae	**Raphanus raphanistrum*
Campanulaceae	**Wahlenbergia capensis*
Caryophyllaceae	**Silene gallica*
Centrolepidaceae	*Centrolepis drummondiana*
Colchicaceae	*Burchardia congesta*
Crassulaceae	*Crassula colorata var. acuminata*
Cyperaceae	*Mesomelaena pseudostygia*
	Schoenus grandiflorus
Dilleniaceae	*Hibbertia racemosa*
Droseraceae	*Drosera erythrorhiza*
	Drosera menziesii subsp. penicillaris
Ericaceae	*Leucopogon nutans*
Euphorbiaceae	**Euphorbia peplus*
	**Euphorbia terracina*
	**Ricinus communis*
Fabaceae	*Hardenbergia comptoniana*
	Jacksonia furcellata
	Jacksonia sternbergiana
	**Lupinus angustifolius*

Family	Name
Geraniaceae	**Pelargonium capitatum*
Haemodoraceae	*Conostylis aculeata subsp. aculeata*
	Haemodorum laxum
	Haemodorum sp.
Hemerocallidaceae	*Caesia micrantha*
	Dianella revoluta
Iridaceae	**Gladiolus caryophyllaceus*
	Orthrosanthus laxus
	**Romulea rosea*
Molluginaceae	*Macarthuria australis*
Myrtaceae	*Corymbia calophylla*
	Eucalyptus marginata
Orchidaceae	**Disa bracteata*
	Microtis media
	Pterostylis ?recurva
Oxalidaceae	**Oxalis sp.*
Phyllanthaceae	*Phyllanthus calycinus*
Poaceae	**Avena barbata*
	**Briza maxima*
	**Bromus diandrus*
	Bromus sp.
	**Ehrharta calycina*
	**Ehrharta longiflora*
Primulaceae	**Lysimachia arvensis*
Proteaceae	*Banksia attenuata*
	Banksia menziesii
	Hakea prostrata
	Stirlingia latifolia
Restionaceae	*Desmocladus flexuosus*
Rubiaceae	*Opercularia vaginata*
Violaceae	*Hybanthus calycinus*
Xanthorrhoeaceae	*Xanthorrhoea gracilis*
	Xanthorrhoea preissii
Zamiaceae	*Macrozamia riedlei*

APPENDIX J

Flora Survey Area Data Sheets

Opportunistic Collections

Arctotheca calendula
Bromus sp.
Burchardia congesta
Conostylis aculeata subsp. aculeata
Dianella revoluta
Euphorbia terracina
Hibbertia racemosa
Hybanthus calycinus
Lupinus angustifolius
Macarthuria australis
Mesomelaena pseudostygia
Opercularia vaginata
Orthrosanthus laxus
Pelargonium capitatum
Podotheca gnaphalioides
Ptilotus polystachyus
Raphanus raphanistrum
Ricinus communis
Schoenus grandiflorus
Ursinia anthemoides

Inghams Flora Survey **Site** INGQ1

Described by NW **Date** 13/09/2016 **Type** Q 10 x 10m

Location NW Corner of fence

MGA Zone 50 386911 **mE** 6487411 **mN** 115.806082 **E** -31.743064 **S**

Habitat Flat gentle slope

Soil Grey brown sand - yellow at depth

Vegetation Woodland of *Eucalyptus marginata* over *Banksia attenuata* over *Xanthorrhoea preissii*, *Macrozamia reidlei* and grass weeds

Veg Condition Good to Degraded

Fire Age Old (8-12)

Notes Aspect: N/A
Disturbance: Weeds
Ground Cover: 0% Bareground, 0% Logs, 2% Twigs, 4% Leaves

SPECIES LIST:

Name	Cover	Height	Specimen	Notes
Anagallis arvensis	+	10		Anagalis arvensis
Asteraceae sp.	+	10	ING1-5	Fleshy weed herb
Desmocladus flexuosus	3	20	ING1-4	Desmoclad flex
Ehrharta calycina	75	40	ING1-1	Erharta calycina
Ehrharta longiflora	5	35	ING1-2	Baby Avena
Eucalyptus marginata	60	1200		Eucalyptus marginata
Euphorbia peplus	+	15	ING1-3	Euphorbia umbrella
Haemodorum sp.	+	50	nc	Haemodorum sp.
Hardenbergia comptoniana	+	c		Hardenbergia comptoniana
Macrozamia riedlei	2	120		Macrozamia reidlei
Phyllanthus calycinus	+	55		Phyllanthus calycin
Romulea rosea	1	20		Romulea rosea
Xanthorrhoea gracilis	2	100		Xanthorrhoea gracilis
Xanthorrhoea preissii	11	120		Xanthorrh preis

Inghams Flora Survey **Site** INGQ1-2

Described by AB **Date** 1/11/2016 **Type**

Location NW corner of fence

MGA Zone 50 386911 **mE** 6487411 **mN** 115.806082 **E** -31.743064 **S**

Habitat Flat gentle slope

Soil Grey brown sand - yellow at depth

Vegetation Woodland of *Eucalyptus marginata* over *Banksia attenuata* over *Xanthorrhoea preissii*, *Macrozamia reidlei* and grass weeds

Veg Condition Good to Degraded

Fire Age Old (8-12)

Notes Aspect: N/A
Disturbance: Weeds
Ground Cover: 0% Bareground, 0% Logs, 2% Twigs, 4% Leaves

SPECIES LIST:

Name	Cover	Height
Anagallis arvensis	*1*	*10*
Asteraceae sp.		*10*
Avena barbata	*1*	*10*
Briza maxima	+	*10*
Bromus diandrus	*2*	*30*
Desmocladus flexuosus		*20*
Disa bracteata	+	*120*
Ehrharta calycina	*7.5*	*40*
Ehrharta longiflora	*5*	*35*
Eucalyptus marginata	*60*	*1200*
Euphorbia careyi	*1*	*30*
Euphorbia peplus	*1*	*15*
Haemodorum *sp.*	*1*	*50*
Hardenbergia comptoniana	*1*	*c*
Macrozamia riedlei	*2*	*120*
Oxalis *sp.*	+	*20*
Phyllanthus calycinus		*120*
Romulea rosea		*55*
Silene gallica	+	*30*
Sonchus oleraceus	+	*20*
Xanthorrhoea gracilis	*2*	*20*
Xanthorrhoea preissii	*11*	*100*

Inghams Flora Survey **Site** INGQ2

Described by NW **Date** 13/09/2016 **Type** Q 10 x 10m

Location Along northern boundary

MGA Zone 50 387075 **mE** 6487414 **mN** 115.807813 **E** -31.743053 **S**

Habitat Flat

Soil Loam sand

Vegetation Woodland of *Corymbia calophylla* and *Banksia attenuata* over *Xanthorrhoea preissii*, *Xanthorrhoea gracilis* and weeds
Eucalyptus marginata and *Allocasuarina fraseriana* are also in community but just outside quadrat

