Appendix A : Certificate of titles and letters of authority

WESTERN AUSTRALIA

REGISTER NUMBER	
102/DP31366	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	N/A

VOLUME LR3089 FOLIO 61

RECORD OF CERTIFICATE OF CROWN LAND TITLE

UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 102 ON DEPOSITED PLAN 31366

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF CROWN LAND TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	DP31366
PREVIOUS TITLE:	LR3089-61
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF LAKE GRACE
RESPONSIBLE AGENCY:	DEPARTMENT OF PLANNING, LANDS AND HERITAGE (SLSD)

NOTE 1: A000001A CORRESPONDENCE FILE 03243-1922-02RD.
NOTE 2: LAND PARCEL IDENTIFIER OF ROE LOCATION 102 ON SUPERSEDED PAPER CERTIFICATE OF CROWN LAND TITLE CHANGED TO LOT 102 ON DEPOSITED PLAN 31366 ON 28-AUG-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.
NOTE 3: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE.

WESTERN AUSTRALIA

REGISTER NUMBER	
208/DP193928	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	N/A

VOLUME LR3112 FOLIO 109

RECORD OF QUALIFIED CERTIFICATE OF CROWN LAND TITLE

UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 208 ON DEPOSITED PLAN 193928

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.
(2) The land and interests etc. shown hereon may be affected by interests etc. that can be, but are not, shown on the register.
(3) The interests etc. shown hereon may have a different priority than shown.

----------END OF CERTIFICATE OF CROWN LAND TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	LR3112-109 (208/DP193928)
PREVIOUS TITLE:	LR3112-109
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF LAKE GRACE
RESPONSIBLE AGENCY:	DEPARTMENT OF PLANNING, LANDS AND HERITAGE (SLSD)

NOTE 1: A000001A CORRESPONDENCE FILE 2939/1968 V/2.
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES

END OF PAGE 1 - CONTINUED OVER

NOTE 3: LAND PARCEL IDENTIFIER OF NEWDEGATE TOWN LOT/LOT 208 ON SUPERSEDED PAPER CERTIFICATE OF CROWN LAND TITLE CHANGED TO LOT 208 ON DEPOSITED PLAN 193928 ON 02-SEP-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

NOTE 4: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE.

Government of Western Australia
Public Transport Authority

Your ref : 01911-1982
Our ref : PTA1142/12
Enquiries : Shelley Brindal
9326 2510

30 July 2019

Co-operative Bulk Handling Limited
Level 6, 240 St Georges Terrace
PERTH WA 6000

Dear Lee

PROPOSED CLEARING PERMIT OVER PART RAIL RESERVE NEWDEGATE - CBH

We write regarding Co-operative Bulk Handling Limited's ("CBH") request for a letter of authorisation from the Public Transport Authority of WA ("PTA") to advance CBH's clearing permit application process (DWER reference CPS 8516/1) over the parcels of Crown land listed below ("Adjoining Land"), unnamed road reserve and a portion of rail reserve land at Newdegate.

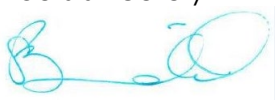
- Part Lot 102 on DP 31366 (3089/061)
- Part Lot 208 on DP 193928 (3112/109)
- Unnumbered UCL (PIN 643570)

We understand CBH has obtained a Letter of Authorisation from the Department of Planning, Lands and Heritage ("DPLH") for the Adjoining Land.

The PTA has no objections in principle to CBH progressing this clearing permit application with Department of Water and Environmental Regulation over a portion of rail reserve land subject to:

1. There being no actual clearing on the rail reserve land until PTA and relevant authorities have granted final approval.
2. Confirmation of the Adjoining Land being acquired prior to PTA considering a formal lease or Licence with CBH. CBH will need to seek from PTA a formal lease or licence over the portion of rail reserve land that it wishes to clear once CBH has secured tenure for the Adjoining Land parcels from DPLH. Note, PTA is required to seek Arc Infrastructure's approval in this regard and it should not be assumed that the application will be successful.

Yours sincerely



Shelley Brindal
Corridor & Heritage Coordinator
Infrastructure Planning & Land Services

Public Transport Centre, West Parade, Perth, Western Australia 6000
PO Box 8125, Perth Business Centre, Western Australia 6849
Telephone (08) 9326 2000 email enquire@pta.wa.gov.au
www.pta.wa.gov.au
ABN - 61 850 109 576

Department of **Planning, Lands and Heritage**

GOVERNMENT OF WESTERN AUSTRALIA

LAND USE MANAGEMENT

Your ref:
Our ref: 03423-1922,
Objective ID: A9718837
Enquiries: Leanne Shaw, Ph 08 6552 4615
Email: Leanne.Shaw@dplh.wa.gov.a

Cooperative Bulk Handling Limited
31 Delhi Street
WEST PERTH WA 6005

Attention: Tim Dolling, Planning and Approvals Coordinator

Proposed Clearing Permit over Lot 102 on Deposited Plan 31366, Lot 208 on Deposited Plan 193928 and unnumbered Unallocated Crown Land (UCL) identified by PIN 643570 - Shire of Lake Grace.

The Department of Planning, Lands and Heritage (DPLH) refers to electronic mail dated 25th September 2018 whereby Cooperative Bulk Handling Limited (CBH) sought a letter of authorization from the landowner for its clearing permit over the above-mentioned Crown land in the Shire of Lake Grace.

It is CBH's intent to lodge an application for a clearing permit to test the likely outcome of the determination and conditions of the determination. DPLH has no objections to CBH lodging a clearing permit over the following land (otherwise known as the Subject Land):

- Lot 102 on Deposited Plan 31366 as shown on Crown Land Title Volume 3089 Folio 061 and being unallocated Crown land (UCL); and
- Lot 208 on Deposited Plan 193928 as shown on Crown Land Title Volume 3112 Folio 109 and being UCL; and
- unnumbered UCL identified by PIN 643570

subject to no clearing of the land until Native title is cleared and CBH have secured tenure over the Subject Land.

For further enquiries please contact Ms Leanne Shaw, Senior State Land Officer, Land Use Management, Department of Planning, Lands and Heritage on telephone 08 6552 4615.

Yours sincerely

Jason Gibbons
A/Case Manager
Goldfields, Esperance, Wheatbelt
Case Management South

4 October 2018

Shire of Lake Grace

PO Box 50 Lake Grace WA 6353 • Phone 9890 2500 • Fax 9890 2599 • Email: shire@lakegrace.wa.gov.au

Please address all correspondence to the Chief Executive Officer
Your Ref:
Our Ref: 0365 / OCR410
Enquiries: D. Gobbart

Tim Dolling
Planning and Approvals Coordinator
Cooperative Bulk Handling Limited
31 Delhi Street
WEST PERTH WA 6005

Dear Tim,

PROPOSED CLEARING PERMIT OVER LOT 102 ON DEPOSITED PLAN 31366, LOT 208 ON DEPOSITED PLAN 193928 AND UNNUMBERED UNALLOCATED CROWN LAND (UCL) IDENTIFIED BY PIN 643570 – SHIRE OF LAKE GRACE

I write in response to your letter dated 17 December 2018, regarding the request from Cooperative Bulk Handling Limited (CBH), seeking authorization from the Shire of Lake Grace for its clearing permit over the UCL unmade road reserve.

The Shire of Lake Grace has no objections to CBH lodging a clearing permit over the UCL unmade road reserve, subject to the following conditions:

- No clearing of the land until Native Title is cleared;
- CBH to secure tenure of the site/land; and
- There being no actual clearing on the land until the Public Transport Authority and other relevant authorities have granted their final approval.

Should you require further information, please contact the undersigned on 08 9890 2500.

Yours faithfully,

p/p Denise Gobbart
CHIEF EXECUTIVE OFFICER

07 August 2019
drg:cc

Appendix B : Newdegate Grain Receival Site Flora and Fauna Survey (ELA 2018a)

Flora, vegetation and fauna assessment

Newdegate Grain Receival Site Expansion

Prepared for
CBH Group

13 December 2018




DOCUMENT TRACKING

Item	Detail
Project Name	CBH Newdegate Grain Receival Site Approvals
Project Number	18PER-11736
Project Manager	Rebecca Hide +61 8 6218 2200 Level 1, Bishops See, 235 St Georges Terrace, Perth WA 6000
Prepared by	Rebecca Hide
Reviewed by	Jeff Cargill, Sarah Dalgleish
Approved by	Jen Longstaff
Status	FINAL
Version Number	2
Last saved on	13 December 2018
Cover photo	(L-R) Eucalypt woodland of the WA Wheatbelt TEC (R. Hide 2018); *Eucalyptus salmonophloia* woodland (Eco Logical Australia 2018); Mural on CBH grain silos in Newdegate (J. Morris 2018); *Tecticornia* and *Atriplex* heath (R. Hide 2018).

This report should be cited as 'Eco Logical Australia 2018. *Newdegate Grain Receival Site Expansion flora, vegetation and fauna assessment*. Prepared for CBH Group.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from CBH Group

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Abbreviations

Abbreviation	Description
BAM Act	State *Biosecurity and Agriculture Management Act 2007*
BoM	Bureau of Meteorology
CBH	CBH Group
CLUSTER	Hierarchical Clustering
CR	Critically Endangered
DAFWA	Department of Agriculture and Food Western Australia
DBCA	Department of Biodiversity Conservation and Attractions
DoEE	Department of the Environment and Energy

DPIRD	Department of Primary Industries and Regional Development
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
ELA	Eco Logical Australia
EN	Endangered
EP Act	State *Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Areas
GPS	Global Positioning System
ha	hectare
HQC	Habitat quality category
IBRA	Interim Biogeographical Regionalisation for Australia
km	kilometre
MAL2	Western Mallee IBRA subregion
mm	millimetres
NVIS	National Vegetation Information System
P	Priority
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
PRIMER	Plymouth Routines in Multivariate Ecological Research v6
SIMPER	Similarity Percentages
SIMPROF	Similarity Profile
TEC	Threatened Ecological Community
VU	Vulnerable
WA	Western Australia
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WC Act	State *Wildlife Conservation Act 1950*

Executive summary

Eco Logical Australia (ELA) was engaged by CBH Group (CBH) to undertake a flora, vegetation and fauna assessment at a 24.8 ha expansion site adjacent to the existing Newdegate Grain Receival Site (the study area). A detailed flora and vegetation survey, targeted flora survey, a Level 1 fauna survey and a targeted Malleefowl (*Leipoa ocellata*) survey was required to fill in previous ecological survey information gaps within the study area in accordance with relevant State and Commonwealth guidance, prior to the submission of an *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Referral and a Native Vegetation Clearing Permit under Part V of the *Environmental Protection Act 1986* for the future development. The field survey was conducted from the 5 to 7 November 2018. Results were combined with data from previous ecological surveys undertaken at the site, predominately a Level 2 flora and vegetation survey undertaken by 360 Environmental (2015a) and a Level 1 flora, vegetation and fauna survey completed by Cardno (2014).

A total of 178 taxa (including species, subspecies, varieties and forms, and specimens not identified to species level) from 111 genera and 42 families were recorded from quadrats, relevés and opportunistic collections in the study area during the current and previous surveys (360 Environmental 2015a; Cardno 2014). Of these taxa, 32 were introduced. The ELA and 360 Environmental (2015a) quadrat species richness ranged from 7 to 35 taxa with an average of 17.2 taxa per quadrat.

Priority 1 flora species *Thysanotus lavanduliflorus* was recorded in the north-west corner of the study area. A total of 15 individuals were observed in vegetation association Es. No other threatened or priority flora taxa were recorded within the study area during the current or past surveys. A post-field likelihood of occurrence assessment determined that one other priority species, *Haegiela tatei* (P4), had the potential to occur in the study area, and may have been overlooked due to its small stature.

Six vegetation communities were originally mapped within the study area (360 Environmental 2015a), and are predominantly comprised of *Eucalyptus* open forest, with some areas of *Melaleuca* shrubland and *Tecticornia* heath. The current survey completed eight additional quadrats, which following statistical analysis, were found to correlate with the existing vegetation communities. Vegetation within the study area was primarily in Very Good condition (86.6% of the study area). The remainder was in Good, Degraded and Completely Degraded condition, with some areas cleared for tracks.

An assessment utilising the key diagnostic characteristics (DoE 2015) of the Eucalypt woodlands of the Western Australian Wheatbelt community, a Critically Endangered Threatened Ecological Community (TEC) listed under the EPBC Act and a State-listed Priority 3 Priority Ecological Community (PEC), determined that 16.6 ha of this TEC/PEC was present in the study area. Of this area, 8.8 ha is also considered to represent the Red Morrel Woodlands of the Wheatbelt, a Priority 1 PEC that can co-occur with the Eucalypt woodlands of the Western Australian Wheatbelt TEC/PEC.

Three broad fauna habitats are present within the study area, *Eucalyptus* open forest, *Eucalyptus* mallee over *Melaleuca* shrubland and *Tecticornia* heath. Fifteen species of native vertebrate fauna were recorded during current and previous fauna surveys, including two mammals, twelve birds and one reptile. Three introduced mammals and two introduced birds were also recorded (Cardno 2014; 360 Environmental 2015a, b; ELA 2018a).

One conservation listed fauna species has previously been observed within the study area, the Red-tailed Phascogale (*Phascogale calura*). A likelihood of occurrence assessment for other conservation listed fauna species determined two species were likely to occur within the study area, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and the Western Rosella (*Platycercus icterotis xanthogenys*). A

further ten species were considered to potentially occur, with six of these species considered to be vagrant birds that may occasionally visit the study area. Malleefowl were not observed during the field survey, but may potentially utilise the area on occasion to forage.

1 Introduction

1.1 Background

CBH Group (CBH) is proposing an expansion to the existing Newdegate Grain Receival Site. Eco Logical Australia (ELA) was engaged by CBH to undertake a flora, vegetation and fauna assessment at the expansion site (the study area). This assessment is proposed to ensure ecological information gaps for the site are filled prior to the submission of a Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Referral and Western Australian Native Vegetation Clearing Permit application under Part V of the *Environmental Protection Act 1986* (EP Act) in support of the future development. The assessment included targeted *Thysanotus lavanduliflorus* and Malleefowl (*Leipoa ocellata*) surveys. The results from the field survey have been combined with data from previous ecological surveys undertaken at the site, predominately a Level 2 flora and vegetation survey undertaken by 360 Environmental (2015a) and a Level 1 flora, vegetation and fauna survey completed by Cardno (2014).

1.2 Study area

The study area is 24.8 hectare (ha) vegetated area located on Lake Biddy Road, Newdegate, approximately 400 kilometres (km) south-east of Perth, Western Australia. The study area comprises partial Lots 102 and 208, unallocated crown land, an unmade road reserve and a rail reserve located at Lake Biddy Road, and lies adjacent to CBH's existing grain receival site and the Water Corporation's waste water treatment ponds. The study area is approximately 0.5 km south east from the main street of Newdegate town (**Figure 1**). The town cemetery is located adjacent to the north west border, and Lake Stubbs is located to the north east. The CBH railway is runs along the south west border, parallel to Lake Biddy Road. Under the Shire of Lake Grace Local Planning Scheme, the site is a mixture of general agriculture zoning and conservation reserve.

Figure 1: Location of the study area

2 Desktop assessment

2.1 Biophysical environment

2.1.1 Regional context

The study area is located in the Western Mallee (MAL2) subregion within the Mallee Interim Biogeographic Regionalisation for Australia (IBRA) bioregion (Department of the Environment and Energy (DoEE) 2018). The Mallee bioregion is the south-eastern part of Yilgarn Craton. It is described as having a gently undulating landscape, with partially obstructed drainage. Mallee over myrtaceous-proteaceous heaths on duplex (sand over clay) soils are common. A mosaic of mixed eucalypt woodlands and mallee occur on calcareous earth plains and sandplains overlying Eocene limestone strata in the east. The landscape is fragmented, with particular surface-types almost completely cleared as wheat fields (Beecham and Danks 2001).

2.1.2 Climate

The Western Mallee subregion experiences a warm, Mediterranean climate, with annual rainfall between 250 – 500 mm. The Newdegate Research Station (station number 10692), located approximately 16 km to the west of the study area, reports that on average, the area receives 372.4 mm of rainfall per annum (Bureau of Meteorology (BoM) 2018a). This rainfall falls throughout the year, with the greatest falls during winter. Maximum mean monthly temperatures range from 31.2°C (January) to 15.2°C (July). Minimum mean monthly temperatures range from 14.1°C (February) to 4.1°C (July).

2.1.3 Broad-scale vegetation mapping

Vegetation type and extent have been mapped at a regional scale by Beard (1972) who categorised vegetation into broad vegetation associations. Based on this mapping, the Department of Primary Industries and Regional Development (DPIRD; previously Department of Agriculture and Food Western Australia; DAFWA) has compiled a list of vegetation extent and types across WA (Shepherd et al. 2002).

Five of these vegetation associations were found to occur within the broader vicinity of the study area (**Table 1**), and comprise of shrublands, medium woodland and salt lakes. The study area is mapped as vegetation association Hyden 511 (e8,9Mi; medium woodland; Salmon Gum and Morrel). A total of 38,059 ha (37%) of Hyden 511 remains within the Western Mallee sub-region (Government of WA 2018).

Table 1: Beard (1972) / Shepherd *et al.* (2002) vegetation associations in the vicinity of the study area.

Vegetation association	Description	Mapping code	Class	Structural formation
125	Bare areas; salt lakes	sl	N/A	N/A
380	Shrublands; scrub-heath on sandplain	x3SZc	Mallee	Open mallee shrubland
511	Medium woodland; salmon gum & morrel	e8,9Mi	Tree	Woodland
519	Shrublands; mallee scrub, *Eucalyptus eremophila*	e15Si	Tree	Isolated trees
945	Mosaic: Medium woodland; salmon gum / Shrublands; mallee scrub, redwood & black marlock	e8Mi/e10,27Si	Tree	Woodland
			Mallee	Open mallee shrubland

2.1.4 Geology and soils

The site is mapped as the following broad scale geology units (1:250,000 scale geological maps from Geological Survey of WA and Geoscience Australia 2008):

- Qdlu (lunette dunes 72955): Quartz and gypsum dunes and mounds (kopi); may include minor silt, sand, gravel, and clay flats adjacent to playas; locally includes some playa sediments; and
- Czs (sand plain 38499): Sand or gravel plains; quartz sand sheets commonly with ferruginous pisoliths or pebbles, minor clay; local calcrete, laterite, silcrete, silt, clay, alluvium, colluvium, aeolian sand.

Soil-landscape mapping describes broad soil and landscape characteristics from regional to local scales. The study area is within the South-eastern Zone of Ancient Drainage within the Avon Province, which is described as a smooth to irregularly undulating plain dominated by salt lake chains in the main valleys with duplex and lateritic soils on the uplands. It supports mallee vegetation on duplex soils, and proteaceous vegetation on gravels and sands (DAFWA 2014).

2.1.5 Surface and groundwater

The majority of the study area lies within the Albany Coast basin, the Magenta Internal catchment and the Lake Stubbs sub-catchment (Department of Water and Environment Regulation (DWER) 2018a). The study area slopes gradually towards Lake Stubbs, a salt lake located to the north east. The groundwater in the study area is mapped as very saline, at >35,000 mg/L TSD (DPIRD 2018). The study area is not located within in any designated wetlands or watercourses.

2.1.6 Areas of conservation significance

While a portion of the study area is reserved for conservation under the Shire of Lake Grace Local Planning Scheme, this area is classified as Unallocated Crown Land and road reserve, and is not vested with the Conservation and Parks Commission as conservation estate. The study area is not located in proximity to a conservation area. The closest conservation area is Lake Biddy Nature Reserve, a C Class reserve for the purpose of conservation and fauna, which is located 9 km from the study area.

Environmentally Sensitive Areas (ESAs) are defined in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 under section 51B of the EP Act. ESAs include areas declared as World Heritage, included on the Register of the National Estate[1], defined wetlands, and vegetation containing rare (Threatened) flora and Threatened Ecological Communities (TECs).

Priority Ecological Communities (PECs) are biological flora or fauna communities that are recognised to be of significance, but do not meet the criteria for a TEC. There are five categories of PECs, none of which are currently protected under legislation.

A Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Communities database search (DBCA 2018c) identified the presence of the Eucalypt woodlands of the Western Australian Wheatbelt community, a Critically Endangered TEC listed under the EPBC Act, and a DBCA Priority 3 PEC within the study area. Previous ecological surveys (360 Environmental 2015a) have also identified the presence of Red Morrel Woodlands of the Wheatbelt community, a DBCA Priority 1 PEC, within the study area.

[1]Note the Register of National Estate was closed in 2007 and is no longer a statutory list. The Register of National Estate has been replaced by the National Heritage List under the EPBC Act.

2.2 Database searches and literature review

A desktop review was undertaken to inform the field survey and to identify the likelihood of occurrence of conservation significant flora and fauna species and ecological communities within the study area. The desktop review consisted of database searches and a review of any available literature relevant to the study area.

2.2.1 Database searches

The following Commonwealth and State databases were searched for information relating to conservation listed flora, fauna and ecological communities in order to compile and summarise existing data to inform the field survey and the likelihood of occurrence assessments. **Table 2** below presents the database searches undertaken around the central coordinates -33.084214° S, 119.015699° E. It should be noted that the buffers for the DBCA database searches are selected by DBCA on a case-by-case basis, and are therefore not always consistent with other searches undertaken in the area.

Table 2: Database searches undertaken as part of the desktop assessment

Database	Reference	Buffer (km)
Commonwealth EPBC Act Protected Matters Search Tool (PMST) for Threatened species and communities listed under the EPBC Act.	DoEE 2018b	40
Department of Parks and Wildlife (Parks and Wildlife) and Western Australian Museum's (WAM) NatureMap online database.	Parks and Wildlife 2007-2018	40 (fauna) 15 (flora)
DBCA Threatened and Priority fauna database search	DBCA 2018a	50
DBCA Threatened and Priority flora database search	DBCA 2018b	20
DBCA Threatened and Priority communities database search	DBCA 2018c	50
DWER ESA database	DWER 2018b	N/A

2.2.2 Previous ecological surveys

Four previous field studies have been undertaken in the study area in relation to flora, vegetation and fauna, a Level 1 (reconnaissance) flora and fauna survey by Cardno (2014), Level 2 (detailed) flora and vegetation survey by 360 Environmental (2015a), a targeted black cockatoo assessment by 360 Environmental (2015b) and a targeted Red-tailed Phascogale assessment by ELA (2018). These studies are outlined in **Table 3** (flora and vegetation) and **Table 4** (fauna) below.

Table 3: Previous flora and vegetation surveys conducted in the study area

Attribute	Cardno 2014	360 Environmental 2015a
Report name	CBH Grain Facility Expansion, Newdegate. Flora, Fauna and Vegetation	Newdegate Flora and Vegetation assessment
Level of survey	Level 1 (reconnaissance) – three relevés conducted (one per vegetation association)	Level 2 (detailed), single season – 10 quadrats and three relevés conducted
Survey area (ha)	13 ha; however vegetation mapping encompassed a greater area	21.6 ha
Field survey timing	1-2 October 2014	2-4 September 2015
Field effort	Two days with two ecologists	Equivalent to two days with two ecologists
Recorded survey limitations	Not all plants would have been present or flowering during the survey period; species list not considered exhaustive.	13 sites were surveyed; 10 quadrants and three relevés. Each of the six vegetation communities contained at least two sites, with the exception of ElgMl which only contained one site due to its small size.
Number of vascular plant species	88 vascular plant species from 69 genera from 29 families, including 16 introduced species. The most diverse families were Asteraceae (14 species), Poaceae (10 species) and Chenopodiaceae (10 species).	130 vascular plant taxa from 90 genera from 37 families, including 20 introduced species. The most diverse families were Asteraceae (20 taxa), Chenopodiaceae (17 taxa) and Myrtaceae (13 taxa).
WONS or Declared weeds	None	None
Vegetation communities	Three vegetation communities: *Eucalyptus kondoniensis* and *E. salmonophloia* woodland over *Atriplex bunburyana* and *A. cinerea* low sparse shrubland.	Six vegetation communities: EkElg: *Eucalyptus kondininensis*, *E. longicornis* open forest over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs. Some parts included where *E. longicornis* occurs as the single dominant tree species (7.8 ha).

Attribute	Cardno 2014	360 Environmental 2015a
	Eucalyptus loxophleba subsp. *gratiae* low woodland over *Dodonaea ptarmicaefolia* and *Acacia hemitales* open shrubland over *A. eriaceae*, *Enchylaena tomentosa* and *Olearia muelleri* low open shrubland. *Eucalyptus loxophleba* subsp. *gratiae* low open woodland over *Melaleuca acuminata* subsp. *acuminata* tall open shrubland over *Austrostipa elegantissima* very open grassland.	EkAv: *Eucalyptus kondininensis* open forest over *Atriplex vesicaria* low open shrubland over *Threlkeldia diffusa* very open low herbland (4.5 ha). Elx: *Eucalyptus loxophleba* subsp. *gratiae* low open mallee forest over *Melaleuca acuminata* subsp. *acuminata* scattered tall shrubs to tall open shrubland (open to closed scrub in parts) over *Dodonaea ptarmicaefolia*, *Acacia hemiteles* shrubland over *Austrostipa elegantissima* very open grassland (3.9 ha). Es: *Eucalyptus salmonophloia* open to closed forest over *Dodonaea stenozyga* scattered shrubs to open shrubland over *Olearia muelleri, Acacia erinacea* low open shrubland (2.9 ha). TuAv: *Tecticornia undulata*, *Atriplex vesicaria, Tecticornia syncarpa* low open heath over *Disphyma crassifolium* subsp. *clavellatum* very open herbland (1.8 ha). ElgMl: *Eucalyptus longicornis* open forest over *Melaleuca lanceolata* open scrub over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs (0.6 ha).
Vegetation condition	Majority of vegetation in Excellent to Very Good Condition, with some small Degraded areas.	The majority of the vegetation was in Very Good (20.3 ha) condition. The remainder was in Good (0.1 ha), Degraded (1.1 ha) and Completely Degraded (0.1 ha) condition.
Presence of conservation significant flora species	None identified	No Threatened or Priority species were recorded. The Priority 1 species *Thysanotus lavanduliflorus* was considered likely to occur in the study area, although no individuals were recorded during the field survey. Four species were of interest due to range extensions, or due to their location near the edge of their current known distribution.
Presence of conservation significant vegetation communities	None identified	A qualitative assessment of floristic values determined 15.8 ha of the study area represented the Eucalypt Woodlands of the Western Australian Wheatbelt community, a Critically Endangered TEC listed under the EPBC Act, and a DBCA Priority 3 PEC. 8.4 ha of this area was also considered to represent the Red Morrel Woodlands of the Wheatbelt, a DBCA Priority 1 PEC.

Attribute	Cardno 2014	360 Environmental 2015a
Survey gaps identified	Study area size not quantified. Unsure if survey effort was contained to the 13 ha 'proposed expansion area' or a larger 'study area' (area not provided). Area of each vegetation community not quantified.	360 Environmental (2015a) acknowledge that it is possible that the Priority 1 flora species, *Thysanotus lavanduliflorus*, could have been present, but overlooked during the survey due to its low form and absence of flowers during the survey period. Survey effort does not meet current guidance – a minimum of three quadrats should be sample in each vegetation association. Presence of the TEC has not been quantified using the diagnostic characteristics and condition thresholds (DoE 2015).

Table 4: Previous fauna surveys conducted in the study area

Attribute	Cardno 2014	360 Environmental 2015b	ELA 2018a
Report name	CBH Grain Facility Expansion, Newdegate. Flora, Fauna and Vegetation	Newdegate Black Cockatoo Habitat Assessment	Red-tailed Phascogale Assessment, Lots 102, 194 and 208 Lake Biddy Road, Newdegate
Level of survey	Level 1 (broad scale general fauna assessment)	Targeted Black Cockatoo survey	Targeted Red-tailed Phascogale survey
Survey area (ha)	13 ha; however vegetation mapping encompassed a greater area (size not disclosed)	21.9 ha	22 ha
Field survey timing	1-2 October 2014	26-27 May 2015	11-15 June 2018
Field effort	Two days with two ecologists	Two days with two ecologists	Four nights with two ecologists: • 713 Elliott trap nights; • 36 camera trap nights; and • 72 cage trap nights.

Attribute	Cardno 2014	360 Environmental 2015b	ELA 2018a
Recorded survey limitations	None	None	None
Fauna species recorded	Australian Shelduck, Australian Ringneck Parrot, Grey Kurrawong, Galah, White-browed Scrub Wren, Australian Raven, Bronzewing Pigeon, Bobtail, Cat, unidentified macropod.	Galah, Elegant Parrot and unidentified bee species. A Red-tailed Phascogale was captured on a motion sensor camera (G. Penter, pers. comm. 2018).	Red-tailed Phascogale, House Mouse, Cat
Fauna habitats	Not mapped or described. Suitability to provide habitat discussed for conservation significant fauna considered likely to occur.	Black Cockatoo habitat was classed by habitat quality categories (HQC), and consisted of: • 1.4 ha of HQC 1 (potential nesting and foraging habitat); and • 18.9 ha of HQC 2 (foraging habitat). The 1.4 ha of HQC 1 contained 92 potential breeding trees: • 84 Salmon Gum; • Three Red Morrel; and • Five stags (species unknown). These trees had 31 observable hollows suitable to be used for Black Cockatoo nesting.	All vegetation within the study area was suitable to provide habitat for the Red-tailed Phascogale.
Presence of conservation significant fauna species or communities	None identified as observed during the survey. Seven species were assessed as a 'high' likelihood of occurring in the study area, of which three are currently conservation listed: • Carnaby's Black Cockatoo; • Chuditch; and • Western Brush Wallaby.	Carnaby's Black Cockatoo potential breeding and foraging habitat. No Black Cockatoos or foraging evidence were heard or observed during the survey.	Red-tailed Phascogale (four individuals)

Attribute	Cardno 2014	360 Environmental 2015b	ELA 2018a
	A further three species were considered to have a 'medium' likelihood of occurrence, of which two are currently conservation listed: • Peregrine Falcon; and • Fork-tailed Swift.		
Survey gaps identified	Fauna habitats were not mapped or described in the text, as required by the relevant guidelines. Study area size was not quantified, leaving to uncertainties whether the survey effort was contained to the 13 ha 'proposed expansion area' or a larger 'study area' (area not provided). Conservation listing of some fauna species has changed since the publication of the report. Potential Quenda diggings were noted; however this species was not included in the likelihood of occurrence assessment and records are not present in the general area. Digging evidence may have been misinterpreted.	Habitat quality was not defined using a scale (e.g. low, medium or high quality). Hollow signs of use were not recorded. Roosting habitat was not quantified. The report did not include information about the closest known breeding, foraging and roosting sites.	None.

