West Erregulla Exploration Program

Wells 4 and 5 Flora and Vegetation Risk Assessment

STRIKE ENERGY LTD

MARCH 2020

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West Erregulla Exploration Program: Wells 4 and 5 Flora and Vegetation Risk Assessment

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0	Final	EM/AS/CG	GW/AS	19/03/2020		

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EXECUTIVE SUMMARY

Strike Energy Ltd (Strike) is proposing to undertake exploration activities within the West Erregulla Field, approximately 300km north of Perth within the North Perth Basin, including drilling of two appraisal wells (Well 4 and Well 5), including two optional layouts for each well site. Strike have commissioned Woodman Environmental to undertake a Risk Assessment of the proposed Well Site 4 and 5 Project Areas.

The desktop assessment involved a review of all publicly available flora and vegetation data relevant to the Desktop Study Area. A total of 70 listed significant flora taxa or habitat for significant taxa, and 3 unlisted potentially significant flora taxa are known from within the Desktop Study Area, including 55 DBCA-classified Priority flora, and 15 Threatened flora. Seven significant flora taxa are known from within the Project Areas including *Banksia scabrella* (P4), *Eucalyptus* ?*crispata* (T), *Mesomelaena stygia* subsp. *deflexa* (P3), *Micromyrtus rogeri* (P1), *Stylidium drummondianum* (P3), *Synaphea oulopha* (P3) and *Thelymitra stellata* (T). A further 44 significant taxa (including two Threatened taxa) could potentially occur in the Project Areas as identified by the significant flora risk assessment.

A total of eight Vegetation Types (VTs) have been previously mapped over the Project Area by Woodman Environmental (2013), two of which were considered to be of potential regional significance and six of which were considered to be of high local significance. However, the proposed area of disturbance is relatively small and is unlikely to have a significant impact on the vegetation. None of these VTs represent any listed TECs or PECs.

A total of 33 introduced taxa or habitat for such taxa are known to occur in the Desktop Study Area including three Declared Pests and three WoNS. The vegetation condition within the Well Site 4 and 5 Project Areas was mapped as 'Pristine'.

Although the clearing proposed for the development of West Erregulla Well Sites 4 and 5 is relatively small, these Project Areas are located in a large, intact block of remnant vegetation in largely pristine condition within a region that has largely been cleared for agriculture, containing a number of different habitat types and a high number of significant flora taxa. It is important to consider this in planning the proposed development of the wells and ensure rehabilitation of any disturbance is undertaken promptly using appropriate techniques.

Based on the findings of the desktop assessment of the Well Site 4 and 5 Project Areas, it is recommended that Targeted flora survey should be undertaken to assess for the presence of significant flora identified as potentially or likely to occur in the West Erregulla 4 and 5 Well Project Areas. Two spring-timed surveys are recommended; a September survey to target all significant flora (including *Thelymitra stellata* (T)) except *Paracaleana dixonii* (T), and a November survey to target *Paracaleana dixonii* (T).

1. INTRODUCTION

1.1 Project Overview

Strike Energy Ltd (Strike) is proposing to undertake exploration activities within the West Erregulla Field, approximately 300km north of Perth within the North Perth Basin. from the previous operator (Warrego Energy Ltd) completed a three-dimensional (3D) onshore seismic survey and an exploration well drilling program within Exploration Permit 469 (ongoing). Prior to this Risk Assessment, Woodman Environmental Consulting Pty Ltd (Woodman Environmental) conducted a detailed flora and vegetation assessment for the West Erregulla Project for Warrego Resources during spring of 2011 and 2012 (Woodman Environmental 2013).

Strike intend to drill two Wells (West Erregulla 4 and 5) within unallocated Crown Land (uCL) in the area previously subject to three-dimensional seismic survey during 2011/2012 (Figure 1). The proposed West Erregulla 4 Well is proposed to be drilled to the east of the existing wells West Erregulla 1 and 2, and West Erregulla 5 is proposed to be drilled to the north of these two existing wells.

Strike have commissioned Woodman Environmental to undertake a Risk Assessment of the proposed well sites, to determine whether sufficient data exists from previous surveys to support the approval of the proposed wells under relevant State and Commonwealth legislation. The Risk Assessment provides information regarding potential impacts of the proposed wells on significant flora and vegetation factors of the area and the requirement for further survey where required.

1.2 Study and Project Area Definition

The West Erregulla Study Area is located within the Shire of Three Springs, approximately 300 km north-west of Perth and 42 km south-east of Dongara / Port Denison (Figure 1). The majority of the West Erregulla Study Area consists of remnant vegetation on uCL, and covers an area of 70,686ha located between Tomkins Road and Sand Plain Creek. The vegetation of the entire West Erregulla Study Area was mapped by Woodman Environmental (2013).

The Well Site 4 and 5 Project Areas (Figure 1) are wholly encompassed within the West Erregulla Study Area. Each Well Site Project Area will contain the following infrastructure:

- Drill pad boundary (centred around proposed well drill site);
- Water Storage Pond (within drill pad boundary);
- Access track to drill pad from existing fire break;
- Water bore and associated monitoring: one water production well will be drilled within a 500m radius of the proposed well site (bore locations have not been confirmed). Two water monitoring bores will be also drilled (locations not confirmed).

The Well Sites 4 and 5 Project Areas each have two location options. Option 1b encompasses an area of 4.98 ha and 5.08 ha for Well 4 and Well 5 (and associated access tracks) respectively. Option 2b encompasses an area of 4.64 ha and 5.08 ha for Well 4 and Well 5 (and associated access tracks) respectively. The location and layout of Option 1b is presented on Figure 1.1 and Option 2b is presented on Figure 1.2.

A Desktop Study Area has been defined to encompass the Project Areas and includes a 15 km buffer zone surrounding a centre point location of 336000 m E, 6743000 m N (Zone 50 J, Datum GDA94). The Desktop Study Area is also presented on Figure 1.1 and 1.2, and was created as a boundary within which to update database searches associated with the Risk Assessment.

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6760000 6755000 6750000 6745000 6740000 6735000 6730000 6725000 6720000

WARRADONG SPRING RD
YANDANOOKA RD
MOORIARY RD
YANDANOOKA WEST RD
MINGENEW SOUTH RD
BENSON RD
METCALFE RD
CAREY RD
SCOTT RD
MT ADAMS RD
NATTA RD
MITCHELL RD
TOMKINS RD
SUNDALARA RD
ROBINSON RD
BUNNEY RD
ROBB RD

Well 5
Well 4

MINGENEW
IRWIN
DONGARA
PORT DENISON
YANDANOOKA
ARRINO
ILLAWONG
ENEABBA

Legend

- Townsites
- WEC (2013) Study Area
- Desktop Study Area
- Potential Bore Water Area
- Proposed Access Tracks
- Proposed Drill Pad Boundary
- Roads

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Well Site 4 and 5 Project Areas
Option 1b

Revision: A - 26 Feb 2020 Scale: 1:120,000 (A3)

Author: Cathy Godden
WEC Ref: Strike20-05-01
Filename: Strike20-05-01-f01-1.mxd
Projection: GDA 1994 MGA Zone 50

Figure
1.1

320000 325000 330000 335000 340000 345000 350000

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WARRADONG SPRING RD
YANDANOOKA RD
MOORIARY RD
YANDANOOKA WEST RD
MINGENEW SOUTH RD
BENSON RD
METCALFE RD
CAREY RD
SCOTT RD
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NATTA RD
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TOMKINS RD
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ROBINSON RD
BUNNEY RD
ROBB RD

Well 5
Well 4

IRWIN
MINGENEW
DONGARA
PORT DENISON
YANDANOOKA
ARRINO
ILLAWONG
ENEABBA

Legend

- Townsites
- WEC (2013) Study Area
- Desktop Study Area
- Potential Bore Water Area
- Proposed Access Tracks
- Proposed Drill Pad Boundary
- Roads

320000 325000 330000 335000 340000 345000 350000

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Well Site 4 and 5 Project Areas Option 2b

Revision: A - 26 Feb 2020 Scale: 1:120,000 (A3)

Author: Cathy Godden

WEC Ref: Strike20-05-01

Filename: Strike20-05-01-f01-2.mxd

Projection: GDA 1994 MGA Zone 50

Figure

1.2

1.3 Aim and Objectives

The aim of the Risk Assessment was to determine the level of risk of impact to conservation significant flora and/or vegetation by the West Erregulla 4 and 5 appraisal program. This risk assessment includes a revision of the significant flora and vegetation factors as reported by Woodman Environmental (2013).

The overall objectives of the assessment were to:

- Compile and evaluate publicly available flora and vegetation survey reports and data as relevant to the Desktop Study Area to determine the presence of conservation significant flora and vegetation, as defined by the following documentation and legislation;
  - Listed Threatened species under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Commonwealth);
  - Threatened flora under the Biodiversity Conservation Act 2016 (BC Act) (Western Australia (WA));
  - Priority flora taxa as classified by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA); and
  - Other significant flora taxa as defined by the Environmental Protection Authority (EPA) (2016a; b).
- Identify potential significant vegetation within the Desktop Study Area using mapping datasets for:
  - Listed Threatened Ecological Communities (TEC) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth);
  - TEC as classified by DBCA and endorsed by the Minister for the Environment (WA);
  - Priority Ecological Communities (PEC) as classified by DBCA;
- Review existing Woodman Environmental data for the West Erregulla Seismic Survey Project to determine what level of investigation has been conducted over the Well Site 4 and 5 Project Areas;
- Provide a description of the known flora and vegetation values of the proposed Well Site 4 and 5 Project Areas (from Woodman Environmental 2013);
- Assess the risk to conservation significant flora and/or vegetation present on the proposed Well Site 4 and 5 Project Areas; and
- Provide recommendations for any additional flora and/or vegetation survey required to meet regulator expectation under legislation and relevant guidance (for the clearing of native vegetation).

The Desktop Assessment addresses and/or complies with the following documents:

- *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a);
- *Environmental Factor Guideline – Flora and Vegetation* (EPA 2016b);
- *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Commonwealth of Australia 2013).

2. METHODS

2.1 Searches Undertaken for the Desktop Study

A review of all publicly available flora and vegetation data relevant to the Desktop Study Area was undertaken for the Desktop Review and Risk Assessment of the Project. This included interrogation of relevant regional databases and other sources as listed in Table 1, as well as obtaining and reviewing copies of reports of previous flora and vegetation surveys undertaken within the vicinity of the Desktop Study Area (where available), including interrogation of the Index of Biodiversity Surveys for Assessments (IBSA) website.

Table 1: Searches Undertaken for the Desktop Study

Source	Search Attributes	Search Purpose
DBCA Threatened and Priority Ecological Communities Database (DBCA 2020b)	Database interrogated using Desktop Study Area boundary	Obtain records of DBCA-classified TECs and/or DBCA-classified PECs within the Desktop Study Area
DBCA TEC and PEC lists (DBCA 2018; DBCA 2019b)	Review of current DBCA TEC and PEC lists	Identify whether there are any DBCA listed TECs or PECs that could occur within the Desktop Study Area
DBCA Significant Flora Databases (WA Herbarium specimen database and Threatened and Priority Flora (TPFL) database) (DBCA 2020a)	Database interrogated using Desktop Study Area boundary	Obtain records of listed significant flora within the Desktop Study Area
Department of the Environment and Energy (DoEE) Species Profile and Threats (SPRAT) Database (interrogated using the Protected Matters Search Tool) (DoEE 2020)	Database interrogated using approximate Desktop Study Area boundary	Identify Matters of National Environmental Significance (MNES), including Threatened flora and TECs, listed under the EPBC Act, that occur or have the potential to occur within the Desktop Study Area
DBCA *NatureMap* (WA Herbarium and TPFL records) (DBCA 2007-)	Database interrogated using approximate Desktop Study Area boundary	Obtain records of listed significant flora within the Desktop Study Area.
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Government of Western Australia 2019)	Well Site 4 and 5 Project Areas	Identify extent of Vegetation System Associations within the Project Area

2.2 Taxon Nomenclature

Taxon nomenclature generally follows *FloraBase* (WA Herbarium 1998-) with all names checked against the current DBCA Max database to ensure their validity. However, in cases where names of plant taxa have been published recently in scientific literature but have not yet been adopted on *FloraBase* due to time constraints (WA Herbarium 1998-), nomenclature in the published literature is followed. The conservation status of each taxon was checked against *FloraBase*, which provides the most up-to-date information regarding the conservation status of flora taxa in Western Australia.