Veg Condition Good to Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds
Ground Cover: 2% Bareground, 0% Logs, 2% Twigs, 5% Leaves

SPECIES LIST:

Name	Cover	C Class	Height
Asteraceae sp.	+		*10*
Banksia attenuata	*25*		*700*
Corymbia calophylla	*30*		*1000*
Ehrharta calycina	*25*		*40*
Ehrharta longiflora	*45*		*40*
Euphorbia peplus	+		*15*
Leucopogon nutans	+		*30*
Romulea rosea	*3*		*15*
Sonchus oleraceus	+		*15*
Xanthorrhoea gracilis	*10*		*110*
Xanthorrhoea preissii	*65*		*120*

Inghams Flora Survey **Site** INGQ2-2

Described by AB **Date** 1/11/2016 **Type** Q

Location Along northern boundary

MGA Zone 50 387075 **mE** 6487414 **mN** 115.807813 **E** -31.743053 **S**

Habitat flat

Soil loam sand

Vegetation Woodland of *Corymbia calophylla* and *Banksia attenuata* over *Xanthorrhoea preissii*, *Xanthorrhoea gracilis* and weeds
Eucalyptus marginata and *Allocasuarina fraseriana* are also in community but just outside quadrat

Veg Condition Good to Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds
Ground Cover: 2% Bareground, 0% Logs, 2% Twigs, 5% Leaves

SPECIES LIST:

Name	Cover	C Class	Height	Specimen Notes
Asteraceae sp.	+		10	
Avena barbata	5		50	
Banksia attenuata	25		700	
Bromus diandrus	5		50	
Corymbia calophylla	30		1000	
Ehrharta calycina	25		40	
Ehrharta longiflora	45		40	
Euphorbia peplus	2		15	
Leucopogon nutans	2		10	
Lysimachia arvensis	1		20	
Silene gallica	1		20	
Wahlenbergia capensis	1		30	
Xanthorrhoea gracilis	10		110	
Xanthorrhoea preissii	65		120	

Inghams Flora Survey **Site** INGQ3

Described by NW **Date** 13/09/2016 **Type** Q 10 x 10

Location Off Southern boundary

MGA Zone 50 387295 **mE** 6487131 **mN** 115.810103 **E** -31.745628 **S**

Habitat Flat - very gentle slope

Soil Brown grey sand

Vegetation Woodland of *Corymbia calophylla, Eucalyptus marginata* over *Xanthorrhoea preissii, Xanthorrhoea gracilis, Stirlingia latifolia* and weeds

Veg Condition Good to Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds, Kangaroos
Ground Cover: 2% Bareground, 1.5%Logs, 8% Twigs, 30% Leaves

SPECIES LIST:

Name	Cover	Height
Briza maxima	6	35
Caesia micrantha	+	45
Conostylis aculeata	+	20
Corymbia calophylla	75	1500
Desmocladus flexuosus	3	15
Ehrharta calycina	2	40
Ehrharta longiflora	3	35
Eucalyptus marginata	5	1400
Hardenbergia comptoniana	+	c
Lomandra ? caespitosa	1.5	35
Macrozamia riedlei	1.5	130
Pterostylis ?recurva	+	10
Romulea rosea	5	25
Stirlingia latifolia	1	50
Ursinia anthemoides	+	20
Xanthorrhoea gracilis	2	100
Xanthorrhoea preissii	12	120

Inghams Flora Survey **Site** INGQ3-2

Described by AB **Date** 1/11/2016 **Type**

Location Off southern boundary

MGA Zone 50 387295 **mE** 6487131 **mN** 115.810103 **E** -31.745628 **S**

Habitat Flat - very gently slope

Soil Brown grey sand

Vegetation Woodland of *Corymbia calophylla*, *Eucalyptus marginata* over *Xanthorrhoea preissii*, *Xanthorrhoea gracilis*, *Stirlingia latifolia* and weeds

Veg Condition Good to Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds, Kangaroos
Ground Cover: 2% Bareground, 1.5% Logs, 8% Twigs, 30% Leaves

SPECIES LIST:

Name	Cover	Height
Avena barbata	5	20
Briza maxima	30	35
Caesia micrantha	+	45
Conostylis aculeata	+	20
Corymbia calophylla	75	1500
Desmocladus flexuosus	3	15
Ehrharta calycina	5	40
Ehrharta longiflora	5	35
Eucalyptus marginata	5	1400
Hardenbergia comptoniana	1	c
Hypochaeris glabra	1	20
Lomandra ? caespitosa	1.5	35
Macrozamia riedlei	1.5	130
Microtis media		
Pterostylis ?recurva	+	10
Romulea rosea	+	25
Sonchus oleraceus	1	20
Stirlingia latifolia	1	50
Ursinia anthemoides	5	20
Xanthorrhoea gracilis	2	100
Xanthorrhoea preissii	12	120

Inghams Flora Survey **Site** INGQ4

Described by NW **Date** 13/09/2016 **Type** Q 10 x 10m

Location Off Southern edge

MGA Zone 50 387268 **mE** 6487114 **mN** 115.809816 **E** -31.745778 **S**

Habitat Flat - very gentle slope

Soil Grey sand

Vegetation Woodland of *Banksia menziesii* and *Banksia attenuata* over *Xanthorrhoea preissii*, *Xanthorrhoea gracilis* and weeds

Veg Condition Good to Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds, unknown death of Banksias
Ground Cover: 8% Bareground, 2%Logs, 4% Twigs, 10% Leaves

SPECIES LIST:

Name	Cover	C Class	Height
Asteraceae sp.	+		*4*
Asteraceae sp.	+		*25*
Banksia attenuata	*2*		*400*
Banksia menziesii	*25*		*700*
Burchardia congesta	+		*60*
Centrolepis drummondiana	+		*3*
Conostylis aculeata	+		*15*
Crassula colorata var. acuminata	+		*3*
Drosera erythrorhiza	+		*1*
Drosera menziesii subsp. penicillaris	+		*c*
Ehrharta calycina	*1*		*50*
Gladiolus caryophyllaceus	+		*30*
Haemodorum laxum	+		*35*
Hybanthus calycinus	+		*30*
Lomandra ? caespitosa	*1.5*		*30*
Lomandra ? caespitosa	+		*15*
Mesomelaena pseudostygia	*1*		*55*
Romulea rosea	+		*15*
Trachymene pilosa	+		*2*
Ursinia anthemoides	+		*15*
Xanthorrhoea gracilis	*2*		*100*
Xanthorrhoea preissii	*12*		*155*

Inghams Flora Survey

Site INGQ4-2

Described by AB **Date** 1/11/2016 **Type**

Location Off Southern edge

MGA Zone 50 387268 **mE** 6487114 **mN** 115.809816 **E** -31.745778 **S**

Habitat Flat - very gentle slope

Soil Grey sand

Vegetation Woodland of *Banksia menziesii* and *Banksia attenuata* over *Xanthorrhoea preissii*, *Xanthorrhoea gracilis* and weeds