2.3 Likelihood of occurrence assessment

Likelihood of occurrence assessments are undertaken in order to identify conservation listed flora and fauna species that may occur within the study area from a review of key datasets and literature. Previous likelihood of occurrence assessments were undertaken for the study area as part of previous ecological surveys (Cardno 2014; 360 Environmental 2015a). Based on new database records and the results of the current field survey, these likelihood of occurrence assessments were updated as part of the assessment (see section 4.1.2 and 4.2.3); with the exception of flora species considered unlikely to occur by 360 Environmental (2015a). The criteria used are outlined in **Appendix D**, and the full likelihood of occurrence assessments are detailed in **Appendix E** and **Appendix F**.

3 Methodology

3.1 Survey team and timing

The flora, vegetation and fauna assessment was undertaken by Sarah Dalgleish (Botanist) and Jeni Morris (Ecologist). The surveys were undertaken over three days from 5-7 November 2018. The timing of the surveys was appropriate for the scope (EPA 2016a, c). Rainfall in the months preceding the survey was lower than average, however temperatures were consistent with the long term mean (BoM 2018b; **Figure 2**). Survey limitations are discussed in section 3.8.

The survey team's relevant qualifications, experience and licences are provided in **Table 5**.

Table 5: Survey team

Name	Qualification	Relevant experience	Licences
Sarah Dalgleish	BSc Environmental Management (Hons)	Sarah has extensive experience undertaking flora and vegetations surveys across the South-West Botanical Province, with previous survey experience in the Mallee and Avon Wheatbelt bioregions. She has previously undertaken a detailed flora and vegetation and a level 1 fauna survey in Newdegate.	Flora scientific collection licence: SL012349 DRF collection licence: 194-1718
Jeni Morris	BSc Conservation and Wildlife Biology	Jeni has undertaken flora and vegetations surveys across the South-West Botanical Province, with previous survey experience in the Mallee and Avon Wheatbelt bioregions. She has previously undertaken a targeted Red-tailed Phascogale survey in the study area.	Flora scientific collection licence: SL012347 DRF collection licence: 196-1718

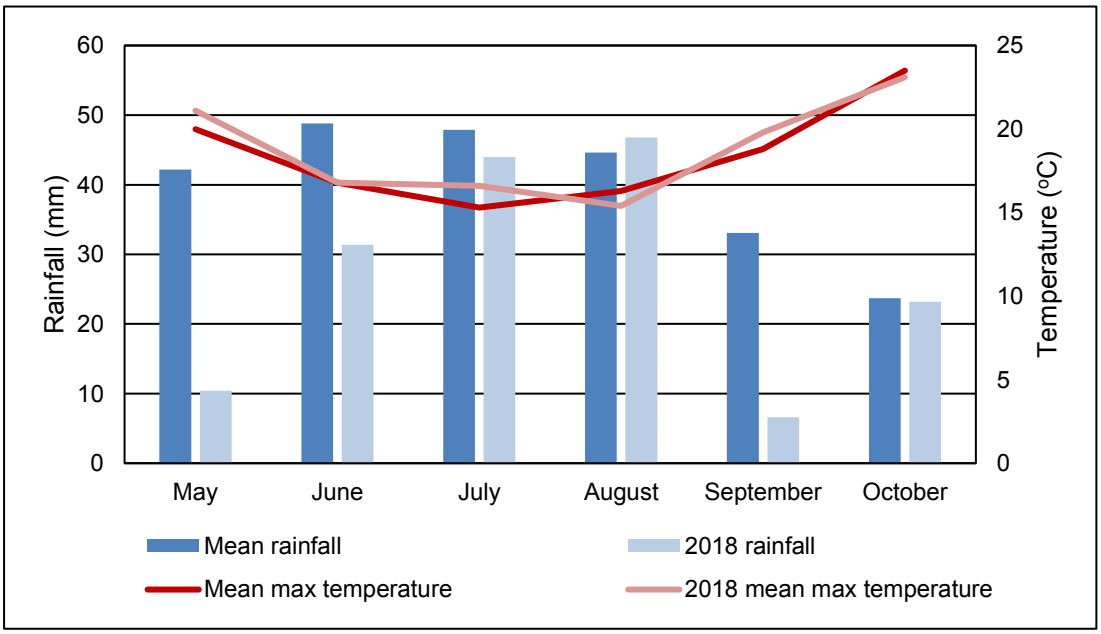

Figure 2: Rainfall and max mean temperatures in the six months preceding the field survey, compared to the long term mean. Data source: Newdegate Research Station (station 010692); BOM 2018b

3.2 Flora and vegetation survey

Current EPA guidance (EPA 2016a) states that a minimum of three quadrats should be sampled in each vegetation association during a detailed survey. However, a previous flora and vegetation survey (360 Environmental 2015a) conducted in the study area surveyed two 10 m x 10 m quadrats per vegetation association (this was in accordance with the available guidance at the time of the survey), with the exception of a restricted vegetation association that contained a single relevé. ELA's flora and vegetation survey aimed to fill the identified ecological information gaps (see **Table 3** and ELA 2018b) and was conducted in accordance with the following current guidance:

- EPA Technical Guide – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a); and
- *Approved Conservation Advice for the Eucalypt Woodlands of the Western Australian Wheatbelt* (DoE 2015).

A total of eight additional 10 m x 10 m quadrats (20 m x 20 m overstorey) were established across the study area (**Figure 3**), to ensure three quadrats were located in each vegetation association. In the restricted vegetation association ElgMl, two quadrats were established. The following information was recorded at each quadrat:

- A colour photograph of representative vegetation;
- Coordinate location;
- Description of vegetation associations in accordance with Level V of the National Vegetation Information System (NVIS) and Aplin's (1979) modification of vegetation classification adapted from Specht (1970). For each stratum, this included:
    - Dominant growth form;
    - Height;
    - Cover;
    - Three dominant genera;
- Description of vegetation condition classification, in accordance with EPA (2016a);
- Average % cover of leaf litter and bare ground;
- Disturbance details including:
    - Fire history (time since last fire);
    - Physical disturbance including evidence of erosion;
    - Evidence of grazing; and
    - Weed invasion.

Other tasks undertaken included the:

- Description and mapping of TECs and PECs, including collection of data to allow for an assessment against the key diagnostic characteristics of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC;
- Adding to the existing flora species inventory (including weeds) and undertaking opportunistic sampling;
- Mapping of Declared Pest Plants listed under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and Weeds of National Significance (WONS), if observed; and
- Updating the vegetation condition mapping, in accordance with EPA (2016a).

3.3 Targeted flora survey

A targeted survey for conservation significant flora has been previously conducted as part of an earlier ecological survey (360 Environmental 2015a), and a likelihood of occurrence assessment dismissed all flora species, with the exception of *Thysanotus lavanduliflorus*, which was not flowering during September 2015. This current assessment targeted *Thysanotus lavanduliflorus* and new conservation significant flora species not included in the previous assessment (identified by current database searches).

The targeted surveys were conducted in accordance with EPA (2016a). The target survey methodology involved personnel walking transects spaced less than 50 m apart in suitable habitat. Locations of survey transects are shown in **Figure 4**.

The following information was recorded for any conservation significant flora observed:

- A colour photograph;
- GPS location;
- Population size estimate;
- Location of population boundaries (if applicable);
- Associated habitat/landscape element;
- Time and date observed;
- Observer details; and
- A voucher specimen suitable for use as a reference specimen (if appropriate to do so for conservation significant flora).

The field survey was undertaken using an Android Nexus 7 tablet operating the ArcGIS Collector app. It should be noted that these units can have errors of 3-20 m (subject to availability of satellites on the day) with an average of 5 m, which is comparable to a standard GPS unit. Some data such as the traverse paths were recorded on Garmin GPSmap 62s GPS units.

3.4 Fauna survey

A Level 1 Fauna survey was conducted in accordance with the following guidelines:

- EPA Technical Guidance - *Terrestrial fauna surveys* (EPA 2016b); and
- EPA Technical Guidance - *Sampling methods for Terrestrial vertebrate fauna* (EPA 2016c).

General fauna habitats were not mapped or described in a previous Level 1 fauna survey undertaken in the study area (Cardno 2014). However, fauna habitats had been extrapolated from the vegetation mapping in ELA (2018a). The field survey ground truthed and mapped these habitats.

Opportunistic fauna observations were recorded for all species, and included direct observations, opportunistic sightings and other signs of fauna such as tracks, scats, burrows, mounds, foraging / diggings etc. All points of interest were recorded on a GPS and a photo of the species/habitat taken for inclusion in the report.

3.5 Targeted Malleefowl survey

Targeted searches for signs of Malleefowl, such as birds, mounds, tracks and scats were undertaken in areas of suitable habitat (*Eucalyptus* mallee over *Melaleuca* shrubland), in accordance within the EPBC Act *Survey guidelines for Australia's threatened birds* (Department of the Environment, Water, Heritage and the Arts 2010). The target survey methodology involved personnel walking transects spaced less than 50 m apart. Survey effort for the targeted Malleefowl survey is shown in **Figure 4**.

3.6 Specimen identification and nomenclature

Nomenclature used for the flora species within this report follows the WA Plant Census as available on FloraBase (Western Australian Herbarium (WAH) 1998-2018).

Voucher specimens were collected in the field of all actual or potential conservation significant flora species where required, where sufficient material was available. Collections were made of other species, if required, to enable correct identification. All collections were assigned a unique collecting number.

Specimen identification was undertaken by Sarah Dalgleish. Species identification utilised taxonomic literature and keys and where required specimens were confirmed using the WAH reference collection. Suitable material that meets WAH specimen lodgement requirements, such as flowering material and range extensions, was submitted along with Threatened and Priority Report forms to DBCA, as required by conditions of collection licences issued under the State *Wildlife Conservation Act 1950* (WC Act).

The *Thysanotus* sp. 1 specimen could not be adequately identified to species level in-house, so was submitted to WAH for identification, where it was confirmed to be *Thysanotus lavanduliflorus* (P1).

Fauna species were identified in situ. Nomenclature used for the vertebrate fauna species within this report follows the WAM Checklist of the Vertebrates of Western Australia (WAM 2018).

3.7 Data analysis

3.7.1 Flora species accumulation curve

A flora species accumulation curve was undertaken to indicate adequacy of the survey effort (Clarke and Gorley 2006). As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence-based coverage estimator of species richness. When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered adequate.

3.7.2 Vegetation Communities

Plymouth Routines in Multivariate Ecological Research v6 (PRIMER) statistical analysis software was used to analyze species-by-site data and discriminate survey sites based on their species composition (Clarke and Gorley 2006). A presence/absence transformation was applied to the dataset prior to analysis. Introduced species (weeds), specimens not identified to species level and singletons (species recorded at a single quadrat and not forming a dominant structural component) were excluded from the data set prior to analysis. In addition, annuals were also removed from the dataset prior to analysis due to the likelihood of substantial differences between years based on seasonality of local rainfall events. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including Similarity Profile (SIMPROF), Hierarchical Clustering (CLUSTER) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities.

3.8 Limitations

The EPA *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) and *Technical Guidance – Sampling methods for terrestrial vertebrate fauna* (EPA 2016b) recommends including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the flora, vegetation and fauna assessment are summarised in **Table 6**.

Table 6: Limitations of the survey

Factor	Limitations
Sources of information	Flora, vegetation and fauna surveys have previously been undertaken in the study area and this information was readily available. Broad-scale vegetation mapping at a scale of 1:1,000,000 was also available. The information which was available was sufficient and as such sources of information were not considered a major limitation.
Scope of works	The survey requirement of a detailed flora and vegetation survey, targeted flora survey, a Level 1 fauna survey and a targeted Malleefowl survey to fill in previous ecological survey information gaps within the study area in accordance with relevant State and Commonwealth guidance was met was adequately met.
Completeness and intensity of survey	The study area was surveyed to the satisfaction of the scope and the relevant survey guidelines, and the data will be pooled with existing ecological survey data to provide a comprehensive ecological information base. Together with existing data, the number of quadrats established was sufficient to determine the vegetation types and identify vegetation communities of significance.
Timing, weather, season, cycle	The study area is located in the Western Mallee subregion of Western Australia. The recommended flora survey timing for this region is Spring (September – November) for flora (EPA 2016a) and in the season following maximum rainfall for fauna (EPA 2016b). The field survey was conducted in early November, following the wet season, and was undertaken to coincide in Spring and with the November/December flowering period of the Priority 1 species *Thysanotus lavanduliflorus*. However, lower than average rainfall (particularly in September; BoM 2018b) meant the timing was sub-optimal for the identification of many annual flora species. However, as the survey was specifically designed as a supplementary survey to satisfy gaps associated with previous ecological surveys, the absence of annuals was not considered a significant limitation as a high number of annual species were recorded in the September 2015 survey (360 Environmental 2015a). With the exception of the Priority 4 annual herb *Haegiela tatei*, the additional conservation listed flora species identified in the database assessment that were not previously assessed by 360 Environmental (2015a) were perennial species and would have been readily visible despite the site conditions. The early November timing was appropriate for conducting a Level 1 fauna survey and a targeted Malleefowl assessment.
Disturbances	Disturbances within the study area included clearing of vegetation for tracks, presence of introduced (feral) fauna species and dumping of rubbish (cars, bottles etc.). Disturbances did not limit the study.
Resources	Field staff were suitably qualified and experienced to identify target and non-target species in the field. One specimen that potentially represented the Priority 1 flora species *Thysanotus lavanduliflorus* was sent to WAH for expert identification.
Accessibility	The study area was easily accessed via a road adjacent to the study area and was able to be surveyed on foot. Accessibility was not a survey limitation.

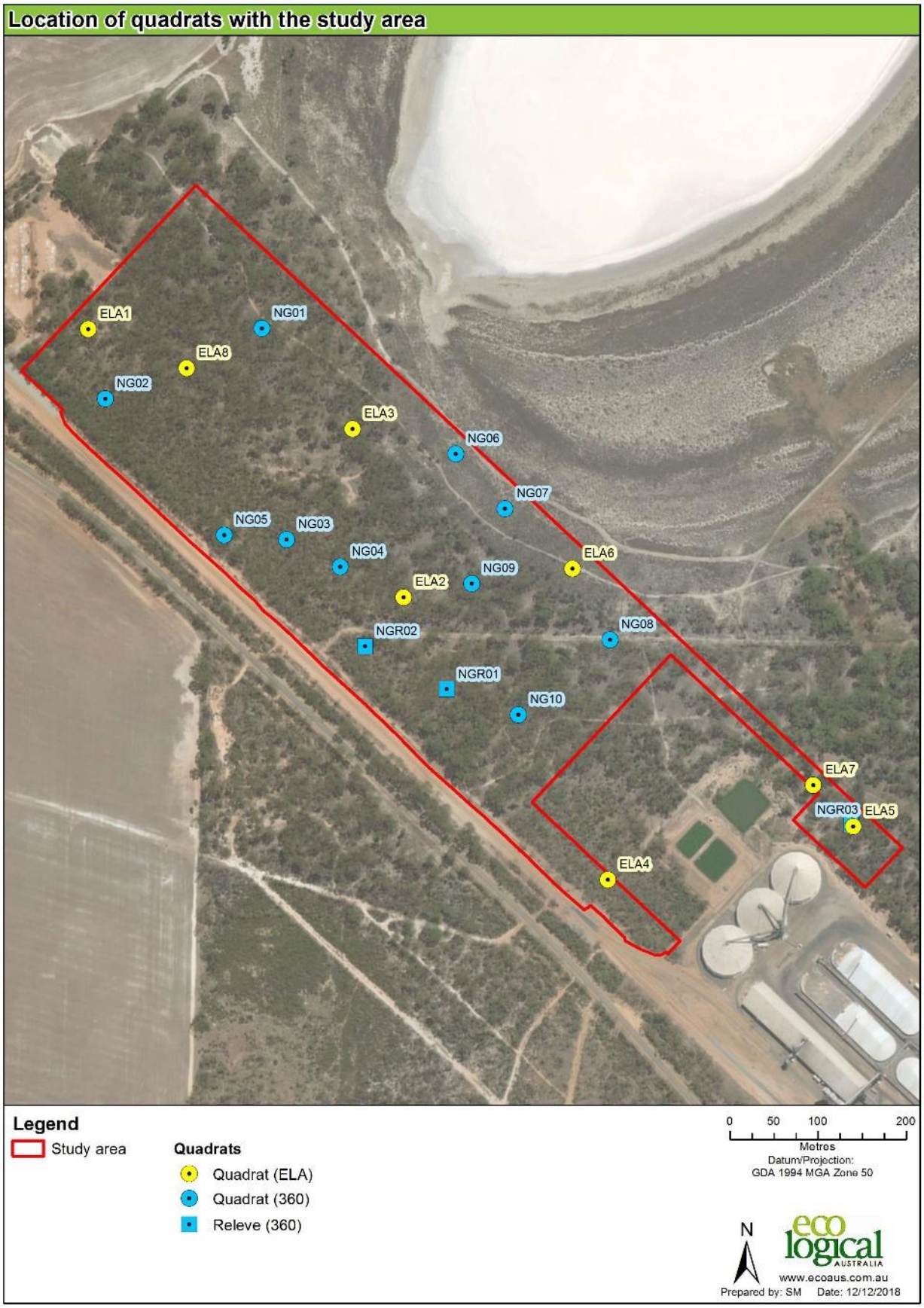

Figure 3: Location of quadrats with the study area.

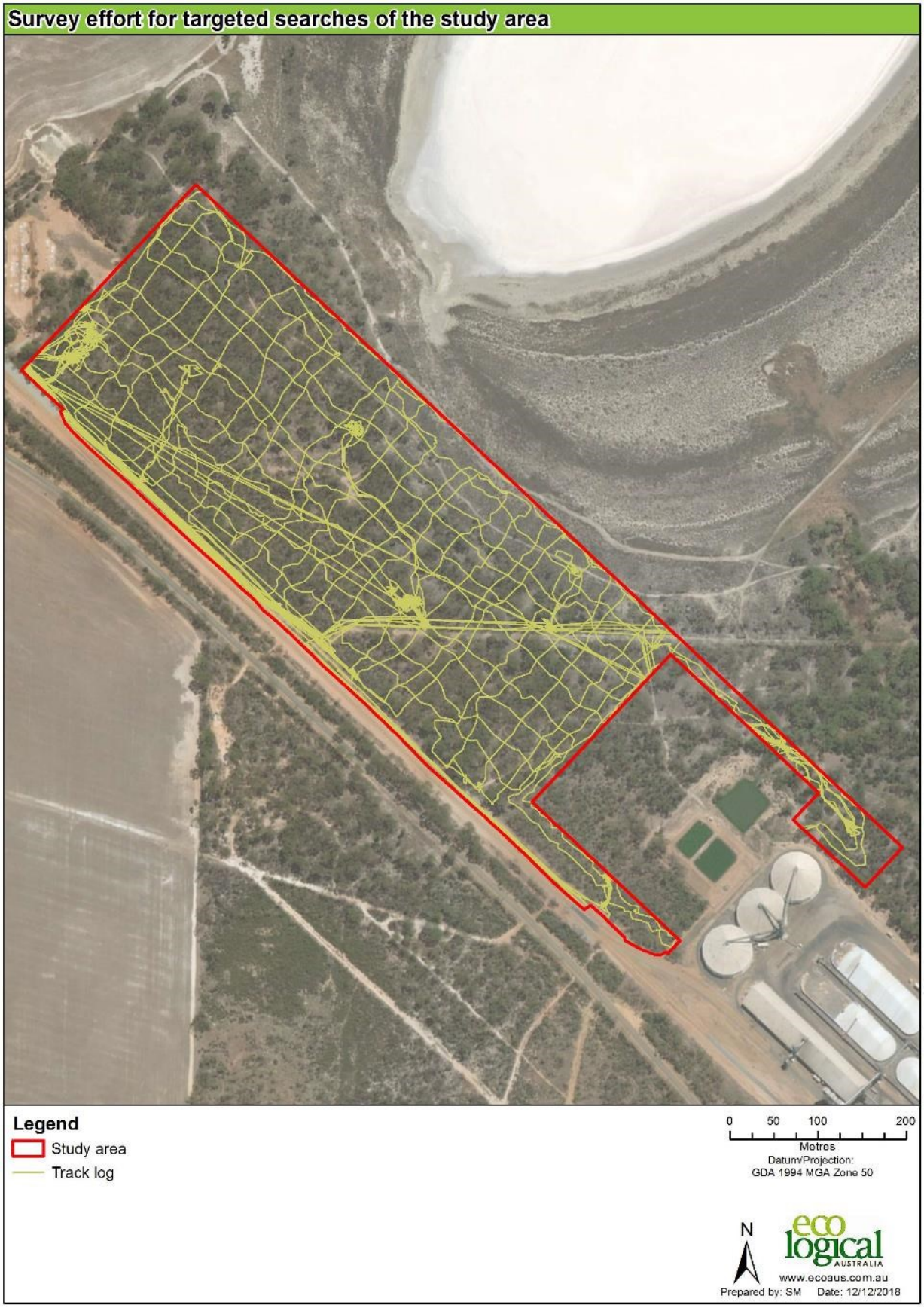

Figure 4: Survey effort for targeted searches of the study area.

4 Results

4.1 Flora and vegetation survey

4.1.1 Flora overview

The current survey recorded a total of 59 taxa (including species, subspecies, varieties and forms and specimens not identified to species level) from 43 genera and 18 families from eight quadrats and opportunistic collections during the field survey. Quadrat species richness varied from 7 (ELA5 and ELA 7) to 20 (ELA 2) taxa.

A total of 178 taxa (including species, subspecies, varieties and forms, and specimens not identified to species level) from 111 genera and 42 families were recorded from quadrats, relevés and opportunistic collections in the study area during the current and previous surveys (360 Environmental 2015a; Cardno 2014). Of these taxa, 32 were introduced, including three taxa not identified to species level. None of these species are listed as WONS or Declared under the BAM Act. The current survey added five additional taxa to the flora inventory, excluding two taxa that could not be identified to species level (**Appendix C**). The ELA and 360 Environmental (2015a) quadrat species richness ranged from 7 to 35 taxa with an average of 17.2 taxa per quadrat (**Appendix A** and **Appendix B**).

Collectively, the most commonly occurring families were Asteraceae (30 taxa), Chenopodiaceae (23 taxa) and Poaceae (19 taxa) over the three surveys (360 Environmental 2015a; Cardno 2014). The most frequently recorded genera were *Melaleuca* (eight taxa), *Austrostipa* (six taxa), and *Eucalyptus*, *Maireana*, *Acacia* and *Tecticornia* (five taxa each). One specimen could not be identified due to poor material ('Indeterminant sp.'; 360 Environmental 2015a) while three specimens could only be identified to family level and further nine taxa to genus level.

A species accumulation curve (**Figure 5**) was used to evaluate the adequacy of sampling (Clarke and Gorley 2006), using a combined ELA/360 Environmental (2015a) dataset. Only species data recorded from defined survey sites (quadrats) were used; no opportunistic flora collections and relevé data were included. Using this analysis, the incidence-based coverage estimator of species richness was calculated to be 143.8. Based on this value, and the total of 102 species recorded within quadrats, approximately 71% of the flora species potentially present within the study area were recorded. When data from relevés (Cardno 2014; 360 Environmental 2015a) and opportunistic sightings is included, the taxa records rise to 175 (includes taxa not identified to species level).

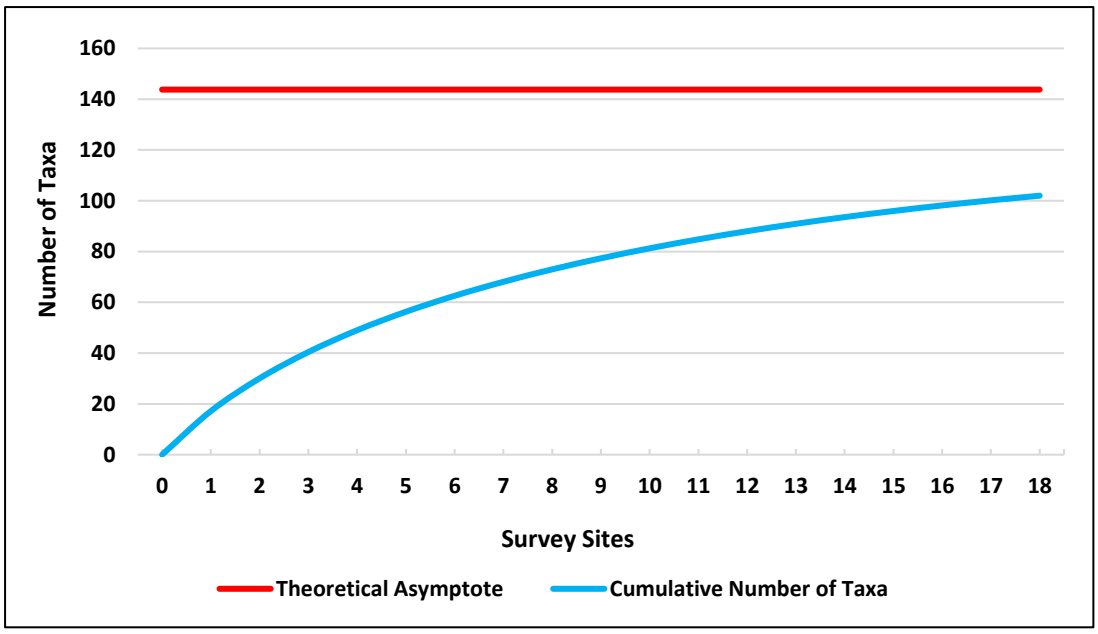

Figure 5: Averaged randomised species accumulation curve.
Note: Only native species recorded from quadrats were used to calculate the species accumulation curve and theoretical maximum number of species (asymptotic value). Includes data from 360 Environmental (2015a).

4.1.2 Conservation significant flora

The Priority 1 flora species *Thysanotus lavanduliflorus* was recorded during the current survey, with its identification confirmed by the WAH (see **Plate 1**). A total of 15 individuals of this species were recorded in vegetation association Es within a 20 m radius of the coordinates - 33.082859 ºS 119.012644 ºE; the location of the records of *Thysanotus lavanduliflorus* are mapped in **Figure 7**. No other threatened or priority flora taxa were recorded within the study area during the current or past surveys.

Plate 1: *Thysanotus lavanduliflorus*

Previous surveys recorded several non-conservation listed flora taxa records of interest due to range extensions, or due to their location near the edge of their current known distribution (360 Environmental 2015a):

- *Austrostipa acrociliata*;
- *Chenopodium desertorum* subsp. *desertorum*;
- *Tecticornia undulate*; and
- *Trymalium myrtillus* subsp. *myrtillus.*

A likelihood of occurrence assessment for other conservation listed flora species was undertaken (**Appendix E**). One species, *Haegiela tatei* (listed as Priority 4 by DBCA), was assessed as having potential to occur within the study area. The remaining 58 taxa were considered unlikely to occur within the study area.

4.1.3 Vegetation associations

Six vegetation communities were originally mapped within the study area (360 Environmental 2015a), and are predominantly comprised of *Eucalyptus* open forest, with some areas of *Melaleuca* shrubland. The current survey completed eight additional quadrats, which following statistical analysis, were found to correlate with the existing vegetation communities (**Figure 6**).

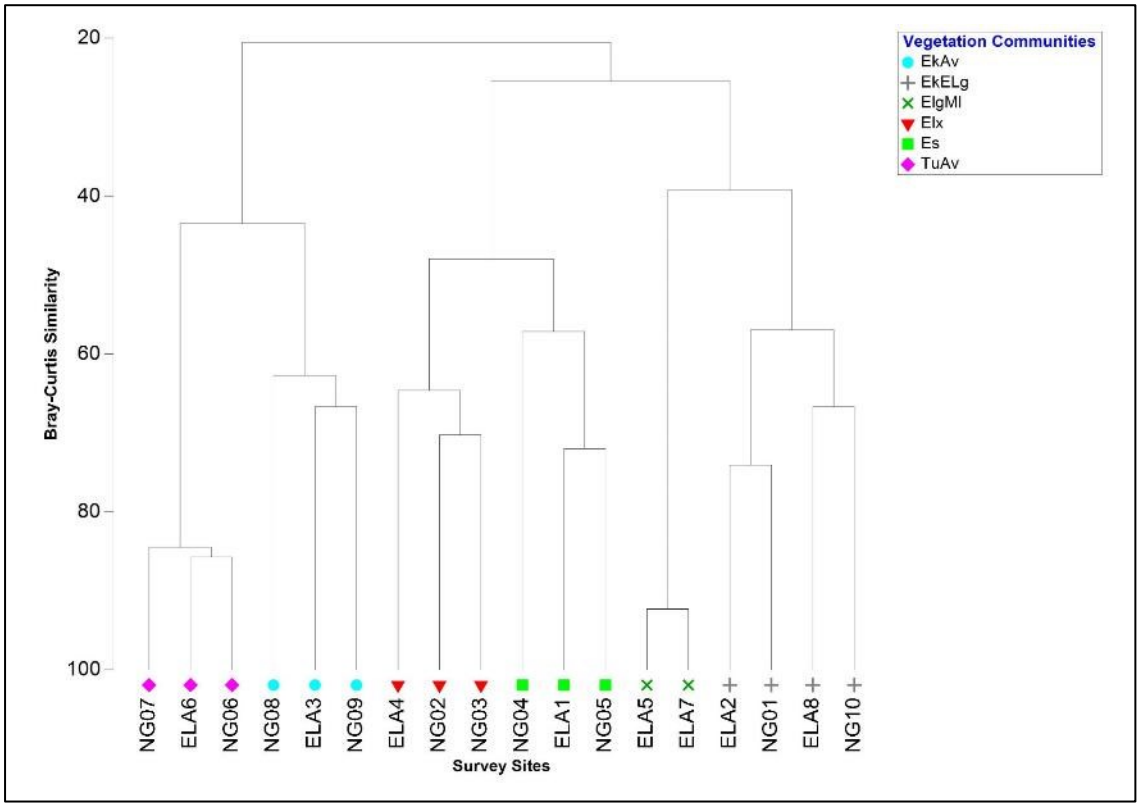

Figure 6: Results of the Bray-Curtis Similarity measure, comparing ELA and 360 Environmental (2015a) quadrats ('NG').