2.3 Vegetation Condition

Known vegetation condition within the Desktop Study Area is included in section 4.3. Vegetation condition is described using the vegetation condition scale presented in EPA (2016a) as presented in Table 2.

Table 2: Vegetation Condition Scale for the South-West and Interzone Botanical Provinces (EPA 2016a)

Condition Ranking	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

2.4 Significant Flora and Vegetation and Introduced Flora

2.4.1 Significant Flora

As per EPA (2016b), flora taxa may be significant for a range of reasons, including, but not limited to the following:

- Being identified as a Threatened or Priority species (formally listed significant taxa – includes taxa listed under both State and Commonwealth legislation, and classified as Priority by DBCA);
- Locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or species with anomalous features that indicate a potential new species;
- Representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant taxa with records within the Desktop Study Area are discussed in Section 5.1 with reference to the above categories.

2.4.2 Introduced Flora

Introduced flora for the purposes of this desktop report are defined as those which are not native to Western Australia. Some flora species which are native to Western Australia but not endemic to the area in question can also be classified as weeds, as they behave in an invasive manner which outside their natural environment. Weeds which are listed as Weeds of National Significance (WoNS) or otherwise listed as Declared Pests under the *Biosecurity and Agricultural Management Act 2016* (BAM Act) for the region in which the study area is located are identified as such in this desktop review.

2.4.3 Significant Vegetation

As per EPA (2016b), vegetation may be significant for a range of reasons, including, but not limited to the following:

- Being identified as a TEC or PEC (formally listed significant vegetation – includes vegetation listed under Commonwealth legislation, endorsed as a TEC by the Western Australian Government, or classified as a PEC by DBCA);
- Having restricted distribution;
- Degree of historical impact from threatened processes;
- A role as a refuge; and
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

Significant vegetation with records within the Desktop Study Area are discussed in Section 5.2 with reference to the above categories.

3. LIMITATIONS

The majority of flora and vegetation data (including previous local surveys and specimen collections vouchered with the WA Herbarium) presented in this desktop assessment are from surveys conducted by Woodman Environmental (2013), with the data being therefore approximately 8 years old (see section 4.3). This indicates a lack of more recent survey work undertaken in the Desktop Study Area, or if surveys have been undertaken, they are not publicly available. These surveys, in particular Woodman Environmental (2013), have been referenced in multiple other desktop assessments since its 'publication'.

Although flora and vegetation surveys and survey reporting included in this assessment pre-dated the requirements of EPA Technical Guidance (EPA 2016a), the results of the previous surveys are considered both reliable and relatively comprehensive. In particular, the *West Erregulla Project Flora and Vegetation Assessment* (Woodman Environmental 2013) was conducted as a Level 2 survey (as per EPA 2004), determining the presence of conservation significant flora and provided mapping of vegetation types.

4. RESULTS – DESKTOP STUDY AREA REVIEW

4.1 Regional Flora

The interrogation of the DBCA WA Herbarium specimen database and TPFL database (DBCA 2020b) returned a total of 55 significant vascular flora taxa that have records within the Desktop Study Area; 50 of which are priority listed taxa (P) and five listed as Threatened. These are presented in Section 4.4.

A search of these databases using *NatureMap* (DBCA 2007-) was also undertaken as part of the Desktop Study to check for any recently added records and to confirm the records returned from the DBCA WA Herbarium specimen database and TPFL database search. As per Table 1, the database was interrogated using the approximate Desktop Study Area boundary. The *NatureMap* search did not return any additional significant flora taxa. Appendix A presents conservation codes for Western Australia flora (DBCA 2019a).

The search of Department of the Environment and Energy (DoEE) Species Profile and Threats (SPRAT) Database was undertaken to identify Matters of National Environmental Significance (MNES), including Threatened flora taxa, which are known or may occur in the Desktop Study Area. The search returned 15 flora taxa listed as Threatened Species, or habitat for Threatened Species, that are known, are likely to or may to occur in the Desktop Study Area as listed below:

- *Chorizema humile* (Endangered) (species or habitat may occur);
- *Conostylis dielsii* subsp. *teres* (Endangered) (species or habitat likely to occur);
- *Conostylis micrantha* (Endangered) (species or habitat may occur);
- *Dasymalla axillaris* (Critically Endangered) (species or habitat may occur);
- *Daviesia speciosa* (Endangered) (species or habitat known to occur);
- *Eucalyptus crispata* (Endangered) (species or habitat known to occur);
- *Eucalyptus impensa* (Endangered) (species or habitat likely to occur);
- *Eucalyptus leprophloia* (Endangered) (species or habitat known to occur);
- *Eucalyptus* x *balanites* (Endangered) (species or habitat may occur);
- *Hakea megalosperma* (Vulnerable) (species or habitat may occur);
- *Hemiandra gardneri* (Endangered) (species or habitat may occur);
- *Leucopogon obtectus* (Endangered) (species or habitat likely to occur);
- *Paracaleana dixonii* (Endangered) (species or habitat known to occur);
- *Thelymitra stellata* Endangered) (species or habitat known to occur); and
- *Wurmbea tubulosa* (Endangered) (species or habitat may occur).

The search of the DoEE database also identified four significant invasive introduced flora taxa, or habitat for these taxa, as likely to occur within the Desktop Study Area as listed below:

- *Asparagus asparagoides*;
- *Cenchrus ciliaris*;
- *Lycium ferocissimum*; and
- *Tamarix aphylla*.

The full results of the DoEE database search are presented in Appendix B.

4.2 Regional Vegetation

As previously indicated, the Desktop Study Area is located within the Geraldton Sandplains IBRA region, specifically within the GES02 Lesueur Sandplain IBRA subregion (Commonwealth of Australia 2012). The Geraldton Sandplains bioregion comprises mainly of proteaceous scrub-heaths, rich in endemics (Desmond and Chant 2001).

Beard *et al.* (2013) described and mapped vegetation system associations (VSA) of Western Australia, at a scale of 1:300,000. A total of two VSAs occur in the Well Site 4 and 5 Project Areas, as summarised in Table 3**.** Table 3 also presents the percentage of the pre-european mapped extent which is uncleared, and the percentage of the current extent which is protected for conservation, within the GES02 Lesueur Sandplain IBRA subregion (Government of Western Australia 2019).

Table 3: Vegetation System Associations within the Well Site 4 and 5 Project Areas

Vegetation System Association	Description	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent Protected for Conservation (%)
Tathra_49	Heath: Low shrubs of mixed composition.	13,619	41.1	9.63
Tathra_379	Shrublands; scrub-heath on lateritic sandplain in the central Geraldton Sandplain Region.	111,607	30.23	5.58

The interrogation of the DBCA TEC and PEC Database (DBCA 2020c) returned two significant communities, or their DBCA-defined buffer zones, within the Desktop Study Area as listed below:

- Assemblages of the organic mound springs of the Three Springs area TEC (Endangered); and
- Ferricrete floristic community (Rocky Springs type) (Vulnerable)TEC.

Neither these TEC locations nor their buffer zones were recorded within the Well Site 4 and 5 Project Areas. The TEC buffer zones are located approximately 9 km east of the Well Site 4 Project Area. Appendix C presents definitions, categories and criteria for TECs and PECs (DBCA 2013).

The search of the DoEE SPRAT for MNES listed under the EPBC Act database did not return any TECs listed under the EPBC Act, which occur or have the potential to occur within the vicinity of the Desktop Study Area (Appendix B).

4.3 Local Flora and Vegetation Surveys

A limited number of publicly available flora and vegetation survey reports have been undertaken within the Desktop Study Area. A summary of surveys relevant to the Project

Areas and Desktop Study Area is presented in Table 4. Surveys for a transmission line included the eastern edge of the uCL which is subject to this desktop, as well as within smaller remnant vegetation areas along the transmission line route (Woodman Environmental 2009a; 2011). Flora and vegetation surveys for Warrego for the West Erregulla project were also undertaken in 2008, 2011 and 2012 (data now being 7-11 years old), reporting of which culminated in a Level 2 survey (Woodman Environmental 2013).

It should be noted that changes to Priority listing and taxonomic name changes have occurred since reporting provided by Woodman Environmental (2013). These include:

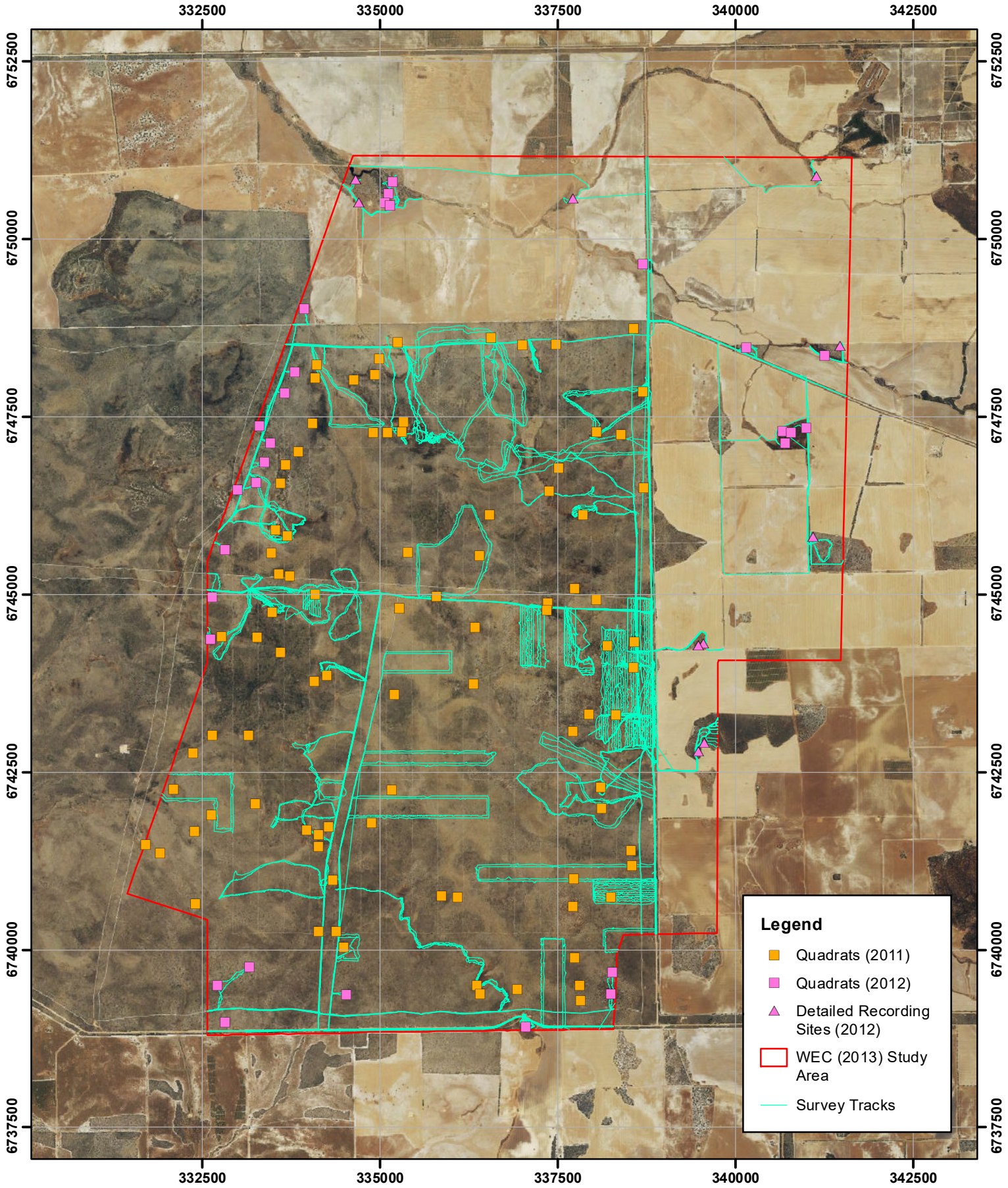
- *Schoenus griffinianus* currently a P4 conservation rank (ranked at the time of production of Woodman Environmental (2013) as P1);
- *Synaphea oulopha* currently a P3 conservation rank (ranked at the time of production of Woodman Environmental (2013) as P1);
- *Synaphea aesphynsa* (P3) as recorded in Woodman Environmental (2013) is no longer of listed conservation status; and
- Nomenclature for *Thryptomene* sp. Mingenew (Diels & Pritzel 332) (P3) has been updated to *Thryptomene nitida* (P3).