Veg Condition Good to Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds, unknown death of Banksias
Ground Cover: 8% Bareground, 2% Logs, 4% Twigs, 10% Leaves

SPECIES LIST:

Name	Cover	Height
Asteraceae sp.	+	*25*
Asteraceae sp.	+	*4*
Banksia attenuata	*2*	*400*
Banksia menziesii	*25*	*700*
Briza maxima	*5*	*30*
Bromus diandrus	*5*	*30*
Centrolepis drummondiana	+	*3*
Conostylis aculeata	+	*15*
Crassula colorata var. acuminata	+	*3*
Drosera erythrorhiza	+	*1*
Drosera menziesii subsp. penicillaris	+	*c*
Ehrharta calycina	*1*	*50*
Gladiolus caryophyllaceus	*1*	*30*
Haemodorum laxum	+	*35*
Hybanthus calycinus	+	*30*
Jacksonia sternbergiana	+	*20*
Lomandra ? caespitosa	*1.5*	*30*
Lomandra hermaphrodita	+	*20*
Mesomelaena pseudostygia	*1*	*55*
Romulea rosea	+	*15*
Trachymene pilosa	+	*2*
Ursinia anthemoides	*5*	*15*
Wahlenbergia capensis	*1*	*30*
Xanthorrhoea gracilis	*2*	*100*
Xanthorrhoea preissii	*12*	*155*

Inghams Flora Survey **Site** INGQ5

Described by NW **Date** 13/09/2016 **Type** Q 10 x 10m

Location Just south of chook sheds

MGA Zone 50 386924 **mE** 6487133 **mN** 115.806187 **E** -31.745573 **S**

Habitat Mid Slope - Gentle slope

Vegetation Woodland of *Corymbia calophylla* over *Xanthorrhoea preissii* and *Macrozamia riedlei*

Veg Condition Degraded

Fire Age Very Old (>12)

Notes Canopy is denser, understorey absent except for Xanthorrhoea preissii and Macrozamia riedlei

Aspect: N/A
Disturbance: Weeds
Ground Cover: 0% Bareground, 0%Logs, 1% Twigs, 2% Leaves
Notes: Canopy is denser, understorey is absent except for Xanthorrhoea preissii and Macrozamia riedlei

SPECIES LIST:

Name	Cover	Height
Arctotheca calendula	+	*25*
Corymbia calophylla	*75*	*1400*
Ehrharta longiflora	*90*	*40*
Macrozamia riedlei	*3.5*	*170*
Xanthorrhoea preissii	*12*	*130*

Inghams Flora Survey

Site INGQ5-2

Described by AB **Date** 1/11/2016 **Type** Q

Location Just south of chook sheds

MGA Zone 50 386924 **mE** 6587133 **mN** 115.817504 **E** -30.843490 **S**

Habitat Mid slope - Gentle slope

Vegetation Woodland of *Corymbia calophylla* over *Xanthorrhoea preissii* and *Macrozamia riedlei*

Veg Condition Degraded

Fire Age Very Old (>12)

Notes Aspect: N/A
Disturbance: Weeds
Ground Cover: 0% Bareground, 0% Logs, 1% Twigs, 2% Leaves
Notes: Canopy is denser, understorey is absent except for Xanthorrhoea preissii and Macro ried

SPECIES LIST:

Name	Cover	Height
Arctotheca calendula	+	*25*
Bromus diandrus	*10*	*30*
Corymbia calophylla	*75*	*1400*
Ehrharta calycina	*5*	*50*
Ehrharta longiflora	*90*	*40*
Macrozamia riedlei	*3.5*	*170*
Sonchus oleraceus	+	*30*
Xanthorrhoea preissii	*12*	*130*

Inghams Flora Survey

Site INGR1

Described by NW **Date** 13/09/2016 **Type** R 10 x 10m

Location Off east boundary

MGA Zone 50 387350 **mE** 6487215 **mN** 115.810693 **E** -31.744875 **S**

Habitat Altered landscape - very undulated with yellow surface sand

Soil Yellow

Vegetation Tall shrubland of *Jacksonia sternbergia*, *Jacksonia furcellata* with scattered *Banksia attenuata* and *Hakea prostrata* over weeds and exposed sand

Veg Condition Degraded

Fire Age (>12 yrs)

Notes Aspect: N/A
Disturbance: Weeds, Jacksonia death - dumped soil?
Ground Cover: 25% Bareground, 2%Logs, 20% Twigs, 1% Leaves

SPECIES LIST:

Name	Cover	Height
Arctotheca calendula	3	20
Asteraceae sp.	+	20
Banksia attenuata	2	400
Hakea prostrata	2	400
Jacksonia furcellata	5	500
Jacksonia sternbergiana	15	300
Ptilotus polystachyus	+	45
Ursinia anthemoides	3	25
Xanthorrhoea preissii	2	110

APPENDIX K

Fauna Species List

AMPHIBIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DPaW = Department of Parks and Wildlife Priority Code, A = Listed in Naturemap, B= DPaW Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey;

Note: For Definitions of Conservation Codes see Appendix A.

Scientific Name	Common Name	Conservation Codes						
		EPBC	WC	DPaW	A	B	C	D
CHELUIDAE								
Chelodina colliei	Oblong Turtle				X			
LIMNODYNASTIDAE								
Heleioporus eyrei	Moaning Frog				X			
Limnodynastes dorsalis	Western Banjo Frog				X			
MYOBATRACHIDAE								
Crinia insignifera	Squelching Froglet				X			
Myobatrachus gouldii	Turtle Frog				X			
HYLIDAE								
Litoria adelaidensis	Slender Tree Frog				X			
Litoria moorei	Motorbike Frog				X			

REPTILIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DPaW = Department of Parks and Wildlife Priority Code, A = Listed in Naturemap, B= DPaW Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey:

Note: For Definitions of Conservation Codes see Appendix A.