The six vegetation communities contained within the study area are (**Table 7**; **Figure 8**):

- **EkElg**: *Eucalyptus kondininensis*, *E. longicornis* open forest over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs. Some parts included where *Eucalyptus longicornis* occurs as the single dominant tree species;
- **Elx**: *Eucalyptus loxophleba* subsp. *gratiae* low open mallee forest over *Melaleuca acuminata* subsp. *acuminata* scattered tall shrubs to tall open shrubland (open to closed scrub in parts) over *Dodonaea ptarmicaefolia*, *Acacia hemiteles* shrubland over *Austrostipa elegantissima* very open grassland;
- **EkAv**: *Eucalyptus kondininensis* open forest over *Atriplex vesicaria* low open shrubland over *Threlkeldia diffusa* very open low herbland;
- **Es**: *Eucalyptus salmonophloia* open to closed forest over *Dodonaea stenozyga* scattered shrubs to open shrubland over *Olearia muelleri, Acacia erinacea* low open shrubland;
- **TuAv**: *Tecticornia undulata*, *Atriplex vesicaria, Tecticornia syncarpa* low open heath over *Disphyma crassifolium* subsp. *clavellatum* very open herbland;
- **ElgMl**: *Eucalyptus longicornis* open forest over *Melaleuca lanceolata* open scrub over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs.

The remaining 0.8 ha (3.2% of the study area), is considered to be cleared and has not been mapped as vegetation.

Table 7: Vegetation associations within the study area. Vegetation descriptions from 360 Environmental (2015a).

Image	Vegetation Description	Quadrats/ relevés	Extent in study area (ha)	Portion of study area (%)
	**EkElg**: *Eucalyptus kondininensis*, *E. longicornis* open forest over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs. Some parts included where *Eucalyptus longicornis* occurs as the single dominant tree species	ELA2 ELA8 NG01 NG10 NGR01	7.90	31.85
	**Elx**: *Eucalyptus loxophleba* subsp. *gratiae* low open mallee forest over *Melaleuca acuminata* subsp. *acuminata* scattered tall shrubs to tall open shrubland (open to closed scrub in parts) over *Dodonaea ptarmicaefolia*, *Acacia hemiteles* shrubland over *Austrostipa elegantissima* very open grassland	ELA4 NG02 NG03 NGR02	5.72	23.07

	**EkAv**: *Eucalyptus kondininensis* open forest over *Atriplex vesicaria* low open shrubland over *Threlkeldia diffusa* very open low herbland	ELA3 NG08 NG09	4.56	18.38
	**Es**: *Eucalyptus salmonophloia* open to closed forest over *Dodonaea stenozyga* scattered shrubs to open shrubland over *Olearia muelleri, Acacia erinacea* low open shrubland	ELA1 NG04 NG05	3.26	13.13
	**TuAv**: *Tecticornia undulata*, *Atriplex vesicaria, Tecticornia syncarpa* low open heath over *Disphyma crassifolium* subsp. *clavellatum* very open herbland	ELA6 NG06 NG07	1.71	6.89
	**ElgMl**: *Eucalyptus longicornis* open forest over *Melaleuca lanceolata* open scrub over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs	ELA5 ELA7 NGR03	0.87	3.49
Cleared: cleared areas, completely devoid of vegetation		N/A	0.79	3.19

4.1.4 Vegetation condition

The majority of the vegetation was in Very Good condition (21.5 ha; 86.6% of the study area). The remainder was in Good (2.0 ha), Degraded (0.5 ha) and Completely Degraded (0.1 ha) condition (**Table 8** and **Figure 9**). A total of 0.8 ha of the study area is cleared of vegetation. Disturbances within the project area, in addition to clearing of vegetation for tracks, include the presence of introduced (feral) fauna species and dumping of rubbish (cars, bottles etc.).

Table 8: Vegetation condition within the study area.

Condition	Extent (ha)	Proportion of study area (%)
Very Good	21.48	86.60
Good	1.97	7.93
Degraded	0.49	1.96
Completely Degraded	0.08	0.32
Total vegetation	24.01	96.81
Cleared	0.79	3.19
Grand total	24.80	100.00

4.1.5 Vegetation of conservation significance

A qualitative assessment of floristic values (360 Environmental 2015a) determined that the Eucalypt woodlands of the Western Australian Wheatbelt community, a Critically Endangered TEC listed under the EPBC Act and a DBCA Priority 3 PEC, was present in the study area. The Eucalypt woodlands of the Western Australian Wheatbelt community is described as (DBCA 2017):

Eucalypt-dominated woodlands in the Western Australian Wheatbelt region as defined by the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions with the specific exceptions of woodlands and forests dominated by Jarrah (*Eucalytpus marginata*) or Marri (*Corymbia calophylla*) where they occur without York Gum present; and non-woodland communities dominated by eucalypts, specifically those dominated by eucalypts with a mallee growth form. Community is defined primarily by its structure as a woodland. The presence in the canopy layer of eucalypt trees - most commonly Salmon Gum (*E. salmonophloia*), York Gum (*Eucalyptus loxophleba*), Red Morrel (*E. longicornis*) or Gimlet (*E. salubris*) defines the Wheatbelt woodlands. Several of the other emergent eucalypt species which may be present as a defining species (e.g. Kondinin Blackbutt (*E. kondinensis*), *E. myriadena*, Salt River Gum (*E. sargentii*), Silver Mallet (*E. ornata*) and Mallet (*E. singularis*)) are found only in the Western Australian Wheatbelt.

An assessment, presented in **Table 9** and **Table 10**, has now been undertaken utilising the key diagnostic characteristics of the TEC (DoE 2015). This assessment has concluded that 16.58 ha of vegetation (related to vegetation associations EkAv, EkElg, ElgMl and Es) within the study area is characterised as the Eucalypt woodlands of the Western Australian Wheatbelt TEC (and subsequently, the associated State listed PEC).

Of this area, 8.77 ha (related to vegetation associations ElgML and EkElg) is also considered to represent the Red Morrel Woodlands of the Wheatbelt, a DBCA Priority 1 PEC that can co-occur with the Eucalypt woodlands of the Western Australian Wheatbelt TEC/PEC. This PEC is described as (DBCA 2017):

Tall open woodlands of *Eucalyptus longicornis* (Red Morrel) found in the Wheatbelt on lateritic, ironstone or granitic soil types. Sometimes found with *E. salmonophloia* (Salmon Gum), or *E. loxophleba* (York Gum) woodlands and has very little understorey. It is also found directly above lake systems in the central and eastern Wheatbelt. The landscape unit in which it is found is valley floors, usually adjacent to saline areas.

These areas of conservation listed vegetation communities are mapped in **Figure 10**.

Table 9: Assessment of the Eucalypt woodlands of the Western Australian Wheatbelt community within the study area for TEC status

Key diagnostic characteristics (DoE 2015)	Outcome
Indicators	
Location and physical environment The distribution of the ecological community is limited to these IBRA bioregions and subregions: • Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning; • Mallee - MAL02 Western Mallee only; and • Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall. They are effectively an extension of the Avon Wheatbelt landscape in that they comprise areas subject to similar climate, landscape and threats.	Yes – the study area is located in the Mallee bioregion, in the Western mallee subregion (MAL02).
Structure The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% (crowns measured as if they are opaque).	Yes – the crown cover in the woodland vegetation associations EkAv, EkElg, ElgMl, Es and ELx is ≥10%. Vegetation association TuAv is a low open heathland, so is excluded.
Presence of key species The key species of the tree canopy are species of Eucalyptus as identified in Table 2a (DoE 2015). These are species that typically have a single trunk. One or more of the tree species in Table 2a are dominant or co-dominant within a patch of the ecological community. If other species are present in the tree canopy (e.g. species in Table 2b or other taxa) then these collectively do not occur as dominants in the tree canopy.	Yes – *Eucalyptus kondininensis*, *E. longicornis and E. salmonophloia* are dominants/co-dominants within vegetation associations EkAv, EkElg, ElgMl and Es and are listed in Table 2a. Vegetation association Elx does not contain a dominant/co-dominant listed in Table 2a, so is excluded.
Presence of understorey A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in section 2.3.2 and in Table A1 of Appendix A (DoE 2015).	Yes – native understorey is present. 45 of the 87 taxa recorded in the quadrats associated with vegetation associations EkAv, EkElg, ElgMl and Es are listed in Table A1 of Appendix A (DoE 2015). However, the plant species list in Table A1 of Appendix A (DoE 2015) does not include all plant species that may be encountered in the WA Wheatbelt woodland ecological community.

Key diagnostic characteristics (DoE 2015)	Outcome
Contra-indicators	
A dominant presence of eucalypts with a mallee growth form. However, mallee species can occur as an understorey or minor canopy component of the ecological community, as noted in the diagnostic features, above.	No – Mallee eucalypts are not dominant in vegetation associations EkAv, EkElg, ElgMl and Es.
A dominant presence of non-eucalypt species in the tree canopy, for instance *Acacia acuminata* (jam) or *Allocasuarina huegeliana* (rock sheoak). However, these non-eucalypt species can be present as an understorey or minor canopy component of the ecological community.	No - There are no dominant non-eucalypt species present in the tree canopy.
Shrublands or herblands in which the tree canopy layer is very sparse to absent, either naturally or maintained so through long-term disturbance. Native vegetation where a tree canopy was formerly present is often referred to as 'derived' or 'secondary' vegetation. These sites would fall below the 10 per cent minimum canopy cover threshold for a woodland, noted in the diagnostic features, above.	No - Vegetation associations EkAv, EkElg, ElgMl and Es are woodlands with a tree canopy present.
Woodlands that have the same key eucalypt species but occur in adjacent bioregions, notably the Coolgardie, Esperance Sandplains, Yalgloo and Geraldton Sandplains bioregions. These are not part of the national ecological community. All woodlands that occur in bioregions outside the wheatbelt, as defined in this conservation advice, are not part of the WA Wheatbelt Woodland ecological community.	No - The study area is not located in the Coolgardie, Esperance Sandplains, Yalgloo and Geraldton Sandplains bioregions.
Woodlands dominated by eucalypts that are restricted to granite outcrops and rocky rises, for instance *Eucalyptus caesia* (caesia or gungurru). However, some woodlands occur on the base round rock outcrops, but not on the actual outcrop, and these may be part of the ecological community, for instance York gum – jam woodlands.	No - The woodlands within the study area do not occur on granite outcrops or rocky rises.
Condition thresholds and minimum patch size	
Where native vegetation meets the description and key diagnostic characteristics of the WA Wheatbelt Woodland ecological community, above, the condition thresholds and considerations in Table 3 (DoE 2015) apply. There are four categories a patch can be classified as: • Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014). • Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.	Yes – together, the vegetation associations EkAv, EkElg, ElgMl and Es meet the criteria for Category A (see **Table 10**): • Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy) • Mature trees may be present or absent • Patch size 2 hectares or more.

Key diagnostic characteristics (DoE 2015)	Outcome
• Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014). • Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features. The criteria for these categories are listed in **Table 10** below.	While areas of vegetation mapped as Good, Degraded and Completely Degraded occur within vegetation associations ElgMl and Es, weed species were below 30% cover in all quadrats, so Category A is still relevant. A small area of Es (0.4 ha) is isolated from the rest of the mapped area of the TEC within the study area due to the presence of other vegetation associations, however was classified as part of the same patch. This is due to the patch definition (DoE 2015) where 'A patch is defined as a discrete and mostly continuous area of the ecological community. A patch may include small-scale variations and disturbances, such as tracks or breaks, watercourses/drainage lines or localised changes in vegetation that do not act as a permanent barrier or significantly alter its overall functionality.'

Table 10: Minimum condition for patches of the WA Wheatbelt Woodlands ecological community. For each category, both the weed cover and mature tree presence criteria must apply plus one of either patch size or patch width, depending on whether the patch is a roadside remnant or not. Source: Table 3 (DoE 2015).

Cover of exotic plants (weeds) AND	Mature trees[1] AND	Minimum patch size (non-roadside patches)[2] OR	Minimum patch width (roadside patches only)[3]
Category A: *Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).*			
Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees may be present or absent.	2 hectares or more	5 metres or more
Category B: *Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.*			
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy)	Mature trees are present with at least 5 trees per 0.5 ha.	2 hectares or more	5 metres or more
Category C: *Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).*			

Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees either absent or less than 5 trees per 0.5 ha are present.	5 hectares or more	5 metres or more
Category D: *Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.*			
Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees are present with at least 5 trees per 0.5 ha.	5 hectares or more	5 metres or more

[1] Mature trees have a diameter at breast height (DBH) of 30 cm or above. Trunk diameter varies among eucalypt species, for instance gimlet and mallets tend to have slender trunks (Gosper et al. 2013b, as cited in DoE 2015). The DBH for mature trees aligns with the EPBC referral guidelines for the breeding habitat of threatened black cockatoo species (DSEWPaC 2012). These note that, for salmon gum and wandoo trees, suitable nest hollows can develop in trees with a DBH of 30 cm or more. Note that larger trees may be killed by factors such as intense fire or flood but the patch may still be in reasonable condition if there are immature trees regenerating.

[2] The minimum patch size thresholds apply to native vegetation remnants that do not occur along roadsides.

[3] Minimum patch width applies only to vegetation remnants along roadsides and tend to be long but narrow. This criterion recognises the importance of native vegetation remnants along road verges, e.g their value as wildlife corridors particularly if linking to other non-roadside remnants, habitat for threatened species and other reasons as detailed by Jackson (2002) and RCC (2015), as cited in DoE (2015). The width here is based on the native understorey component rather than width of the tree canopy. Some allowance must be made for small breaks or variations in native species cover along linear patches. Given the generally open nature of the tree canopy and some understorey structures, a break in the continuity of native vegetation cover of 50 metres or more, is likely to indicate that separate patches are present. An exception is for main, often bitumen-covered, roads that bisect otherwise continuous vegetation; most local government roads in the Wheatbelt have a road reserve of 20 metres. In these cases, native vegetation along either side of the road is considered to be a separate patch.

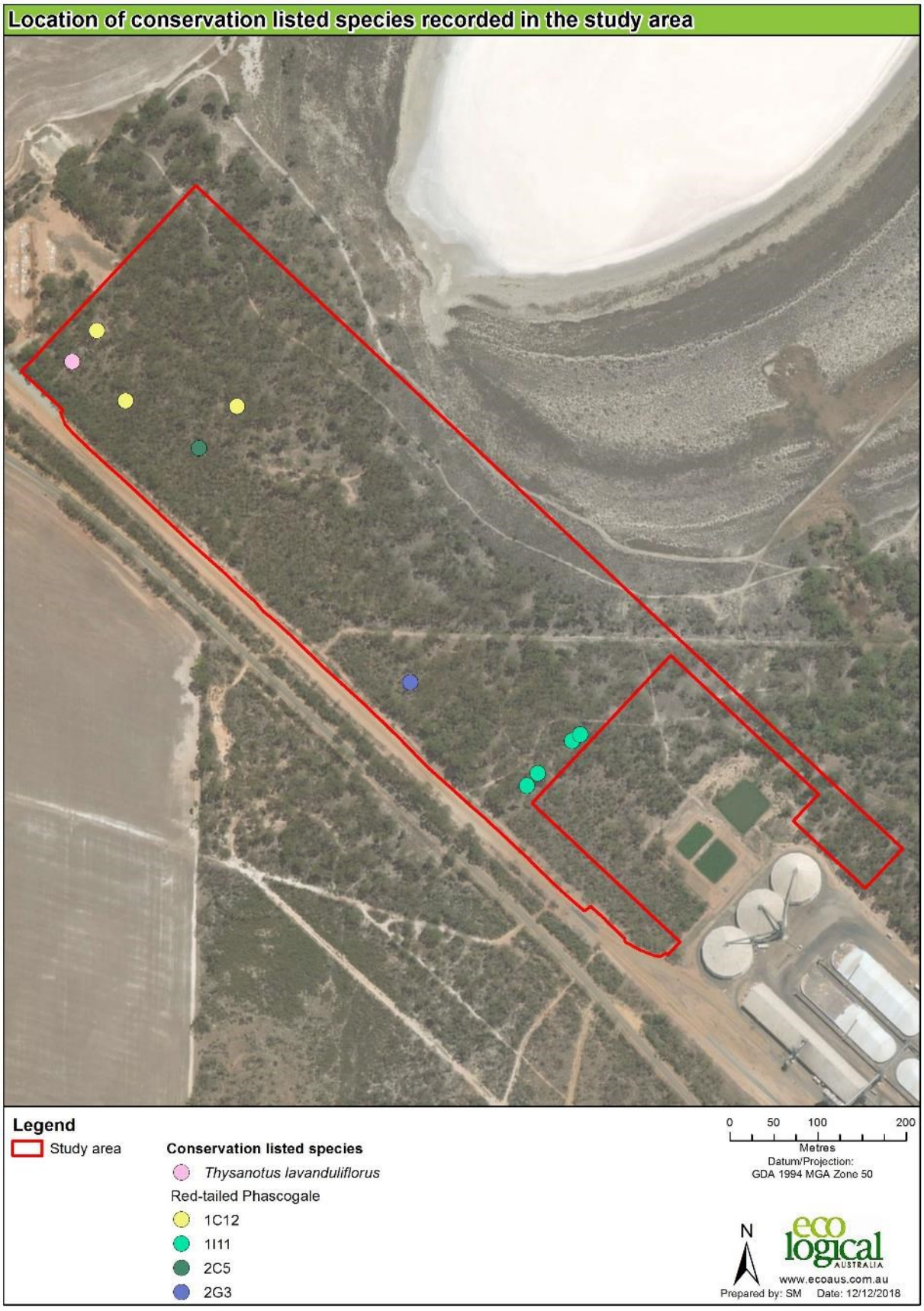

Figure 7: Location of *Thysanotus lavanduliflorus* and Red-tailed Phascogale within the study area. Red-tailed Phascogale records are presented displaying the field ID number of the animal, showing the captures over four nights.

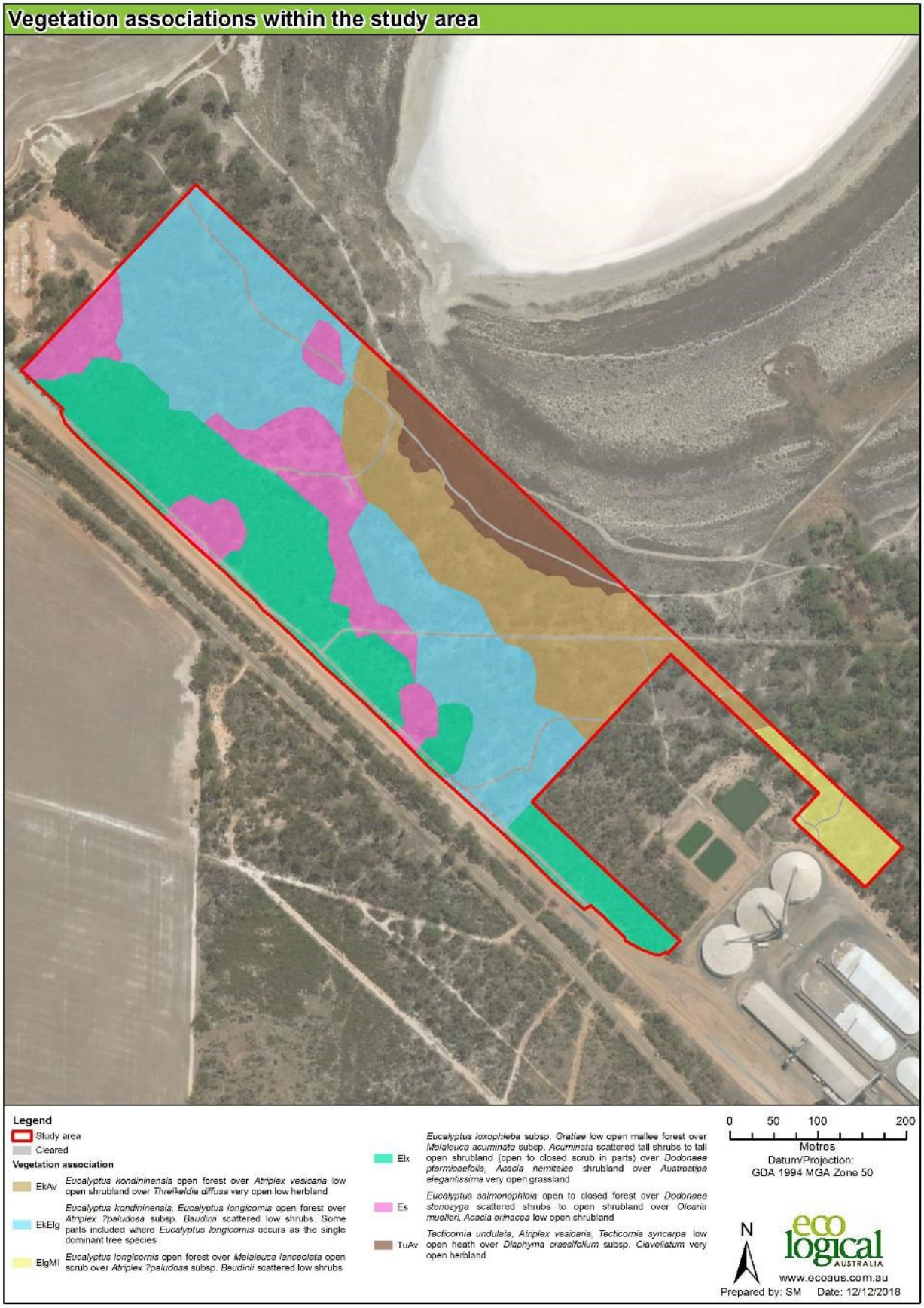

Figure 8: Vegetation associations within the study area. Adapted from 360 Environmental 2015a.

Figure 9: Vegetation condition within the study area.

Figure 10: Extent of TECs and PECs within the study area.

4.2 Fauna survey

4.2.1 Fauna overview

Fifteen species of native vertebrate fauna were recorded during current and previous fauna surveys, including two mammals, twelve birds and one reptile (**Table 11**). Three introduced mammals and two introduced birds were also recorded (Cardno 2014; 360 Environmental 2015a, b; ELA 2018a).

Table 11: Fauna species recorded in the study area.

Scientific name	Common name	Record	Source
Native species			
Anthochaera carunculata	Red Wattlebird	Heard	This survey
Corvus coronoides	Australian Raven	Direct observation	Cardno 2014, this survey
Cacatua roseicapilla	Galah	Direct observation	Cardno 2014, 360 Environmental 2015b, this survey
Hirundo neoxena	Welcome Swallow	Direct observation	This survey
Macropus fuliginosus melanops	Western Grey Kangaroo	Skeletal remains and scats	Cardno 2014, this survey
Merops ornatus	Rainbow Bee-eater	Direct observation	This survey
Neophema elegans	Elegant Parrot	Direct observation	360 Environmental 2015b
Phaps chalcoptera	Common Bronzewing	Direct observation	Cardno 2014
Phascogale calura	Red-tailed Phascogale	Direct observation (trapped)	ELA 2018a
Platycercus zonarius	Australian Ringneck Parrot	Direct observation	Cardno 2014, this survey
Sericornis frontalis	White-browed Scrub Wren	Direct observation	Cardno 2014
Smicrornis brevirostris	Weebill	Heard	This survey
Strepera versicolor	Grey Currawong	Direct observation	Cardno 2014, this survey
Tadorna tadornoides	Australian Shelduck	Direct observation	Cardno 2014
Tiliqua rugosa	Bobtail	Direct observation	This survey, Cardno 2014
Introduced species			
Dacelo novaeguineae	Kookaburra	Heard	This survey
Felis catus	Cat	Direct observation (trapped); skeletal remains, scats	ELA 2018a, Cardno 2014, this survey
Mus musculus	House Mouse	Direct observation (trapped)	ELA 2018a
Ovis aries	Sheep	Scats and tracks	Cardno 2014

Trichoglossus moluccanus	Rainbow Lorikeet	Direct observation	This survey

4.2.2 Fauna habitats

Three broad fauna habitats are present within the study area (**Figure 11**):

- *Eucalyptus* open forest (16.6 ha; 66.8% of the study area);
- *Eucalyptus* mallee over *Melaleuca* shrubland (5.7 ha; 23.1% of the study area); and
- *Tecticornia* heath (1.7 ha; 6.9% of the study area).

The remaining 0.8 ha (3.2% of the study area) is cleared, and does not provide habitat to fauna.

4.2.3 Conservation significant fauna

The Red-tailed Phascogale (listed as Vulnerable under the EPBC Act and Conservation Dependent under the WC Act) was previously trapped during a targeted field survey (ELA 2018a). This species is the only conservation listed fauna species directly observed during field studies, including the current survey (ELA 2018a; 360 Environmental 2015b; Cardno 2014).

A likelihood of occurrence assessment for other conservation listed fauna species was undertaken (**Appendix F**). Two species were assessed as likely to occur within the study area:

- Carnaby's Black Cockatoo, *Calyptorhynchus latirostris* (listed as Endangered under the EPBC Act and the WC Act); and
- Western Rosella (inland), *Platycercus icterotis xanthogenys* (listed as Priority 4 by DBCA).

A further ten species were considered to potentially occur, with six of these species considered to be vagrant birds that may occasionally visit the study area:

- Bradshaw's bothriembryontid land snail (Tambellup), *Bothriembryon bradshawi* (listed as Priority 3 by DBCA);
- Western Brush Wallaby, *Notamacropus irma* (listed as Priority 4 by DBCA);
- Western Whipbird (western mallee), *Psophodes nigrogularis oberon* (listed as Priority 4 by DBCA);
- Malleefowl, *Leipoa ocellata*, (listed as Vulnerable under the EPBC Act and WC Act);
- Peregrine Falcon, *Falco peregrinus* (listed as Other Specially Protected Fauna under the WC Act) – vagrant;
- Fork-tailed Swift, *Apus pacificus* (listed as Migratory under the EPBC Act and WC Act) – vagrant;
- Red-necked Stint, *Calidris ruficollis* (listed as Migratory under the EPBC Act and WC Act) – vagrant;
- Sharp-tailed Sandpiper, *Calidris acuminata* (listed as Migratory under the EPBC Act and WC Act) – vagrant;
- Common Greenshank, *Tringa nebularia* (listed as Migratory under the EPBC Act and WC Act) – vagrant; and
- Hooded Plover, *Thinornis rubricollis* (listed as Priority 4 by DBCA) – vagrant.

Figure 11: Fauna habitats within the study area.

5 Discussion

5.1 Flora

A total of 178 taxa (including species, subspecies, varieties and forms, and specimens not identified to species level) from 111 genera and 42 families were recorded from quadrats, relevés and opportunistic collections in the study area during the current and previous surveys (360 Environmental 2015a; Cardno 2014). The ELA and 360 Environmental (2015a) quadrat species richness ranged from 7 to 35 taxa with an average of 17.2 taxa per quadrat. A species accumulation curve was used to evaluate the adequacy of sampling, using a combined ELA/360 Environmental (2015a) dataset. Using this analysis, the incidence-based coverage estimator of species richness was calculated to be 143.8; based on this value, and the total of 102 species recorded within quadrats only, approximately 71% of the flora species potentially present within the study area were recorded. However, when data from relevés (Cardno 2014; 360 Environmental 2015a), weeds and opportunistic sightings is included, the taxa records rise to 175 (includes taxa not identified to species level), exceeding the species richness estimator value of 143.8. Therefore, the level of sampling conducted over the three surveys is considered appropriate.

Woodland Watch was a collaborative project involving WWF Australia and the WAM. The objective of the project was to carry out floristic surveys of selected remnant eucalypt woodlands (and other priority under-represented vegetation types) on private farmlands of the Avon Wheatbelt and Western Mallee Bioregions. The Woodland Watch survey recorded seven sites within the vicinity of Newdegate (WAH 2007, 2009a, b). The species richness for these quadrats ranged from 8-29 (mean of 16 taxa). This is similar to the species richness recorded in the quadrats in the study area; indicating that the species richness of the study area contains a comparable flora diversity to nearby eucalypt woodland communities.

The early November timing of the current survey is in line with the recommenced EPA guidance (EPA 2016a, 2016b); the survey was also planned to account for the November/December flowering period of the Priority 1 species *Thysanotus lavanduliflorus*. While lower than average rainfall (particularly in September; BoM 2018b) meant the timing was sub-optimal for the identification of many annual flora species, as the survey was specifically designed as a supplementary survey to satisfy gaps associated with previous ecological surveys, the absence of annuals was not considered a significant limitation as a high number of annual species were recorded in the September 2015 survey (360 Environmental 2015a).

A likelihood of occurrence assessment was undertaken as part of the previous flora and vegetation assessment completed at the site in 2015 (360 Environmental 2015a). Following the field survey, one species (*Thysanotus lavanduliflorus*) was considered likely to occur, and a further nine species were considered to potentially occur (360 Environmental 2015a). The remaining 35 species were considered unlikely to be present in the study area. The likelihood of occurrence assessment was updated as part of the current survey for new taxa, identified utilising up-to-date database searches. The likelihood of occurrence assessment was not repeated for species considered unlikely to occur by 360 Environmental (2015a).

Priority 1 species *Thysanotus lavanduliflorus* was recorded in the study area during the current survey. This species is a caespitose perennial herb with tuberous roots that grows to 0.25 m in height. It produces purple flowers in November and December and is found in sand/sandy loam soils in the Lake Grace area (WAH 1998-2018). There are four previous records within 20 km of the study area (DBCA 2018b), which recorded the individuals in November/December in similar habitat, where specified (Eucalypt woodland and/or mallee on sandy loam).

The updated likelihood of occurrence assessment determined *Haegiela tatei* (listed as Priority 4 by DBCA) has the potential to occur within the study area. *Haegiela tatei* is an ascending to erect annual herb that grows approximately 2-8 cm high (WAH 1998-2018). The closest record is 17 km from the study area. While the flowering period for this species is August to November, given the dry site conditions in early November 2018 and its small stature, this cryptic species could have been overlooked during the field surveys. This species is found on clay, sandy loam and gypsum soils in saline habitats. The vegetation association TuAv adjacent to Lake Stubbs could contain 1.7 ha of suitable habitat; thus this species is considered to have the potential to occur within the study area.

The remaining taxa were considered unlikely to occur within the study area; with the exception of *Haegiela tatei*, the 14 additional conservation listed flora species identified in the database assessment that were not previously assessed by 360 Environmental (2015a) were perennial species and would have been visible despite the dry site conditions. Previous surveys at the site (Cardno 2014; 360 Environmental (2015a), also failed to observe these species. The nine taxa that were considered to have potential to occur in the study area by 360 Environmental (2015a), were also downgraded to unlikely to occur following the recent field survey, following the same reasoning.

5.2 Vegetation and communities

Following statistical analysis, the eight additional quadrats undertaken as part of the current survey in line with current guidance (EPA 2016a) were found to correlate with the six existing vegetation communities originally mapped within the study area (360 Environmental 2015a). With the exception of the restricted vegetation association ElgMl, which contained had one relevé (360 Environmental 2015a) and two ELA quadrats, all vegetation associations contained at least three quadrats.