Table 4: Summary of Flora and Vegetation Surveys and Desktop Assessments Previously Conducted in the Desktop Study Area

Report Title and Author	Location and Survey type	Key Findings
West Erregulla-2 Well Site Flora and Vegetation Assessment - prepared for Warrego Energy Ltd. Woodman Environmental (2009b)	Within the WEC (2013) Study Area Level 1 Survey (EPA 2004) Survey undertaken in Spring 2008.	• Recorded 69 taxa from 21 families. • 2 detailed recording sites assessed as well as the proposed well site being transected with transects 10m apart to survey for DRF and priority flora. • Nine Priority Flora species were recorded within the survey area. Eight of these species were recorded on the access track, and three were recorded within the well-site area. • Field survey was conducted November 2008. • No formal mapping of plant communities was undertaken during this survey. • Vegetation condition recorded as Very Good with localised disturbance (due to existing track). • No communities described were considered to be equivalent to represent a state / EPBC listed TEC at the time of the assessment.
Flora and Vegetation of the Proposed Eneabba – Moonyoonooka 330kV Transmission Line Supplementary Field Survey 2008; and *2009 Addendum Report* – prepared for Western Power Woodman Environmental (2009a; 2010)	Partially within the WEC (2013) Study Area Level 1 / 2 Survey (EPA 2004) Survey undertaken in July and September 2008; August and October 2009)	• Structural vegetation communities mapped along transmission line survey area from Eneabba – Moonyoonka • Survey consisted of a reconnaissance survey originally conducted in 2007; followed by targeted flora survey (DRF; Priorities) in 2008, and further survey of selected areas in 2009. • Survey included the uCL located on the western side of Natta Road, as well as remnant vegetation on Sundalara Rd and Yandanooka West Road. • A total of 41 conservation significant flora taxa were recorded within the Eneabba-Moonyoonooka survey area in 2007 – 2009 (including several which are no longer listed Priority flora, including *Hakea polyanthema* (was P3); *Isopogon tridens* (was P3), within the WEC (2013) Study Area). • Total of 34 structural plant communities were mapped within the Eneabba-Moonyoonooka survey area in 2007 – 2009; no TECS or PECs were described or mapped.

Report Title and Author	Location and Survey type	Key Findings

West Erregulla Project Flora and Vegetation Assessment – prepared for Warrego Energy Ltd.
 	
Woodman Environmental (2013)
	Within the Study Area
	
	Level 2 Survey (EPA 2004)
	
	Survey undertaken in Spring 2011 and Spring 2012.
		• Recorded 535 taxa from 64 families.
		• Field surveys were conducted September, October and November 2011.
		• 3 confirmed taxa listed as Threatened including *Thelymitra stellata*, *Paracaleana dixonii*, and *Eucalyptus crispata*.
		• 25 priority taxa were recorded (see section 4.4).
		• Three taxa which may be of conservation significance were recorded: *Eucalyptus* sp. (unidentified 2) (recorded at one location); *Cryptandra* aff. *intermedia* (atypical variant) (recorded at six locations) and *Leucopogon* aff. sp. Coomallo (R.J. Cranfield 1457) (one location).
		• 22 introduced flora taxa were recorded (see section 4.5).
		• 119 quadrats were assessed in the West Erregulla Study Area (90 permanent quadrats in 2011 and 29 non-permanent quadrats in 2012) and 10 detailed recording sites were assessed in 2012.
		• Vegetation condition ranged from Very Poor to Pristine, with the majority of the polygons recording between Very Good and Pristine.
		• A total of 17 VTs were mapped, 5 of potential regional significance (5, 8, 9, 11, 12) and 16 of high local conservation significance as summarised below:
		  ○ VTs 1a, 1b, 2, 3, 4, 5, 6 and 9 comprised less than 1 % of the Study area, and generally occurred on landforms and soils that were restricted in the West Erregulla Study Area, including decaying breakaways, clay and sandy soils supporting Eucalyptus accedens, or in the vicinity of drainage lines.
		  ○ VTs 7a, 7b, 8, 10, 11, 12, and 13a, although comprising 1-10 % (or > 10 % in the case of VTs 10 and 13a) of the West Erregulla Study Area, and occurring on landforms that were common and widespread locally, provided habitat for one or more taxa listed as T, as well as numerous Priority flora taxa, some of which were restricted to one or a few of these VTs.
		• No communities described were considered to be equivalent to represent a state / EPBC listed TEC at the time of the assessment.
		• Vegetation condition ranged from 'Poor' to 'Pristine', with the majority of the West Erregulla Study Area mapped as 'Pristine'.



Historical Survey Intensity of the WEC (2013) Study Area	Author: Cathy Godden	N
	WEC Ref: Strike20-05-01	
WOODMAN ENVIRONMENTAL	Filename: Strike20-05-01-f01.mxd	**Figure**
	Scale: 1:70,000 (A4)	2
	Projection: GDA 1994 MGA Zone 50	
This map should only be used in conjunction with WEC report Strike20-05-01.	Revision: A - 26 February 2020	

4.4 Summary of Significant Flora

A summary of significant flora taxa, or habitat for significant taxa, known from within the Desktop Study Area is presented in Table 5. This list has been compiled from the results of the desktop searches of the DBCA WA Herbarium and TPFL Databases (DBCA 2020a), DBCA *NatureMap* (DBCA 2007-), DoEE's SPRAT Database (DoEE 2020) and the results of local surveys as outlined in Section 4.3.

A total of 70 significant taxa or habitat for significant taxa, are known from within the Desktop Study Area including 55 DBCA-classified Priority flora, and 15 Threatened flora. A further three unlisted taxa of potential conservation significance area also known.

Table 5: Significant Flora Taxa Known from Within the Desktop Study Area

Taxon	Status	Source*
Acacia isoneura subsp. *isoneura*	P3	WEC
Acacia lanceolata	P3	DBCA; WEC
Acacia megacephala	P3	DBCA
Acacia vittata	P2	DBCA
Allocasuarina grevilleoides	P3	DBCA; WEC
Banksia cypholoba	P3	DBCA
Banksia elegans	P4	DBCA
Banksia fraseri var. *crebra*	P3	DBCA
Banksia scabrella	P4	DBCA; WEC
Beyeria gardneri	P3	DBCA; WEC
Calectasia palustris	P2	DBCA
Calothamnus arcuatus	P2	DBCA
Calytrix chrysantha	P4	DBCA
Chorizema humile	T	DoEE
Comesperma griffinii	P2	DBCA
Comesperma rhadinocarpum	P3	DBCA
Conostylis dielsii subsp. *teres*	T	DoEE
Conostylis micrantha	T	DoEE
Dasymalla axillaris	T	DoEE
Daviesia speciosa	T	DBCA; DoEE
Diuris eburnea	P1	DBCA
Eucalyptus abdita	P2	DBCA; WEC
Eucalyptus x *balanites*	T	DoEE
Eucalyptus crispata	T	DBCA; WEC; DoEE
Eucalyptus impensa	T	DoEE
Eucalyptus leprophloia	T	DBCA; WEC; DoEE
Eucalyptus macrocarpa subsp. *elachantha*	P4	DBCA; WEC
Eucalyptus macrocarpa x *pyriformis*	P3	DBCA; WEC
Grevillea erinacea	P3	DBCA
Grevillea makinsonii	P3	DBCA
Guichenotia alba	P3	DBCA
Guichenotia impudica	P3	WEC
Haemodorum loratum	P3	WEC
Hakea megalosperma	T	DoEE
Hemiandra gardneri	T	DoEE
Hemiandra sp. Eneabba (H. Demarz 3687)	P3	DBCA; WEC
Hensmania stoniella	P3	DBCA; WEC

Taxon	Status	Source*
Homalocalyx chapmanii	P2	DBCA; WEC
Lasiopetalum ogilvieanum	P1	DBCA; WEC
Leucopogon grammatus	P3	DBCA
Leucopogon obtectus	T	DoEE
Malleostemon decipiens	P1	DBCA
Melaleuca sclerophylla	P3	DBCA
Mesomelaena stygia subsp. *deflexa*	P3	DBCA; WEC
Micromyrtus rogeri	P1	DBCA; WEC
Micromyrtus uniovulum	P2	DBCA; WEC
Paracaleana dixonii	T	DBCA; WEC; DoEE
Persoonia chapmaniana	P3	DBCA
Persoonia filiformis	P3	DBCA; WEC
Persoonia rudis	P3	DBCA; WEC
Pityrodia viscida	P4	DBCA
Schoenus badius	P2	DBCA; WEC
Schoenus griffinianus	P4	WEC
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	P2	DBCA
Stawellia dimorphantha	P4	DBCA
?Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490)	P1	WEC
Stylidium drummondianum	*P3*	*DBCA; WEC*
Stylidium pseudocaespitosum	P2	DBCA; WEC
Stylidium sp. Three Springs (J.A. Wege & C. Wilkins JAW 600)	P2	DBCA
Stylidium torticarpum	P3	DBCA; WEC
Synaphea oulopha	P3	DBCA; WEC
Synaphea sparsiflora	P2	DBCA
Thelymitra stellata	T	DBCA; WEC; DoEE
Thryptomene nitida	P3	DBCA
Thysanotus vernalis	P3	DBCA
Verticordia dasystylis subsp. *oestopoia*	P1	DBCA
Verticordia densiflora var. *roseostella*	P3	DBCA
Verticordia luteola var. *luteola*	P3	DBCA
Verticordia luteola var. *rosea*	P1	DBCA
Wurmbea tubulosa	T	DoEE
POTENTIALLY SIGNIFICANT – REQUIRES FURTHER INVESTIGATION		
Eucalyptus sp. (unidentified 2)	-	WEC (2013) (requires fruiting or flowering material to confirm)
Cryptandra aff. *intermedia*	-	WEC (2013) (further material required)
Leucopogon aff. sp. Coomallo (R.J. Cranfield 1457)	-	WEC (2013) (flowering material required)

*Sources are:
DBCA – DBCA WA Herbarium and TPFL Databases (2020a); *NatureMap* – (DBCA 2007-);
DoEE – DoEE (2020)
WEC – Woodman Environmental (2009b; 2010; 2013).

4.5 Summary of Introduced Flora

A list of introduced flora taxa or habitat for such taxa known from within the Desktop Study Area is presented in Table 6. The information presented has been compiled from the DBCA *NatureMap* search (DBCA 2007-), DoEE's SPRAT Database (DoEE 2020) and the results of

local surveys (where data is available) as outlined in Section 4.3. A total of 33 introduced taxa or habitat for such taxa are known to occur in the Desktop Study Area. Of these three are Declared Pests (DPIRD 2019) and three are listed WoNS (AWC 2019) as presented in Table 6.

Table 6: Introduced Taxa Known from Within the Desktop Study Area

Taxon	Common Name	Source*	Comments
Arctotheca calendula	Cape Weed	WEC	
Avena barbata	Bearded Oat	WEC	
Asparagus asparagoides	Bridal Creeper	DoEE	Declared Pest; WoNS
Brassica tournefortii	Mediterranean Turnip	WEC	
Briza maxima	Blowfly Grass	WEC	
Bromus diandrus	Great Brome	WEC	
Cenchrus ciliaris	Buffel-grass	DoEE	
Centaurea melitensis	Maltese Cockspur	DBCA	
Corrigiola litoralis	Strapwort	WEC	
Cuscuta epithymum	Lesser Dodder	WEC	
Echium plantagineum	Paterson's Curse	WEC	Declared pest
Ehrharta brevifolia	Annual Veldt Grass	WEC	
Ehrharta calycina	Perennial Veldt Grass	WEC	
Ehrharta longiflora	Annual Veldt Grass	WEC	
Erodium cicutarium	Common Storksbill	WEC	
Hypochaeris glabra	Smooth Cats-ear	WEC	
Isolepis marginata	Coarse Club-rush	WEC	
Lepidium didymum	Lesser Swinecress	DBCA	
Lupinus angustifolius	Narrowleaf Lupin	WEC	
Lycium ferocissimum	African Boxthorn	DoEE	WoNS
Lysimachia arvensis	Pimpernel	DBCA; WEC	
Monoculus monstrosus	Stinking Roger	WEC	
Parentucellia latifolia	Common Bartsia	WEC	
Pentameris airoides subsp. *airoides*	-	WEC	
Petrorhagia dubia	Hairy Pink	WEC	
Rostraria pumila	Hairgrass	DBCA	
Schinus molle	California pepper tree	DBCA	
Tamarix aphylla	Athel Pine	DoEE	Declared Pest; WoNS
Trifolium campestre var. *campestre*	Hop Clover	WEC	
Ursinia anthemoides	Ursinia	WEC	
Verbesina encelioides	Golden Crownbeard	DBCA	
Vulpia myuros	Rat's Tail Fescue	WEC	
Wahlenbergia capensis	Cape Bluebell	WEC	

*Sources are:
DoEE – DoEE (2020);
DBCA – DBCA (2007-);
WEC – Woodman Environmental (2013).