Scientific Name	Common Name	Conservation Codes						
		EPBC	WC	DPaW	A	B	C	D
DIPLODACTYLIDAE								
Crenadactylus ocellatus	Clawless Gecko				X			
Diplodactylus granariensis	Wheat-belt Stone Gecko				X			
Diplodactylus polyophthalmus	Speckled Stone Gecko				X			
Strophurus spinigerus spinigerus	South-western Spint-tailed Gecko				X			
PYGOPODIDAE								
Aprasia rapens	Sand-plain Worm-lizard				X			
Delma grayii	Side-barred Delma				X			
Lialis burtonis	Burtons Snake Lizard				X			
Pygopus lepidopous	Common Scaly Foot				X			
GEKKONIDAE								
Christinus marmoratus	Marbled Gecko				X			
Gehyra variagata								X
Hemidactylus frenatus	Asian House Gecko						X	
Underwoodisaurus milii	Barking Gecko				X			
SCINCIDAE								
Acritoscincus trilineatus	Western Three-lined Skink				X			
Cryptoblepharus buchananii	Buchanans Snake-eyed Skink				X			X
Ctenotus fallens	West-coast Laterite Ctenotus				X			
Ctenotus impar	Odd-striped Ctenotus				X			
Cyclodomorphus celatus	Western Slender Blue-tongue				X			
Egernia napoleonis	South-western Crevice Skink				X			
Hemiergis quadrillineata	Two-toed Earless Skink				X			
Lerista elegans	Elegant Slider				X			
Lerista lineopunctulata	Dotted-line Robust Slider				X			
Lerista praepedita	Blunt-tailed West-coast Slider				X			

Scientific Name	Common Name	Conservation Codes						
		EPBC	WC	DPaW	A	B	C	D
Menetia greyii	Common Dwarf Skink				X			
Morethia obscura	Shrubland Morethia Skink				X			
Tiliqua occipitalis	Western Bluetongue				X			
Tiliqua rugosa	Shingleback				X			
AGAMIDAE								
Ctenophorus adelaidensis	Southern Heath Dragon				X			
Pogona minor	Dwarf Bearded Dragon				X			
VARANIDAE								
Varanus gouldii	Sand Monitor				X			
Varanus tristis	Racehorse Monitor				X			
TYPHLOPIDAE								
Ramphotyphlops braminus	Flowerpot Blind Snake						X	
BOIDAE								
Morelia spilota imbricata	Carpet Python				X			
ELAPIDAE								
Brachyyrophis semifasciatus	Southern Shovel-nosed Snake				X			
Demansia psammophis reticulata	Yellow-faced Whipsnake				X			
Echiopsis curta	Bardick				X			
Elapognathus coronatus	Crowned Snake				X			
Neelaps Bimaculatus	Black-naped Snake				X			
Neelaps calonotos	Black-striped Snake			P3	X	X		
Notechis scutatus	Tiger Snake				X			
Parasuta gouldii	Gouds Snake				X			
Parasuta nigriceps	Black-backed Snake				X			
Pseudonaja affinis affinis	Dugite				X			
Simoselaps bertholdi	Jan's Banded Snake				X			

AVIAN (Birds in Noongar: Djert) SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DPaW = Department of Parks and Wildlife Priority Code, A = Listed in Naturemap, B= DPaW Threatened and Priority fauna search, C= EPBC Protected Matters search, D= Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

Scientific Name	Common Name	Conservation Codes						
		EPBC	WC	DPaW	A	B	C	D
MEGAPODIIDAE								
Leipoa ocellata	Malleefowl	Vu	S1				X	
PHASIANIDAE								
Coturnix ypsilophora	Brown Quail				X			
ANATIDAE								
Anas castanea	Chestnut Teal				X			
Anas gracillis	Grey Teal				X			
Anas platyrhynchos	Mallard				X		X	
Anas rhynchotis	Australian Shoveler				X			
Anas superciliosa	Pacific Black Duck				X			X
Anser anser	Greylag Goose				X			
Aythya australis	Hardhead				X			
Biziura lobata	Musk Duck				X			
Chenonetta jubata	Australian Wood Duck				X			
Cygnus atratus	Black Swan				X			
Dendrocygna eytoni	Plumed whistling Duck				X			
Malacorhynchus membranaceus	Pink-eared Duck				X			
Oxyura australis	Blue-billed Duck			P4	X	X		
Stictonetta naevosa	Freckled Duck				X			
Tadorna tadornoides	Australian Shelduck				X			X
PODICIPEDIDAE								
Poliocephalus poliocephalus	Hoary-headed Greb				X			
Podiceps cristatus	Great Crested Grebe				X			
Tachybaptus novaehollandiae	Australian Grebe				X			
ANHINGIDAE								
Anhinga melanogaster	Oriental Darter				X			
Anhinga novaehollandiae	Australasian Darter				X			
PHALACROCORACIDAE								
Microcarbo melanoleucos	Little Pied Cormorant				X			

Scientific Name	Common Name	EPBC	WC	DPaW	A	B	C	D
Phalacrocorax carbo	Great Cormorant				X			
Phalacrocorax sulcirostris	Little Black Cormorant				X			
Phalacrocorax varius	Pied Cormorant				X			
PELECANIDAE								
Pelecanus conspicillatus	Australian Pelican				X			
ARDEIDAE								
Ardea garzetta	Little Egret				X			
Ardea ibis	Cattle Egret	MiMa			X	X	X	
Ardea modesta	Great Egret	MiMa			X	X	X	
Ardea novaehollandiae	White-faced Heron				X			
Ardea pacifica	White-necked Heron				X			
ixobrychus dubius	Black Backed Bittern				X			
Ixobrychus flavicollis australis	Black Bittern (southwest pop)			P1	X	X		
Ixobrychus minutus	Little Bittern			P4	X	X		
Nycticorax caledonicus	Rufous Night Heron				X			
RECURVIROSTRIDAE								
Cladorhynchus leucocephalus	Banded Stilt				X			
Himantopus himantopus	Black-winged Stilt	Ma			X		X	
Recurvirostra novaehollandiae	Red-necked Avocet	Ma			X		X	
CHARADRIIDAE								
Charadrius leschenaultii	Greater Sand Plover	MiMa			X	X		
Charadrius ruficapillus	Red-capped Plover				X		X	
Elseyornis melanops	Black-fronted Dotterel				X			
Erythrogonys cinctus	Red-kneed Dotterel				X			
Thinornis rubricollis	Hooded Plover	Ma		P4			X	
ROSTRATULIDAE								
Rostratula australis	Australian Painted Snipe	En, MiMa					X	
SCOLOPACIDAE								
Actitis hypoleucos	Common Sandpiper	MiMa			X			
Calidris acuminata	Sharp-tailed Sandpiper	MiMa					X	
Calidris ferruginea	Curlew Sandpiper	CR, MiMa			X	X	X	
Calidris ruficollis	Red-necked Stint	MiMa	S3		X	X	X	
Calidris subminuta	Long-toed Stint	MiMa					X	
Limosa limosa	Black-tailed Godwit	MiMa			X	X		
Numenius madagascariensis	Eastern Curlew	CR, MiMa					X	
Tringa glareola	Wood Sandpiper	MiMa			X		X	
Tringa nebularia	Common Greenshank	MiMa	S3		X	X	X	
COLUMBIDAE								
Columba livia	Domestic Pigeon				X		X	
Ocyphaps lophotes	Crested Pigeon				X			
Phaps chalcoptera	Common Bronzewing				X			X