Vegetation condition within the study area was also updated, and was found to roughly align with the previous condition mapping (360 Environmental 2015a), with some minor differences. The majority of the study area remains in Very Good condition. The vegetation association mapping remained consistent with 360 Environmental (2015a), with the exception of the ‘completely degraded’ area of vegetation mapped in the south-eastern corner around a drain. This area was previously considered not to align with a mapped vegetation association (and therefore was not considered ‘vegetation’), however, based on the results of the current survey, this area has remained in ‘completely degraded’ condition, however was assessed to contain enough structure and composition to be considered part of vegetation association ElgMl.

Disturbances within the project area include the clearing of vegetation for tracks, the presence of introduced (feral) fauna species and dumping of rubbish (cars, bottles etc.). A total of 18% of flora taxa recorded were weed species (32 taxa in total), including three taxa not identified to species level. None of these species are listed as WONS or Declared under the BAM Act. Quadrats within vegetation associations EkLg (10 taxa) and TuAv (8 taxa) recorded the highest weed diversity.

The Eucalypt woodlands of the Western Australian Wheatbelt community TEC/PEC was previously mapped in the study area (360 Environmental 2015a); however, an assessment utilising the key diagnostic characteristics of the TEC (DoE 2015) had not been previously completed. This assessment was undertaken as part of the current study, and determined 16.6 ha of this TEC occurred within the study area (and subsequently the State-listed PEC), aligned with the mapped occurrences of vegetation associations EkAv, EkElg, ElgMl and Es.

The patch of the TEC present within the study area was classified (DoE 2015) as ‘Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014)’. While areas of vegetation mapped as Good, Degraded and Completely Degraded occur

within vegetation associations ElgMl and Es, weed species were below 30% cover in all quadrats, so Category A was still considered appropriate.

A small area of Es (0.4 ha), while isolated from the rest of the mapped area of the TEC within the study area by vegetation association Elx, was classified as part of the same patch, as patches are defined (DoE 2015) as '…a discrete and mostly continuous area of the ecological community. A patch may include small-scale variations and disturbances, such as tracks or breaks, watercourses/drainage lines or localised changes in vegetation that do not act as a permanent barrier or significantly alter its overall functionality.'

A total of 8.8 ha of the Red Morrel Woodlands of the Wheatbelt PEC (Priority 1), which can co-occur with the Eucalypt woodlands of the Western Australian Wheatbelt TEC/PEC, was also mapped within the study area.

5.3 Fauna

Three broad fauna habitats were mapped within the study area, with the most common habitat *Eucalyptus* open forest (66.8% of the study area). There were also smaller occurrences of *Eucalyptus* mallee over *Melaleuca* shrubland (23.1% of the study area) and *Tecticornia* heath adjacent to Lake Stubbs (6.9% of the study area).

During current and previous fauna surveys (Cardno 2014; 360 Environmental 2015b, ELA 2018a), 15 species of native vertebrate fauna were recorded, including two mammals, twelve birds and one reptiles. Three introduced mammals and two introduced birds were also recorded. One previous conservation listed fauna species, the Red-tailed Phascogale, was previously observed during a targeted field survey in June 2018 (ELA 2018a), where four individuals were trapped. A likelihood of occurrence assessment for other conservation listed fauna species determined that two species were assessed as likely to occur within the study area, Carnaby's Black Cockatoo and Western Rosella (inland). This was on the basis of suitable habitat and nearby records; in the case of the Western Rosella closest record was less than 1 km from the study area. A Carnaby's Black Cockatoo assessment has previously been undertaken on site (360 Environmental 2015b), and mapped 22.5 ha of foraging habitat and 1.5 ha of potential breeding habitat (contained within the mapped foraging habitat; areas altered to account for slight changes in the study area and the removal of cleared areas). A total of 92 potential breeding trees, predominantly Salmon Gum, were recorded, with 31 hollows observed that were potentially suitable to be used for Black Cockatoo nesting (360 Environmental 2015b).

A further ten conservation listed fauna species were considered to potentially occur, with six of these species considered to be vagrant birds that may occasionally fly over the study area or visit the area to forage. Four of these vagrant species are associated with salt lakes, and are likely to only utilise the 1.7 ha of *Tecticornia* heath habitat present within the study area. While the targeted Malleefowl assessment failed to find evidence of this species (e.g. sightings of individuals, mounds or prints), given the proximity and number of nearby records (23 records within 10 km, within the closest non-historical record 1.1 km away) and the mobile nature of this species, it is possible that this species could occasionally utilise the study area for foraging purposes. No species were considered to rely solely on the habitats present in the study area for survival.

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Appendix A ELA Floristic quadrat data

Site name and number	Date	Site type	Observer
ELA1	05/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Very Good	Weeds	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Sandy loam	Brown	60	20
Latitude		Longitude	
-33.082529 ºS		119.012831 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Acacia erinacea	1	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Acacia hemiteles		3 (1-2m)	Shrub, cycad, grass-tree, tree-fern (M)
Austrostipa elegantissima		1 (<0.5 m)	Other grass (G)
Crassula colorata		1 (<0.5 m)	Forb (G)
Dodonaea stenozyga		3 (1-2m)	Shrub, cycad, grass-tree, tree-fern (M)
Enchylaena tomentosa		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eucalyptus salmonophloia	10	7 (10-30)	Tree, palm (U)
Eucalyptus loxophleba subsp. *gratiae*		6 (<10)	Tree, palm (U)
Olearia muelleri	2	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)

**Raphanus raphanistrum*		1 (<0.5 m)	Forb (G)
Rhagodia drummondii		1 (<0.5 m)	Chenopod shrub (M)
Rhagodia preissii subsp. *preissii*		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Rytidosperma acerosum		1 (<0.5 m)	Other grass (G)
Sclerolaena diacantha		1 (<0.5 m)	Forb (G)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
Templetonia rossii		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Thysanotus lavanduliflorus		1 (<0.5 m)	Forb (G)

Site name and number	Date	Site type	Observer
ELA2	05/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Very Good	Weeds	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Sandy loam	Dark brown	90	0
Latitude		Longitude	
-33.085214 ºS		119.016726 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Austrostipa elegantissima		1 (<0.5 m)	Other grass (G)
Austrostipa trichophylla		1 (<0.5 m)	Other grass (G)
**Avena barbata*		1 (<0.5 m)	Other grass (G)
Calandrinia sp.		1 (<0.5 m)	Forb (G)
Enchylaena tomentosa	0.1	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eucalyptus kondininensis	15	7 (10-30)	Tree, palm (U)
Eucalyptus longicornis	30	7 (10-30)	Tree, palm (U)
Eucalyptus loxophleba subsp. *gratiae*		6 (<10)	Tree, palm (U)
Lepidium rotundum		1 (<0.5 m)	Forb (G)
**Lolium rigidum*		1 (<0.5 m)	Other grass (G)
**Pentameris airoides*		1 (<0.5 m)	Forb (G)
Pittosporum angustifolium		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)

**Raphanus raphanistrum*		1 (<0.5 m)	Forb (G)
Rhagodia drummondii		1 (<0.5 m)	Chenopod shrub (M)
Rhagodia drummondii		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
Senna artemisioides subsp. *filifolia*		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
**Sonchus oleraceus*		1 (<0.5 m)	Forb (G)
Templetonia rossii		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
**Trifolium* sp.		1 (<0.5 m)	Forb (G)
**Ursinia anthemoides*		1 (<0.5 m)	Forb (G)

Site name and number	Date	Site type	Observer
ELA3	05/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Very Good	Weeds	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Sandy loam	Dark brown	90	0
Latitude		Longitude	
-33.083502 ºS		119.016065 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
**Cirsium vulgare*		1 (<0.5 m)	Forb (G)
Atriplex vesicaria	40	2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Austrostipa elegantissima		1 (<0.5 m)	Other grass (G)
Eucalyptus kondininensis	30	7 (10-30)	Tree, palm (U)
Exocarpos aphyllus		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Lepidium rotundum		1 (<0.5 m)	Forb (G)
Rhagodia drummondii		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Rytidosperma acerosum		2 (0.5-1 m)	Sedge (G)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
**Sonchus oleraceus*		1 (<0.5 m)	Forb (G)
Templetonia rossii		1 (<0.5 m)	Forb (G)
Threlkeldia diffusa		1 (<0.5 m)	Chenopod shrub (M)

Thysanotus patersonii		1 (<0.5 m)	Forb (G)
**Vulpia* sp.		1 (<0.5 m)	Other grass (G)

Site name and number	Date	Site type	Observer
ELA4	06/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Very Good	Edge effects	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Clay loam	Light brown /orange	20	50
Latitude		Longitude	
-33.088065 ºS		119.019277 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Acacia erinacea	2	2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Acacia hemiteles		2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Alyxia buxifolia	0.5	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Arthropodium curvipes		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Austrostipa elegantissima		1 (<0.5 m)	Other grass (G)
Cryptandra wilsonii		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eremophila decipiens subsp. *decipiens*		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eucalyptus loxophleba subsp. *gratiae*	2	6 (<10)	Tree mallee (U)
Melaleuca acuminata subsp. *acuminata*	30	6 (<10)	Shrub, cycad, grass-tree, tree-fern (M)

Melaleuca scalena	1	3 (1-2m)	Shrub, cycad, grass-tree, tree-fern (M)
Olearia muelleri	5	2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Ptilotus spathulatus		1 (<0.5 m)	Forb (G)
Rhagodia drummondii		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Rytidosperma acerosum		1 (<0.5 m)	Other grass (G)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
Thysanotus patersonii		1 (<0.5 m)	Forb (G)

Site name and number	Date	Site type	Observer
ELA5	06/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Good	Clearing/edge effects	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Loam	Dark brown	80	2
Latitude		Longitude	
-33.087472 ºS		119.022244 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Atriplex paludosa subsp. *baudinii*	10	2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eucalyptus longicornis	5	6 (<10)	Tree, palm (U)
Maireana suaedifolia		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Melaleuca lanceolata	5	6 (<10)	Shrub, cycad, grass-tree, tree-fern (M)
Rhagodia crassifolia		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
Threlkeldia diffusa	0.1	1 (<0.5 m)	Chenopod shrub (M)

Site name and number	Date	Site type	Observer
ELA6	06/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Very Good	Tracks nearby	Old (>20 years)	Clay plain
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Clay loam	Grey	1	5
Latitude		Longitude	
-33.084888 ºS		119.018775 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Atriplex vesicaria	0.5	1 (<0.5 m)	Chenopod shrub (M)
Brachyscome eyrensis		1 (<0.5 m)	Forb (G)
**Cotula bipinnata*		1 (<0.5 m)	Forb (G)
Crassula colorata		1 (<0.5 m)	Forb (G)
Disphyma crassifolium subsp. *clavellatum*	5	2 (0.5-1 m)	Chenopod shrub (M)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
**Sonchus oleraceus*		2 (0.5-1 m)	Forb (G)
Tecticornia indica subsp. *bidens*	1	1 (<0.5 m)	Samphire shrub (M)
Tecticornia syncarpa	5	1 (<0.5 m)	Samphire shrub (M)
Tecticornia undulata	30	2 (0.5-1 m)	Samphire shrub (M)

Site name and number	Date	Site type	Observer
ELA7	06/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Good	Clearing	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Clay loam	Brown	10	50
Latitude		Longitude	
-33.087058 ºS		119.021753 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Atriplex paludosa subsp. *baudinii*	5	2 (0.5-1 m)	Shrub, cycad, grass-tree, tree-fern (M)
Enchylaena tomentosa	0.5	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eucalyptus longicornis	30	6 (<10)	Tree, palm (U)
Melaleuca lanceolata	15	6 (<10)	Shrub, cycad, grass-tree, tree-fern (M)
Rhagodia crassifolia	3	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)
Threlkeldia diffusa	1	1 (<0.5 m)	Chenopod shrub (M)

Site name and number	Date	Site type	Observer
ELA8	06/11/2018	10 x 10 m understory 20 x 20 m overstory	SD & JM
Condition	Disturbance	Fire history - years	Landscape type
Very Good	-	Old (>20 years)	Flat
Soil type	Soil colour	Leaf litter cover (%)	Bare ground cover (%)
Sandy loam	Brown	90	0
Latitude		Longitude	
-33.082913 ºS		119.014036 ºE	

Species	Cover (%)	Height Class	Stratum (U=Upper, M=Middle, G=Ground)
Atriplex paludosa subsp. *baudinii*	1	2 (0.5-1 m)	Chenopod shrub (M)
Austrostipa exilis		1 (<0.5 m)	Other grass (G)
Calandrinia sp.		1 (<0.5 m)	Forb (G)
Disphyma crassifolium subsp. *clavellatum*		1 (<0.5 m)	Forb (G)
Enchylaena tomentosa	0.5	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Eucalyptus kondininensis	5	7 (10-30)	Tree, palm (U)
Eucalyptus longicornis	10	7 (10-30)	Tree, palm (U)
Olearia muelleri	0.5	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Rhagodia drummondii		1 (<0.5 m)	Chenopod shrub (M)
Rhagodia drummondii	1	1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Rhagodia preissii subsp. *preissii*		1 (<0.5 m)	Shrub, cycad, grass-tree, tree-fern (M)
Rytidosperma acerosum		1 (<0.5 m)	Other grass (G)
Sclerolaena diacantha		1 (<0.5 m)	Chenopod shrub (M)

Appendix B Flora taxa by quadrat matrix

Quadrat data from this survey (quadrats 'ELA') and 360 Environmental (2015a; quadrats 'NG').

Taxa	ELA1	ELA2	ELA3	ELA4	ELA5	ELA6	ELA7	ELA8	NG01	NG02	NG03	NG04	NG05	NG06	NG07	NG08	NG09	NG10
Acacia erinacea	1	0	0	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0
Acacia hemiteles	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Acacia merrallii	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Alyxia buxifolia	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropodium curvipes	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Asteridea athrixioides	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Atriplex paludosa subsp. *baudinii*	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1
Atriplex vesicaria	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0
Austrostipa acrociliata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Austrostipa elegantissima	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	1	0
Austrostipa exilis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Austrostipa sp.	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0
Austrostipa trichophylla	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
**Avena barbata*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brachyscome eyrensis	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
**Brassica napus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
**Bromus rubens*	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Caladenia dimidia	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Caladenia hirta subsp. *rosea*	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Calandrinia sp.	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
Calotis hispidula	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Cassytha melantha	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Chenopodiaceae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chenopodium desertorum subsp. *desertorum*	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
**Cirsium vulgare*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Comesperma integerrimum	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

Taxa	ELA1	ELA2	ELA3	ELA4	ELA5	ELA6	ELA7	ELA8	NG01	NG02	NG03	NG04	NG05	NG06	NG07	NG08	NG09	NG10
Corunastylis fuscoviridis	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1
Cotula bipinnata	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
Crassula colorata	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0
Crassula colorata var. *acuminata*	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Cryptandra wilsonii	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Daucus glochidiatus	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
Disphyma crassifolium subsp. clavellatum	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	1	1	0
Dodonaea ptarmicaefolia	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Dodonaea stenozyga	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Drosera bulbosa	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Enchylaena tomentosa	1	1	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0
Eremophila decipiens subsp. *decipiens*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Ericksonella saccharata	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Eriochilus dilatatus subsp. *undulatus*	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Erymophyllum tenellum	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Eucalyptus kondininensis	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1
Eucalyptus longicornis	0	1	0	0	1	0	1	1	1	0	0	1	0	0	0	0	0	1
Eucalyptus loxophleba subsp. *gratiae*	1	1	0	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0
Eucalyptus salmonophloia	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Exocarpos aphyllus	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Goodenia berardiana	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
**Hypochaeris glabra*	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0
Lawrencia squamata	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Lepidium rotundum	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	1	1	0
**Lolium rigidum*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
**Lysimachia arvensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Taxa	ELA1	ELA2	ELA3	ELA4	ELA5	ELA6	ELA7	ELA8	NG01	NG02	NG03	NG04	NG05	NG06	NG07	NG08	NG09	NG10
Maireana enchylaenoides	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Maireana erioclada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Maireana marginata	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
Maireana suaedifolia	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Melaleuca acuminata subsp. *acuminata*	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Melaleuca lanceolata	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Melaleuca thyoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Melaleuca scalena	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Olearia muelleri	1	0	0	1	0	0	0	1	1	0	1	1	1	0	0	0	0	1
Omphalolappula concava	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Oxalis perennans	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Pelargonium havlasae	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Pentameris airoides	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pittosporum angustifolium	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Plantago debilis	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Poaceae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Pterostylis mutica	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1
Pterostylis scabra	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Ptilotus holosericeus	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Ptilotus spathulatus	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0
**Raphanus raphanistrum*	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhagodia crassifolia	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1
Rhagodia drummondii	1	1	1	1	0	0	0	1	1	0	1	0	1	0	0	0	0	1
Rhagodia preissii subsp. *preissii*	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Roepera glauca	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
Rytidosperma acerosum	1	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0
Sclerolaena diacantha	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1

Taxa	ELA1	ELA2	ELA3	ELA4	ELA5	ELA6	ELA7	ELA8	NG01	NG02	NG03	NG04	NG05	NG06	NG07	NG08	NG09	NG10
Senecio glomeratus	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Senecio glossanthus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
Senna artemisioides subsp. *filifolia*	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Senna sp. Pallinup River (J.W. Green 4847)	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
**Sonchus oleraceus*	0	1	1	0	0	1	0	0	1	0	1	0	0	1	1	1	0	0
Stellaria filiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Stenopetalum lineare var. *lineare*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Tecticornia indica subsp. *bidens*	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Tecticornia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Tecticornia syncarpa	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0
Tecticornia undulata	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
Templetonia rossii	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1
Thelymitra graminea	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Threlkeldia diffusa	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0
Thysanotus patersonii	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0
Thysanotus lavanduliflorus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trachymene pilosa	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
**Trifolium* sp. 1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
**Trifolium* sp. 2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Trymalium myrtillus subsp. *myrtillus*	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
**Ursinia anthemoides*	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
**Vulpia* sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waitzia suaveolens var. *suaveolens*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total number of taxa	**16**	**20**	**14**	**16**	**7**	**10**	**7**	**12**	**28**	**35**	**35**	**14**	**18**	**17**	**11**	**18**	**19**	**12**

Appendix C Flora species list

Family	Known name
	Indeterminant sp.
Aizoaceae	*Carpobrotus modestus*
	Disphyma crassifolium subsp. *clavellatum*
	**Mesembryanthemum nodiflorum*
Amaranthaceae	*Ptilotus holosericeus*
	Ptilotus spathulatus
Apiaceae	*Daucus glochidiatus*
Apocynaceae	*Alyxia buxifolia*
Araliaceae	*Hydrocotyle pilifera* var. *glabrata*
	Trachymene ornata
	Trachymene pilosa
Asparagaceae	*Arthropodium curvipes*
	Lomandra effusa
	Thysanotus manglesianus
	Thysanotus patersonii
	Thysanotus lavanduliflorus
Asteraceae	**Arctotheca calendula*
	Asteraceae sp.
	Asteridea athrixioides
	Blennospora drummondii
	Blennospora phlegmatocarpa
	Brachyscome ciliaris
	Brachyscome eyrensis
	Brachyscome perpusilla
	Calotis hispidula
	**Cirsium vulgare*
	**Conyza bonariensis*
	**Cotula bipinnata*
	Erymophyllum tenellum

	Helichrysum leucopsideum
	Helichrysum luteoalbum
	Hyalosperma glutinosum
	**Hypochaeris glabra*
	Millotia myosotidifolia
	**Monoculus monstrosus*
	Olearia muelleri
	Olearia subspicata
	Pogonolepis sp.
	Rhodanthe heterantha
	Rhodanthe pygmaea
	Senecio glomeratus
	Senecio glossanthus
	Siloxerus humifusus
	**Sonchus oleraceus*
	**Ursinia anthemoides*
	Waitzia suaveolens var. *suaveolens*
Boraginaceae	*Omphalolappula concava*
Brassicaceae	**Brassica napus*
	**Brassica tournefortii*
	Lepidium rotundum
	Lepidium sp.
	**Raphanus raphanistrum*
	Stenopetalum lineare var. *lineare*
Caryophyllaceae	*Stellaria filiformis*
Chenopodiaceae	*Atriplex bunburyana*
	Atriplex cinerea
	Atriplex paludosa subsp. baudinii
	Atriplex vesicaria
	Chenopodiaceae sp.
	Chenopodium desertorum subsp. *desertorum*
	Enchylaena tomentosa
	Enchylaena lanata

	Maireana enchylaenoides
	Maireana erioclada
	Maireana marginata
	Maireana suaedifolia
	Maireana trichoptera
	Rhagodia crassifolia
	Rhagodia drummondii
	Rhagodia preissii subsp. *preissii*
	Sclerolaena diacantha
	Tecticornia indica subsp. *bidens*
	Tecticornia pergranulata subsp. *pergranulata*
	Tecticornia sp.
	Tecticornia syncarpa
	Tecticornia undulata
	Threlkeldia diffusa
Colchicaceae	*Wurmbea tenella*
Convolvulaceae	*Wilsonia rotundifolia*
Crassulaceae	*Crassula colorata*
	Crassula colorata var. *acuminata*
Cyperaceae	*Lepidosperma diurnum*
	Lepidosperma drummondii
Droseraceae	*Drosera bulbosa*
Fabaceae	*Acacia acanthoclada* subsp. *acanthoclada*
	Acacia erinacea
	Acacia hemiteles
	Acacia leptospermoides subsp. *leptospermoides*
	Acacia merrallii
	Daviesia scoparia
	Senna artemisioides subsp. *filifolia*
	Senna sp. Pallinup River (J.W. Green 4847)
	Templetonia rossii
	**Trifolium* sp. 1
	**Trifolium* sp. 2

	**Trifolium hirtum*
	**Trifolium tomentosum* var. *tomentosum*
Geraniaceae	**Erodium cicutarium*
	Erodium cygnorum
	Dianella revoluta
	Pelargonium havlasae
Goodeniaceae	*Coopernookia strophiolata*
	Dampiera lavandulacea
	Goodenia berardiana
	Goodenia pusilliflora
	Scaevola spinescens
Hypoxidaceae	*Pauridia glabella*
Lamiaceae	**Salvia verbenaca*
	Teucrium sessiliflorum
	Westringia cephalantha
	Westringia rigida
Lauraceae	*Cassytha melantha*
Malvaceae	*Lawrencia squamata*
Myrtaceae	*Eucalyptus kondininensis*
	Eucalyptus longicornis
	Eucalyptus loxophleba subsp. *gratiae*
	Eucalyptus salmonophloia
	Eucalyptus salubris
	Melaleuca acuminata subsp. *acuminata*
	Melaleuca adnata
	Melaleuca lanceolata
	Melaleuca lateriflora
	Melaleuca pauperiflora subsp. *pauperiflora*
	Melaleuca scalena
	Melaleuca sp.
	Melaleuca thyoides
Orchidaceae	*Caladenia dimidia*
	Caladenia hirta subsp. *rosea*

	Corunastylis fuscoviridis
	Ericksonella saccharata
	Eriochilus dilatatus subsp. *undulatus*
	Pterostylis mutica
	Pterostylis scabra
	Thelymitra graminea
Oxalidaceae	*Oxalis perennans*
	**Oxalis pes-caprae*
	Prasophyllum gracile
	Pterostylis picta
	Thelymitra macrophylla
Parmeliaceae	*Xanthoparmelia semiviridis*
Pittosporaceae	*Pittosporum angustifolium*
Plantaginaceae	*Plantago debilis*
	**Plantago coronopus* subsp. *commutata*
Poaceae	*Austrostipa acrociliata*
	Austrostipa elegantissima
	Austrostipa exilis
	Austrostipa pycnostachya
	Austrostipa sp.
	Austrostipa trichophylla
	**Avena barbata*
	**Bromus rubens*
	**Cenchrus clandestinus*
	**Ehrharta longiflora*
	**Hordeum leporinum*
	**Lolium rigidum*
	Neurachne alopecuroidea
	**Pentameris airoides*
	Poaceae sp.
	Rytidosperma acerosum
	**Triticum aestivum*
	**Vulpia myuros forma myuros*

	**Vulpia* sp.
Polygalaceae	*Comesperma integerrimum*
	**Rumex crispus*
Portulacaceae	*Calandrinia* sp.
	Calandrinia calyptrata
Primulaceae	**Lysimachia arvensis*
Rhamnaceae	*Cryptandra minutifolia* subsp. *minutifolia*
	Cryptandra nutans
	Cryptandra wilsonii
	Trymalium myrtillus subsp. *myrtillus*
Rutaceae	*Microcybe multiflora* subsp. *multiflora*
Santalaceae	*Exocarpos aphyllus*
	Santalum acuminatum
Sapindaceae	*Dodonaea ptarmicaefolia*
	Dodonaea stenozyga
Scrophulariaceae	*Eremophila decipiens* subsp. *decipiens*
	Eremophila deserti
Solanaceae	*Lycium australe*
Zygophyllaceae	*Roepera glauca*

Data from current survey, 360 Environmental (2015a) and Cardno (2014).

Appendix D Likelihood of occurrence criteria

Criteria used for likelihood of assessment

Likelihood	Criteria
Known to occur:	Recorded from the study area, through database search results and/or from previous surveys of the study area (<20 years)
Likely to occur:	The study area is within the species current distribution and contains suitable habitat for the species, however; • The species utilises seasonal habitat or has a large home range, so is not always present/visible in the study area; and/or • Survey limitations identified.
Potential to occur:	The study area is within the species current distribution and contains habitat, however (at least two of below); • The study area is located on the edge of the species range or it has a patchy distribution; and/or • Survey limitations identified; and/or • Habitat is less suitable; and/or • Species is cryptic, and/or difficult to record utilising traditional survey methods.
Potential to occur - vagrant	Species has the potential to occur on a transient, or vagrant, basis only in that: • may occasionally occur within the site; • may occasionally fly or forage over the site (aerial species only); • are unlikely to utilise the site for foraging, breeding or nesting; and • are unlikely to utilise the site on an ongoing or permanent basis.
Unlikely to occur	The study area is within the species current distribution and either: • contains habitat, was adequately surveyed (including for seasonal, migratory and cryptic species and fauna species with large home ranges) and did not record the species; or • the habitat is modified and unlikely to support the species and survey limitations identified.
Does not occur	The study area is within the species current distribution, and was adequately surveyed (including for seasonal, migratory and cryptic species and fauna species with large home ranges) and did not record the species. The study area may not contain suitable habitat. There is certainty that the species is not present in the study area.

Appendix E Flora likelihood of occurrence assessment

Scientific name	Conservation status[3]		Source[4]				Likelihood
	EPBC Act[1]	WC Act/ DBCA[2]	WAH	TPFL	NM	PMST	
Acacia auratiflora	EN	VU	X	X	X	X	**Unlikely**. The study area contained suitable habitat and the closest record is 10 km away. However, this species is a spreading shrub 0.3-1 m high, to 2 m wide, and would have been visible if present.
Acacia depressa	VU	EN	X		X		**Unlikely[5]**. Species is highly localised near Lake Grace. Laterite which is closely associated with this species is not present in the study area.
Acacia drewiana subsp. *minor*		P2	X	X	X		**Unlikely[5]**. No suitable habitat in the study area.
Acacia lanuginophylla	EN	VU	X	X	X	X	**Unlikely**. Known only from near Lake Biddy (North of Newdegate), near Lake Lockhart (c. 30 km South of Lake Biddy) and the type collection area c.120 km NE of Lake Biddy. The study area contains part of Salt Lake at the eastern boundary. While the closest record is within 13 km, this species is a dense shrub, 0.5-1.2 m high, and would have been visible if present.
Acacia leptalea	EN	VU				X	**Unlikely**. Species is confined to near Chinocup and Nyabing in the Katanning District. Closest record is approximately 60 km away.
Acacia mutabilis subsp. *stipulifera*		P3	X				**Unlikely**. Habitat is potentially suitable and the closest record is 19 km away, however this species is a shrub 0.3-1 m high and would have been visible if present.
Acacia sclerophylla var. *teretiuscula*		P1	X	X	X		**Unlikely**. Poorly collected variety known only from a few localities between Bruce Rock and Lake Grace. The study area contained suitable habitat. Shrub is 0.25-2.5 high, and would have been visible if present.

Scientific name	Conservation status[3]		Source[4]				Likelihood
	EPBC Act[1]	WC Act/ DBCA[2]	WAH	TPFL	NM	PMST	
Acacia sedifolia subsp. *pulvinata*		P3	X				**Unlikely**. No laterite hills or gravelly ridges are present in the study area. Shrub is 0.75-1.8 m high and would have been visible if present.
Acacia singula		P3	X		X		**Unlikely**[5]. No laterite or white/yellow sand is present in the study area.
Astroloma chloranthum		P2	X		X		**Unlikely**. The study area contained suitable habitat and the closest record is within 15 km. however this species is a shrub very low, spreading shrub (10 cm high and 100 cm wide) and would have been visible if present.
Astroloma sp. Dumbleyung (A.J.G. Wilson 146)		P3	X		X		**Unlikely**[5]. No laterite or granite is present in the study area.
Banksia rufa subsp. chelomacarpa		P3	X		X		**Unlikely**[5]. No gravelly soils are present in the study area
Banksia idiogenes		P2	X		X		**Unlikely**[5]. No gravelly soils are present in the study area.
Banksia xylothemelia		P3	X		X		**Unlikely**[5]. No gravelly soils are present in the study area
Bentleya spinescens		P4	X	X	X		**Unlikely**[5]. The study area contained suitable habitat with nearby records (<2 km). However, this species is a perennial herb or shrub growing between 0.05-0.2 m high, and would have been visible if present.
Caladenia hoffmanii	EN	EN				X	**Unlikely**[5]. This taxon is only found between Geraldton and Murchison River.
Calectasia obtusa		P3	X	X			**Unlikely**. Closest record is 18 km away, however no gravelly soils or laterite are present in the study area.
Calectasia pignattiana	VU	VU				X	**Unlikely**. This species is an erect shrub to 0.5 m high with stilt roots. The closest record is 32 km away. No suitable habitat (laterite) is present in the study area.

Scientific name	Conservation status[3]		Source[4]				Likelihood
	EPBC Act[1]	WC Act/ DBCA[2]	WAH	TPFL	NM	PMST	
Dampiera orchardii		P2	X	X			**Unlikely**. This species is an erect perennial herb that grows to 0.2-0.4 m high on sand. The closest record is 16 km away. This species would have been observed, if present in the study area.
Daviesia implexa		P3	X	X	X		**Unlikely**[5]. No laterite is present in the study area.
Daviesia lineata		P2	X				**Unlikely**. This species is an erect, bushy shrub, 0.6-2 m high. While potentially suitable habitat is present, this species would have been observed if located within the study area.
Daviesia uncinata		P3	X	X			**Unlikely**. This species is an intricate, many-stemmed shrub that grows between 0.2-0.7 m high. While potentially suitable habitat is present, this species would have been observed if located within the study area.
Duma horrida subsp. *abdita*	CR	EN				X	**Unlikely**[5]. Currently all known records are from the Lake Bryde system.
Eremophila serpens		P4	X				**Unlikely**. This species, while prostrate, forms large patches to 2 m wide. Suitable habitat is present adjacent to the salt lake; however this species would have been readily observed if present.
Eremophila subteretifolia	EN	CR				X	**Unlikely**[5]. Currently this species is only known from 4 populations at 3 localities in the Wheatbelt.
Eremophila veneta		P4	X	X	X		**Unlikely**[5]. The study area contained suitable habitat with nearby records (<2 km). However, this species is a spreading or straggly shrub between 0.3-1.2 m high, and would have been visible if present in the study area.
Eremophila verticillata	EN	CR		X		X	**Unlikely**[5]. Currently this species is only known from 2 populations near Lake Cobham.