4.6 Summary of Significant Vegetation

A summary of significant vegetation known from within the Desktop Study Area is presented in Table 7. This has been compiled from the results of the desktop searches of the DBCA WA Herbarium and TPFL Databases (DBCA 2020b), DBCA *NatureMap* (DBCA 2007-) (see Table 5), DoEE's SPRAT Database (DoEE 2020) and the results of local surveys as outlined in Section 4.3.

A total of two significant vegetation communities are known from the Desktop Study Area.

Table 7: Significant Vegetation Known from Within the Vicinity of the Study Area

Community	Conservation Status (W.A.)	EPBC Act Ranking	Source
Assemblages of the organic mound springs of the Three Springs area	Endangered	-	DBCA
Ferricrete floristic community (Rocky Springs type)	Vulnerable	-	DBCA

*Sources are:
DBCA – DBCA WA TEC PEC Databases (2020b)

320000 325000 330000 335000 340000 345000 350000

6765000 6760000 6755000 6750000 6745000 6740000 6735000 6730000 6725000

Legend

WEC (2013) Study Area

Desktop Study Area

Threatened Ecological Community Buffers (DBCA 2020b)

Ferricrete floristic community (Vulnerable)

Mound Springs (Three Springs area) (Endangered)

Significant Flora

Threatened Flora Locations

Priority Flora Locations

Other Significant Flora Locations

320000 325000 330000 335000 340000 345000 350000

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N

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Known Significant Flora and Vegetation of the Dekstop Study Area

Revision: A - 26 Feb 2020 Scale: 1:120,000 (A3)

Author: Cathy Godden

WEC Ref: Strike20-05-01

Filename: Strike20-05-01-f03.mxd

Projection: GDA 1994 MGA Zone 50

Figure

3

5. RESULTS – WELL SITE 4 AND 5 PROJECT AREAS

The flora and vegetation values of the Well 4 and 5 project areas are described below. This includes known values (Woodman Environmental 2013), and an assessment of the likelihood of occurrence of additional significant values that may be present but have not been identified due to lack of Targeted survey.

5.1 Significant Flora Values of the Well Site 4 and 5 Project Areas

Figure 4.2 present the extent of historical on-ground survey of the Well 4 and Well 5 Project Areas (track logs; Woodman Environmental 2013) and known locations of significant flora within and adjacent to these Project Areas, for Options 1b and 2b respectively. Figure 4.3 presents a legend for Figures 4.1 and 4.2.

The majority of the Well Site 4 Project Area has been subject to targeted flora grid searching, with two flora survey quadrats also located in this area, and therefore the contextual information for Well Site 4 Project Area is considered good. The Well Site 4 Project Area contains known records of a total of seven significant flora taxa (both Options 1b and 2b) as presented in Table 8.

There has been no targeted flora searching undertaken or flora quadrats assessed within the Well Site 5 Project Area, with very minimal traverses undertaken in the Project Area (Figure 4.1 and 4.2). The contextual information for Well Site 5 Project Area is therefore considered poor. One significant flora taxon is known to occur at one location within the Well Site 5 Project Area for option 2b (*Micromyrtus rogeri* (P1)). There are no locations of significant flora taxa currently known from Well Site 5 Project Area for option 1b.

Table 8: Significant Flora Taxa Known in the Well Site 4 and 5 Project Areas

Project Area	Taxon	Status	Number of Individuals*	
			Option 1b	Option 2b
Well 4	*Banksia scabrella*	P4	102	102
Well 4	*Eucalyptus ?crispata*	Threatened	1	1
Well 4	*Mesomelaena stygia* subsp. *deflexa*	P3	1080	1007
Well 4	*Micromyrtus rogeri*	P1	443	458
Well 4	*Stylidium drummondianum*	P3	904	922
Well 4	*Synaphea ?oulopha*	P3	1	1
Well 4	*Synaphea oulopha*	P3	445	474
Well 4	*Thelymitra ?stellata*	Threatened	4	4
Well 4	*Thelymitra stellata*	Threatened	2	2
Well 5	*Micromyrtus rogeri*	P1	0	15

***Approximate numbers of individuals**

335000 336000 337000 338000 339000

6747000 6746000 6745000 6744000 6743000

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This map should only be used in conjunction with WEC report Strike20-05-01.

N

Flora and Vegetation Values of the Well 4 and Well 5 Project Areas (Option 1b)

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Author: Cathy Godden

WEC Ref: Strike20-05-01

Filename: Strike20-05-01-f04-1.mxd

Projection: GDA 1994 MGA Zone 50

Figure

4.1

335000 336000 337000 338000 339000

6747000 6746000 6745000 6744000 6743000

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This map should only be used in conjunction with WEC report Strike20-05-01.

N

Flora and Vegetation Values of the Well 4 and Well 5 Project Areas (Option 2b)

Revision: A - 26 Feb 2020 Scale: 1:15,000 (A3)

Author: Cathy Godden

WEC Ref: Strike20-05-01

Filename: Strike20-05-01-f04-2.mxd

Projection: GDA 1994 MGA Zone 50

Figure

4.2

Legend

- Quadrats (2011)
- Survey Tracks
- Potential Bore Water Area
- Proposed Access Tracks
- Proposed Drill Pad Boundary

Vegetation Types

- 1b Mid open forest of *Eucalyptus accedens* over low open shrubland dominated by *Gastrolobium plicatum* and *Dodonaea divaricata* over low open forbland of mixed species including *Goodenia berardiana, Rhodanthe manglesii, Podolepis lessonii* and *Acanthocarpus canaliculatus* on grey-brown sandy or clay loams on mid-upper slopes
- 7a Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* or mid open shrubland of *Allocasuarina campestris* over low shrubland and sedgeland of mixed species frequently dominated by *Ecdeiocolea monostachya* and *Melaleuca aspalathoides,* or occasionally *M. tinkeri, Hakea auriculata* or *Hakea lissocarpha,* on gravelly grey or brown clay loams or sands, usually with laterite on or near the surface, on slopes and crests
- 7b Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* or mid open shrubland of *Allocasuarina campestris* over low shrubland and sedgeland of mixed species dominated by *Banksia carlinoides, Ecdeiocolea monostachya, Hakea incrassata, Hibbertia hypericoides* and *Melaleuca aspalathoides* on gravelly grey or brown clay loams or sands, usually with laterite on or near the surface, on slopes and crests
- 8 Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* over mid shrubland to open shrubland dominated by *Allocasuarina campestris* over low shrubland and sedgeland of mixed species dominated by *Ecdeiocolea monostachya, Hakea auriculata, Melaleuca radula, M. aspalathoides* and *Banksia fraseri* var. *fraseri* on gravelly grey or brown clay loams usually over massive laterite on breakaway tops, ridges and lateritic rises
- 9 Mid to low open shrubland of *Allocasuarina campestris, Melaleuca concreta* and *Melaleuca marginata* over low shrubland dominated by *Melaleuca tinkeri* and occasionally *Gastrolobium plicatum* over low shrubland and forbland dominated by *Stylidium torticarpum* (P3), *Leucopogon* sp. Yandanooka (M. Hislop 2507) and *Micromyrtus rogeri* (P1) on gravelly pink-brown or white-grey clay or clay loam over decaying laterite on breakaway tops and slopes
- 10 Mid sparse to open shrubland of mixed species including *Calothamnus quadrifidus* subsp. *angustifolius, Grevillea biformis* subsp. *biformis* and *Banksia attenuata* over low shrubland and sedgeland of mixed species dominated by *Ecdeiocolea monostachya, Melaleuca leuropoma, Daviesia divaricata* subsp. *divaricata* ms, *Mesomelaena pseudostygia* and *Banksia shuttleworthiana* on yellow-brown or occasionally grey sand on slopes and valley floors
- 11 Mid sparse to open shrubland of *Allocasuarina campestris* and *Grevillea biformis* subsp. *biformis* over low shrubland and sedgeland dominated by *Hakea circumalata, Lepidobolus preissianus* subsp. *preissianus, Mesomelaena pseudostygia* and *M. stygia* subsp. *deflexa* (P3) on yellow or yellow-brown sand or sandy loam on mid to upper slopes
- 13a Low open woodland of *Eucalyptus todtiana* over mid to low shrubland of mixed species dominated by *Allocasuarina humilis*, *Banksia scabrella* (P4), *Calothamnus sanguineus, Eremaea beaufortioides* var. *microphylla, Melaleuca* aff. *leuropoma* and *Hibbertia hypericoides* over low shrubland and sedgeland of mixed species including *Banksia dallanneyi* subsp. *media, Conostylis canteriata, Mesomelaena pseudostygia* and *Caustis dioica* on grey or brown sand on lower and mid slopes
- 13b Low open woodland of *Eucalyptus todtiana* over mid to low shrubland of mixed species dominated by *Allocasuarina humilis, Calothamnus sanguineus, Hakea trifurcata, Hibbertia hypericoides* and *Melaleuca leuropoma* over low shrubland and rushland of mixed species including *Banksia dallanneyi* subsp. *media, Conostylis aculeata* subsp. *breviflora* and *Conostylis canteriata* on grey, brown or yellow sand on flats, in depressions and on slopes
- 14 Low open shrubland dominated by *Calothamnus quadrifidus* subsp. *angustifolius, Banksia carlinoides, Hakea lissocarpha* and *Verticordia densiflora* over low open shrubland, sedgeland and forbland dominated by *Dampiera teres* (broad-leaf variant), *Jacksonia angulata, Harperia lateriflora, Opercularia vaginata* and *Melaleuca trichophylla* on grey-brown sands, sandy loams and clay loams in minor drainage lines and on flats

Other Mapped Areas

- 8D Degraded area of VT 8
- C Cleared Land

Significant Flora

- Age *Allocasuarina grevilleoides* (P3)
- Bfr?c *Banksia fraseri* var. ?*crebra* (P3)
- Bsc *Banksia scabrella* (P4)
- E?ab *Eucalyptus ?abdita*
- E?cri *Eucalyptus ?crispata*
- Eab *Eucalyptus abdita* (P2)
- Ecri *Eucalyptus crispata* (T)
- Ele *Eucalyptus leprophloia* (T)
- Emae *Eucalyptus macrocarpa* subsp. *elachantha* (P4)
- EspU2 *Eucalyptus sp. (unidentified 2)*
- Gim *Guichenotia impudica* (P3)
- Hlor *Haemodorum loratum* (P3)
- HspE *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3)
- Mro *Micromyrtus rogeri* (P1)
- Mstd *Mesomelaena stygia* subsp. *deflexa* (P3)
- Pdix *Paracaleana dixonii* (T)
- Pfi *Persoonia filiformis* (P3)
- Pru *Persoonia rudis* (P3)
- S?ou *Synaphea ?oulopha* (P1)
- Sba *Schoenus badius* (P2)
- ScaN *Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490) (P1)
- Sdr *Stylidium drummondianum* (P3)
- Sgr *Schoenus griffinianus* (P4)
- Sou *Synaphea oulopha* (P3)
- Sto *Stylidium torticarpum* (P3)
- T?st *Thelymitra ?stellata*
- Tst *Thelymitra stellata* (T)

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This map should only be used in conjunction with WEC report Strike20-05-01.