Scientific Name	Common Name	EPBC	WC	DPaW	A	B	C	D
Streptopelia chinensis	Spotted Turtle-Dove				X		X	
Streptopelia senegalensis senegalensis	Laughing Dove				X		X	
PODARGIDAE								
Podargus strigoides	Tawny Frogmouth				X			
APODIDAE								
Apus pacificus	Fork-tailed Swift	MiMa			X	X	X	
PROCELLARIIDAE								
Macronectes giganteus	Southern Giant-Petrel				X			
Pachyptila desolata	Antarctic Prion				X			
THRESKIORNITHIDAE								
Plegadis falcinellus	Glossy Ibis	MiMa	S5		X	X		
Platalea regia	Royal Spoonbill				X			
Plegadis flavipes	Yellow-billed Spoonbill				X			
Threskiornis molucca	Australian White Ibis				X			
Threskiornis spinicollis	Straw-necked Ibis				X			
ACCIPITRIDAE								
Accipiter cirrocephalus cirrocephalus	Collared Sparrowhawk				X			
Accipiter fasciatus didimus	Brown Goshawk				X			
Aquila audax	Wedge-tailed Eagle				X			
Aquila morphnoides	Little Eagle				X			
Circus approximas	Swamp harrier				X			
Elanus axillaris	Black Souldered Kite				X			
Haliaeetus leucogaster	White-bellied Sea Eagle	Ma			X		X	
Haliastur sphenurus	Whistling Kite				X			
Pandion haliaetus	Osprey	MiMa			X		X	
FALCONIDAE								
Falco cenchroides	Australian Kestrel				X			
Falco longipennis	Australian Hobby				X			
Falco peregrinus	Peregrine Falcon		S7		X	X		
RALLIDAE								
Fulica atra	Eurasian Coot				X			
Gallinula tenebrosa	Dusky Moorhen				X			
Gallirallus philippensis	Buff-banded Rail				X			
Porphyrio porphyrio bellus	Purple Swamphen				X			
Porzana fluminea	Australian Spotted Crake				X			
Porzana pusilla	Ballions Crake				X			
Porzana tabuensis	Spotless Crake				X			
Tribonyx ventralis	Black-tailed Native-hen				X			
LARIDAE								
Larus pacificus	Pacific Gull				X			
Sternula nereis	Fairy Tern	Vu			X	X		

Scientific Name	Common Name	EPBC	WC	DPaW	A	B	C	D
PSITTACIDAE								
Cacatua galerita	Sulphur-crested Cockatoo				X			
Cacatua pastinator	Western Long-billed Corella				X			
Cacatua sanguinea	Little Corella				X			X
Cacatua tenuirostris	Eastern Long-billed Corella				X			
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	Vu	S1			X	X	
Calyptorhynchus baudinii	Baudin's Cockatoo	Vu	S1		X	X		
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	En	S1		X	X	X	X
Eolophus roseicapilla	Galah				X			X
Glossopsitta porphyrocephala	Purple-crowned Lorikeet				X			
Neophema elegans	Elegant Parrot				X			
Platycercus icterotis	Western Rosella				X			
Purpureicephalus spurius	Red-capped Parrot				X			
Platycercus zonarius	Australian Ringneck				X			X
Trichoglossus haematodus moluccanus	Rainbow Lorikeet				X			
CUCULIDAE								
Cacomantis flabelliformis	Fan-tailed Cockoo				X			
Cacomantis pallidus	Pallid Cuckoo				X			
Chrysococcyx lucidus plagosus	Shining Bronze Cockoo				X			
STRIGIDAE								
Ninox novaeseelandiae boobook	Boobook Owl				X			
TYTONIDAE								
Tyto alba deliculata	Barn Owl				X			
HALCYONIDAE								
Dacelo novaeguineae	Laughing Kookaburra				X			
Todiramphus sanctus sanctus	Sacred Kingfisher				X			
MEROPIDAE								
Merops ornatus	Rainbow Bee-eater	Ma			X	X	X	
CLIMACTERIDAE								
Climacteris rufa	Rufous Treecreeper				X			
MALURIDAE								
Malurus lamberti	Variegated Fairy-wren				X			
Malurus leucopterus	White-winged Fairy-wren				X			
Malurus splendens	Splendid Fairy-wren				X			
ACANTHIZIDAE								
Acanthiza apicalis	Inland Thornbill				X			
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				X			
Acanthiza inornata	Western Thornbill				X			
Gerygone fusca	Western Gerygone				X			
Sericrornis brevirostris	Weebill				X			X
Sericornis frontalis	White-browed Scrubwren				X			

Scientific Name	Common Name	EPBC	WC	DPaW	A	B	C	D
PARDALOTIDAE								
Pardalotus punctatus	Spotted Pardalote				X			
Pardalotus striatus	Striated Pardalote				X			
MELIPHAGIDAE								
Acanthagenys rufogularis	Spiny-cheeked Honeyeater				X			
Acanthorhynchus superciliosus	Western Spinebill				X			
Anthochaera carunculata	Red Wattlebird				X			X
Anthochaera lunulata	Western Little Wattlebird				X			
Epthianura albifrons	White-fronted Chat				X			
Lichmera indistincta	Brown Honeyeater				X			X
Manorina flavigula	Yellow-throated Miner				X			
Melithreptus brevirostris	Brown-headed Honeyeater				X			
Phylidonyris novaehollandiae	New Holland Honeyeater				X			
Ptilotula ornatus	Yellow-plumed Honeyeater				X			
NEOSITTIDAE								
Daphoenositta chyrstoptera	Varied Sittella				X			
CAMPEPHAGIDAE								
Coracina novaehollandiae	Black-faced Cuckoo-shrike				X			
PACHYCEPHALIDAE								
Colluricincla harmonica	Grey Shrike Thrush				X			
Falcunculus frontatus leucogaster	Western Shrike-tit				X			
Pachycephala pectoralis	Golden Whistler				X			
Pachycephala rufiventris	Rufous Whistler				X			X
ARTAMIDAE								
Artamus cinereus	Black-faced Woodswallow				X			
Artamus cyanopterus	Dusky Woodswallow				X			
DICRURIDAE								
Grallina cyanoleuca	Magpie-lark				X			
Rhipidura albiscapa	Grey Fantail				X			
Rhipidura leucophrys	Willie Wagtail				X			X
CRACTICIDAE								
Cracticus nigrogularis	Pied Butcherbird				X			X
Cracticus tibicen	Australian Magpie				X			X
Cracticus torquatus	Grey Butcherbird				X			
Strepera versicolour	Grey Curranwong				X			
CORVIDAE								
Corvus bennetti	Little Crow				X			
Corvus coronoides	Australian Raven				X			X
PETROICIDAE								
Petroica boodang	Scarlet Robin				X			
Petroica goodenovii	Red-capped Robin				X			

Scientific Name	Common Name	EPBC	WC	DPaW	A	B	C	D
DICAEIDAE								
Dicaeum hirundinaceum	Mistletoebird				X			
ACROCEPHALIDAE								
Acrocephalus australis	Australian Reed-Warbler				X			
MEGALURIDAE								
Megalurus gramineus	Little Grassbird				X			
TIMALIIDAE								
Zosterops lateralis	Silvereye				X			
HIRUNDINIDAE								
Hirundo neoxena	Welcome Swallow				X			
Hirundo nigricans	Tree Martin				X			
STURINADAE								
Acridotheres tristis	Common Myna						X	
Sturnus vulgaris	Common Starling						X	
PASSERIDAE								
Passer domesticus	House Sparrow				X		X	
Passer montanus	Eurasian Tree Sparrow						X	
MOTACILLIDAE								
Motacilla cinerea	Grey Wagtail	MiMa					X	
FRINGILLIDAE								
Carduelis carduelis	European Goldfinch						X	

MAMMALIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DPaW = Department of Parks and Wildlife Priority Code, A = Listed in Naturemap, B= DPaW Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

Scientific Name	Common Name	Conservation Codes						
		EPBC	WC	DPaW	A	B	C	D
TACHYGLOSSIDAE								
Tachyglossus aculeatus	Short-beaked Echidna				X			
DASYURIDAE								
Dasyurus geoffroii Chuditch	Western Quoll	Vu	S1				X	
PERAMELIDAE								
Isoodon obesulus fusciventer	Southern Brown Bandicoot			P5	X	X		
BURRAMYDAE								
Cercartetus concinnus	Wstern Pygmy-possum				X			
PHALANGERIDAE								
Trichosurus vulpecula	Common Brushtail Posusm				X			
MACROPODIDAE								
Macropus fuliginosus	Western Grey Kangaroo				X			X
MURIDAE								
Hydromys chrysogaster	Water Rat			P4	X			
Mus musculus	House Mouse				X		X	
Rattus norvegicus	Brown Rat						X	
Rattus rattus	Black Rat				X		X	
SCIURIDAE								
Funambulus pennantii	Northern Palm Squirrel						X	
CANIDAE								
Canis lupus familiaris	Domestic Dog						X	
CARNIVORA								
Vulpes vulpes	Red Fox						X	
FELIDAE								
Felis catus	Cat				X		X	
LEPORIDAE								
Oryctolagus cuniculus	European Rabbit				X		X	

Scientific Name	Common Name	Conservation Codes						
		EPBC	WC	DPaW	A	B	C	D
BOVIDAE								
Bos taurus	Cattle						X	

APPENDIX L

Black Cockatoo Potential Breeding Trees

Species	Co-ordinates	
Corymbia calophylla	386693	6487431
Corymbia calophylla	386699	6487426
Corymbia calophylla	386699	6487426
Corymbia calophylla	386707	6487407
Corymbia calophylla	386707	6487407
Corymbia calophylla	386731	6487408
Corymbia calophylla	386731	6487408
Corymbia calophylla	386737	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386751	6487420
Corymbia calophylla	386804	6487425
Corymbia calophylla	386804	6487425
Corymbia calophylla	386823	6487418
Corymbia calophylla	386823	6487418
Corymbia calophylla	386862	6487333
Corymbia calophylla	386860	6487318
Corymbia calophylla	386864	6487310
Corymbia calophylla	386873	6487310
Corymbia calophylla	386873	6487297
Corymbia calophylla	386871	6487283
Corymbia calophylla	386871	6487283
Corymbia calophylla	386871	6487283
Corymbia calophylla	386854	6487325
Corymbia calophylla	386900	6487325
Corymbia calophylla	386915	6487352
Corymbia calophylla	386915	6487352
Corymbia calophylla	386884	6487376
Corymbia calophylla	386897	6487377
Corymbia calophylla	386925	6487421
Corymbia calophylla	386940	6487424
Corymbia calophylla	386938	6487408
Corymbia calophylla	386969	6487415
Corymbia calophylla	387008	6487410
Corymbia calophylla	387035	6487421
Corymbia calophylla	387049	6487392
Corymbia calophylla	387066	6487409
Corymbia calophylla	387071	6487396
Corymbia calophylla	387088	6487389
Corymbia calophylla	386933	6487348
Corymbia calophylla	387007	6487381
Corymbia calophylla	387019	6487367
Corymbia calophylla	387030	6487374

Corymbia calophylla	387094	6487306
Corymbia calophylla	387094	6487306
Corymbia calophylla	387088	6487295
Corymbia calophylla	387115	6487382
Corymbia calophylla	387158	6487418
Corymbia calophylla	387307	6487163
Corymbia calophylla	387307	6487163
Corymbia calophylla	387074	6487107
Corymbia calophylla	387041	6487118
Corymbia calophylla	387037	6487106
Corymbia calophylla	387033	6487093
Corymbia calophylla	387027	6487109
Corymbia calophylla	387003	6487112
Corymbia calophylla	386999	6487094
Corymbia calophylla	386971	6487087
Corymbia calophylla	386971	6487087
Corymbia calophylla	386970	6487095
Corymbia calophylla	386967	6487114
Corymbia calophylla	386958	6487106
Corymbia calophylla	306966	6487098
Corymbia calophylla	386952	6487091
Corymbia calophylla	386952	6487091
Corymbia calophylla	386945	6487136
Corymbia calophylla	386915	6487120
Corymbia calophylla	386906	6487110
Corymbia calophylla	386915	6487096
Corymbia calophylla	386905	6487112
Corymbia calophylla	386865	6487116
Corymbia calophylla	386830	6487134
Corymbia calophylla	386830	6487134
Corymbia calophylla	386830	6487134
Corymbia calophylla	386815	6487130
Corymbia calophylla	386802	6487131
Corymbia calophylla	386813	6487210
Corymbia calophylla	386813	6487210
Corymbia calophylla	386813	6487210
Corymbia calophylla	386813	6487210
Corymbia calophylla	386795	6487224
Corymbia calophylla	386806	6487238
Corymbia calophylla	38653	6487226
Corymbia calophylla	386742	6487208
Corymbia calophylla	386742	6487208
Corymbia calophylla	386774	6487232
Corymbia calophylla	386603	6487302
Corymbia calophylla	386591	6487277
Corymbia calophylla	386591	6487277
Corymbia calophylla	386591	6487277
Corymbia calophylla	386591	6487277
Corymbia calophylla	386197	6487353
Corymbia calophylla	386604	6487387