Scientific name	Conservation status[3]		Source[4]				Likelihood
	EPBC Act[1]	WC Act/ DBCA[2]	WAH	TPFL	NM	PMST	
Eucalyptus microschema		P3	X				**Unlikely**. This Eucalypt is a Mallee that grows between 1.2-3 m high. It would have been observed in the study area if present.
Eucalyptus mimica subsp. *continens*		P1	X		X		**Unlikely**. The study area contains suitable habitat; however this species is a mallee or tree to 2 to 6 m high, and would have been easily observed if present.
Eucalyptus mimica subsp. *mimica*		P3	X	X	X		**Unlikely**. The study area contained suitable habitat; however this species is a mallee that grow between 3.5 to 8 m high, and would have been easily observed if present.
Eucalyptus ornata		P3	X		X		**Unlikely**[5]. No laterite is present in the study area
Fitzwillia axilliflora		P2	X		X		**Unlikely**[5]. The study area contained suitable habitat with nearby records (<2 km). However, this annual species would have been visible during the 360 Environmental (2015a) survey, if present.
Frankenia drummondii		P3	X				**Unlikely**. This prostrate shrub occurs in sand on lake edges. While suitable habitat is available, it would have been observed in the study area if present.
Gastrolobium cruciatum		P3	X	X	X		**Unlikely**[5]. No laterite or gravel is present in the study area
Gastrolobium euryphyllum		P1	X				**Unlikely**[5]. No laterite is present in the study area.
Grevillea involucrata	EN	EN	X	X	X	X	**Unlikely**[5]. No laterite is present in the study area.
Grevillea prostrata		P4	X	X	X		**Unlikely**[5]. No laterite is present in the study area
Guichenotia asteriskos		P2	X	X	X		**Unlikely**[5]. No gravelly soils are present in the study area.
Haegiela tatei		P4	X	X			**Potential**. This small annual herb occurs in saline habitats. The closest record is 17 km away. Given its small form and as it is an annual herb, it may not have been readily visible during the field survey. It was not specifically targeted by 360 Environmental (2015a).

Scientific name	Conservation status[3]		Source[4]				Likelihood
	EPBC Act[1]	WC Act/ DBCA[2]	WAH	TPFL	NM	PMST	
Hemigenia sp. Newdegate (E. Bishop 75)		P1	X				**Unlikely**. This shrub grows 0.2-0.45 m high to 0.5 m wide. It would have been visible if present in the study area.
Hydrocotyle muriculata		P1	X	X	X		**Unlikely[5]**. The study area contained suitable habitat with nearby records (<2 km). This species is a low spreading to prostrate annual herb with yellow flowers. The 360 Environmental (2015a) survey was taken after suitable winter rainfall with high number of annual species being present, which indicates that this species would visible during this survey, if present.
Jacksonia debilis		P1	X		X		**Unlikely**. The study area contained suitable habitat however there are no records in the immediate area. This shrub would have been visible if present in the study area.
Leucopogon sp. Lake Magenta (K.R. Newbey 3387)		P1	X		X		**Unlikely[5]**. No laterite is present in the study area.
Mirbelia densiflora		P3	X		X		**Unlikely[5]**. The study area contained suitable habitat with nearby records (<2km).
Olearia laciniifolia		P2	X		X		**Unlikely**. The study area contained suitable habitat. However, this species is a shrub that grows to 0.6-1.2 m high, and would have been readily visible during the surveys.
Persoonia brevirhachis		P3	X	X	X		**Unlikely[5]**. No gravelly soils are present in the study area.
Persoonia hakeiformis		P2	X		X		**Unlikely[5]**. No laterite is present in the study area.
Ricinocarpos trichophorus	EN	VU				X	**Unlikely[5]**. This species grows in Fitzgerald River National Park and north east of Esperance.
Rinzia affinis		P4	X		X		**Unlikely[5]**. No laterite is present in the study area.
Roycea pycnophylloides	EN	VU				X	**Unlikely**. The study area contains some suitable habitat along the margin of the salt lake however there are no records in the immediate vicinity; the closest record is 37

Scientific name	Conservation status[3]		Source[4]				Likelihood
	EPBC Act[1]	WC Act/ DBCA[2]	WAH	TPFL	NM	PMST	
							km from the study area. It is a perennial herb, forming densely branched, silvery mats to 1 m wide, and would have been visible if present within the study area.
Stylidium thylax		P2	X	X			**Unlikely**. This small, creeping perennial herb grows 0.04-0.08 m high, and flowers in October. Some suitable habitat is present in the study area, and the closest record is 18 km away. However, although small, this species would have been visible if present within the study area.
Synaphea bifurcata		P3	X		X		**Unlikely**. This bushy shrub grows to 0.3-0.5 m high and flowers in Sep to Nov. It would have been readily visible if present in the study area.
Synaphea cervifolia		P2	X		X		**Unlikely[5]**. No gravelly soils are present in the study area.
Tetratheca aphylla subsp. *megacarpa*	VU	VU	X	X	X	X	**Unlikely[5]**. No banded iron formation is in the study area.
Thysanotus acerosifolius		P2	X	X	X		**Unlikely[5]**. No laterite or sandplains are present in the study area.
Thysanotus lavanduliflorus		P1	X	X	X		**Known.** This species was recorded in the study area during the current survey, with a specimen positively identified by the WAH.
Tribonanthes purpurea	VU	VU	X	X	X	X	**Unlikely[5]**. No granite outcrops occur in the study area.
Verticordia integra		P4	X		X		**Unlikely[5]**. No laterite is present in the study area
Verticordia staminosa var. *cylindracea*	EN	VU				X	**Unlikely[5]**. No granite outcrops occur in the study area.
Verticordia staminosa var. *erecta*		CR	X		X		**Unlikely[5]**. No granite outcrops occur in the study area.

[1] EPBC Act = Environment Protection and Biodiversity Conservation Act 1999 List of Threatened Flora

[2] WC Act = Wildlife Conservation Act 1950 Threatened Flora (Rare Flora)

[3] Conservation codes:

CR = listed as Critically Endangered under the EPBC Act.

EN = listed as Endangered under the EPBC Act.

VU = listed as Vulnerable under the EPBC Act.

CR = Flora that is rare or is likely to become extinct as critically endangered flora

EN = Flora that is rare or likely to become extinct as endangered flora

VU = Flora that are considered likely to become extinct or rare, as vulnerable flora.

P1 = Species that are known from one or a few locations (generally five or less) which are potentially at risk.

P2 = Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation.

P3 = Priority 3: Poorly known species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat.

P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring but not currently threatened; could become threatened if present circumstances change. Listed by DBCA.

[4] WAM = Western Australian Herbarium Specimen database

TPFL = DBCA Threatened (Declared Rare) and Priority Flora database

NM = NatureMap database search (Parks and Wildlife 2007 - 2018)

PMST = EPBC Act Protected Matters Report (DoEE 2018b)

[5] Indicates the likelihood of occurrence assessment was completed by 360 Environmental (2015a), and was not altered for the purpose of this current assessment.

Appendix F Fauna likelihood of occurrence assessment

Scientific name	Common name	Conservation status[3]		Source[4]			Likelihood
		EPBC Act[1]	WC Act/ DBCA[2]	DBCA	NM	PMST	
Apus pacificus	Fork-Tailed Swift	M	IA			X	**Potential - vagrant**. The closest record is 80 km away. This aerial forager has a wide distribution and may occasionally fly over the study area.
Actitis hypoleucos	Common Sandpiper	M	IA			X	**Unlikely.** Suitable habitat is not present. This species forages in shallow water and bare soft mud at the edges of wetlands and lakes.
Bettongia penicillata ogilbyi	Woylie, Brush-Tailed Bettong	EN	CR	X	X	X	**Does not occur**. This species is regionally extinct.
Botaurus poiciloptilus	Australasian Bittern	EN	EN	X	X		**Unlikely.** Suitable habitat is not present. This species occurs in permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds.
Bothriembryon bradshawi	Bradshaw's Bothriembryontid Land Snail (Tambellup)		P3	X			**Potential.** Closest record is 42 km from the study area. Suitable habitat is unknown. It is likely this species is understudied and records do not reflect its true distribution. Conservatively listed as potentially occurring due to the lack of data.
Calidris acuminata	Sharp-Tailed Sandpiper	M	IA	X	X	X	**Potential - vagrant.** The closest record is 35 km away. This migratory species occurs on muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. It may occasionally forage in the study area.
Calidris ferruginea	Curlew Sandpiper	CR/M	CR/IA			X	**Unlikely**. The closest record is 60 km away, and there are very few records in the region. This species mainly occurs on intertidal

Scientific name	Common name	Conservation status[3]		Source[4]			Likelihood
		EPBC Act[1]	WC Act/ DBCA[2]	DBCA	NM	PMST	
							mudflats in sheltered coastal areas. While they are also recorded inland, in both fresh and brackish waters. They forage on mudflats and nearby shallow water. The habitat present within the study area is unlikely to be suitable for this species.
Calidris melanotos	Pectoral Sandpiper	M	IA			X	**Unlikely**. The closest record is 128 km away, and this species is rarely recorded in WA. It occurs in shallow fresh to saline wetlands, usually near coastal habitat but occasionally found further inland. They forage in shallow water or soft mud at the edge of wetlands. The habitat present within the study area is unlikely to be suitable for this species.
Calidris ruficollis	Red-Necked Stint	M	IA	X	X		**Potential - vagrant**. The closest record is 1.2 km from the study area, in Lake Burkett. This migratory species mainly forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water. They have been known to forage in samphire. It may occasionally forage in the study area.
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	EN	EN	X	X	X	**Likely**. Suitable breeding and foraging habitat is present within the study area, and there are records within 18 km.
Dasyurus geoffroii	Chuditch, Western Quoll	VU	VU	X	X	X	**Unlikely**. This species has been recorded recently (2014 and 2015) in Dragon Rocks Nature Reserve. The closest record is 34 km from the study area. While potentially suitable habitat is present in the study area (woodlands and mallee shrublands), given the lack of records in the remnant vegetation surrounding Newdegate and the level of fragmentation of the vegetation in the region, it is considered unlikely to occur in the study area. Low density cage trapping (72 trap nights) and camera trapping (36 trap nights) undertaken as part

Scientific name	Common name	Conservation status[3]		Source[4]			Likelihood
		EPBC Act[1]	WC Act/ DBCA[2]	DBCA	NM	PMST	
							of a targeted Red-tailed Phascogale survey did not record the species.
Falco peregrinus	Peregrine Falcon		OS	X	X		**Potential - vagrant**. The closest record is 9 km from the study area. This species inhabits a wide range of habitats and has a wide distribution. It may occasionally fly over or forage in the study area.
Hylaeus globuliferus	Woolybush Bee		P3	X	X		**Unlikely**. While the closest record is 24 km from the study area, this species is known to feed on *Adenanthos* sp., *Grevillea* spp. and *Banksia* spp., which are not present within the study area.
Isoodon fusciventer	Quenda, Southern Brown Bandicoot		P4	X			**Unlikely**. The closest record is 40 km from the study area in Lake Magenta Nature Reserve, however Quenda are no longer detectable in this reserve (Morris et al. 2008). This species prefers low, dense vegetation such as heath and swampy habitat and is often associated with forests, woodland, shrubland and riparian areas. While potentially suitable habitat is present in the study area, given the lack of records in the remnant vegetation surrounding Newdegate and the level of fragmentation of the vegetation in the region, it is considered unlikely to occur in the study area. Low density cage trapping (72 trap nights) and camera trapping (36 trap nights) undertaken as part of a targeted Red-tailed Phascogale survey did not record the species. Cardno (2014) recorded potential diggings, however, these have been dismissed as unlikely to be caused by Quenda.
Leipoa ocellata	Malleefowl	VU	VU	X	X	X	**Potential**. A small area of suitable habitat is present in the study area, however targeted searches failed to find evidence of this species. However, given the proximity and number of nearby records (23 records within 10 km, within the closest non-historical

Scientific name	Common name	Conservation status[3]		Source[4]			Likelihood
		EPBC Act[1]	WC Act/ DBCA[2]	DBCA	NM	PMST	
							record 1.1 km away), this species could occasionally utilise the study area.
Limosa lapponica	Bar-tailed Godwit	M	IA		X		**Unlikely** - this species is mainly found in coastal habitats.
Macrotis lagotis	Bilby	VU	VU	X	X		**Does not occur.** This species is regionally extinct.
Motacilla cinerea	Grey Wagtail	M	IA			X	**Unlikely.** Closest record is over 300 km from the study area.
Myrmecobius fasciatus	Numbat	EN	EN	X		X	**Unlikely**. Records at Dragon Rocks Reserve (42 km from the study area) are from a translocated population. The only known remnant populations are located in the Dryandra Woodland and the Upper Warren area.
Notamacropus eugenii derbianus	Tammar Wallaby		P4	X	X		**Unlikely**. The only record within 50 km is from 1988, and this species is only known from a selection number of locations.
Notamacropus irma	Western Brush Wallaby		P4	X	X		**Potential.** There is suitable habitat present within the study area. This species occurs in open forest and woodland with open scrubby thickets and low grasses. There are three records of this species within 20 km of the study area.
Numenius madagascariensis	Eastern Curlew	CR/M	CR/IA			X	**Unlikely.** The closest record of this migratory coastal species is over 150 km from the study area.
Oxyura australis	Blue-billed Duck		P4	X	X		**Unlikely.** Suitable habitat is not present within the study area, as it prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.
Pandion haliaetus	Osprey	M	IA			X	**Unlikely**. The closest record of this coastal species is 120 km from the study area.

Scientific name	Common name	Conservation status[3]		Source[4]			Likelihood
		EPBC Act[1]	WC Act/ DBCA[2]	DBCA	NM	PMST	
Parantechinus apicalis	Dibbler	EN	EN			X	**Does not occur**. There are no records in the region of this species
Phascogale calura	Red-tailed Phascogale	VU	CD	X	X	X	**Known.** Recorded in the study area by ELA (2018a).
Platycercus icterotis xanthogenys	Western Rosella (Inland)		P4	X	X		**Likely.** The closest record is less than 1 km from the study area. This species, while relatively uncommon, is found in open dry eucalypt forest and timbered areas.
Pseudocheirus occidentalis	Western Ringtail Possum	VU	CR		X		**Does not occur**. This species is regionally extinct.
Pseudomys occidentalis	Western Mouse		P4	X	X		**Unlikely**. While suitable habitat is present within the study area and the closest record is 20 km away, Elliott trapping (713 trap nights) did not record this species within the study area.
Pseudomys shortridgei	Heath Mouse	VU	VU	X	X	X	**Unlikely.** As this species is primarily recorded in heath, the habitat present within the study area is unlikely to be suitable. Elliott trapping (713 trap nights) did not record this species within the study area.
Psophodes nigrogularis oberon	Western Whipbird (Western Mallee)		P4	X	X		**Potential. T**his species occurs in mallee, often in open mallee vegetation with a dense, tall shrub layer up to 1.5 m tall. The closest record is 16 km away; given some suitable habitat is present on site, this species has the potential to occur within the study area.
Thinornis rubricollis	Hooded Plover, Hooded Dotterel		P4	X	X		**Potential - vagrant**. This species moves from the coast to salt lakes some distance inland in winter. There are records within 6 km of the study area. This species may be found in proximity to the salt lake within the study area on occasion.

Scientific name	Common name	Conservation status[3]		Source[4]			Likelihood
		EPBC Act[1]	WC Act/ DBCA[2]	DBCA	NM	PMST	
Tringa nebularia	Common Greenshank	M	IA	X			**Potential - vagrant**. This species is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water around sparse, emergent or fringing vegetation, such as sedges or saltmarsh. The closest record is 35 km from the study area; this species may occasionally forage within the study area.

[1] EPBC Act = Environment Protection and Biodiversity Conservation Act 1999 List of Threatened Fauna

[2] WC Act = Wildlife Conservation Act 1950 Threatened Fauna (Rare Fauna)

[3] Conservation codes:

CR = listed as Critically Endangered under the EPBC Act.

EN = listed as Endangered under the EPBC Act.

VU = listed as Vulnerable under the EPBC Act.

IA = listed as Migratory under the EPBC Act.

CR = Fauna that is rare or is likely to become extinct as critically endangered fauna.

EN = Fauna that is rare or likely to become extinct as endangered fauna.

VU = Fauna that are considered likely to become extinct or rare, as vulnerable fauna.

IA = Migratory birds protected under an international agreement.

CD = Fauna that is of special conservation need as conservation dependent fauna.

OS = Other specially protected fauna

P3 = Priority 3: Poorly known species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat.

P4 = Priority 4: Rare, Near Threatened and other species in need of monitoring but not currently threatened; could become threatened if present circumstances change. Listed by DBCA.

[4] DBCA = DBCA Threatened and Priority Fauna database

NM = NatureMap database search (Parks and Wildlife 2007 - 2018)

PMST = EPBC Act Protected Matters Report (DoEE 2018b)

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Appendix C : Black Cockatoo Habitat Assessment (Harewood 2019)

Black Cockatoo Habitat Assessment

Newdegate Grain Receival Site

Proposed Expansion

CBH Group

May 2019
Version 2

On behalf of:
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SUMMARY

This report details the results of a targeted black cockatoo habitat assessment undertaken over an area of land adjacent to the existing Newdegate Grain Receival Site. The land, herein referred as the study area, has an area of 24.8 ha and is comprised of part Lots 102 and 208, unallocated crown land, an unmade road reserve and a rail reserve.

CBH Group (CBH) is proposing to utilise the land within the study area for a planned expansion of existing grain receival facilities. This assessment has been carried out to assist in filling information gaps prior to the submission of a *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) referral and Western Australian Native Vegetation Clearing Permit application under Part V of the *Environmental Protection Act 1986* (*EP Act*) in support of the future development.

The habitat assessment has been carried out in accordance with methods described within the Revised Draft Black Cockatoo *EPBC Act* Referral Guidelines (Commonwealth of Australia 2017), with the primary aim being to identifying habitat used for foraging, breeding or roosting within the study area. The assessment has included a review of 31 trees, previously assessed by 360 Environmental in 2015, that had observable hollows considered potentially suitable for Carnaby's cockatoo. A review of available regional information has also been undertaken. Information was also gathered to allow use of the “scoring tool” which has been developed to assist in determining if the study area contains quality foraging habitat.

During their survey 360 Environmental (2015b) identified the following black cockatoo habitat elements within the study area:

- Foraging Habitat

  20.3 ha of vegetation contains plant species known to or thought to be used as a foraging resource (i.e. all areas of salmon gum, red morell and Kondinin blackbutt).

  No evidence of actual foraging observed.

- Breeding Habitat

  92 trees identified as representing potential black cockatoo breeding habitat (i.e. DBH (1.3 metres from the ground) of 500 mm, or 300 mm if salmon gum).

  31 of the 92 trees had observable hollow entrances that were considered to be large enough and at a height to be suitable for black cockatoos to use for nesting.

  No actual breeding activity observed.

- Roosting Habitat

  No evidence of roosting or any other black cockatoo activity observed.

The review of black cockatoo habitat values at the Newdegate Grain Receival Site carried out in March 2109 identified the following:

- Foraging Habitat

  8.98 ha of vegetation contains plant species documented as being used as a foraging resource (i.e. all areas of salmon gum and York gum as mapped by ELA (2018)). Areas containing red morell and Kondinin blackbutt included by 360 Environmental (2015b) as forging habitat have been excluded from this total as they are not specifically documented as being fed upon by black cockatoos.

  No evidence of actual foraging observed.

- Breeding Habitat

  88 potential black cockatoo breeding trees (i.e. DBH (1.3 metres from the ground) of 500 mm, or 300 mm if salmon gum);

  61 of the 88 trees do not contain any hollows or possible small hollows only;

  4 of the 31 previously identified hollow bearing trees are no long present (fallen over or felled);

  17 of the 31 previously identified hollow bearing trees appear unsuitable for black cockatoos due to hollows appearing to be too small and/or too low to the ground. This disparity with 360 Environmental results appears to be a consequence of their nitial assessment apparently being almost totally based on the hollow entrance size only (>100mm), with no other characteristics of the hollow (such as the size of the branch into which it provides entry) being taken into consideration when determining its suitability.

  10 of the previously identified hollow bearing trees appear potentially suitable for black cockatoos based on apparent suitable internal dimensions, orientation and position.

- Two hollows show some evidence of possible blackcoat cockatoo activity but In no case was it possible to conclusively state that any of the hollows had definitely been used for nesting by black cockatoos.

- Roosting Habitat

  No evidence of roosting or any other black cockatoo activity observed. The survey was however undertaken outside of the period when Carnaby's cockatoo would be most likely to frequent the area and therefore the lack of any roosting activity may not be indicative of the study areas actual degree of use for the purpose.

Based on available vegetation mapping it is estimated that there is approximately 5,500 ha of native vegetation within 12 km of the study area. These areas have not been specifically assessed however are very likely to contain some potential black cockatoo habitat of some

sort (foraging, breeding and/or roosting). It should be noted that there are no historical records of Carnaby's cockatoos from within a search radius of 16 km from the Newdegate town site based on NatureMap (accessed 4 April 2019). Most records are concentrated around the larger nature reserves and remnants and particularly, to the south of the study area.

Birdlife Australia have indicated that black cockatoo nesting has been recorded around "Lake Magenta and further east" in recent years (A. Peck, personal communication, 4 April 2019). These areas are located roughly 40 km south and south east of Newdegate. NatureMap (accessed 4 April 2019) also shows some apparent Carnaby's cockatoo breeding records from a location about 34 km south east of Newdegate (dated November 2016).

These areas south of Newdegate may be favoured by Carnaby's cockatoos for breeding due to their proximity to the larger nature reserves where large expanses of quality foraging habitat are likely to occur.

A review of the 2018 Great Cocky Count report shows no roost sites within or near the study area, with the closest documented sites being situated over 130 km south east near the coast (Peck *et al.* 2018).

An assessment of the study area using the DoTEE's "foraging habitat scoring tool" (Commonwealth of Australia 2017) returned a habitat quality score of eight (8). This score equates to a habitat quality rating of "very high" to "high quality". While it could be argued that this rating has been incorrectly inflated by the lack of options for a starting score which better reflect the nature of the vegetation present, a score of seven (7) or six (6) would still result in a recommendation for referral being advisable.

It should be noted that if the removal of any one of the identified habitat trees is required then the proposed expansion qualifies as "likely to have a significant impact" using the draft revised DotEE criteria, in which case the submission of a referral, to ensure compliance with the *EPBC Act*, would be advisable in any event (if these referral guidelines were in place), irrespective of the habitat score rating.

1. INTRODUCTION

This report details the results of a targeted black cockatoo habitat assessment undertaken over an area of land adjacent to the existing Newdegate Grain Receival Site. The land, herein referred as the study area, has an area of 24.8 ha and is comprised of part Lots 102 and 208, unallocated crown land, an unmade road reserve and a rail reserve (Figure 1 and 2).

CBH Group (CBH) is proposing to utilise the land within the study area for a planned expansion of existing grain receival facilities. This assessment has been carried out to assist in filling information gaps prior to the submission of a *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) referral and Western Australian Native Vegetation Clearing Permit application under Part V of the *Environmental Protection Act 1986* (*EP Act*) in support of the future development.

The study area is within the known distribution of Carnaby's cockatoo (*Calyptorhynchus latirostris*) only, with Baudin's cockatoo (*Calyptorhynchus baudinii*) and the forest red-tailed black cockatoos (*Calyptorhynchus banksii naso*) having distribution limits that do not extend into this section of Western Australia. Carnaby's cockatoo is therefore the only species of black cockatoo considered within this report.

2. SCOPE OF WORKS

The scope of works was defined as:

- Define and map potential foraging, breeding and roosting habitat quality using a scale and assess the habitat against the revised draft Cockatoo *EPBC Act* Referral Guidelines (Commonwealth of Australia 2017), or finalised guidelines, if released prior to the survey date;
- Inspect the 31 trees with hollows previously identified by 360 Environmental for suitability and signs of black cockatoo breeding use; and
- Provide a report detailing survey findings (including photos of breeding use of hollows), including a discussion outlining the proximity to the closest known breeding, foraging and roosting sites, and the implications of clearing the habitat present in the study area.

3. METHODS

The field aspect of this assessment was undertaken on the 24 and 25 March 2019 by Greg Harewood (zoologist) and Kristopher Harewood (field assistant).

The habitat assessment has been carried out in accordance with methods described within the Revised Draft Black Cockatoo *EPBC Act* Referral Guidelines (Commonwealth of Australia 2017), with the primary aim being to identifying habitat used for foraging, breeding or roosting within the study area. Information was gathered to allow use of the "scoring tool" which has been developed to assist in determining if the study area contains **quality** foraging habitat.

The following information was be gathered during the field survey where possible and where necessary literature reviews to allow for the "scoring tool" to be used:

- The presence of all plant species that provide foraging, including non-native food sources used by black cockatoos.

  This has primarily included a review of the flora and vegetation survey carried out within the study area by Eco Logical Australia (2018) with the aim of identify all plant species present known to be used by Carnaby's cockatoos as a forging resource. Evidence of foraging by black cockatoos was also searched for and recorded during the field survey period.

- The presence of tree species used for breeding.

  This facet of the assessment has already been completed by 360 (360 Environmental 2015). Results of this assessment have been reviewed in the field to ensure appropriate methods were employed and that there are no data gaps (see Section 3.2).

- Use as a roosting site;

  One dusk survey was carried out during the field survey to determine if any roosting is occurring. This also included looking for evidence of roosting in the form of accumulated branch clippings, feathers and dropping at the base of trees.

- The vegetation present in the surrounding area, i.e. at least 12 km from the study area, including proximity to any breeding habitat, roosting sites or watering points;

  A review of available mapping will be carried out to provide an estimate of the amount of remnant native vegetation present with 12km of the assessment area.

- Breeding habitat, such as an estimate of the number of trees with a diameter at breast height (1.3 metres from the ground) of 500 mm, or 300 mm if salmon gum or wandoo;

This facet of the assessment has already been completed by 360 (360 Environmental 2015b). Results of this assessment have been reviewed in the field to ensure appropriate methods were employed and that there are no data gaps. (see Section 3.2)

- Numbers of any known nesting trees.

  This facet of the assessment has already been completed by 360 (360 Environmental 2015). Results of this assessment have been reviewed in the field to ensure appropriate methods were employed and that there are no data gaps. (see Section 3.2)

- Presence of disease, such as *Phytophthora cinnamomi* or marri canker (*Quambalaria coyrecup*).

  Evidence of impacts of any plant pathogens were recorded if observed during the field survey.

3.1 Foraging Habitat

The foraging potential of each plant species identified by Eco Logical Australia (2018) as being present has been assessed using available literature and placed into one of two categories:

- Known – specific plant species documented in literature as being foraged upon by Carnaby's cockatoos;

- Not Documented - specific plant species not documented in literature as being foraged upon by Carnaby's cockatoos.

Primary sources of information for Carnaby's cockatoo foraging species have included DPaW (2016), Davies (1966), DEC (2012), Groom (2011), Higgins (1999), Johnstone and Storr (1998), Johnstone and Kirkby (2011), Saunders (1974, 1979a, 1979b, 1980 & 1986), Saunders *et al.* (1982), Commonwealth of Australia (2012) and Shah (2006).

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the field survey were recorded.

A review of available literature was also carried out to determine the location/extent of any known/likely black cockatoo foraging habitat areas in the vicinity of the study area.

3.2 Breeding Habitat

As part of the assessment all previously identified habitat trees containing observable hollows (31 in total) deemed "suitable to be used for Carnaby's cockatoo nesting" (360 Environmental 2015b) (Figure 3) were revisited and specific details on any hollows present recorded. This included but was not be limited to recording specific details on any evidence of actual use (e.g. significant chew marks around hollow entrances).

Where practical to do so a drone (DJI Mavic Air) was used to examine and photograph each potential hollow at close range to assist in determining suitability and to aid in identifying any signs of current or previous use by black cockatoos.

Identified hollows have initially been placed into one of three categories based on the type of hollow entry (Birdlife Australia 2018a):

- Chimney: the hollow entry faces directly upwards in the end of the trunk;
- Spout: hollow entry which is at the end of a broken branch; or
- Side: the entry is directly into the side of the trunk or a branch with no protrusions.

For the purpose of this review, hollows have then been placed into one of seven categories based on the observable characteristics of each hollow. The categories used were:

- Confirmed Hollow: Black cockatoos observed utilising the hollow for breeding purposes;
- Chewed Hollow: The hollow shows signs of chewing ("chipping" around or near entrance and/or internally) attributed to black cockatoo activity (in most cases indicating nesting activity, but in some cases possibly marks left by black cockatoos investigating ("prospecting") hollows);
- Unused Hollow: The hollow appears to be of a suitable size for black cockatoos to use for nesting, but no conclusive evidence of this activity seen. It should be noted that chew marks/chipping are not always evident or present on some hollows that have been used for nesting. Hollows classified as "unused" may therefore have been used for nesting but cannot be specifically classified as such. Alternatively, some "unused" hollows may not be suitable for black cockatoos as a range of characteristics, not all of which can be seen or measured, ultimately determined if a hollow will ever actually be used;
- Unsuitable Hollow: The hollow has been assessed, based on information obtained, as being unlikely to be suitable for black cockatoos (generally because of the entrance appearing to be too small or because the actual hollow or accommodating branch/tree trunk appears to be too small or as having an unfavourable orientation);
- No Hollow: The tree was not observed to contain any hollows. During the initial assessment no hollows were observed. Trees previously identified as having a hollow/s can also be re-classified into this category. Generally, this would be due to mis-identification from ground level during the initial assessment where a feature of the tree appeared to possibly represent a hollow but upon closer inspection was found not to qualify as such;
- No Tree Present: A standing tree is no longer present i.e. the original tree has fallen over, been burnt or has been removed/felled.

- Status Unknown: The tree could not be found or was not revisited.