N

Flora and Vegetation Values of the Well 4 and Well 5 Project Areas (Legend)

Revision: A - 26 Feb 2020 Scale: 1:15,000 (A3)

Author: Cathy Godden

WEC Ref: Strike20-05-01

Filename: Strike20-05-01-f04-3.mxd

Projection: GDA 1994 MGA Zone 50

Figure 4.3

5.2 Vegetation Values of the Well Site 4 and 5 Project Areas

Both Wells 4 and 5 Project Areas, for both options 1b and 2b, occur on two VSAs (Tathra_49 and Tathra_379). Both of these VSAs have more than 30% of the pre-european extent remaining (Table 3); to this end, Principle E of the Clearing principles for native vegetation under Schedule 5 of the EP Act are not likely to be triggered by clearing for either option for the well sites.

Figure 4 presents the vegetation type (VT) mapping of the Well 4 and Well 5 Project Areas, and extent of historical on-ground survey within these areas (track logs) (Woodman Environmental 2013). A total of eight VTs have been mapped within Well Site 4 and 5 Project Areas (seven VTs for the Well Site 4 Project Area, and four VTs for the Well Site 5 Project Area) (Table 9). Of these:

- VT 8 and 11 were considered to be of potential regional significance
- VT 1b, 7a, 7b, 8, 11 and 13a were considered to be of high local significance
- VT 14 was considered to be of moderate local significance
- None of the VTs represent any listed TECs or PECs

The vegetation within the Well Site 4 and 5 Project Areas was mapped as 'Pristine' (see scale presented in section 2.3).

No locations of listed significant vegetation (TECs or PECs) or their buffer zones are known to occur within the Well Site 4 and 5 Project Areas (Figure 3).

Table 9: VT Mapping of Well Site 4 and Well Site 5 Project Areas

VT	VT Description	Well Site 4 Project Area (ha)		Well Site 5 Project Area (ha)	
		Option 1b	Option 2b	Option 1b	Option 2b
1b	Mid open forest of *Eucalyptus accedens* over low open shrubland dominated by *Gastrolobium plicatum* and *Dodonaea divaricata* over low open forbland of mixed species including *Goodenia berardiana, Rhodanthe manglesii, Podolepis lessonii* and *Acanthocarpus canaliculatus* on grey-brown sandy or clay loams on mid-upper slopes	0.34	0.58	-	-
7a	Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* or mid open shrubland of *Allocasuarina campestris* over low shrubland and sedgeland of mixed species frequently dominated by *Ecdeiocolea monostachya* and *Melaleuca aspalathoides,* or occasionally *M. tinkeri, Hakea auriculata* or *Hakea lissocarpha,* on gravelly grey or brown clay loams or sands, usually with laterite on or near the surface, on slopes and crests	29.32	27.17	-	-
7b	Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* or mid open shrubland of *Allocasuarina campestris* over low shrubland and sedgeland of mixed species dominated by *Banksia carlinoides, Ecdeiocolea monostachya, Hakea incrassata, Hibbertia hypericoides* and *Melaleuca aspalathoides* on gravelly grey or brown clay loams or sands, usually with laterite on or near the surface, on slopes and crests	-	-	6.30	8.47
8	Mid mallee woodland to isolated mallees of *Eucalyptus conveniens* over mid shrubland to open shrubland dominated by *Allocasuarina campestris* over low shrubland and sedgeland of mixed species dominated by *Ecdeiocolea monostachya, Hakea auriculata, Melaleuca radula, M. aspalathoides* and *Banksia fraseri* var. *fraseri* on gravelly grey or brown clay loams usually over massive laterite on breakaway tops, ridges and lateritic rises	18.27	20.04	-	-
11	Mid sparse to open shrubland of *Allocasuarina campestris* and *Grevillea biformis* subsp. *biformis* over low shrubland and sedgeland dominated by *Hakea circumalata, Lepidobolus preissianus* subsp. *preissianus, Mesomelaena pseudostygia* and *M. stygia* subsp. *deflexa* (P3) on yellow or yellow-brown sand or sandy loam on mid to upper slopes	6.18	8.41	32.48	32.09
13a	Low open woodland of *Eucalyptus todtiana* over mid to low shrubland of mixed species dominated by *Allocasuarina humilis*, *Banksia scabrella* (P4), *Calothamnus sanguineus, Eremaea beaufortioides* var. *microphylla, Melaleuca* aff. *leuropoma* and *Hibbertia hypericoides* over low shrubland and sedgeland of mixed species including *Banksia dallanneyi* subsp. *media, Conostylis canteriata, Mesomelaena pseudostygia* and *Caustis dioica* on grey or brown sand on lower and mid slopes	7.00	4.55	-	-

VT	VT Description	Well Site 4 Project Area (ha)		Well Site 5 Project Area (ha)	
		Option 1b	Option 2b	Option 1b	Option 2b
13b	Low open woodland of *Eucalyptus todtiana* over mid to low shrubland of mixed species dominated by *Allocasuarina humilis, Calothamnus sanguineus, Hakea trifurcata, Hibbertia hypericoides* and *Melaleuca leuropoma* over low shrubland and rushland of mixed species including *Banksia dallanneyi* subsp. *media, Conostylis aculeata* subsp. *breviflora* and *Conostylis canteriata* on grey, brown or yellow sand on flats, in depressions and on slopes	17.87	17.86	40.22	38.44
14	Low open shrubland dominated by *Calothamnus quadrifidus* subsp. *angustifolius, Banksia carlinoides, Hakea lissocarpha* and *Verticordia densiflora* over low open shrubland, sedgeland and forbland dominated by *Dampiera teres* (broad-leaf variant), *Jacksonia angulata, Harperia lateriflora, Opercularia vaginata* and *Melaleuca trichophylla* on grey-brown sands, sandy loams and clay loams in minor drainage lines and on flats	0.34	0.58	0.09	0.09

5.3 Likelihood of Occurrence of Significant Flora Taxa

Table 10 presents the likelihood of significant flora taxa occurring in the Well 4 and Well 5 Project Areas, based on records of occurrence of from within those areas and surrounds, and utilising knowledge of the habitat preferences of these flora taxa.

A total of 70 listed significant flora taxa, or habitat for such taxa are known from the Desktop Study Area. Of these, a total of seven significant flora taxa are known from within the Project Area itself including *Banksia scabrella* (P4), *Eucalyptus* ?*crispata* (T), *Mesomelaena stygia* subsp. *deflexa* (P3), *Micromyrtus rogeri* (P1), *Stylidium drummondianum* (P3), *Synaphea oulopha* (P3) and *Thelymitra stellata* (T). It is considered that a further 42 significant flora taxa could potentially occur in the Project Area as suitable habitat may be present. These are indicated in Table 10. The remaining 21 taxa are considered unlikely to occur in the Project Area, primarily because suitable habitat is not considered to be present.

It is considered that all taxa were identifiable during the previous survey period (Woodman Environmental 2011 and 2012) (either because the survey period coincided with the taxon's flowering period or the taxon can be identified reliably when in fruit or sterile), excluding the species *?Stylidium carnosum* subsp. Narrow leaves (J.A.Wege 490) (P1). This taxon was recorded in the Woodman Environmental (2013) 2012 survey period and within the Desktop Study Area as defined in this assessment. Only a single individual was recorded at the location and identification was incomplete due to the absence of the flowering spike from the collection (the species has previously been collected from areas within the vicinity of the Desktop Study Area.

Table 10: Likelihood of Occurrence of Significant Flora Taxa in the Well 4 and 5 Project Areas