Corymbia calophylla	386598	6487373
Corymbia calophylla	386584	6487360
Corymbia calophylla	386582	6487358
Corymbia calophylla	386572	6487375
Corymbia calophylla	386575	6487351
Corymbia calophylla	386580	6487310
Corymbia calophylla	386570	6487349
Corymbia calophylla	386556	6487286
Corymbia calophylla	386537	6487380
Corymbia calophylla	386551	6487272
Corymbia calophylla	386534	6487269
Corymbia calophylla	386412	6487402
Corymbia calophylla	386425	6487223
Corymbia calophylla	386361	6487403
Corymbia calophylla	386341	6487408
Corymbia calophylla	386320	6487409
Corymbia calophylla	386311	6487406
Corymbia calophylla	386304	6487418
Corymbia calophylla	386304	6487418
Corymbia calophylla	386292	6487402
Corymbia calophylla	386260	6487410
Corymbia calophylla	386260	6487410
Corymbia calophylla	386272	6487266
Corymbia calophylla	386268	6487256
Corymbia calophylla	386243	6487360
Corymbia calophylla	386243	6487360
Corymbia calophylla	386252	6487299
Corymbia calophylla	386253	6487282
Corymbia calophylla	386243	6487284
Corymbia calophylla	386235	6487331
Corymbia calophylla	386223	6487312
Corymbia calophylla	386223	6487312
Corymbia calophylla	386223	6487312
Corymbia calophylla	386223	6487312
Corymbia calophylla	386210	6487314
Corymbia calophylla	386210	6487314
Corymbia calophylla	386186	6487380
Corymbia calophylla	386186	6487380
Eucalyptus gomphocephala	387255	6487421
Eucalyptus gomphocephala	387312	6487416
Eucalyptus gomphocephala	387329	6487411
Eucalyptus gomphocephala	387347	6487391
Eucalyptus gomphocephala	387289	6487391
Eucalyptus gomphocephala	387269	6487880
Eucalyptus gomphocephala	387323	6487323
Eucalyptus gomphocephala	387323	6487323
Eucalyptus gomphocephala	387323	6487323
Eucalyptus gomphocephala	387323	6487323
Eucalyptus gomphocephala	387323	6487323
Eucalyptus gomphocephala	387323	6487323

Eucalyptus gomphocephala	387323	6487323
Eucalyptus gomphocephala	387299	6487297
Eucalyptus marginata	386905	6487325
Eucalyptus marginata	386903	6487309
Eucalyptus marginata	386908	6487412
Eucalyptus marginata	386914	6487410
Eucalyptus marginata	386914	6487410
Eucalyptus marginata	386935	6487422
Eucalyptus marginata	386953	6847425
Eucalyptus marginata	387008	6487410
Eucalyptus marginata	387019	6487422
Eucalyptus marginata	387039	6487408
Eucalyptus marginata	387057	6487407
Eucalyptus marginata	387105	6487398
Eucalyptus marginata	387114	6487388
Eucalyptus marginata	386948	6487337
Eucalyptus marginata	386990	6487357
Eucalyptus marginata	387031	6487372
Eucalyptus marginata	387087	6487364
Eucalyptus marginata	387105	6487364
Eucalyptus marginata	387120	6487331
Eucalyptus marginata	387126	6487317
Eucalyptus marginata	387119	6487325
Eucalyptus marginata	387122	6487362
Eucalyptus marginata	387121	6487373
Eucalyptus marginata	387119	6487418
Eucalyptus marginata	387119	6487418
Eucalyptus marginata	387133	6487426
Eucalyptus marginata	387154	6487424
Eucalyptus marginata	387172	6487421
Eucalyptus marginata	387197	6487413
Eucalyptus marginata	387197	6487413
Eucalyptus marginata	387206	6487419
Eucalyptus marginata	387267	6487361
Eucalyptus marginata	387280	6487363
Eucalyptus marginata	387285	6487358
Eucalyptus marginata	387353	6487153
Eucalyptus marginata	387356	6487117
Eucalyptus marginata	387355	6487105
Eucalyptus marginata	387355	6487105
Eucalyptus marginata	387330	6487163
Eucalyptus marginata	387330	6487163
Eucalyptus marginata	387299	6487118
Eucalyptus marginata	387281	6487121
Eucalyptus marginata	387782	6487133
Eucalyptus marginata	387278	6487143
Eucalyptus marginata	387280	6487163
Eucalyptus marginata	387228	6487106
Eucalyptus marginata	387207	6487129
Eucalyptus marginata	387189	6487124

Eucalyptus marginata	387105	6487143
Eucalyptus marginata	387083	6487127
Eucalyptus marginata	387105	6487143
Eucalyptus marginata	387074	6487107
Eucalyptus marginata	387060	6487116
Eucalyptus marginata	386984	6487116
Eucalyptus marginata	386977	6487148
Eucalyptus marginata	386898	6487114
Eucalyptus marginata	386773	6487119
Eucalyptus marginata	386743	6487109
Eucalyptus marginata	386743	6487109
Eucalyptus marginata	386743	6487109
Eucalyptus marginata	386743	6487109
Eucalyptus marginata	386706	6487080
Eucalyptus marginata	386775	6487137
Eucalyptus marginata	386789	6487137
Eucalyptus marginata	386789	6487137
Eucalyptus marginata	386789	6487137
Eucalyptus marginata	386824	6487174
Eucalyptus marginata	386824	6487174
Eucalyptus marginata	386563	6487235
Eucalyptus marginata	386560	6487202
Eucalyptus marginata	386569	6487175
Eucalyptus marginata	386566	6487168
Eucalyptus marginata	386650	6487108
Eucalyptus marginata	386664	6487131
Eucalyptus marginata	386696	6481145
Eucalyptus marginata	386696	6487195
Eucalyptus marginata	386712	6487209
Eucalyptus marginata	386712	6487209
Eucalyptus marginata	386688	6487273
Eucalyptus marginata	386631	6487286
Eucalyptus marginata	386610	6487313
Eucalyptus marginata	386603	6487302
Eucalyptus marginata	386574	6487380
Eucalyptus marginata	386559	6487376
Eucalyptus marginata	386529	6487420
Eucalyptus marginata	386525	6487421
Eucalyptus marginata	386507	6487369
Eucalyptus marginata	386498	6487416
Eucalyptus marginata	386495	6487385
Eucalyptus marginata	386510	6487268
Eucalyptus marginata	386510	6487268
Eucalyptus marginata	386497	6487243
Eucalyptus marginata	386451	6487414
Eucalyptus marginata	386411	6487414
Eucalyptus marginata	386411	6487414
Eucalyptus marginata	386405	6487405
Eucalyptus marginata	386384	6487407
Eucalyptus marginata	386384	6487407

Eucalyptus marginata	386384	6487407
Eucalyptus marginata	386384	6487407
Eucalyptus marginata	386332	6487420
Eucalyptus marginata	386289	6487403
Eucalyptus marginata	386273	6487402
Eucalyptus marginata	386248	6487410
Eucalyptus marginata	386254	6487341
Eucalyptus marginata	386231	6487408
Eucalyptus marginata	386239	6487318
Eucalyptus marginata	386220	6487411
Eucalyptus marginata	386231	6487337
Eucalyptus marginata	386213	6487400
Eucalyptus marginata	386220	6487337
Eucalyptus marginata	386199	6487353
Eucalyptus marginata	386190	6487407
Eucalyptus wandoo	386930	6487334

APPENDIX M

Fauna Habitat Assessments

FAUNA HABITAT ASSESSMENT SHEET - 360 ENVIRONMENTAL

(South West)

Location: Inghams		Site Number Habitat Assessment #1				
Project: 1833						
Date: 27/09/2016	Easting: 386982	Aspect	N	NE	SW	NW
Quadrat Size: 50 x 50 m	Northing: 6487348		E	SE	W	N/A