A review of available literature was carried out to determine the location/extent of any known/likely black cockatoo breeding habitat areas in the vicinity of the study area.

3.3 Roosting Habitat

A single dusk survey was carried out on the 24 March 2019 from about 5:30pm to 6:30pm and involved observing and listening for any black cockatoo activity from a vantage point near the southern end of the study area.

Direct and indirect evidence of black cockatoos roosting within trees within the study area site was noted during the field survey if observed (e.g. branch clippings, droppings or moulted feathers).

A review of available literature was also carried out to determine the location/extent of any known/likely black cockatoo roosting habitat areas in the vicinity of the study area.

4. RESULTS

4.1 Foraging Habitat

The vegetation units present as mapped by ELA (2018) are shown in Figure 4. The identified units are:

- **EkElg**: *Eucalyptus kondininensis*, *E. longicornis* open forest over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs. Some parts included where *Eucalyptus longicornis* occurs as the single dominant tree species (7.90 ha/31.85%);

- **Elx**: *Eucalyptus loxophleba* subsp. *gratiae* low open mallee forest over *Melaleuca acuminata* subsp*. acuminata* scattered tall shrubs to tall open shrubland (open to closed scrub in parts) over *Dodonaea ptarmicaefolia*, *Acacia hemiteles* shrubland over *Austrostipa elegantissima* very open grassland (5.72 ha/23.07%);

- **EkAv**: *Eucalyptus kondininensis* open forest over *Atriplex vesicaria* low open shrubland over *Threlkeldia diffusa* very open low herbland (4.56 ha/18.38%);

- **Es**: *Eucalyptus salmonophloia* open to closed forest over *Dodonaea stenozyga* scattered shrubs to open shrubland over *Olearia muelleri, Acacia erinacea* low open shrubland (3.26 ha/13.13%);

- **TuAv**: *Tecticornia undulata*, *Atriplex vesicaria, Tecticornia syncarpa* low open heath over *Disphyma crassifolium* subsp. *clavellatum* very open herbland (1.71 ha/6.89%);

- **ElgMl**: *Eucalyptus longicornis* open forest over *Melaleuca lanceolata* open scrub over *Atriplex paludosa* subsp. *baudinii* scattered low shrubs (0.87 ha/3.49%);

- **Cleared**: Cleared areas, completely devoid of vegetation (0.79 ha/3.19%).

A total of 178 taxa (including species, subspecies, varieties and forms, and specimens not identified to species level) from 111 genera and 42 families were recorded from quadrats, relevés and opportunistic collections in the study area by ELA (2018) and previous surveys (360 Environmental 2015a; Cardno 2014).

Table 1 below lists the all flora species recorded along with their documented black cockatoo foraging status.

Table 1: Identified Flora Species within the Study Area and Black Cockatoo Foraging Status

Genus & Species	Status	Carnaby's Cockatoo Foraging Species
Acacia acanthoclada		Not documented
Acacia erinacea		Not documented
Acacia hemiteles		Not documented
Acacia leptospermoides		Not documented
Acacia merrallii		Not documented
Alyxia buxifolia		Not documented
Arctotheca calendula	Introduced	Not documented
Arthropodium curvipes		Not documented
Asteraceae sp.		Not documented
Asteridea athrixioides		Not documented
Atriplex bunburyana		Not documented
Atriplex cinerea		Not documented
Atriplex paludosa		Not documented
Atriplex vesicaria		Not documented
Austrostipa acrociliata		Not documented
Austrostipa elegantissima		Not documented
Austrostipa exilis		Not documented
Austrostipa pycnostachya		Not documented
Austrostipa sp.		Not documented
Austrostipa trichophylla		Not documented
Avena barbata	Introduced	Not documented
Blennospora drummondii		Not documented
Blennospora phlegmatocarpa		Not documented
Brachyscome ciliaris		Not documented
Brachyscome eyrensis		Not documented
Brachyscome perpusilla		Not documented
Brassica napus	Introduced	Not documented
Brassica tournefortii	Introduced	Not documented
Bromus rubens	Introduced	Not documented
Caladenia dimidia		Not documented
Caladenia hirta		Not documented
Calandrinia calyptrata		Not documented
Calandrinia sp.		Not documented
Calotis hispidula		Not documented
Carpobrotus modestus		Not documented
Cassytha melantha		Not documented
Cenchrus clandestinus	Introduced	Not documented
Chenopodiaceae sp.		Not documented
Chenopodium desertorum		Not documented
Cirsium vulgare	Introduced	Not documented
Comesperma integerrimum		Not documented
Conyza bonariensis	Introduced	Not documented
Coopernookia strophiolata		Not documented
Corunastylis fuscoviridis		Not documented
Cotula bipinnata	Introduced	Not documented

Genus & Species	Status	Carnaby's Cockatoo Foraging Species
Crassula colorata		Not documented
Crassula colorata acuminata		Not documented
Cryptandra minutifolia		Not documented
Cryptandra nutans		Not documented
Cryptandra wilsonii		Not documented
Dampiera lavandulacea		Not documented
Daucus glochidiatus		Not documented
Daviesia scoparia		Not documented
Dianella revoluta		Not documented
Disphyma crassifolium clavellatum		Not documented
Dodonaea ptarmicaefolia		Not documented
Dodonaea stenozyga		Not documented
Drosera bulbosa		Not documented
Ehrharta longiflora	Introduced	Not documented
Enchylaena lanata		Not documented
Enchylaena tomentosa		Not documented
Eremophila decipiens		Not documented
Eremophila deserti		Not documented
Ericksonella saccharata		Not documented
Eriochilus dilatatus		Not documented
Erodium cicutarium	Introduced	Not documented
Erodium cygnorum		Not documented
Erymophyllum tenellum		Not documented
Eucalyptus kondininensis		Not documented
Eucalyptus longicornis		Not documented
Eucalyptus loxophleba		Known
Eucalyptus salmonophloia		Known
Eucalyptus salubris		Not documented
Exocarpos aphyllus		Not documented
Goodenia berardiana		Not documented
Goodenia pusilliflora		Not documented
Helichrysum leucopsideum		Not documented
Helichrysum luteoalbum		Not documented
Hordeum leporinum	Introduced	Not documented
Hyalosperma glutinosum		Not documented
Hydrocotyle pilifera		Not documented
Hypochaeris glabra	Introduced	Not documented
Indeterminant sp.		Not documented
Lawrencia squamata		Not documented
Lepidium rotundum		Not documented
Lepidium sp.		Not documented
Lepidosperma diurnum		Not documented
Lepidosperma drummondii		Not documented
Lolium rigidum	Introduced	Not documented
Lomandra effusa		Not documented
Lycium australe		Not documented
Lysimachia arvensis	Introduced	Not documented
Maireana enchylaenoides		Not documented
Maireana erioclada		Not documented
Maireana marginata		Not documented
Maireana suaedifolia		Not documented
Maireana trichoptera		Not documented
Melaleuca acuminata		Not documented
Melaleuca adnata		Not documented
Melaleuca lanceolata		Not documented
Melaleuca lateriflora		Not documented
Melaleuca pauperiflora		Not documented
Melaleuca scalena		Not documented
Melaleuca sp.		Not documented
Melaleuca thyoides		Not documented

Genus & Species	Status	Carnaby's Cockatoo Foraging Species
Mesembryanthemum nodiflorum	Introduced	Not documented
Microcybe multiflora		Not documented
Millotia myosotidifolia		Not documented
Monoculus monstrosus	Introduced	Not documented
Neurachne alopecuroidea		Not documented
Olearia muelleri		Not documented
Olearia subspicata		Not documented
Omphalolappula concava		Not documented
Oxalis perennans		Not documented
Oxalis pes-caprae	Introduced	Not documented
Pauridia glabella		Not documented
Pelargonium havlasae		Not documented
Pentameris airoides	Introduced	Not documented
Pittosporum angustifolium		Not documented
Plantago coronopus	Introduced	Not documented
Plantago debilis		Not documented
Poaceae sp.		Not documented
Pogonolepis sp.		Not documented
Prasophyllum gracile		Not documented
Pterostylis mutica		Not documented
Pterostylis picta		Not documented
Pterostylis scabra		Not documented
Ptilotus holosericeus		Not documented
Ptilotus spathulatus		Not documented
Raphanus raphanistrum	Introduced	Known
Rhagodia crassifolia		Not documented
Rhagodia drummondii		Not documented
Rhagodia preissii		Not documented
Rhodanthe heterantha		Not documented
Rhodanthe pygmaea		Not documented
Roepera glauca		Not documented
Rumex crispus	Introduced	Not documented
Rytidosperma acerosum		Not documented
Salvia verbenaca	Introduced	Not documented
Santalum acuminatum		Not documented
Scaevola spinescens		Not documented
Sclerolaena diacantha		Not documented
Senecio glomeratus		Not documented
Senecio glossanthus		Not documented
Senna artemisioides		Not documented
Senna sp.		Not documented
Siloxerus humifusus		Not documented
Sonchus oleraceus	Introduced	Not documented
Stellaria filiformis		Not documented
Stenopetalum lineare		Not documented
Tecticornia indica		Not documented
Tecticornia pergranulata		Not documented
Tecticornia sp.		Not documented
Tecticornia syncarpa		Not documented
Tecticornia undulata		Not documented
Templetonia rossii		Not documented
Teucrium sessiliflorum		Not documented
Thelymitra graminea		Not documented
Thelymitra macrophylla		Not documented
Threlkeldia diffusa		Not documented
Thysanotus lavanduliflorus		Not documented
Thysanotus manglesianus		Not documented
Thysanotus patersonii		Not documented
Trachymene ornata		Not documented
Trachymene pilosa		Not documented

Genus & Species	Status	Carnaby's Cockatoo Foraging Species
Trifolium hirtum	Introduced	Not documented
Trifolium sp. 1	Introduced	Not documented
Trifolium sp. 2	Introduced	Not documented
Trifolium tomentosum	Introduced	Not documented
Triticum aestivum	Introduced	Not documented
Trymalium myrtillus		Not documented
Ursinia anthemoides	Introduced	Not documented
Vulpia myuros forma myuros	Introduced	Not documented
Vulpia sp.	Introduced	Not documented
Waitzia suaveolens		Not documented
Westringia cephalantha		Not documented
Westringia rigida		Not documented
Wilsonia rotundifolia		Not documented
Wurmbea tenella		Not documented
Xanthoparmelia semiviridis		Not documented

Only three species of plant present with the study area are confirmed/known dietary items of Carnaby's cockatoo, these being:

- Salmon Gum (*Eucalyptus salmonophloia*);
- York Gum (*Eucalyptus loxophleba*); and
- Wild Radish (*Raphanus raphanistrum*) (introduced).

Salmon gum (**Es**) and York gum (**Elx**) dominated units make up about 8.98 ha (~36.2%) of the study area (see Figure 4). York gum was also recorded in low densities within areas dominated by Kondinin blackbutt (*Eucalyptus kondininensis)* and red morrel (*E. longicornis*) (**EkElg**) (ELA 2018). Wild radish (a small weed) was recorded in two quadrats by ELA (2018) but is not expected to represent foraging habitat of any significance as its contribution to the overall foraging resource available in the study area would be small/negligible.

Both salmon gum and York gum both have relatively small fruits and as such can be regarded as being of low to moderate foraging value given the amount of effort that would be required by black cockatoos to extract seeds when compared to other more favourable species. The absence of any other flora species known to be utilised by black cockatoos as a food source (in particular diverse shrublands/kwongon heath/banksia) also lowers the overall foraging value of vegetation with the study area.

With respect to the DotEE foraging habitat scoring tool (Commonwealth of Australia 2017) the foraging habitat present in the study area (estimated to cover about 8.98 ha) must still be rated as having an initial starting score of 7 (high quality habitat) when assessed using the broad criteria listed (see Table 3 - Commonwealth of Australia 2017). This is based on the fact that the area contains "eucalypt woodland" comprised of some documented foraging species, albeit only species with apparent low relative value.

No evidence of any black cockatoo foraging activity was observed during the course of the field survey or during any previous surveys (Cardno 2014, 360 Environmental 2015a &

2015b and ELA 2018) which is consistent with the conclusion that the foraging habitat is of low value and therefore possibly rarely utilised.

It should be noted that 360 (360 Environmental 2015b) incorrectly document red morrel as representing foraging habitat when in fact the reference they refer to (Groom (DEC) 2011) indicates it represents potential breeding habitat only. 360 have also considered Kondinin blackbutt as representing foraging habitat. Like red morrel, this tree species is not specifically identified as a plant species fed upon by black cockatoos in any of the available references, which suggests it should not be considered foraging habitat for the purpose of any assessment as it is likely to exaggerate the areas actual value.

These eucalypt species are possibly not favoured by black cockatoos due to the small size of their fruiting bodies making seed extraction time consuming and energy inefficient relative to more favoured plant species. Because of the inclusion of these two tree species 360 have mapped the extent of foraging habitat within the study area as being ~ 20.3 ha, which appears, based on the current review, to be an overestimation of what is actually foraging habitat of any value.

Based on available vegetation mapping it is estimated that there is approximately 5,500 ha of native vegetation within 12 km the study area. These areas have not been specifically assessed but at least some areas are very likely to represent potential black cockatoo foraging habitat of some type. The foraging habitat identified within the study area makes up about 0.1% of the total area of remnant vegetation present in this 12 km area.

No evidence of any impacts on vegetation that could be attributed to plant pathogens were observed during the field survey.

4.2 Breeding Habitat

A summary of the results of the black cockatoo tree review are presented in Table 2 below. Additional details (photos and descriptions) on each tree inspected including their original and reviewed status are held in Appendix A. The location of these trees is shown in Figure 5.

Table 2: Hollow Bearing Habitat Tree Review - Summary Results

ID	Tree Species	No. of Hollows	360 (2015) Classification	Revised (2019) Classification	Comments
2	Red Morrel	1	Suitable Hollow	Unsuitable Hollow	Very low, marginal size, appears unsuitable.
11	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small, possibly occupied by owls?
18	Salmon Gum	2	Suitable Hollow	Unsuitable Hollows	All appear too small.
21	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small, in use by feral bees.
22	Salmon Gum	1	Suitable Hollow	Unused Hollow	Appears suitable, no sign of use.
27	Salmon Gum	1	Suitable Hollow	No Tree Present	Fallen over/felled.
28	Salmon Gum	2	Suitable Hollow	Unsuitable Hollows	All appear too small.
39	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small.

ID	Tree Species	No. of Hollows	360 (2015) Classification	Revised (2019) Classification	Comments
42	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small.
43	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small, used by galahs.
51	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small, used by galahs.
53	Salmon Gum	1	Suitable Hollow	Unused Hollow	Appears suitable, no sign of use.
57	Salmon Gum	1	Suitable Hollow	Chewed Hollow	Marginal size but possible evidence of use.
58	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Low, marginal size, appears unsuitable.
60	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small, used by galahs.
72	Salmon Gum	2	Suitable Hollow	Chewed Hollow	Marginal size but possible evidence of use, used by galahs.
73	Salmon Gum	4	Suitable Hollow	Unsuitable Hollows	All appear too small, used by galahs and feral bees.
74	Salmon Gum	3	Suitable Hollow	Unsuitable Hollows	All appear too small, used by galahs.
76	Salmon Gum	4	Suitable Hollow	Unsuitable Hollows	All appear too small, used by feral bees
77	Salmon Gum	2	Suitable Hollow	No Tree Present	Fallen over/felled.
78	Salmon Gum	4	Suitable Hollow	Unused Hollow	One hollow appears suitable, used by galahs.
79	Salmon Gum	1	Suitable Hollow	Unused Hollow	Appears suitable, no sign of use.
81	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small.
83	Salmon Gum	3	Suitable Hollow	Unused Hollow	One hollow appears suitable, used by galahs.
85	Salmon Gum	1	Suitable Hollow	Unsuitable Hollow	Appears too small, used by galahs.
86	Salmon Gum	2	Suitable Hollow	Unused Hollow	One hollow appears suitable, no sign of use.
87	Salmon Gum	4	Suitable Hollow	Unused Hollow	One hollow appears suitable, used by feral bees.
88	Stag	1	Suitable Hollow	No Tree Present	Felled.
89	Stag	2	Suitable Hollow	Unused Hollow	One hollow appears suitable, no sign of use.
91	Stag	3	Suitable Hollow	Unsuitable Hollows	All appear too small.
92	Stag	3	Suitable Hollow	No Tree Present	Fallen over.

Over half (17) of the trees initially identified as having “hollows large enough for black cockatoos to breed in” (360 Environmental 2015b) have been reassessed as being unsuitable. For most of the trees (15) this reassessment was primarily based on the apparent internal size of the hollow itself or the size of the accommodating branch/tree trunk, with observations made in the field suggesting they would be too small for a black cockatoo to utilise for nesting purposes. Two of the 17 trees have been assessed as unsuitable as the hollows appeared to be both marginal in size and too low to the ground.

This large disparity appears to be a consequence of the initial assessment apparently being almost totally based on the hollow entrance size only ($\geq$100mm), with no other characteristics of the hollow (such as the size of the branch into which it provides entry) being taken into consideration when determining its suitability.

Four (4) trees were found to have either fallen over or been felled, apparently for firewood given evidence of chainsaw use.

The remaining 10 trees from the original data set identified by 360 have been assessed as containing at least one hollow potentially suitable for black cockatoos to use for nesting. This conclusion has been based on the hollows appearing to be of a suitable size, position and orientation based on observations made in the field.

In no case was it possible to conclusively state that any of the hollows had definitely been used for nesting by black cockatoos though two (2) were classified as “chewed hollows” as they showed some evidence of “chipping” (potentially caused by black cockatoos chewing wood from the internal surface or outer rim of the hollow). This is often indicative of nesting activity but sometimes is a consequence of repeated “prospecting” (investigation) for suitable hollows only.

It should also be noted that galahs also chew hollows (referred to as “chipping”) to a certain degree and some overlap in characteristics may occur. Generally, a few chips around a hollow entrance is indicative of Carnaby’s cockatoo activity, chipping around the entire hollow entrance is a sign of galahs. Galahs also chew the bark from the tree in which they are nesting (and sometimes adjacent trees) leaving very obvious scarring.

Galah nesting activity appears to be common within the study area with eight (8) of the 31 trees examined showing some evidence of use for this purpose. This was mainly in the form of extensive scarring of tree bark. Four (4) trees were also found to be occupied by feral bees.

As a consequence of the review the dataset of habitat trees present within the study area now consists of 88 trees with a DBH of >300mm or more (for Salmon Gum, ≥500mm for Red Morrel) (Figure 6). Sixty one (61) of these, as identified by 360 Environmental (2015b), were not observed to have any hollows. Seventeen (17) trees have hollows that have been assessed as being unsuitable for cockatoos.

Ten (10) trees appear to have hollows possibly suitable for cockatoos, with two showing some evidence of use though it can not be conclusively be attributed to nesting black cockatoos at this point in time.

Four (4) trees have been removed from the original dataset as they have fallen over or been felled. The location of the above-mentioned trees is shown in Figure 6 with summary details being provided in Appendix B.

There is a paucity of publicly available breeding data for black cockatoos. This is probably due to both a lack of survey work and/or reporting but also because information is withheld due its sensitive nature.

The most recently available report by Birdlife Australia (2018) does however provide some summary results of surveys carried out between mid-September and mid-January 2017 at 34 sites around regional Western Australia. The report shows the rough location of two survey sites both about 40 km south and south east of Newdegate respectively, one within the Lake Magenta Nature Reserve and one near the Dunn Rock Nature Reserve. The report does not specify if breeding activity was recorded at either location, however

discussion with Adam Peck directly indicates that they have recorded breeding activity, mainly “on private land around Lake Magenta and further east” (A. Peck, personal communication, 4 April 2019). NatureMap (accessed 4 April 2019) also shows some apparent Carnaby’s cockatoo breeding records from a location about 34 km south east of Newdegate, made in November 2016 (Figure 7). These appear to be related to some of Birdlife Australia’s previous monitoring work.

These areas, south of Newdegate, may be favoured by Carnaby’s cockatoos for breeding due to their proximity to the larger nature reserves where large expanses of quality foraging habitat are likely to occur.

Based on available vegetation mapping it is estimated that there is approximately 5,500 ha of native vegetation within 12 km the study area. These areas have not been specifically assessed however some areas are very likely to contain potential black cockatoo breeding habitat of some type (i.e. trees with a DBH $\geq$300mm). The study area as a whole (~24.8 ha) makes up about 0.45% of this remnant vegetation.

4.3 Roosting Habitat

No roosting activity by Carnaby’s cockatoos was recorded during the single dusk survey or during the daytime assessment carried out on the following day. The survey was however undertaken outside of the period when Carnaby’s cockatoo would be most likely to frequent the area and therefore the lack of any roosting activity may not be indicative of the study areas actual degree of use for the purpose.

No roosting activity (or any other black cockatoo activity) has been recorded during previous surveys over the study area (Cardno 2014 (October 2014), 360 Environmental 2015a (September 2015) and 2015b (May 2015) and ELA 2018 (June/December 2018)).

The study area does contain large trees that presumably represent potential roosting habitat and the waste water treatment plant directly adjoining the site contains ponds of water, which may represent a potential drinking site, though the palatability of the water to black cockatoos is not known. It should be noted that there are numerous (possibly thousands) of potential watering sites for black cockatoos throughout the wheatbelt. Most of these are manmade sources (e.g. dams and water troughs) in place for livestock. Which ones have been or are used by black cockatoos is not documented.

Black cockatoo roost surveys have been undertaken across Western Australia for a number of years by Birdlife Australia. A review of the 2018 Great Cocky Count report shows no roost sites within or near the study area, with the closest documented sites being situated over 130 km south east near the coast (Peck *et al.* 2018).

Based on available vegetation mapping it is estimated that there is approximately 5,500 ha of native vegetation within 12 km the study area. These areas have not been specifically assessed however some areas are very likely to contain some potential black cockatoo roosting habitat. It should be noted that there are no historical records of Carnaby’s cockatoos from within a search radius of 16 km from the Newdegate town site based on

NatureMap (accessed 4 April 2019). Most records are concentrated around the larger nature reserves and remnants and particularly, to the south of the study area (Figure 7).

5. REVISED DRAFT REFERRAL GUIDELINES ASSESSMENT

The revised referral guidelines (Commonwealth of Australia 2017) have not been officially adopted but an assessment is provided here as a guide in the event they (or a modified version thereof) are enacted in the near future.

The following summary points contained within the revised document provide general guidance on what, in DotEE's view, may constitute significant impact on black cockatoos. An action that will or is likely to result in a significant impact will require referral to the Australian Government (Commonwealth of Australia 2017).

1. Clearing of known nesting trees or breeding habitat is likely to result in a significant impact;

2. Complete clearance of roost sites that are close to high quality foraging habitat and water resources in non-breeding areas is likely to result in a significant impact;

3. Clearing very high to high quality foraging is likely to result in a significant impact;

    i. Impacts on *higher quality* foraging habitat are likely to have a significant impact, with a lower acceptability of loss in hectares; your action should be referred.

    ii. Impacts on *low quality* foraging habitat is more likely to be acceptable. Committing to priority mitigation actions in the relevant region means your action is less likely to result in a significant impact and require referral.

    iii. Impacts on foraging habitat that is *valued*, with a score of 4 to 6, may still require referral, depending upon how much habitat is being impacted, the location and what measures are proposed to avoid and/or mitigate that impact.

4. Various other actions with indirect or facilitated impacts on black cockatoos (but where there is a commitment to the mitigation objectives and priorities with the guidelines), are less likely to have a significant impact on black cockatoos.

The study area was found to contain 88 trees which would be regarded by the DotEE as representing potential black cockatoo breeding habitat due to their DBH size being 300mm or greater. Despite the fact that no actual breeding within any of these trees has been confirmed, the removal of just one of these trees will compromise criterion 1 and be regarded as "likely to result in a significant impact".

No black cockatoo roosting activity was found during the assessment and therefore it is considered unlikely that criterion 2 will be compromised. The survey was however undertaken outside of the period when Carnaby's cockatoo would be most likely to frequent

the area of its range and therefore the lack of any roosting activity may not be indicative of the study areas actual use for the purpose.

The foraging habitat tool assessment for Carnaby's cockatoo species is provided in the table below to provide guidance in criterion 3.

Table 3: Foraging Habitat Scoring Tool

Scoring Component	Foraging habitat for Carnaby's Cockatoo	Score	Comments
Starting Score	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* spp., as well as **native eucalypt woodland** and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under a RFA.	7 (High Quality)	This starting score can be regarded as being too high given the study area is considered to only support small fruited eucalypts with relatively low foraging value compared to other tree species. Lower criteria however do not specifically apply and can therefore not be used.
Additions	**Context adjustor - attributes improving functionality of foraging habitat**		
	Contains trees with suitable nest hollows	+3	Ten trees identified with potentially suitable hollows.
	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo).	+2	Eighty eight trees with a dbh of ≥300m identified.
Subtractions	**Context adjustor - attributes reducing functionality of foraging habitat**		
	No clear evidence of feeding debris.	-2	None observed during three targeted fauna surveys.
	Is > 12 km from a known breeding location.	-1	Closest documented nest sites are over 30km away.
	Is > 12 km from a known roosting site.	-1	Closest documented roost sites are over 130km away.
Total Score		**8**	

The foraging habitat scoring tool indicates a habitat quality score of eight (8). This score equates to a habitat quality rating of very high to high quality. While it could be argued that this rating has been incorrectly inflated by the lack of options for a starting score which better reflect the nature of the vegetation present, a score of seven (7) or six (6) would still result in a recommendation for referral being advisable.

It should be noted that if the removal of any one of the identified habitat trees is required then the proposed expansion qualifies as "likely to have a significant impact" using the draft revised DotEE criteria, in which case the submission of a referral, to ensure compliance with the *EPBC Act*, would be advisable in any event (if these referral guidelines were in place), irrespective of the habitat score rating.

6. CONCLUSION

The review reported on here was undertaken with the primary aim of providing additional information on potential Carnaby's cockatoo foraging, breeding and roosting habitat with land adjacent to the existing Newdegate Grain Receival Site with specific reference to previous work undertaken by 360 Environmental (2015b) and ELA (2018).

During their survey 360 Environmental (2015b) identified the following black cockatoo habitat elements within the study area:

- Foraging Habitat

  20.3 ha of vegetation contains plant species known to or thought to be used as a foraging resource (i.e. all areas of salmon gum, red morell and Kondinin blackbutt).

  No evidence of actual foraging observed.

- Breeding Habitat

  92 trees identified as representing potential black cockatoo breeding habitat (i.e. DBH (1.3 metres from the ground) of 500 mm, or 300 mm if salmon gum).

  31 of the 92 trees had observable hollow entrances that were considered to be large enough and at a height to be suitable for black cockatoos to use for nesting.

  No actual breeding activity observed.

- Roosting Habitat

  No evidence of roosting or any other black cockatoo activity observed.

The review of black cockatoo habitat values at the Newdegate Grain Receival Site carried out in March 2109 identified the following:

- Foraging Habitat

  8.98 ha of vegetation contains plant species documented as being used as a foraging resource (i.e. all areas of salmon gum and York gum as mapped by ELA (2018)). Areas containing red morell and Kondinin blackbutt included by 360 Environmental (2015b) as forging habitat have been excluded from this total as they are not specifically documented as being fed upon by black cockatoos.

  No evidence of actual foraging observed.

- Breeding Habitat

  88 potential black cockatoo breeding trees (i.e. DBH (1.3 metres from the ground) of 500 mm, or 300 mm if salmon gum);

61 of the 88 trees do not contain any hollows or possible small hollows only;

4 of the 31 previously identified hollow bearing trees are no long present (fallen over or felled);

17 of the 31 previously identified hollow bearing trees appear unsuitable for black cockatoos due to hollows appearing to be too small and/or too low to the ground. This disparity with 360 Environmental results appears to be a consequence of their nitial assessment apparently being almost totally based on the hollow entrance size only (>100mm), with no other characteristics of the hollow (such as the size of the branch into which it provides entry) being taken into consideration when determining its suitability.

10 of the previously identified hollow bearing trees appear potentially suitable for black cockatoos based on apparent suitable internal dimensions, orientation and position.

- Two hollows show some evidence of possible blackcoat cockatoo activity but In no case was it possible to conclusively state that any of the hollows had definitely been used for nesting by black cockatoos.

- <u>Roosting Habitat</u>

  No evidence of roosting or any other black cockatoo activity observed. The survey was however undertaken outside of the period when Carnaby's cockatoo would be most likely to frequent the area and therefore the lack of any roosting activity may not be indicative of the study areas actual degree of use for the purpose.

Based on available vegetation mapping it is estimated that there is approximately 5,500 ha of native vegetation within 12 km of the study area. These areas have not been specifically assessed however are very likely to contain some potential black cockatoo habitat of some sort (foraging, breeding and/or roosting). It should be noted that there are no historical records of Carnaby's cockatoos from within a search radius of 16 km from the Newdegate town site based on NatureMap (accessed 4 April 2019). Most records are concentrated around the larger nature reserves and remnants and particularly, to the south of the study area.

Birdlife Australia have indicated that black cockatoo nesting has been recorded around "Lake Magenta and further east" in recent years (A. Peck, personal communication, 4 April 2019). These areas are located roughly 40 km south and south east of Newdegate. NatureMap (accessed 4 April 2019) also shows some apparent Carnaby's cockatoo breeding records from a location about 34 km south east of Newdegate (dated November 2016).

These areas south of Newdegate may be favoured by Carnaby's cockatoos for breeding due to their proximity to the larger nature reserves where large expanses of quality foraging habitat are likely to occur.

A review of the 2018 Great Cocky Count report shows no roost sites within or near the study area, with the closest documented sites being situated over 130 km south east near the coast (Peck *et al.* 2018).

An assessment of the study area using the DoTEE's "foraging habitat scoring tool" (Commonwealth of Australia 2017) returned a habitat quality score of eight (8). This score equates to a habitat quality rating of "very high" to "high quality". While it could be argued that this rating has been incorrectly inflated by the lack of options for a starting score which better reflect the nature of the vegetation present, a score of seven (7) or six (6) would still result in a recommendation for referral being advisable.

It should be noted that if the removal of any one of the identified habitat trees is required then the proposed expansion qualifies as "likely to have a significant impact" using the draft revised DotEE criteria, in which case the submission of a referral, to ensure compliance with the *EPBC Act*, would be advisable in any event (if these referral guidelines were in place), irrespective of the habitat score rating.