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Acacia isoneura subsp. *isoneura*	P3	August to September	Flats, slopes and low rises on yellow/brown sand	Yes	Known within WEC (2013) Study Area; recorded in one location only approximately 4km to east north-east of Project Areas	VT 5	**Possible** – recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas based on habitat (VT 13a, 13b and 14).
Acacia lanceolata	P3	July - August	Lateritic hills and breakaways	Yes	Not known within WEC (2013) Study Area. Nearest known record is 8km to the north north-west of the Project Areas. Project Areas on edge of known range of taxon.	-	**Possible** –not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b and 8).
Acacia megacephala	P3	July to September	Sandplains, slopes and flats on white/yellow sand	Yes	Not known within WEC (2013) Study Area. Nearest known record is 11km to the north-east of the Project Areas. The Project Areas are located just to the south of the known range of this taxon.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 13a, 13b and 14).
Acacia vittata	P2	June, August and November	Flats, margins of seasonal lakes on grey sand/sandy clay	Yes	Not known within WEC (2013) Study Area. Nearest known record is 13.5km to the south-west of the Project Areas. The Project Areas are located to the north of the northern edge of the range of this taxon.	-	**Unlikely** not recorded by previous surveys in Study Area. Habitat not present in Project Areas.
Allocasuarina grevilleoides	P3	-	Slopes with sand or clay over laterite, gravel	Yes	Known within WEC (2013) Study area; recorded in 37 locations with approximately five sub-populations. Nearest record approximately 3 km south-west of Project Areas	Mainly 7a and 8	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 7a and 8).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Banksia cypholoba	P3	June, August, September	Plains, slopes and hills with sand, often with laterite.	Yes	Not known within WEC (2013) Study Area. Nearest known records are 15km to the east and south south-west of the Project Areas.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on (VT 7a, 7b, 8 and 11).
Banksia elegans	P4	October to November	White sand on slopes, low lateritic hills, brown gravelly loam, grey sandy gravel	Yes	Not known within WEC (2013) Study Area. Nearest known records are 16km to the west of the Project Areas.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b, 8 and 11).
Banksia fraseri var. *crebra*	P3	July to August	Plains, hilltops and slopes with white, grey or yellow sand, sometimes with lateritic gravel	Yes	*Banksia fraseri* ?var. *fraseri* identified in WEC (2013) Study area; considered possible *Banksa fraseri* var. *crebra* occurs in the area.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b, 8 and 11).
Banksia scabrella	P4	September to December or January	White, grey or yellow sand, sometimes with lateritic gravel. Sandplains, lateritic ridges.	Yes	Known within WEC (2013) Study Area (recorded at 463 locations and 26 sub-populations). Nearest other records within 1km of Project Areas.	Main habitat VT 13a, and also in VTs 10, 7a, 7b and 13b.	**Present** – 102 individuals recorded in Well 4 Site Project Areas for both option 1b and 2b
Beyeria gardneri	P3	August to September	Plains, slopes and hills with sand.	Yes	Known from within the WEC (2013) Study Area from a single location. Nearest record is approximately 2 km west of the Project Areas.	VT 12	**Possible** – recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas (VT 12).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Calectasia palustris	P2	July to October	White or grey sand. Seasonally inundated swamplands.	Yes	Not known from within the WEC (2013) Study Area. Nearest record is 13.5km to the south-west of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area. Habitat not present in Project Areas.
Calothamnus arcuatus	P2	October	Breakaways and rocky hillsides with sand, often with sandstone	Yes	Not known from within the WEC (2013) Study Area. Nearest record is 10km to the south-east of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area. Habitat not present in Project Areas.
Calytrix chrysantha	P4	November, December or January to February	Plains and flats, on yellow or grey sand	Yes	Known from one record within the WEC (2013) Study Area, located approximately 5 km SW of the Project Areas.	VT 7a	**Possible** – recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas (VT 7a).
Chorizema humile	T	July to September	Plains, on sandy clay or loam	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 25km to the north-east from the Project Areas, and the main range of the taxon is located to the north and south-east of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Comesperma griffinii	P2	October to November and January	Depressions, flats and slopes with sand or loam	Yes	Not known from within the WEC (2013) Study Area. Nearest record is 11km to the west south-west of the Project Areas.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 11, 13a, 13b and 14).
Comesperma rhadinocarpum	P3	October to November	Gravelly lateritic soils. Undulating plains, rises	Yes	Not known from within the WEC (2013) Study Area. Nearest record is 13.5km to the west of the Project Areas.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b and 8).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Conostylis dielsii subsp. *teres*	T	July to August	White, grey or yellow sand, gravel. Low open woodland	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 30km to the north-west from the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Conostylis micrantha	T	July to August	Sandplains on white or grey sand.	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 25km to the north-west and north-east of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Cryptandra aff. *intermedia*	-	-		Yes	Recorded within 5km of the Project Areas.	VT 7a; 12	**Possible** – suitable habitat (VT 7a) occurs within Well 4 project area
Dasymalla axillaris	T	July, September, October, November or December	Plains and flats with yellow sand	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 90km to the east of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Daviesia speciosa	T	April to May	Gravelly lateritic soils. Undulating plains, rises.	Yes	Not known to occur in the WEC (2013) Study Area. Nearest populations are 8km to the north-west and 10km to the north-east of the Project Areas.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b and 8).
Diuris eburnea	P1	October to November	Damp areas near rivers	Yes	Not known from within the WEC (2013) Study Area. Nearest known location is 14.5km to the south-west of the Project Areas. The Project Areas are outside of the known range of this taxon.		**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Eucalyptus abdita	P2	October and February	Laterite, sandy clay with gravel over laterite. Slopes, breakaways.	Yes	Known from within the WEC (2013) Study Area, from six locations and 3 sub-populations. Nearest records are within 2km south of the Project Areas.	VT 8	**Possible** - recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 7a, 7b and 8).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Eucalyptus x *balanites*	T	Oct to Dec or Jan to Feb	Sandy soils with lateritic gravel	Yes	Not known from within the WEC (2013) Study Area. The nearest known location is over 100km to the south of the Project Areas. The Project Areas are not in the known range of this hybrid.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Eucalyptus crispata	T	March to June	Sand, loam with lateritic gravel. Lateritic breakaways	Yes	Known from within the WEC (2013) Study Area from three locations (and potentially a fourth). Other nearest location is within 2km south of the Project Areas.	VT 8. 10	**Present** – Located (*E. ?crispata*) in the Well 4 Site Project Areas for both option 1b and 2b; Confirmed E. crispata known from within very close proximity to Well Site 4 Project Area.
Eucalyptus impensa	T	June to July	Yellow sand. Lateritic hills	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 50km to the south of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Eucalyptus leprophloia	T	August to October	White or grey sand over laterite. Valley slopes	Yes	Not known to occur in WEC Study Area; two nearest records to the Study Area were inspected in the field and the taxon was not re-located.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a and 7b).
Eucalyptus macrocarpa subsp. *elachantha*	P4	August to September or November to December	White or grey sand over laterite. Hillslopes, ridges, sandplains.	Yes	Known from within the WEC (2013) Study Area, from 121 locations and 19 sub-populations. Nearest records are 4km to the west south-west of the Project Areas.	Variety of VTs, mainly VTs 10 and 7a.	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 7a, 7b and 8).
Eucalyptus macrocarpa x *pyriformis*	P3	August to October	Sand, lateritic sandy soils. Hills, rocky ironstone ridges, sandplains	Yes	Known from the WEC (2013) Study Area at 3 locations. Nearest record is approximately 3 km west of the Project Areas.	VTs 7b, 8, 11	**Possible** - recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 7b and 8).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Eucalyptus sp. 2	-		Unknown	Unknown	Was collected within 1km of Well Site 4 project area.	VT 11	**Possible –** is known to occur in VT 11
Grevillea erinacea	P3	July to December	Plains, hills and slopes with white, grey or yellow sand, often with lateritic gravel	Yes	Not known from within the WEC (2013) Study Area. Nearest location is 17km south-west of the Project Areas, with further locations both further to the north and south.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a and 7b).
Grevillea makinsonii	P3	July or September to October	White, grey or yellow sand over laterite, loam, gravel, clay. Rocky hills, sandplains	Yes	Not known from within the WEC (2013) Study Area. Nearest known locations are approximately 1.5km to the east north-east and east south-east of the Project Area. Project Area near the northern extent of the known range.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a and 7b).
Guichenotia alba	P3	July to August	Sandy and gravelly soils. Low-lying flats, depressions	Yes	Not known from within the WEC (2013) Study Area. Nearest known locations are approximately 10 km NW of the Project Areas.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 13b and 14).
Guichenotia impudica	P3	August to October	Hills and slopes with laterite	Yes	Possible misidentification during surveys in 2011. Nearest location is approximately 150 km north of the Project Areas Considered possible but unlikely it would occur in the WEC (2013) study area.	-	**Unlikely** – not recorded by previous surveys in Study Area (based on misidentification), records are significant distance from Study Area.
Haemodorum loratum	P3	October - November	Plains and slopes with grey sand	Yes	Recorded in the WEC (2013) Study Area at 57 locations and 19 subpopulations. Nearest known records are in close proximity (within 2km) to the Project Areas.	Mainly VTs 10 and 7a	**Likely -** recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 7a).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Hakea megalosperma	T	May to June	Grey sand, loam. Lateritic hills and rocks	Yes	Not known to occur in the WEC (2013) Study Area. Nearest populations are over 30km to the south of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Hemiandra gardneri	T	August to October	Grey or yellow sand, clayey sand	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 70km to the south of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Hemiandra sp. Eneabba (H. Demarz 3687)	P3	February	Sand. Disturbed sites	Yes	Known from the WEC (2013) Study area at 22 locations representing 11 sub-populations. Nearest known records are within 2km of the Project Areas.	Mainly 7a and 13a	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 7a and 13a).
Hensmania stoniella	P3	September to November	Flats and slopes with white, grey or lateritic sand, sometimes winter-wet	Yes	Is known to occur just outside of the WEC (2013) Study Area, approximately 6km south of the Project Area.	-	**Possible** –recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b, 13a and 13b).
Homalocalyx chapmanii	P2	September to October	Undulating plains, slopes and riverbanks with sand or loam	Yes	Is known to occur just outside of the WEC (2013) Study Area, approximately 6km south of the Project Area.	-	**Possible** –recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 14)
Lasiopetalum ogilvieanum	P1	July to October	Undulating plains, lateritic rises	Yes	Known from within the WEC (2013) Study area, recorded at 28 locations representing 8 sub-populations. Nearest records are 4km from the Project Areas.	Mainly VT 13a	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 13a).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Leucopogon grammatus	P3	August	Slopes, breakaways and ridges with laterite.	Yes	Not known to occur in the WEC (2013) Study Area. Nearest location is 12km to the south south-east of the Project Area.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b and 8).
Leucopogon obtectus	T	August to October	Grey sand	Yes	Not known to occur in the WEC (2013) Study Area. Nearest known locations are over 30km to the south south-west of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.
Leucopogon aff. sp. Coomallo (R.J. Cranfield 1457)	-	Unknown	Unknown	-	Recorded within the WEC (2013) Study Area within 5km of the project areas.	VT 3	**Unlikely** – VT 3 does not occur in either Well 4 or 5 project areas
Malleostemon decipiens	P1	September	Breakaways, low rises with sandstone, ironstone or granite with loam.	Yes	Known from within the WEC (2013) Study Area, recorded at 2 locations representing 2 subpopulations. Nearest records are 5km north of the Project Areas.	VTs 4 and 5	**Unlikely** – recorded by previous surveys in Study Area. Potential habitat not present in the Project Areas.
Melaleuca sclerophylla	P3	June to September	Granite outcrops, rises on gravelly sand, clayey sand.	Yes	Not known from within the WEC (2013) Study Area. Nearest known location is 6.5kmk to the south-west; that location is the northern extent of the known range.	-	**Unlikely** –not recorded by previous surveys. Potential habitat not present in the Project Areas.
Mesomelaena stygia subsp. *deflexa*	P3	March to October	Plains, flats and slopes with white, grey or lateritic sand, clay, gravel	Yes	Known from within the WEC (2013) Study Area, from 514 locations representing 16 populations. Nearest known locations are within 2km of the Project Areas.	Mainly VT 8, 11, 10	**Present** – 443 individuals recorded in Well 4 Site Project Areas for option 1b and 458 recorded for option 2b, and 15 individuals recorded for Well Site 5 option 2b

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Micromyrtus rogeri	P1	July to October	Breakaways on yellow-brown sandy soils, gravel, laterite	Yes	Known from within the WEC (2013) Study Area, from 504 locations and 13 sub-populations. Nearest records are within 1km of the Project Areas.	Mainly VT 8	**Present** – 1080 individuals recorded in Well 4 Site Project Areas for option 1b and 1007 recorded for option 2b
Micromyrtus uniovulum	P2	July to October	Ridges, slopes and breakaways with laterite	Yes	Not known to occur in the WEC (2013) Study Area. The nearest location is 13.5km to the south south-east of the Project Areas; the Project Areas are not within the known range of the taxon.	-	**Possible** – not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 8).
Paracaleana dixonii	T	October to November	Flats, plains and slopes with grey sand, sometimes with laterite gravel	Yes	Known to occur in the WEC (2013) Study area at 197 locations representing 30 subpopulations. Nearest known records are within 1.5km of the Project Areas.	Variety of VTs, mainly VTs 13a, 10 and 7b	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 7b and 13a)
Persoonia chapmaniana	P3	September to November	White sandy clay, yellow sand. Vicinity of salt lakes	Yes	Not known to occur in the WEC (2013) Study Area. Nearest location is 13.5km to the south-west of the Project Areas. The Project Areas are not within the known range of this taxon.	-	**Unlikely** –not recorded by previous surveys. Potential habitat not present in the Project Areas.
Persoonia filiformis	P3	November to December	Plains and slopes with yellow or white sand over laterite	Yes	Known from within the WEC (2013) Study Area from 88 locations and 8 sub-populations. Nearest records are 3km to the south-west of the Project Areas.	Mainly VT 10	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 10)
Persoonia rudis	P3	September to December or January	Flats and slopes with white, grey or yellow sand, often over laterite	Yes	Known from within the WEC (2013) Study Area from 17 locations representing 13 sub-populations. Nearest known locations are within 2km to the north-west of the Project Areas.	Mainly VTs 13a and 10 (however 7 VTs in total)	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 10 and 13a)

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Pityrodia viscida	P4	September to December or January to February	Upper slopes and mid slopes with white or grey sand, sometimes over laterite	Yes	Not known to occur in the WEC (2013) Study Area. Nearest location is 7 km north-east of the Project Areas.	-	**Possible** –not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b, 13a and 13b).
Schoenus badius	P2	September to October	Grey sand. Moist areas	Yes	Known from within the WEC (2013) Study Area, from 7 locations and 5 sub-populations. Nearest locations are 2km south-west of the Project Areas.	Mainly VT 14	**Possible** - recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 14)
Schoenus griffinianus	P4	September to October	Undulating sandplains, lower slopes, flats and depressions with grey sand.	Yes	Known from within the WEC (2013) Study Area from a single location. Nearest record is 2 km north-east of the Project Areas.	VT 13a	**Possible** - recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 13a)
Schoenus sp. Eneabba (F. Obbens & C. Godden I154)	P2	April, November	Undulating sandplains, mid slopes, tops of rises on grey, yellow or white sand.	Yes	Not known from within the WEC (2013) Study Area. Nearest location is 14km south-west of the Project Areas.	VT 13a	**Possible** –not recorded by previous surveys. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b, 13a and 13b).
Stawellia dimorphantha	P4	June to November	Undulating plains and slopes with white, grey, yellow sand	Yes	Not known from within the WEC (2013) Study Area. Nearest location is 13.5km south-west of the Project Areas. The Project Areas are not within the known range of this taxon (occurs further west).		**Unlikely** due to the Project Areas not being located in the known range of this taxon.

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
?*Stylidium carnosum* subsp. Narrow leaves (J.A. Wege 490)	P1	October	Lower to midslopes with white/grey sand often with laterite	No	Known from within the WEC (2013) Study Area from a single location. Nearest record is 2.6 km north of the Project Areas.	VT 10	**Possible** – recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 10).
Stylidium drummondianum	P3	August to October	Sand or clayey sand over laterite. Upper hillslopes, breakaways. Low heath, mallee shrubland	Yes	Known from within the WEC (2013) Study Area from 433 records representing 21 sub-populations. Nearest records are known within 1km of the Project Areas.	Mainly VT 8 and 7a	**Present** – 904 individuals recorded in Well 4 Site Project Areas for option 1b and 922 recorded in option 2b
Stylidium pseudocaespitosum	P2	September to November	Breakaways and hillslopes on white, grey or yellow sand over laterite	Yes	Known from a single record in the WEC (2013) Study Area, located 4km to the south-west of the Project Area.	VT 13a	**Possible** – recorded by previous surveys in the Study Area, records in close proximity. Potential habitat present in the Project Areas (VT 13a).
Stylidium sp. Three Springs (J.A. Wege & C. Wilkins JAW 600)	P2	September	Slopes, hills and breakaways with granite or laterite and clay/loam.	Yes	Not known to occur in the WEC (2013) Study Area. The nearest location is 12km to the south south-west of the Project Areas, however the majority of locations are to the east of the Project Areas.	-	**Possible** – not recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas based on habitat (VT 7a, 7b and 8).