Soil Texture	sand	sandy-loam	loam	cracking clay	clay

VEGETATION

Vegetation Description									
Hummock Grassland	Other:			Average Height (M)	Cover				
Acacia Shrubland	Stratum				Scattered Plants	Sparse	Moderate	Thick	
Riverine Woodland	Overstorey	Jarrah and Marri		16	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Other Grassland	Midstorey	Banksia, Xanthorrhoea, Cycad		10	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Low Woodland	Ground Cover	Weedy grasses		1	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	

CONDITION

						LAST FIRE			
Scale:	5 Pristine	4 Excellent	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	3 >5 Yr

DISTURBANCE

	(Cattle)							(Other)	
	0 heavy	1 medium	2 mild	3 none		0 heavy	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Hummock Grass	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Rock	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Other Grass	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Leaf Litter	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Herbs	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Logs >10cm	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Other:	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	

MICROHABITATS									
Burrowing Suitability	0 Rock	1 Stony	2 Sandy Loam	**3 Sand**	Peeling Bark	0 none	1 rare	**2 moderate**	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	Large Hollows	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	Small Hollows	0 none	**1 rare**	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	Water Prescence	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	Distance to Water	0 >5km	1 2 5km	**2 500m - 2km**	3 <500m
Suitability for Bats	YES		NO		Termite Mounds	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present	Total =		Woody Debris	0 none	1 rare	**2 moderate**	3 common

SPECIES			
Black Cockatoo Foraging Habitat			
Species:	**% cover**	**Hollows:**	
Jarrah	10	Small (<120mm)	/
Marri	10		
Banksia	5	Large (>120mm)	/
Xanthorrhoea,	60		

Birds		Mammals	Reptiles
Pied Butcherbird		Kangaroo	
Australian Ringneck			
Crow			
Red Wattlebird			
Weebill			
Brown Honeyeater			

FAUNA HABITAT ASSESSMENT SHEET - 360 ENVIRONMENTAL

(South West)

Location: Inghams	Site Number Habitat Assessment #3
Project: 1833	
Date: 27/09/2016	Easting: 387351
Quadrat Size: 50 x 50 m	Northing: 6487153

Aspect				
N	NE	SW	NW	
E	SE	W	N/A	

Soil Texture	sand	sandy-loam	loam	cracking clay	clay

VEGETATION

Vegetation Description

Hummock Grassland	Other:		Average Height (M)	Cover				
Acacia Shrubland	Stratum			Scattered Plants	Sparse	Moderate	Thick	
Riverine Woodland	Overstorey	Jarrah, Banksia	16	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Other Grassland	Midstorey	Xanthorrhoea	2	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Low Woodland	Ground Cover	Weedy grasses	<0.5	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	

CONDITION

LAST FIRE

Scale:	5 Pristine	4 Excellent	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	3 >5 Yr

DISTURBANCE

	(Cattle)					(Other)				
	0 heavy	1 medium	2 mild	3 none		0 heavy	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Hummock Grass	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Rock	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Other Grass	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Leaf Litter	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Herbs	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Logs >10cm	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Other:	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	

MICROHABITATS									
Burrowing Suitability	0 Rock	1 Stony	2 Sandy Loam	3 Sand	Peeling Bark	0 none	1 rare	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	3 70-100%	Large Hollows	0 none	1 rare	2 moderate	3 common
Exfoliating Slabs	0 none	1 0-30%	2 30-70%	3 70-100%	Small Hollows	0 none	1 rare	2 moderate	3 common
Rock Crevices	0 none	1 0-30%	2 30-70%	3 70-100%	Water Prescence	0 none	1 rare	2 moderate	3 common
Boulders	0 none	1 0-30%	2 30-70%	3 70-100%	Distance to Water	0 >5km	1 2 5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		NO		Termite Mounds	0 none	1 rare	2 moderate	3 common
Caves	Absent	Present	Total =		Woody Debris	0 none	1 rare	2 moderate	3 common

SPECIES			
Black Cockatoo Foraging Habitat			
Species:	% cover	Hollows:	
Jarrah	2	Small (<120mm)	/
Banksia	20		
Xanthorrhoea	20	Large (>120mm)	/

Birds	Mammals	Reptiles
Galah	Kangaroo	
Magpie		

FAUNA HABITAT ASSESSMENT SHEET - 360 ENVIRONMENTAL

(South West)

Location: Inghams		Site Number Habitat Assessment #2				
Project: 1833						
Date: 27/09/2016	Easting: 387353	Aspect	N	NE	SW	NW
Quadrat Size: 50 x 50 m	Northing: 6487340		E	SE	W	N/A

Soil Texture	sand	sandy-loam	loam	cracking clay	clay

VEGETATION

Vegetation Description: Hummock Grassland; Acacia Shrubland; Riverine Woodland; Other Grassland; Low Woodland

Other:		Average Height (M)	Cover				
Stratum			Scattered Plants	Sparse	Moderate	Thick	
Overstorey	Jarrah, Marri Rudis	18	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Midstorey	Banksia, Xanthorrhoea, Allocasuarina	8	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Ground Cover	Weedy grasses	1	0 <5% COVER	1 <20% COVER	2 20-60%	**3 60-100%**	

CONDITION

Scale:	5 Pristine	4 Excellent	3 Very Good	2 Good	1 Degraded	0 Completely Degraded

LAST FIRE

0 <1 year	1 1 -3 Yr	2 4-5 Yr	3 >5 Yr

DISTURBANCE

(Cattle)					(Other)				
0 heavy	1 medium	2 mild	3 none		0 heavy	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Hummock Grass	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Rock	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Other Grass	0 <5% COVER	1 <20% COVER	2 20-60%	**3 60-100%**	
Leaf Litter	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Herbs	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	
Logs >10cm	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	Other:	0 <5% COVER	1 <20% COVER	2 20-60%	3 60-100%	

MICROHABITATS									
Burrowing Suitability	0 Rock	1 Stony	2 Sandy Loam	3 Sand	Peeling Bark	0 none	1 rare	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	3 70-100%	Large Hollows	0 none	1 rare	2 moderate	3 common
Exfoliating Slabs	0 none	1 0-30%	2 30-70%	3 70-100%	Small Hollows	0 none	1 rare	2 moderate	3 common
Rock Crevices	0 none	1 0-30%	2 30-70%	3 70-100%	Water Prescence	0 none	1 rare	2 moderate	3 common
Boulders	0 none	1 0-30%	2 30-70%	3 70-100%	Distance to Water	0 >5km	1 2 5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		NO		Termite Mounds	0 none	1 rare	2 moderate	3 common
Caves	Absent	Present	Total =		Woody Debris	0 none	1 rare	2 moderate	3 common

SPECIES			
Black Cockatoo Foraging Habitat			
Species:	% cover	Hollows:	
Jarrah	15	Small (<120mm)	/
Marri	15		
Rudis	15	Large (>120mm)	/

Birds		Mammals	Reptiles
Galah		Kangaroo	
Magpie			
Crow			