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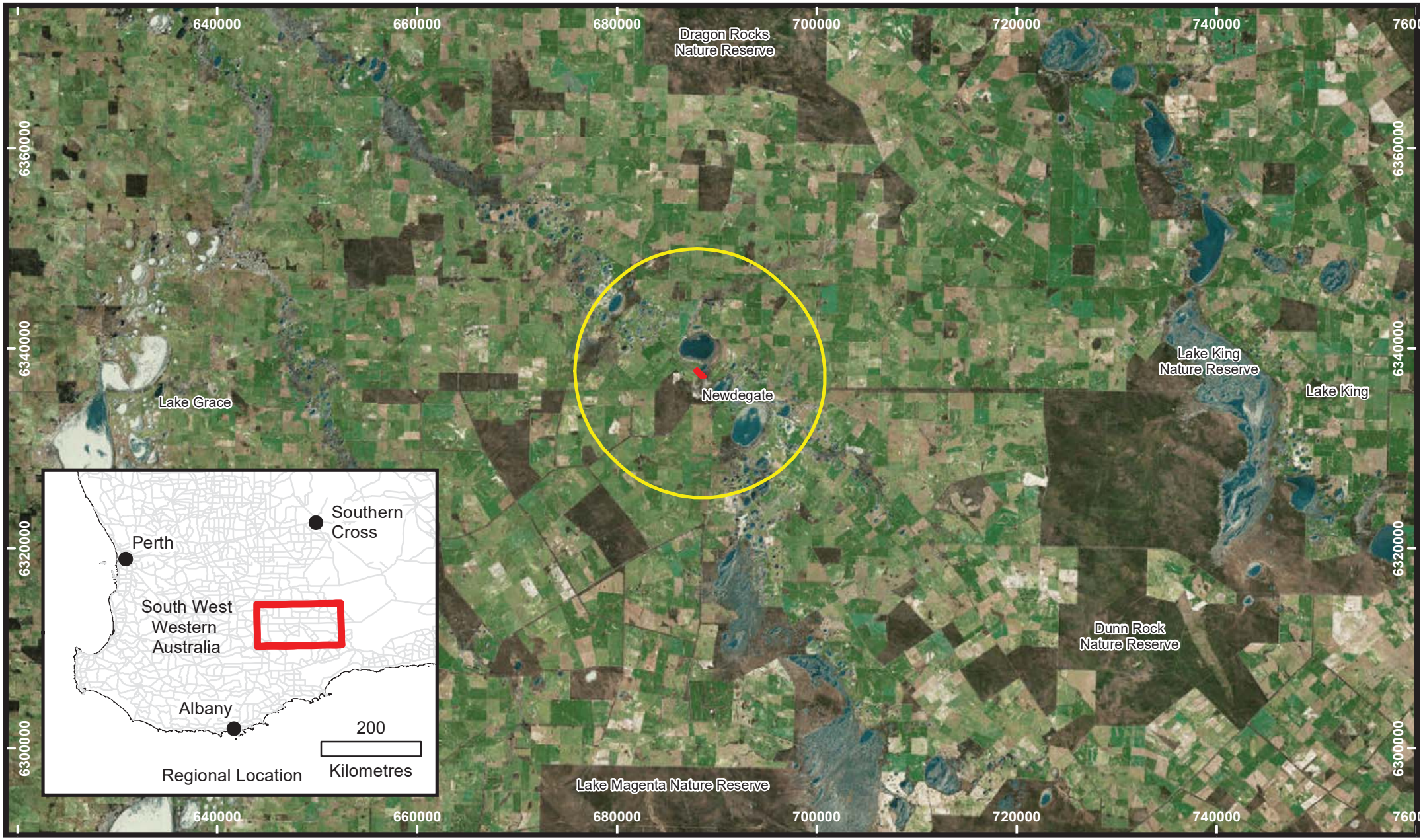
FIGURES



Legend

- Study Area
- 12km buffer

0 10 20 30 40 50

Kilometres

Fauna Survey

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Regional Location Plan

Drawn: G. Harewood	
Date: March 2019	
Scale: 1:500,000	
Projection/Coordinate System: UTM/MGA Zone 50	Figure: 1

Legend

Study Area

N

0 100 200 300 400 500

Metres

Fauna Survey

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Aerial Photograph

Drawn: G. Harewood
Date: April 2019
Scale: 1:5,750
Projection/Coordinate System: UTM/MGA Zone 50

Figure: 2

Legend

Study Area

Habitat Trees with Hollows Suitable for Black Cockatoos (360 Environmental 2015)

0 100 200 300 400 500

Metres

Fauna Survey

Drawn: G. Harewood

Date: April 2019

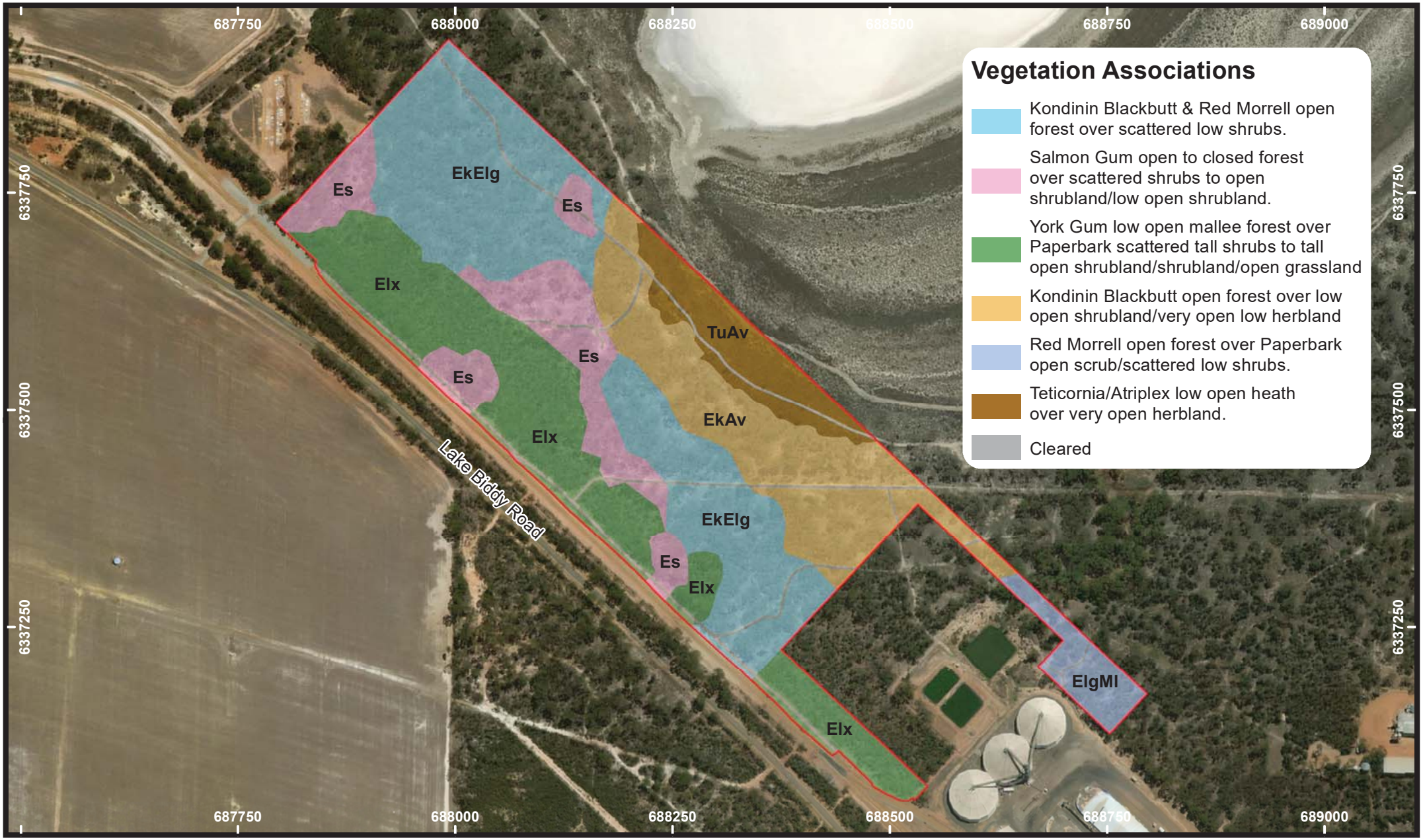
Scale: 1:5,750

Projection/Coordinate System: UTM/MGA Zone 50

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Habitat Trees with Hollows Suitable for Black Cockatoos
(360 Environmental 2015)

Figure: 3



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Study Area

N

0 100 200 300 400 500

Metres

Fauna Survey

Drawn: G. Harewood

Date: April 2019

Scale: 1:5,750

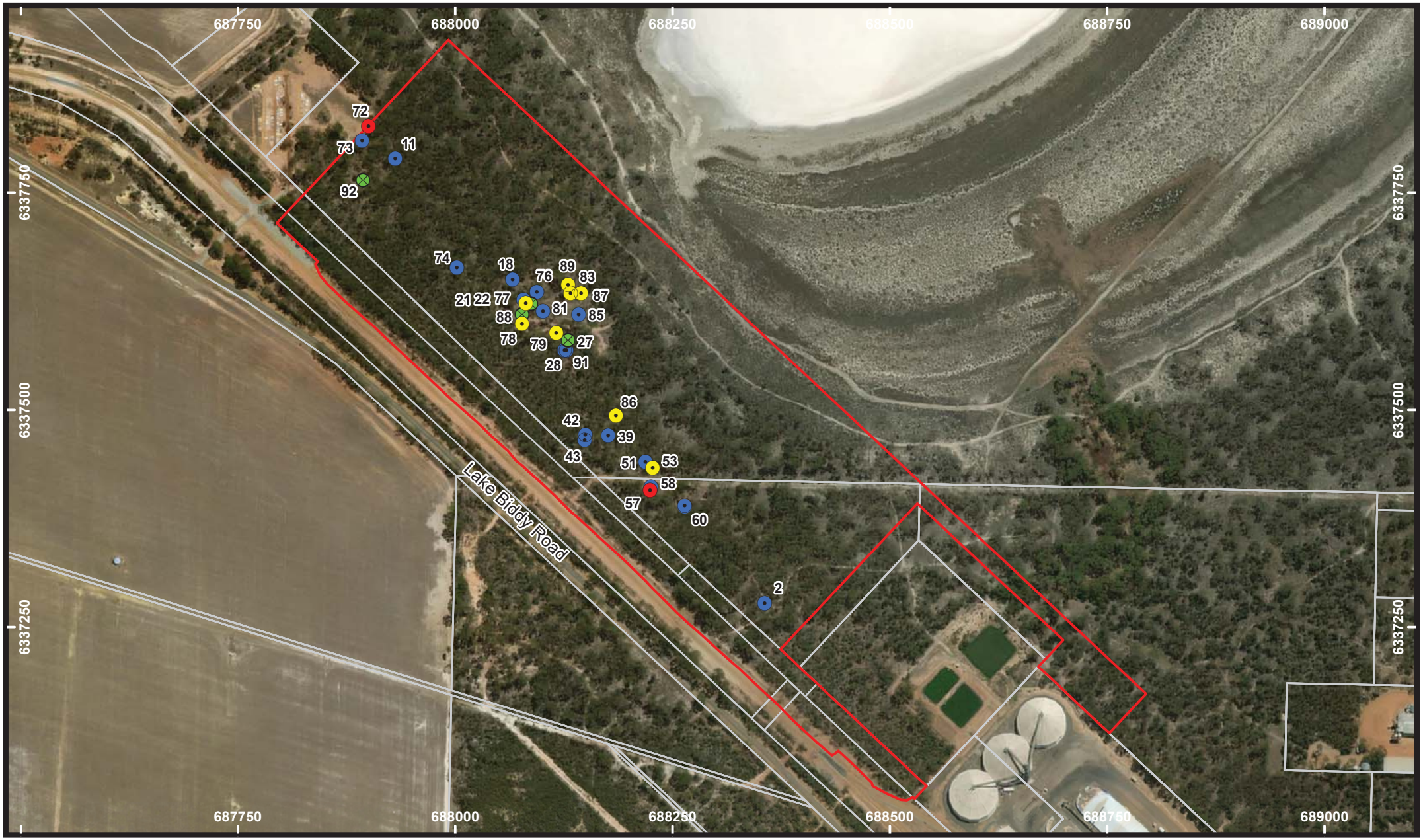
Projection/Coordinate System: UTM/MGA Zone 50

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Vegetation Associations within the Study Area

(ELA 2018)

Figure: 4



Legend

- Study Area
- Chewed Hollow
- Unused Hollow
- Unsuitable Hollow
- No Tree Present

0 100 200 300 400 500

Metres

Fauna Survey

Drawn: G. Harewood

Date: April 2019

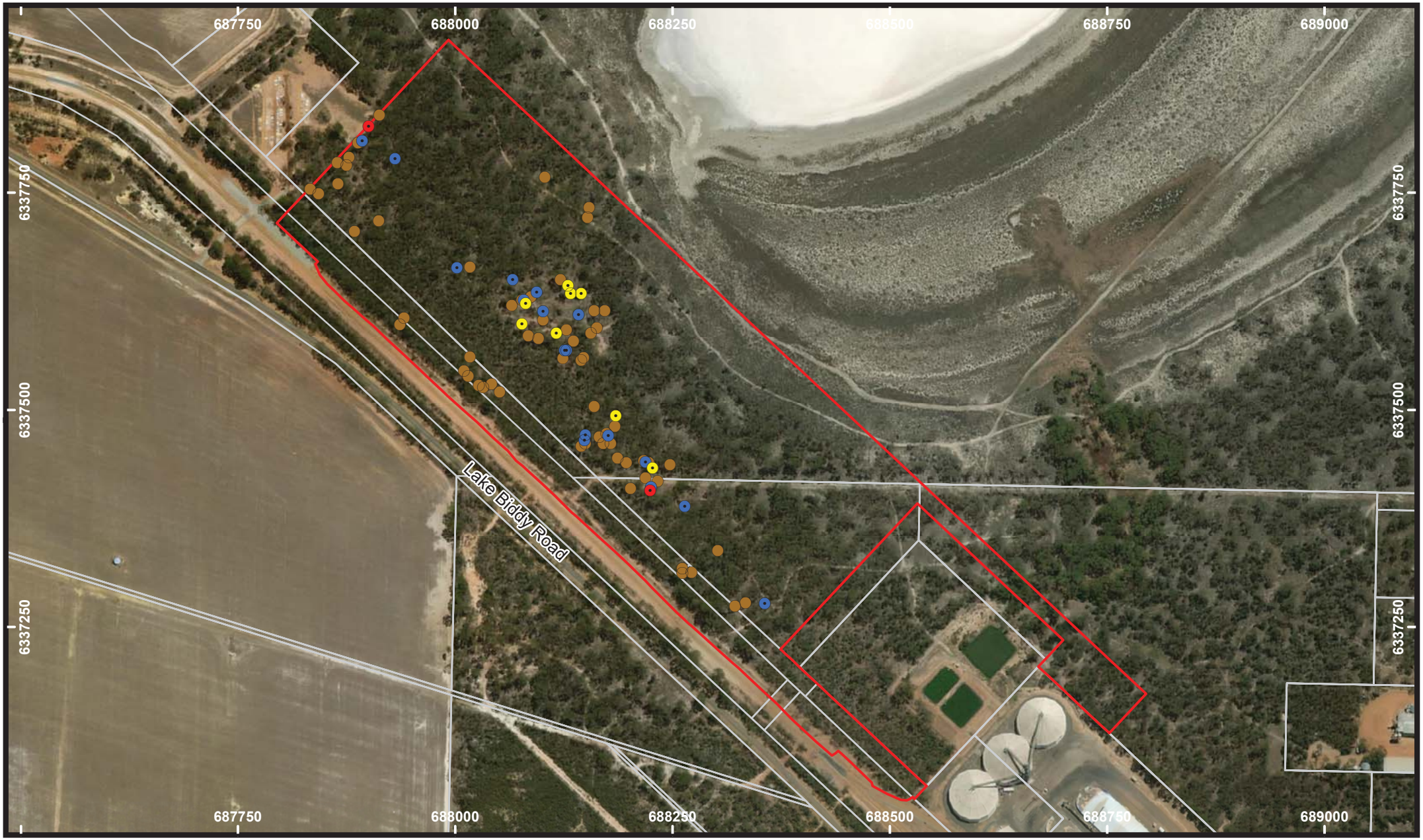
Scale: 1:5,750

Projection/Coordinate System: UTM/MGA Zone 50

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Revised Hollows Suitable for Black Cockatoos

Figure: 5



Legend

- Study Area
- Chewed Hollow
- Unused Hollow
- Unsuitable Hollow
- No Hollow

0 100 200 300 400 500

Metres

Fauna Survey

Drawn: G. Harewood

Date: April 2019

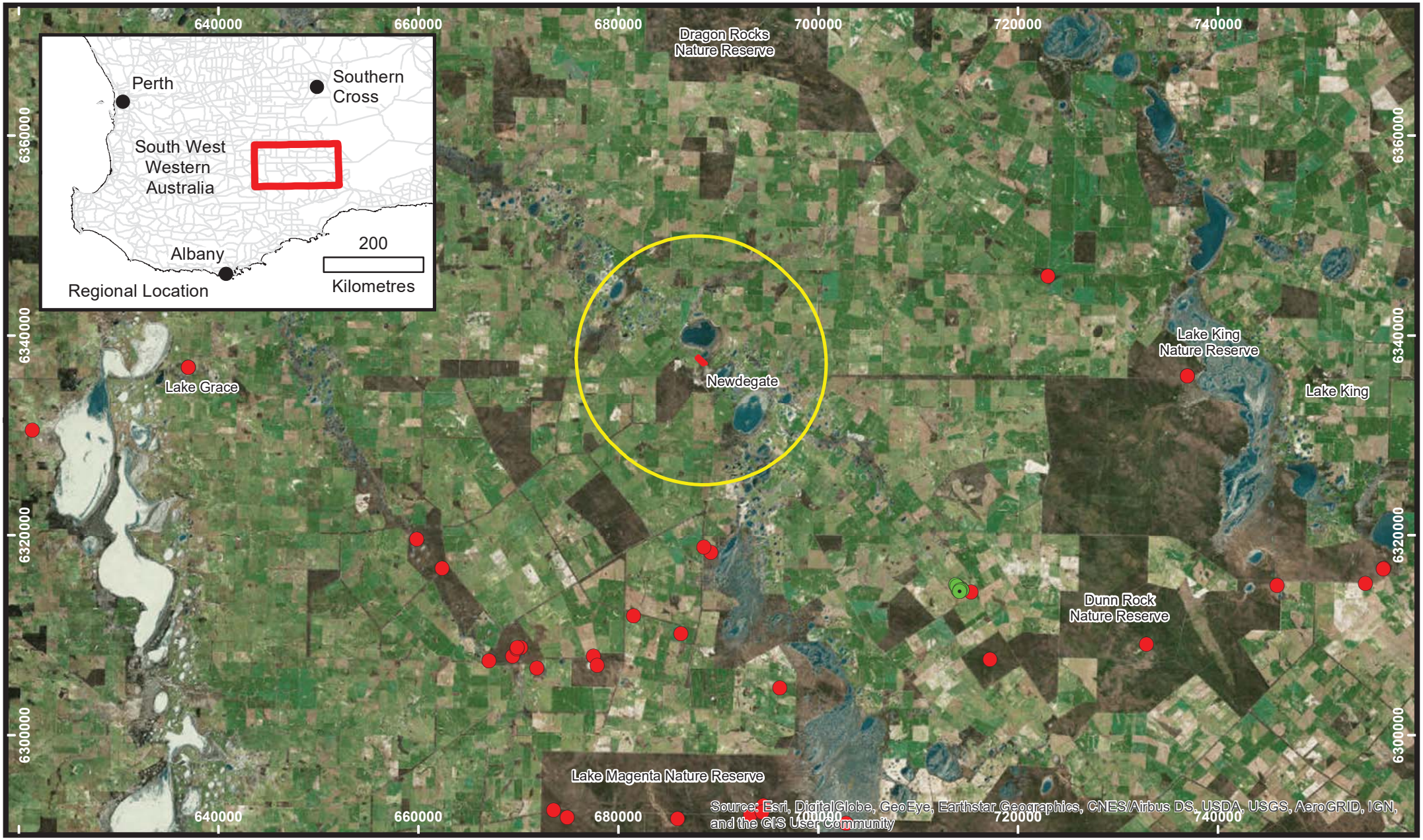
Scale: 1:5,750

Projection/Coordinate System: UTM/MGA Zone 50

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Revised Potential Black Cockatoo Breeding Trees (DBH >300mm)

Figure: 6



Legend

- Study Area
- 12km buffer
- Carnaby's Black Cockatoo Record
- Carnaby's Black Cockatoo Breeding Record

N

0 10 20 30 40 50

Kilometres

Fauna Survey

Drawn: G. Harewood
Date: March 2019
Scale: 1:500,000
Projection/Coordinate System: UTM/MGA Zone 50

Newdegate Grain Receival Site
Proposed Expansion
CBH Group

Carnaby's Cockatoo Records (NatureMap 2019)

Figure: 7

APPENDIX A

Hollow Bearing Habitat Tree Review

Results

ID	Location Data (MGA 94)	Z 50	688356 mE	6337277 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
2	Comments - 360 Environmental (2015)	One hollow (250mm entrance) in *Eucalyptus longicornis* (DBH 624mm).					Original Classification	Suitable Hollow
	Review Comments	Low (2.5m) angled spout. Hollow has some depth though possibly too narrow. No signs of use. Overall characteristics suggest this hollow is unlikely to be suitable for cockatoos.					Revised Classification	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	687931 mE	6337789 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
11	Comments - 360 Environmental (2015)	One hollow (150mm entrance) in *Eucalyptus salmonophloia* (DBH 324mm).					Original Classification	Suitable Hollow
	Review Comments	Side entry hollow into narrow trunk that appears too small for black cockatoos to use for nesting. Some other smaller spouts. Droppings at base of tree suggest use, possibly by owls.					Revised Classification	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	688066 mE	6337650 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
18	Comments - 360 Environmental (2015)	Two hollows (100mm entrances) in *Eucalyptus salmonophloia* (DBH 382mm).					Original Classification	Suitable Hollow
	Review Comments	Two spouts in small branches. Neither appear big enough to accommodate a nest black cockatoo. No signs of use.					Revised Classification	Unsuitable Hollows

ID	Location Data (MGA 94)	Z 50	688079 mE	6337626 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
21	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 414mm). Occupied by feral bees.					Original Classification	Suitable Hollow
	Review Comments	Spout and upward facing side entry hollow (knot hole). Accommodating branches and trunk appear too small for black cockatoos to use for nesting. Spout being used by feral bees.					Revised Classification	Unsuitable Hollow (in use by feral bees)

ID	Location Data (MGA 94)	Z 50	688081 mE	6337622 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
22	Comments - 360 Environmental (2015)	One hollow (250mm entrance) in *Eucalyptus salmonophloia* (DBH 478mm).					Original Classification	Suitable Hollow
	Review Comments	Chimney – appears possible suitable for black cockatoos though no sign of any use.					Revised Classification	Unused Hollow

ID	Location Data (MGA 94)	Z 50	688130 mE	6337580 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
27	**Comments - 360 Environmental (2015)**	One hollow (200mm entrance) in *Eucalyptus salmonophloia* (DBH 318mm).					**Original Classification**	Suitable Hollow
	Review Comments	This tree appears of have fallen over and/or been used for firewood.					**Revised Classification**	No Tree Present

ID	Location Data (MGA 94)	Z 50	688126 mE	6337568 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
28	**Comments - 360 Environmental (2015)**	Two hollows (250mm entrances) in *Eucalyptus salmonophloia* (DBH 484mm).					**Original Classification**	Suitable Hollow
	Review Comments	Spout and side entry hollows (pictured) into narrow trunk which appears too small to be suitable for black cockatoos. One other small spout. No signs of use.					**Revised Classification**	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	688176 mE	6337470 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
39	Comments - 360 Environmental (2015)	One hollow (150mm entrance) in *Eucalyptus salmonophloia* (DBH 433mm).					Original Classification	Suitable Hollow
	Review Comments	Spout and side entry hollow entrances into upward facing branch (pictured). Accommodating branch is too small for use by black cockatoos for nesting. No signs of use.					Revised Classification	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	688150 mE	6337471 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
42	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 398mm).					Original Classification	Suitable Hollow
	Review Comments	Side entry hollow into a narrow branch, too small for black cockatoos to use for nesting. Some other smaller spouts. No signs of use.					Revised Classification	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	688149 mE	6337465 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
43	Comments - 360 Environmental (2015)	One hollow (150mm entrance) in *Eucalyptus salmonophloia* (DBH 433mm). Hollow being used by nesting Galahs.					Original Classification	Suitable Hollow
	Review Comments	One chimney (pictured) and smaller spout. Tree trunk and branch accommodating hollows appear too small for use by black cockatoos. Chew mark on tree by galahs (pictured).					Revised Classification	Unsuitable Hollows (used by galahs)

ID	Location Data (MGA 94)	Z 50	688219 mE	6337440 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
51	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 331mm).					Original Classification	Suitable Hollow
	Review Comments	Side entry hollow. Accommodating tree trunk appears to be too small for black cockatoos to use for nesting. Chew marks around the perimeter of hollow entrance suggest use by galahs.					Revised Classification	Unsuitable Hollow (used by galahs)

ID	Location Data (MGA 94)	Z 50	688227 mE	6337433 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
53	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 430mm).					Original Classification	Suitable Hollow
	Review Comments	Two possible spouts. Accommodating branch forming angled spout (top left picture) appears too small for black cockatoos to use for entry. Upward facing spout (bottom left picture) has a larger entrance into a hollow with depth and may be suitable for use by black cockatoos though possibly marginal dimensions. No signs of use evident.					Revised Classification	Unused Hollow

ID	Location Data (MGA 94)	Z 50	688224 mE	6337407 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
57	Comments - 360 Environmental (2015)	One hollow (150mm entrance) in *Eucalyptus salmonophloia* (DBH 382mm).					Original Classification	Suitable Hollow
	Review Comments	Chimney style hollow. Accommodating branch appears marginal in size for black cockatoos to use for nesting however some evidence of chipping inside the hollow.					Revised Classification	Chewed Hollow

ID	Location Data (MGA 94)	Z 50	688225 mE	6337411 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
58	Comments - 360 Environmental (2015)	One hollow (250mm entrance) in *Eucalyptus salmonophloia* (DBH 478mm).					Original Classification	Suitable Hollow
	Review Comments	Low (~3m) chimney style hollow with some depth. Hollow appears suitable but low height lessens likelihood of actual use. No signs of use. Overall characteristics suggest this hollow is unlikely to be suitable for cockatoos.					Revised Classification	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	688264 mE	6337389 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
60	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 376mm).					Original Classification	Suitable Hollow
	Review Comments	Side entry hollow. Accommodating tree trunk appears too narrow to be suitable for black cockatoos. Chew marks around the complete perimeter of hollow entrance are indicative of use by galahs.					Revised Classification	Unsuitable Hollow (used by galahs)

ID	Location Data (MGA 94)	Z 50	688264 mE	6337389 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
72	Comments - 360 Environmental (2015)	Two hollows (150mm entrances) in *Eucalyptus salmonophloia* (DBH 541mm).					Original Classification	Suitable Hollow
	Review Comments	Chimney and smaller spout (left picture). Internal dimensions of chimney appear marginal for black cockatoos to use for nesting though some evidence of chipping (galahs?). Chew marks on tree trunk also suggest galah activity.					Revised Classification	Chewed Hollow (used by galahs)

ID	Location Data (MGA 94)	Z 50	687893 mE	6337809 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
73	Comments - 360 Environmental (2015)	Four hollows (100mm entrances) in *Eucalyptus salmonophloia* (DBH 631mm). One hollow occupied by feral bees.					Original Classification	Suitable Hollow
	Review Comments	Two side entry hollows (top and bottom left photos) and spout (centre photo) plus several other much smaller spouts. One side entry hollow is in use by feral bees. Accommodating branches and trunk appear too small for black cockatoos to use for nesting. Chew marks on trunk by galahs.					Revised Classification	Unsuitable Hollows (used by galahs/feral bees)

ID	Location Data (MGA 94)	Z 50	688002 mE	6337663 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
74	Comments - 360 Environmental (2015)	Three hollows (100mm entrances) in *Eucalyptus salmonophloia* (DBH 554mm).					Original Classification	Suitable Hollow
	Review Comments	Three spouts, two small (bottom left photo) and one larger (top left photo). Accommodating branches appear too small for black cockatoos in all cases. Scarring on tree trunk indicates galah breeding activity.					Revised Classification	Unsuitable Hollow (used by galahs)

ID	Location Data (MGA 94)	Z 50	688094 mE	6337635 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
76	Comments - 360 Environmental (2015)	Four hollows (100 - 200mm entrances) in *Eucalyptus salmonophloia* (DBH 713mm). One hollow occupied by feral bees. Galahs nesting in another hollow.					Original Classification	Suitable Hollow
	Review Comments	Several spouts. Accommodating branches appear too small for black cockatoos in all cases. Small side entry hollow occupied by bees.					Revised Classification	Unsuitable Hollows (tree used by feral bees)

ID	Location Data (MGA 94)	Z 50	688087 mE	6337621 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
77	Comments - 360 Environmental (2015)	Two hollows (100 - 200mm entrances) in *Eucalyptus salmonophloia* (DBH 669mm). One hollow occupied by feral bees. Elegant parrots present.					Original Classification	Suitable Hollow
	Review Comments	This tree appears of been felled and used for firewood.					Revised Classification	No Tree Present

ID	Location Data (MGA 94)	Z 50	688077 mE	6337599 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
78	Comments - 360 Environmental (2015)	Four hollows (250mm entrances) in *Eucalyptus salmonophloia* (DBH 656mm). One hollow being used by nesting Galahs.					Original Classification	Suitable Hollow
	Review Comments	Two main spouts (top and bottom left photos) and a side entry hollow (centre bottom photo). Other smaller spouts. Largest spout potentially suitable for breeding black cockatoos. No sign of use by black cockatoos by scarring on tree trunk consistent with previously reported galah breeding activity.					Revised Classification	Unused Hollow (used by galahs)