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Stylidium torticarpum	P3	September to November	Sandy clay and clay loam over laterite. Adjacent to creeklines, depressions, and beneath breakaways. Heath or mallee shrubland	Yes	Known from within the WEC (2013) Study Area from 59 locations representing 12 sub-populations. Nearest known records are 3km north-east of the Project Area.	Variety of VTs, mainly VT 8	**Likely** - recorded by previous surveys in the Study Area at numerous locations, records in close proximity. Potential habitat present in the Project Areas (VT 8)
Synaphea oulopha	P3	July to October	Lateritic breakaways and rises on grey sand, gravelly loam, clay	Yes	Known from within the WEC (2013) Study Area from 146 locations and 17 sub-populations. Nearest known locations are within 1km of the Project Areas.	Mainly VT 8 and 7a	**Present** – 445 individuals recorded in Well 4 Site Project Areas for option 1b and 474 recorded in option 2b
Synaphea sparsiflora	P2	August to September	Slopes / crests of hills and lateritic ridges with grey / brown sand	Yes	Not know to occur in the WEC (2013) Study Area. Nearest known locations are 5km to the east south-east and east north-east of the Project Area, and 9km north-west of the Project Areas.	-	**Possible** – not recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas based on habitat (VT 8).
Thelymitra stellata	T	September to October	Hills and ridges with sand and gravel, often with laterite	Yes	Known from within the WEC (2013) Study Area from 139 locations and 18 sub-populations. Nearest records are within 1km of the Project Areas.	Mainly VT 8	**Present** – 2 individuals recorded in Well 4 Site Project Areas for both option 1b and 2b (also additional individuals recorded as *Thelymitra* ?*stellata*)
Thryptomene nitida	P3	August to November	Lower slopes, flats and drainage lines with clay and clay/sand	No	Known from within the WEC (2013) Study Area from 8 locations representing 7 sub-populations. Nearest records are 3km to the north-west of the Project Areas.	Mainly VT 4	**Possible** – recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas (VT 14).

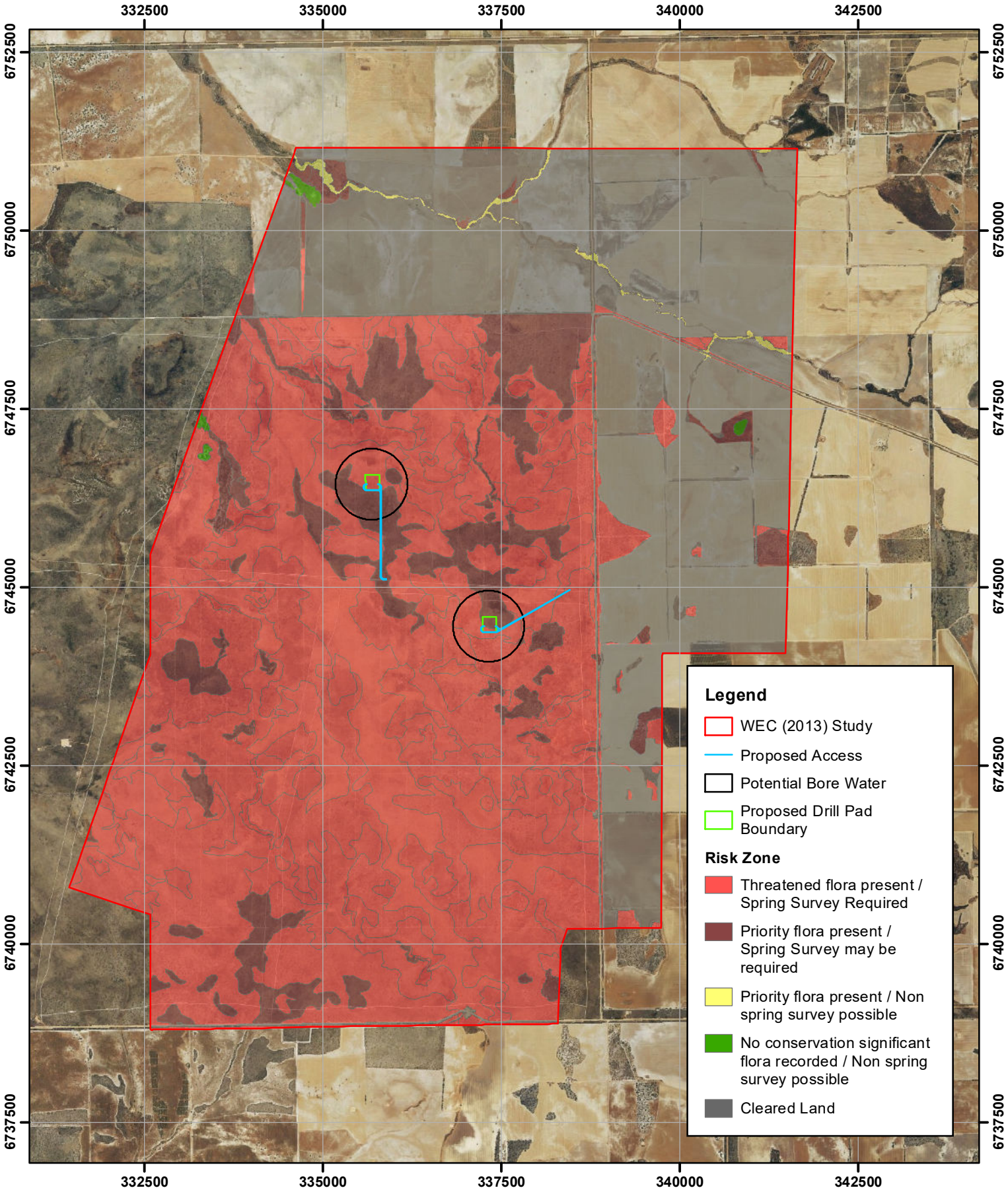
Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Identifiable During Previous Survey*?	Nearest Known Location to Project Areas (WEC 2013; DBCA 2007-)	VT Habitat	Likelihood of Occurrence in Project Area
Thysanotus vernalis	P3	September to October	Flats and depressions with sandy loam	Yes	Not known to occur in the WEC (2013) Study Area. The nearest location is 5.5km to the east of the Project Areas; this location is the furthest north of the range, and the Project Areas are not in the known range.	-	**Possible** – not recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas based on habitat (VT 14).
Verticordia dasystylis subsp. *oestopoia*	P1	October	Granite outcrops with grey / brown loam	Yes	Not known to occur in the WEC (2013) Study Area. Nearest location is 10.5km to the south of the Project Areas.	-	**Unlikely** –not recorded by previous surveys. Potential habitat not present in the Project Areas.
Verticordia densiflora var. *roseostella*	P3	September to December	Plains with grey /white sand	Yes	Not known to occur in the WEC (2013) Study Area. The nearest known location if 7.5km to the north-east of the Project Areas. The Project Areas are in the known range of this taxon.	-	**Possible** – not recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas based on habitat (VT 13a and 13b).
Verticordia luteola var. *luteola*	P3	November to December	Flats on grey sand over gravel	No	Known from within the WEC (2013) Study area from 2 locations representing a single population. Nearest records are 7km south-west of the Project Areas.	VT 13a	**Possible** – recorded by previous surveys in the Study Area. Potential habitat present in the Project Areas (VT 13a).
Verticordia luteola var. *rosea*	P1	December or January	Flats on white sand	No	Not known to occur in the WEC (2013) Study Area. Nearest known location is 13km to the south-west of the Project Areas. The Project Areas are not withn the known range of this taxon.	-	**Unlikely** due to location of Project Areas outside of range.
Wurmbea tubulosa	T	July to August	Clay, loam. River banks, seasonally-wet places	No	Not known from the WEC (2013) Study Area. Nearest known record is 18km to the north north-west of the Project Areas.	-	**Unlikely** – not recorded by previous surveys in Study Area, outside the known range of the taxon.

*Woodman Environmental (2011 and 2012) Survey

5.4 Risk of Significant Flora Based on Vegetation Type Mapping

Conservation significant flora taxa have been recorded (Woodman Environmental 2013) within the majority of mapped VTs. This distribution of significant taxa places constraints on further development within the area. Targeted survey for conservation significant flora will be required in all appropriate habitat prior to impact assessment and approval of further disturbance under relevant legislation and policy. Figure 5 presents four risk categories based on the VTs which Threatened and Priority flora were recorded in during the previous survey (Woodman Environmental 2013). The categories identify whether a spring survey would be required within each mapped VT prior to application for additional disturbance. This assessment is intended to provide an indication of areas that may be accessed following different levels of Targeted flora survey. This assessment is based only on the taxa recorded from the previous survey and does not include the risk for all taxa listed in section 5.3.

Based on the VT mapping polygons and the records of significant flora in the West Erregulla Study Area, the majority of the Study Area would require a spring survey primarily due to the potential for the two Threatened orchids to occur (*Thelymitra stellata* (T) and *Paracaleana dixonii* (T)). There are smaller areas of VTs which have Priority flora taxa present (no Threatened flora taxa) which would also require spring survey. There are only very small polygons in which a survey outside of spring would potentially be considered adequate (Figure 5).



Conservation Significant Flora Risk	Author: Greg Woodman	N
	WEC Ref: Strike20-05-01	
WOODMAN ENVIRONMENTAL	Filename: Strike20-05-01-f05	**Figure**
	Scale: 1:70,000 (A4)	5
	Projection: GDA 1994 MGA Zone 50	
This map should only be used in conjunction with WEC report Strike20-05-01.	Revision: A - 26 February 2020	

6. DISCUSSION AND CONCLUSIONS

The Well Site 4 and 5 Project Areas each have two project options (option 1b and 2b) (although location differences are minor). It is important to reiterate that while the Well Site Project Areas include the Potential Bore Water Areas (500 m radius of the well sites), the water bores and associated monitoring will be located within this larger area in a location that minimises impacts to significant flora, with the actual proposed clearing area being smaller than the overall size of the Project Areas.

The Woodman Environmental (2013) West Erregulla Study Area has been subject to previous flora and vegetation surveys (field surveys undertaken 2008, 2011 and 2012) with VT mapping undertaken over the entire Study Area, including the Well Site 4 and 5 Project Areas (Woodman Environmental (2013). A total of 70 listed significant flora taxa and three potentially significant unlisted taxa were returned as being present within the Desktop Study Area.

A large portion of the Well Site 4 Project Area has been subject to targeted flora grid searching and includes the location of two flora survey quadrats. A total of seven significant flora taxa have records within the Well Site 4 Project Area including *Banksia scabrella* (P4), *Eucalyptus* ?*crispata* (T), *Mesomelaena stygia* subsp. *deflexa* (P3), *Micromyrtus rogeri* (P1), *Stylidium drummondianum* (P3), *Synaphea oulopha* (P3) and *Thelymitra stellata* (T). The Well Site 5 Project Area has not been subjected to any targeted flora grid searching or flora survey quadrats and traverses within the area are very minimal. One significant flora taxon is known from the Well Site 5 Project Area for option 2b, being *Micromyrtus rogeri* (P1). No significant taxa are known from the Well Site 4 Project Area for option 1b.

It is considered that a further 44 listed and non-listed significant flora taxa (including two Threatened taxa) could potentially (possible or likely) occur in the Project Area as suitable habitat may be present. These are indicated in Table 10. The remaining 22 taxa are considered unlikely to occur in the Project Area, primarily because suitable habitat is not considered to be present.

Given the high number of significant flora taxa (including Threatened flora) known to occur within the WEC (2013) Study Area combined with the absence of targeted searching undertaken within the Well Site 5 Project Area, targeted survey for the flora taxa identified as potentially occurring in the Project Areas is recommended. The timing of such survey will need to coincide with the flowering periods of the two Threatened flora orchids known from the West Erregulla Study Area (*Paracaleana dixonii* (T) and *Thelymitra stellata* (T)), which can only be seen easily when in flower. Adequate survey for these taxa is difficult to undertake in a single survey as *Thelymitra stellata* (T) tends to flower earlier (beginning in September) while *Paracaleana dixonii* (T) tends to come into flower after *Thelymitra stellata* (generally in November). Therefore two separate spring surveys are required to adequately survey the Well Site 4 and 5 Project Areas.