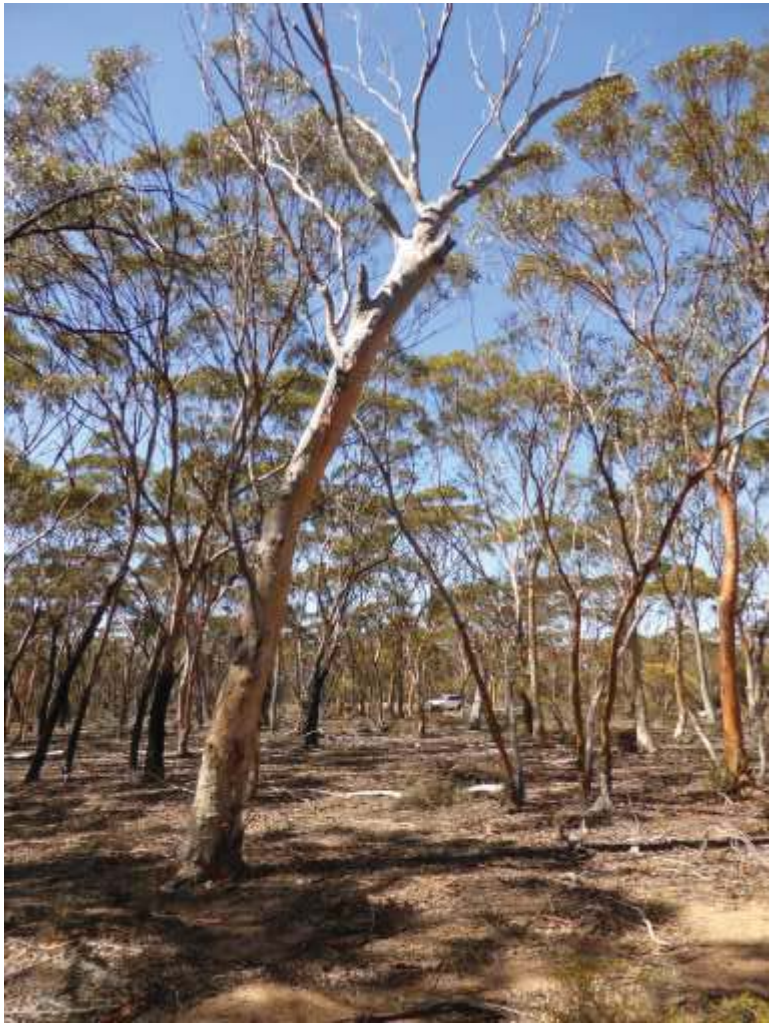
ID	Location Data (MGA 94)	Z 50	688116 mE	6337588 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
79	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 589mm). Hollow being used by nesting Galahs.					Original Classification	Suitable Hollow
	Review Comments	Side entry hollow into main trunk. Appears to be suitable for black cockatoos though accommodating truck possibly marginal in size. Regent parrots observed nearby.					Revised Classification	Unused Hollow

ID	Location Data (MGA 94)	Z 50	688101 mE	6337613 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
81	Comments - 360 Environmental (2015)	One hollow (100mm entrance) in *Eucalyptus salmonophloia* (DBH 510mm).					Original Classification	Suitable Hollow
	Review Comments	Recently created spout (snapped branch) just above small side entry hollow (both pictured). Other smaller spouts. Accommodating branches in all cases too small for black cockatoos. No sign of use.					Revised Classification	Unsuitable Hollow

ID	Location Data (MGA 94)	Z 50	688133 mE	6337634 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
83	Comments - 360 Environmental (2015)	Three hollows (250mm entrances) in *Eucalyptus salmonophloia* (DBH 688mm).					Original Classification	Suitable Hollow
	Review Comments	Spout and side entry hollow in addition to some smaller hollow branches. Spout (bottom left photo) is too small for black cockatoo to use for nesting. Side entry hollow (top left photo) potentially suitable. This hollow and tree trunk (centre photo) have been chewed by galahs.					Revised Classification	Unused Hollow (used by galahs)

ID	Location Data (MGA 94)	Z 50	688142 mE	6337609 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
85	Comments - 360 Environmental (2015)	One hollow (200mm entrance) in *Eucalyptus salmonophloia* (DBH 596mm).					Original Classification	Suitable Hollow
	Review Comments	Upward facing spout (centre and left photos). Accommodating branch appears too small for black cockatoos to use for nesting. Extensive chew marks on trunk indicate galah activity.					Revised Classification	Unsuitable Hollow (used by galahs)

ID	Location Data (MGA 94)	Z 50	688185 mE	6337493 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
86	Comments - 360 Environmental (2015)	Two hollows (150mm entrances) in *Eucalyptus salmonophloia* (DBH 529mm).					Original Classification	Suitable Hollow
	Review Comments	Three chimney type hollow branches are all too small for black cockatoos. Side entry hollow (pictured) appears to have some depth and therefore may be suitable. No signs of use.					Revised Classification	Unused Hollow



ID	Location Data (MGA 94)	Z 50	688145 mE	6337634 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
87	Comments - 360 Environmental (2015)	Four hollows (250-300mm entrances) in *Eucalyptus salmonophloia* (DBH 1051mm).					Original Classification	Suitable Hollow
	Review Comments	Spout and side entry into trunk (top left photo) that appears suitable for black cockatoos. Other smaller spouts unsuitable (bottom left photo). Bees using small knot hole. No other signs of use.					Revised Classification	Unused Hollow (bees in other hollow)

ID	Location Data (MGA 94)	Z 50	688077 mE	6337609 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
88	Comments - 360 Environmental (2015)	One hollow (200mm entrance) in dead stag (DBH 414mm).					Original Classification	Suitable Hollow
	Review Comments	This tree appears of have felled and used for firewood.					Revised Classification	No Tree Present

ID	Location Data (MGA 94)	Z 50	688130 mE	6337643 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
89	Comments - 360 Environmental (2015)	Two hollows (300mm entrances) in dead stag (DBH 389mm).					Original Classification	Suitable Hollow
	Review Comments	Chimney (bottom left photo) and side entry hollow (top left photo) providing entry to same trunk at different levels. Accommodating trunk is possibly marginal is size but maybe suitable. No signs of use.					Revised Classification	Unused Hollow

ID	Location Data (MGA 94)	Z 50	688128 mE	6337568 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
91	Comments - 360 Environmental (2015)	Three hollows (150-200mm entrances) in dead stag (DBH 516mm).					Original Classification	Suitable Hollow
	Review Comments	Chimney (centre photo), spout (top left photo) and side entry (bottom left photo) type hollows. Accommodating trunk/branches appear to be too small for black cockatoos to use for nesting. No signs of use.					Revised Classification	Unsuitable Hollows

ID	Location Data (MGA 94)	Z 50	687894 mE	6337764 mN	Original Survey Date	26-27/05/2015	Photo Date	25/03/2019
92	Comments - 360 Environmental (2015)	Three hollows (150mm entrances) in dead stag (DBH 596mm).					Original Classification	Suitable Hollow
	Review Comments	This tree appears to have fallen over.					Revised Classification	No Tree Present

APPENDIX B

Revised Potential Black Cockatoo Breeding Trees (DBH >300mm)

Summary Details

Habitat Trees
DBH >300mm
Datum GDA 94 Z50

ID	Tree Species	Common Name	mE	mN	DBH (mm)	Size Class (360 2015)	No. of Hollows	Hollow Entrance Size (mm)	360 (2015) Classification	360 (2015) Notes	Revised (2019) Classification	Review (2019) Notes
1	Eucalyptus longicornis	Red Morrell	688322	6337274	500	A			No Hollows			
2	Eucalyptus longicornis	Red Morrell	688356	6337277	624	B	1	250	Suitable Hollow		Unsuitable Hollow	Very low, marginal size, appears unsuitable
3	Eucalyptus longicornis	Red Morrell	688334	6337278	599	B			No Hollows			
4	Eucalyptus salmonophloia	Salmon Gum	687913	6337839	433	A			No Hollows			
5	Eucalyptus salmonophloia	Salmon Gum	687878	6337790	318	A			No Hollows			
6	Eucalyptus salmonophloia	Salmon Gum	687875	6337781	350	A			No Hollows			
7	Eucalyptus salmonophloia	Salmon Gum	687864	6337784	331	A			No Hollows			
8	Eucalyptus salmonophloia	Salmon Gum	687833	6337754	331	A			No Hollows			
9	Eucalyptus salmonophloia	Salmon Gum	687843	6337748	344	A			No Hollows			
10	Eucalyptus salmonophloia	Salmon Gum	687865	6337760	465	A			No Hollows			
11	Eucalyptus salmonophloia	Salmon Gum	687931	6337789	325	A	1	150	Suitable Hollow		Unsuitable Hollow	Appears too small, occupied by owls ?
12	Eucalyptus salmonophloia	Salmon Gum	687884	6337705	318	A			No Hollows			
13	Eucalyptus salmonophloia	Salmon Gum	687912	6337717	328	A			No Hollows			
14	Eucalyptus salmonophloia	Salmon Gum	687941	6337605	338	A			No Hollows			
15	Eucalyptus salmonophloia	Salmon Gum	687936	6337598	366	A			No Hollows			
16	Eucalyptus salmonophloia	Salmon Gum	688017	6337664	318	A			No Hollows			
17	Eucalyptus salmonophloia	Salmon Gum	688103	6337767	322	A			No Hollows			
18	Eucalyptus salmonophloia	Salmon Gum	688066	6337650	382	A	2	100	Suitable Hollow		Unsuitable Hollows	All appear too small
19	Eucalyptus salmonophloia	Salmon Gum	688065	6337620	350	A			No Hollows			
20	Eucalyptus salmonophloia	Salmon Gum	688077	6337626	344	A			No Hollows			
21	Eucalyptus salmonophloia	Salmon Gum	688079	6337626	414	A	1	100	Suitable Hollow	Bees	Unsuitable Hollow	Appears too small, in use by feral bees
22	Eucalyptus salmonophloia	Salmon Gum	688081	6337622	478	A	1	250	Suitable Hollow		Unused Hollow	Appears suitable, no sign of use
23	Eucalyptus salmonophloia	Salmon Gum	688084	6337585	318	A			No Hollows			
24	Eucalyptus salmonophloia	Salmon Gum	688096	6337582	315	A			No Hollows			
25	Eucalyptus salmonophloia	Salmon Gum	688128	6337592	320	A			No Hollows			
26	Eucalyptus salmonophloia	Salmon Gum	688136	6337579	344	A			No Hollows			
27	Eucalyptus salmonophloia	Salmon Gum	688130	6337580	318	A	1	200	Suitable Hollow		No Tree Present	Fallen over/felled
28	Eucalyptus salmonophloia	Salmon Gum	688126	6337568	484	A	2	250	Suitable Hollow		Unsuitable Hollows	All appear too small
29	Eucalyptus salmonophloia	Salmon Gum	688124	6337559	366	A			No Hollows			
30	Eucalyptus salmonophloia	Salmon Gum	688145	6337557	398	A			No Hollows			
31	Eucalyptus salmonophloia	Salmon Gum	688148	6337560	360	A			No Hollows			
32	Eucalyptus salmonophloia	Salmon Gum	688156	6337588	465	A			No Hollows			
33	Eucalyptus salmonophloia	Salmon Gum	688163	6337594	420	A			No Hollows			
34	Eucalyptus salmonophloia	Salmon Gum	688172	6337614	455	A			No Hollows			
35	Eucalyptus salmonophloia	Salmon Gum	688152	6337721	350	A			No Hollows			
36	Eucalyptus salmonophloia	Salmon Gum	688154	6337732	318	A			No Hollows			
37	Eucalyptus salmonophloia	Salmon Gum	688160	6337504	325	A			No Hollows			
38	Eucalyptus salmonophloia	Salmon Gum	688184	6337481	392	A			No Hollows			
39	Eucalyptus salmonophloia	Salmon Gum	688176	6337470	433	A	1	150	Suitable Hollow		Unsuitable Hollow	Appears too small
40	Eucalyptus salmonophloia	Salmon Gum	688174	6337473	459	A			No Hollows			
41	Eucalyptus salmonophloia	Salmon Gum	688166	6337469	414	A			No Hollows			
42	Eucalyptus salmonophloia	Salmon Gum	688150	6337471	398	A	1	100	Suitable Hollow		Unsuitable Hollow	Appears too small
43	Eucalyptus salmonophloia	Salmon Gum	688149	6337465	443	A	1	150	Suitable Hollow	Pink and Greys nesting	Unsuitable Hollow	Appears too small, used by galahs
44	Eucalyptus salmonophloia	Salmon Gum	688150	6337461	318	A			No Hollows			
45	Eucalyptus salmonophloia	Salmon Gum	688145	6337458	382	A			No Hollows			
46	Eucalyptus salmonophloia	Salmon Gum	688170	6337461	408	A			No Hollows			
47	Eucalyptus salmonophloia	Salmon Gum	688179	6337461	369	A			No Hollows			
48	Eucalyptus salmonophloia	Salmon Gum	688187	6337444	424	A			No Hollows			
49	Eucalyptus salmonophloia	Salmon Gum	688197	6337439	344	A			No Hollows			
50	Eucalyptus salmonophloia	Salmon Gum	688217	6337441	392	A			No Hollows			
51	Eucalyptus salmonophloia	Salmon Gum	688219	6337440	331	A	1	100	Suitable Hollow		Unsuitable Hollow	Appears too small, used by galahs
52	Eucalyptus salmonophloia	Salmon Gum	688223	6337439	439	A			No Hollows			
53	Eucalyptus salmonophloia	Salmon Gum	688227	6337433	430	A	1	100	Suitable Hollow		Unused Hollow	Appears suitable, no sign of use
54	Eucalyptus salmonophloia	Salmon Gum	688247	6337437	350	A			No Hollows			
55	Eucalyptus salmonophloia	Salmon Gum	688202	6337409	436	A			No Hollows			
56	Eucalyptus salmonophloia	Salmon Gum	688219	6337422	318	A			No Hollows			
57	Eucalyptus salmonophloia	Salmon Gum	688224	6337407	382	A	1	150	Suitable Hollow		Chewed Hollow	Marginal size but possible evidence of use
58	Eucalyptus salmonophloia	Salmon Gum	688225	6337411	478	A	1	250	Suitable Hollow		Unsuitable Hollow	Low, marginal size, appears unsuitable
59	Eucalyptus salmonophloia	Salmon Gum	688233	6337418	446	A			No Hollows			
60	Eucalyptus salmonophloia	Salmon Gum	688264	6337389	376	A	1	100	Suitable Hollow		Unsuitable Hollow	Appears too small, used by galahs
61	Eucalyptus salmonophloia	Salmon Gum	688261	6337317	318	A			No Hollows			
62	Eucalyptus salmonophloia	Salmon Gum	688261	6337312	398	A			No Hollows			
63	Eucalyptus salmonophloia	Salmon Gum	688272	6337313	318	A			No Hollows			
64	Eucalyptus salmonophloia	Salmon Gum	688302	6337338	312	A			No Hollows			
65	Eucalyptus salmonophloia	Salmon Gum	688027	6337528	318	A			No Hollows			

ID	Tree Species	Common Name	mE	mN	DBH (mm)	Size Class (360 2015)	No. of Hollows	Hollow Entrance Size (mm)	360 (2015) Classification	360 (2015) Notes	Revised (2019) Classification	Review (2019) Notes
66	Eucalyptus salmonophloia	Salmon Gum	688032	6337526	334	A			No Hollows			
67	Eucalyptus salmonophloia	Salmon Gum	688051	6337520	350	A			No Hollows			
68	Eucalyptus salmonophloia	Salmon Gum	688042	6337530	382	A			No Hollows			
69	Eucalyptus salmonophloia	Salmon Gum	688017	6337561	398	A			No Hollows			
70	Eucalyptus salmonophloia	Salmon Gum	688010	6337545	344	A			No Hollows			
71	Eucalyptus salmonophloia	Salmon Gum	688015	6337539	363	A			No Hollows			
72	Eucalyptus salmonophloia	Salmon Gum	687900	6337826	541	B	2	150	Suitable Hollow		Chewed Hollow	Marginal size but possible evidence of use, used by galahs
73	Eucalyptus salmonophloia	Salmon Gum	687893	6337809	631	B	4	100	Suitable Hollow	Bees	Unsuitable Hollows	All appear too small, used by galahs and feral bees
74	Eucalyptus salmonophloia	Salmon Gum	688002	6337663	554	B	3	100	Suitable Hollow		Unsuitable Hollows	All appear too small, used by galahs
75	Eucalyptus salmonophloia	Salmon Gum	688087	6337630	510	B			No Hollows			
76	Eucalyptus salmonophloia	Salmon Gum	688094	6337635	713	B	4	100-200	Suitable Hollow	Bees, Pink and Greys nesting	Unsuitable Hollows	All appear too small, used by feral bees
77	Eucalyptus salmonophloia	Salmon Gum	688087	6337621	669	B	2	100-200	Suitable Hollow	Bees, Elegant parrots	No Tree Present	Fallen over/felled
78	Eucalyptus salmonophloia	Salmon Gum	688077	6337599	656	B	4	250	Suitable Hollow	Pink and Greys nesting	Unused Hollow	One hollow appears suitable, used by galahs
79	Eucalyptus salmonophloia	Salmon Gum	688116	6337588	589	B	1	100	Suitable Hollow		Unused Hollow	Appears suitable, no sign of use
80	Eucalyptus salmonophloia	Salmon Gum	688101	6337603	541	B			No Hollows			
81	Eucalyptus salmonophloia	Salmon Gum	688101	6337613	510	B	1	100	Suitable Hollow		Unsuitable Hollow	Appears too small
82	Eucalyptus salmonophloia	Salmon Gum	688121	6337650	510	B			No Hollows			
83	Eucalyptus salmonophloia	Salmon Gum	688133	6337634	688	B	3	250	Suitable Hollow		Unused Hollow	One hollow appears suitable, used by galahs
84	Eucalyptus salmonophloia	Salmon Gum	688160	6337614	535	B			No Hollows			
85	Eucalyptus salmonophloia	Salmon Gum	688142	6337609	596	B	1	200	Suitable Hollow		Unsuitable Hollow	Appears too small, used by galahs
86	Eucalyptus salmonophloia	Salmon Gum	688185	6337493	529	B	2	150	Suitable Hollow		Unused Hollow	One hollow appears suitable, no sign of use
87	Eucalyptus salmonophloia	Salmon Gum	688145	6337634	1051	C	4	250-300	Suitable Hollow		Unused Hollow	One hollow appears suitable, feral bees
88	Stag	Stag	688077	6337609	414	A	1	200	Suitable Hollow		No Tree Present	Felled
89	Stag	Stag	688130	6337643	389	A	2	300	Suitable Hollow		Unused Hollow	One hollow appears suitable, no sign of use
90	Stag	Stag	687888	6337807	573	B			No Hollows			
91	Stag	Stag	688128	6337568	516	B	3	150-200	Suitable Hollow		Unsuitable Hollows	All appear too small
92	Stag	Stag	687894	6337764	596	B	3	150	Suitable Hollow		No Tree Present	Fallen over

DISCLAIMER

This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances, the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also, it should be recognised that site conditions, can change with time.

Within the limitations imposed by the scope of services, the field assessment and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

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

Appendix D : Environmental Management Standard

OVERVIEW

This document provides the mandatory requirements to support conformance with Environmental Management as part of the CBH Integrated Management System (IMS).

PERFORMANCE REQUIREMENTS

We meet performance requirements by:

- Placing value on sustainability and continually striving for outcomes that benefit the environment.
- Determining key environmental risks through our experience and analysing these to identify where our greatest risk exposures to potentially causing environmental harm are.
- Eliminating risks through use of the “Hierarchy of Controls”, and where this is not possible implement other controls.
- Ensuring all CBH personnel understand our environmental risks and how they are managed.
- Having an environmental and sustainable vision that manages our environmental risks effectively, so we deliver value to all our stakeholders by protecting, sustaining and enhancing the natural resources needed for the future.

References

Title	STORE ID
Health, Safety and Environment Policy	STORE-1473931053-383

CONTENTS

INTRODUCTION

The Environmental Management Standard is a set of mandatory minimum environmental management requirements that apply to all CBH Group activities.

The Standard defines the critical environmental controls required to manage key environmental risks. It has been designed to emphasise the most important requirements to manage risks that have the potential to cause environmental harm.

The Environmental Management Standard is a practical reference to assist you with implementing the required controls into every element of planning and execution of work that involves environmental risks.

Scope

This standard applies to all CBH sites, operations, project sites and associated tasks.

Exemption

Where a part of the business deems it is not reasonably practicable to meet one or more of the requirements defined within this Group Procedure, they can apply for a dispensation for a specific period which requires endorsement by the relevant General Manager, Head or Principal.

The dispensation must be documented by completing a High-Level Risk Assessment, which outlines:

- The reason for the request
- The part of the business that the dispensation applies to
- The specific duration of the dispensation
- An assessment of the risk of not complying with a requirement defined in the Environmental Management Standard, and
- Other controls that will be put in place as an alternative.

Definitions

Acronym / Term	Definition
Bunded	Infrastructure or equipment to contain substances in the event of a spill or leak. A bund might normally be a walled structure around a holding tank
Carbon Dioxide	Carbon dioxide (CO2) is gas formed by combustion of carbon and in the respiration of living organisms and is considered a greenhouse gas
Competent persons	Having the skills, knowledge and attitudes required to perform the task as required in the workplace
Emission	A substance – usually a dust or gas – which is created as a by-product of a physical process and released to the atmosphere
Fauna	The animals of a region, habitat or geological period
Flora	The plants of a region, habitat or geological period
Greenhouse Gas	A gas that contributes to the greenhouse effect by absorbing infrared radiation. Carbon dioxide and chlorofluorocarbons are examples of greenhouse gases
Hazardous Waste	Component of the waste stream which by its characteristics poses a threat or risk to public health, safety of the environment (includes substances such as asbestos, lead, chemicals). Hazardous wastes are generally unsuitable for landfill disposal and should only be transported by and to suitably licensed providers.
Hydrocarbons	Hydrocarbons are substances that contain hydrogen (H) and carbon (C) such as lubricating oils, petrol and diesel fuels, monocyclic aromatic hydrocarbons and polycyclic

Acronym / Term	Definition
	aromatic hydrocarbons (PAHs), and are considered a hazard to environment when released in an uncontrolled manner
Incandescent Lighting	Source of electrical light generated by the heating of a filament
Licensed Waste Carrier	An organisation licensed by the regulating authority to collect, transport and/or receive waste/s
Native Vegetation	Plants that are indigenous to the region including trees, shrubs herbs and grasses. Native vegetation provides habitat for plants and animals and delivers ecosystem and biodiversity benefits
Potable Water	Water fit for human consumption

1. AIR QUALITY

Application

Adverse impacts on local or regional air quality from CBH generated air emissions (such as dust, odour or combustion emissions) are to be minimised.

Critical Controls

- All air quality related emission impacts (such as dust, odour and combustion emissions) must be assessed and mitigation measures put in place where the potential exists for adverse community impacts or legislative non-compliances
- All activities involving excavation or disturbance of soils and vegetation must explore preventive controls and then implement physical controls (e.g. covering of stockpiles, water spraying, containment fencing) to prevent and/or minimise the generation of dust
- All new or refurbished infrastructure (including plant and equipment) must comply with appropriate legislative requirements with respect to Air Quality
- All heavy trafficked areas such as roadways shall be sealed or treated where practicable to reduce dust lift and dust emissions
- All Abrasive Blasting activities are to be undertaken to the requirements of Worksafe Code of Practice for Abrasive Blasting and the Environmental Protection (Abrasive Blasting) Regulations 1998
- All complaints shall be reported as per CBH's Incident Management Procedure.

2. NOISE EMISSIONS

Application

The impact on communities, people and fauna from CBH related noise emissions is to be minimised.

Critical Controls

- Prior to purchasing or hiring plant and equipment, noise emission data is to be obtained from the supplier or manufacturer. Maximum noise emission limits to ensure the workplace can remain below excessive noise levels are to be stated in specifications for the purchase or hire of plant or equipment. As far as practicable, preference shall be given to plant and equipment with low noise emissions (levels lower than 85 dB(A))
- Where possible, noise levels in areas where new plant or equipment is installed is not to exceed 85 dB(A)
- Where the purchase of equipment involves installing more than one item in the same location, the combined noise level is not to exceed 85 dB(A) (where practicable)
- Inspect, maintain and repair all plant, equipment and vehicles regularly to minimise noise levels during operation
- Following any complaint, the source of any excessive noise or vibration will be identified and work practices modified or re-scheduled to reduce or eliminate the risk of future events
- All new or refurbished infrastructure (including plant and equipment) must comply with appropriate legislative requirements with respect to Noise Emissions
- All complaints related to noise shall be reported as per CBH's Incident Management Procedure.

3. FLORA AND FAUNA

Application

Any impact on flora and/or fauna from CBH related activities is to be avoided or minimised.

Critical Controls

- Unauthorised clearing of native vegetation is not permitted. If clearing of native vegetation is necessary for any purpose or sized area (e.g. maintenance, new developments, fire breaks etc.) the project must be referred to the Environment and Sustainability Manager for assessment.
- Only suitably trained, qualified and authorised personnel are to intervene where snakes and other fauna are identified on site
- Any death, injury or damage to native fauna on a CBH site is to be reported as an incident as per CBH's Incident Management Procedure.

4. WATER QUALITY AND CONSUMPTION

Application

Water contamination and pollution causing events are to be prevented and water use efficiencies maximised on all CBH sites, projects and controlled activities.

Critical Controls

Water Quality

- No discharge of materials into the marine environment is permitted, including grain and liquid or solid wastes
- Incidents of an unauthorised discharge into the marine environment are to be reported as an incident as per CBH's Incident Management Procedure
- All equipment servicing is to be undertaken in designated areas and in a manner that ensures containment of all hydrocarbons and chemicals
- Equipment and vehicle wash-down facilities must comply with the requirements of the *Water Quality Protection Note 68 Mechanical Equipment Wash-down* (Department of Water 2006).

Water Consumption

- All mains drinking water should be metered to allow site mains and potable water use to be monitored and logged
- Any project requiring large water use requirements (i.e. 5000 kilolitres or above) should be referred to the Environment and Sustainability Manager for assessment.

5. CARBON EMISSIONS

Application

CBH is committed to reducing greenhouse gas emissions and the carbon intensity of our business and activities.

Critical Controls

- All mains electricity used should be metered to allow site energy consumption to be monitored and logged
- All incandescent lighting is to be phased out and replaced with an energy efficient lighting alternative
- Unnecessary running of plant or equipment is to be avoided to reduce energy or fuel use and minimise greenhouse gas emissions
- Unnecessary idling of vehicles and mobile plant or equipment is to be avoided to reduce fuel usage and minimise greenhouse gas emissions
- Energy efficiency shall be considered as a key factor when sourcing new plant and equipment
- Supplementary energy generation via permanent/stationary/fixed generators requires pre site installation inspection, formal asset tracking via logging in SAP, and sign off by CBH Engineering. Where practicable the most efficient/lowest emission option should be sourced.

6. LAND CONTAMINATION

Application

Ground contamination events are to be prevented from all CBH sites, projects or activities.

Critical Controls

Refuelling

- All chemical and hydrocarbon storage tanks or containers are to be double skinned or must be contained within impervious bunding that contains as a minimum 110% loss of the largest container in the bunded area in the event of a spill
- Bund walls must be at least 1 metre from the edge of fixed tanks
- Separation distances between hydrocarbons and other storage facilities (including grain stacks) are to be maintained
- Refuelling of mobile plant and equipment is to be undertaken on designated hardstand areas or provided with temporary bunding to contain spillages. Provision of spill kits must be available when refuelling
- Emergency fuel flow shut off capability are required for all bulk fuel supplies
- No new underground bulk fuel storage tanks are to be installed on CBH owned or leased sites
- Fuel dispenser nozzles must have the ability to be secured and have a means of drip containment
- All chemical and hydrocarbon storage tanks require signage including labelled contents, safe fill levels, and HAZCHEM signage as needed

Mechanical Equipment Wash Down and Servicing

- Mechanical equipment wash-down facilities must comply with the requirements of the *Water Quality Protection Note 68 Mechanical Equipment Wash-down* (Department of Water 2006)
- Mechanical equipment servicing is to be undertaken in designated areas and in a manner that ensures containment of all hydrocarbons and chemicals
- All hydrocarbon waste from servicing including rags and filters must be disposed of appropriately

Spills

- Spill kit/s must be provided and maintained in all workplaces with contents consistent with the type, nature and scale of the potential spills that could occur, and key personnel should be trained in spill response

- All vehicles transporting fuel must have a documented spill response plan and spill response kit capable of containing and absorbing fuel spills
- All hydrocarbon spills must be reported in SHARE, with any hydrocarbon spill of 25 litres or above to be reported as an incident to the relevant responsible line management (RLM) or Contracts Manager as soon as possible after the incident but no later than the end of the shift

Earth Works and Ground Disturbance

- Any site activities that involve soil or groundwater disturbance where the contamination levels of the soil and groundwater are either unknown, or where evidence of possible contamination is presented, must cease until competent persons are able to determine the contamination status or risk
- All excavation, movement, treatment, processing or remediation of contaminated soils or groundwater must be planned and conducted in accordance with the requirements of a permit that identifies the hazards and controls as per CBH's Critical Risk Control Standard.

7. WASTEApplication

The generation of waste shall be minimised where practical, and sustainable opportunities to maximise resource recovery and recycling in preference to landfill disposal are to be implemented on all CBH sites and projects.

Critical Controls

- A suitably licensed waste contractor must be used for the collection and transport of all non-domestic or industrial wastes for either offsite processing and/or disposal to an appropriately licensed facility
- All solid waste and liquid wastes generated onsite must be stored to prevent unauthorised access and uncontrolled release. All wastes removed and disposed from these structures must be done so via a suitably licensed contractor
- All excavated natural, non-contaminated soil, aggregate or rock should be separately stockpiled and re used on site where possible or offsite. Landfill disposal of clean excavated natural materials should be avoided
- No waste is to be burnt or buried on site
- All hazardous waste storage and removal must be undertaken by a suitably licensed contractor. Confirmation of licences, and waste acceptability criteria at disposal site must be confirmed prior to any removal from site. Traceability of hazardous waste via waste removal and/or disposal certificates is required.

8. CULTURAL HERITAGE

Application

All uncontrolled impacts are to be avoided, and opportunities to enhance cultural and heritage values are to be sought whenever work is undertaken on a CBH controlled site or project.

Critical Controls

- All items of heritage, cultural and or archaeological significance should be signposted and protected in accordance with regulatory requirements
- Any excavations, intrusive works or other operations that have the potential to impact areas of known heritage, cultural or archaeological items must ensure works are performed in accordance with a heritage assessment and regulatory requirements. Such areas should be signposted and segregated by physical barriers to prevent unauthorised entry

- Any activity that involves the discovery of items that may be of cultural or archaeological significance must cease until competent persons are able to determine the status of any potential artefact(s).

9. DOCUMENT CONTROL

Authorities

Approved By	Head of Safety and Environment	**Approval Date**	18/02/2021
Review Frequency	Annual	**Next Review Date**	18/02/2022
Owner(s)	Head of Safety and Environment	**Custodian**	Environment and Sustainability Manager
Division	CBH Group	**Department**	Safety and Environment

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Version	Date	Author	Description of Revision
1.0	13/11/2018	Environment and Sustainability Manager	Approved, published
1.1	06/04/2020	Environment and Sustainability Manager	Scheduled review, updated to new IMS template
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