A total of eight VTs have been previously mapped over the Project Area by Woodman Environmental (2013), two of which were considered to be of potential regional significance

and six of which were considered to be of high local significance. This was primarily because of their limited extent in the West Erregulla Study Area (less than 1% of the Study area) and their occurrence on landforms that were uncommon and restricted in the Study area and / or are habitat for significant flora (Woodman Environmental 2013). However, the proposed area of disturbance is relatively small and is unlikely to have a significant impact on the vegetation. None of these VTs represent any listed TECs or PECs.

A total of 33 introduced taxa (or habitat for such taxa) are known to occur in the Desktop Study Area including three Declared Pests (DPIRD 2020) and three listed WoNS (AWC 2020). Of these, 22 introduced taxa are known from the West Erregulla Study Area including *Echium plantagineum* (Paterson's Curse) which is a Declared Pest. The vegetation condition within the Well Site 4 and 5 Project Areas was mapped as 'Pristine' and the majority of the West Erregulla Study Area in general was also mapped as 'Pristine'. Therefore weed hygiene practices will be an important component of any potential works to be undertaken for the Project.

Although the clearing proposed for the development of West Erregulla Well Sites 4 and 5 is relatively small, these Project Areas are located within a large, intact block of remnant vegetation in largely pristine condition within a region that has largely been cleared for agriculture, containing a number of different habitat types and a high number of significant flora taxa. It is important to consider this in planning the proposed development of the wells and ensure rehabilitation of any disturbance is undertaken promptly using appropriate techniques.

7. RECOMMENDATIONS

The following recommendations have been developed based on the desktop assessment of the proposed West Erregulla 4 and 5 Well Project Areas:

- Targeted flora survey should be undertaken to assess the presence of significant flora identified as potentially or likely to occur in the West Erregulla 4 and 5 Well Project Areas.
- Based on the existing flora and vegetation data available for the Project Area and the significant flora identified as potentially occurring in the Project Area, two spring-timed surveys are recommended; a September survey to target all significant flora (including *Thelymitra stellata* (T)) except *Paracaleana dixonii* (T)), and a November survey to target *Paracaleana dixonii* (T).
- Any potential non-spring survey for conservation significant flora to inform impact assessment should be discussed with the relevant regulators to ensure their acceptance of survey timing and method.

8. REFERENCES

Atlas of Living Australia (ALA) (2020)
The Australasian Virtual Herbarium. Council of Heads of Australasian Herbaria. Available: http://avh.chah.org.au. Accessed January 2020.

Australian Weeds Committee (AWC) (2020)
Weeds Australia - Weeds of National Significance. Available: http://www.weeds.org.au/WoNS/. Last accessed February, 2020.

Beard, J.S. (1990)
Plant Life of Western Australia. Kangaroo Press, Perth.

Beard, J. S., Beeston, G.R., Harvey, J.M., Hopkins, A. J. M. and Shepherd, D. P. (2013)
The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. *Conservation Science Western Australia 9: 1-152.*

Bureau of Meteorology (2020)
Climate Statistics for Australian Locations – Perth Airport. Available: http://www.bom.gov.au/climate/data/. Sourced February, 2020.

Coffey Services Australia Pty Ltd (Coffey Services) (2017)
West Erregulla-2 Exploration Well Environment Plan Summary. Prepared for Warrego by Coffey Services.

Commonwealth of Australia (2012)
Interim Biogeographic Regionalisation for Australia, Version 7. Department of Sustainability, Environment, Water, Population and Communities. Available: http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/index.html#ibra

Commonwealth of Australia (2013)
Matters of National Environmental Significance. Significant Impact Guidelines. EPBC Act Policy Statement 1.1.

Department of Biodiversity, Conservation and Attractions (DBCA) (2007-)
NatureMap: Mapping Western Australia's Biodiversity. Available: https://naturemap.dpaw.wa.gov.au/. Last accessed August, 2019.

Department of Biodiversity, Conservation and Attractions (DBCA) (as Department of Parks and Wildlife, DPaW) (2013)
Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Current January 2013. Available: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf

Department of Biodiversity, Conservation and Attractions (DBCA) (2018)
List of Threatened Ecological Communities (TECs) Endorsed by the Western Australian Minister for Environment. Department of Biodiversity, Conservation and Attractions, 28th June 2018

Department of Biodiversity, Conservation and Attractions (DBCA) (2019a)
Conservation Codes for Western Australian Flora and Fauna. Current 3rd January 2019. Available: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/conservation_code_definitions.pdf

Department of Biodiversity, Conservation and Attractions (DBCA) (2019b)
Priority Ecological Communities for Western Australia, Version 28. Species and Communities Program, Department of Biodiversity, Conservation and Attractions, 10th January 2019

Department of Biodiversity, Conservation and Attractions (DBCA) (2020a)
Interrogation of the DBCA Western Australian Herbarium specimen database, Threatened and Priority Flora database and Threatened and Priority Flora List, performed 14/02/2020. Reference: 20-0220FL.

Department of Biodiversity, Conservation and Attractions (DBCA) (2020b)
Interrogation of the DBCA Threatened Ecological Communities and Priority Ecological Communities database, performed 25/02/2020. Reference: 24-0220EC.

Department of the Environment and Energy (DoEE) (2014)
Key Threatening Processes. http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl (accessed February 2020).

Department of the Environment and Energy (DoEE) (2020)
Interrogation of Species Profile and Threats (SPRAT) Database using Protected Matters Search Tool. Queried 13/02/2020. Available: https://www.environment.gov.au/epbc/protected-matters-search-tool.

Department of Primary Industries and Regional Development (DPIRD) (2020)
Declared Organism Search. Available: http://www.agric.wa.gov.au/organisms. Last accessed February 2020.

Department of Primary Industries and Regional Development (DPIRD) (2019a)
Soil-landscape zones Western Australia. Zones derived from soil-landscape mapping (best available) Version April 2018.

Desmond, A. and Chant, A. (2001)
Geraldton Sandplain 3 (GS3 – Lesueur Sandplain Subregion). A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002.

Eco Logical Australia (2018)
EP469 West Erregulla-2 Exploration Well Environmental Plan Summary. Prepared for Strike West Pty Ltd with support from Strike Energy and Warrego Energy.

Environmental Protection Authority (EPA) (2004)
Guidance for the assessment of environmental factors: Terrestrial fauna surveys for environmental impact assessment in Western Australia. No. 56. Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (EPA) (2016a)
Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment. EPA, Western Australia, December 2016.

Environmental Protection Authority (EPA) (2016b)
Environmental Factor Guideline – Flora and Vegetation. Published 13th December 2016 (www.epa.wa.gov.au/).

Government of Western Australia (2019)
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions. Available: https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Purdie, B R, Tille, P J, and Schoknecht, N R. (2004)
Soil-landscape mapping in south-Western Australia: an overview of methodology and outputs. Department of Agriculture and Food, Western Australia. Report 280, 160p.

Western Australian Herbarium (WA Herbarium) (1998-)
Florabase. Available: https://florabase.dpaw.wa.gov.au/. Last accessed February, 2020.

Woodman Environmental Consulting Pty Ltd (Woodman Environmental) (2009a)
Flora and Vegetation of the Proposed Eneabba-Moonyoonooka 330kV Transmission Line Supplementary Field Survey 2008. Unpublished report (WP08-21-01 Rev 0) February 2009.

Woodman Environmental Consulting Pty Ltd (Woodman Environmental) (2009b)
West Erregulla-2 Well Site Flora and Vegetation Assessment. Unpublished report (Warrego08-46-01) prepared for Warrego Energy Ltd., April 2009.

Woodman Environmental Consulting Pty Ltd (Woodman Environmental) (2010)
Flora and Vegetation of the Proposed Eneabba-Moonyoonooka 330kV Transmission Line Supplementary Field Survey 2008 2009 Survey Addendum report. Unpublished report (WP09-46-01 Rev 0) February 2010.

Woodman Environmental Consulting Pty Ltd (Woodman Environmental) (2013)
West Erregulla Project Area Flora and Vegetation Assessment. Unpublished report (Rev 3) prepared for Warrego Resources, September 2013.

Appendix A: Conservation Codes for Western Australian Flora and Fauna (DBCA 2019a)

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016.*

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR Critically endangered species

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN Endangered species

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU Vulnerable species

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest;

migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three

categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

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

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

Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Notes:
[1] The definition of flora includes algae, fungi and lichens
[2]Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Last updated 3 January 2019

Appendix B: Results of Search of the Department of the Environment and Energy Species Profile and Threats Database (DoEE 2020)

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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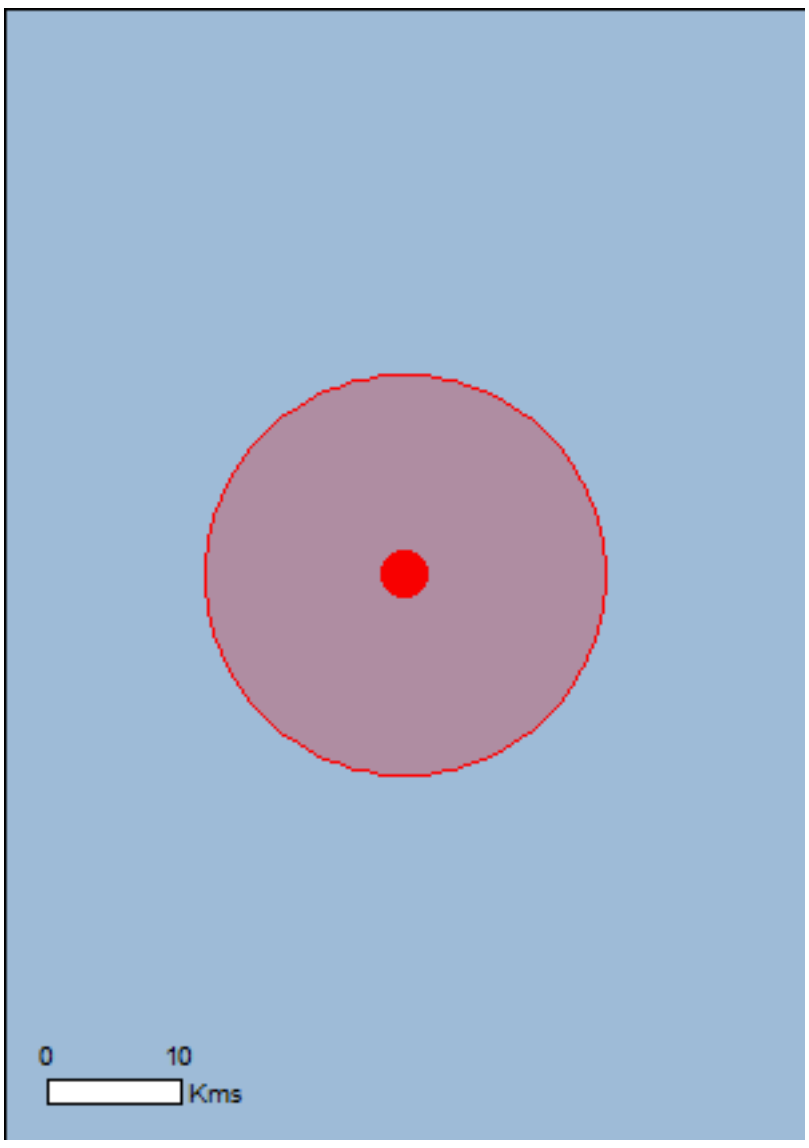

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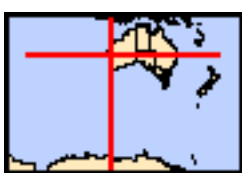

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	24
Listed Migratory Species:	8

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	14
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis		
Dibbler [313]	Endangered	Species or species habitat may occur within area
Other		
Idiosoma nigrum		
Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat may occur within area
Plants		
Chorizema humile		
Prostrate Flame Pea [32573]	Endangered	Species or species habitat may occur within area
Conostylis dielsii subsp. teres		
Irwin's Conostylis [3614]	Endangered	Species or species habitat likely to occur within area
Conostylis micrantha		
Small-flowered Conostylis [17635]	Endangered	Species or species habitat may occur within area
Dasymalla axillaris		
Native Foxglove [38829]	Critically Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Daviesia speciosa Beautiful Daviesia [56698]	Endangered	Species or species habitat known to occur within area
Eucalyptus crispata Yandanooka Mallee [24268]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus impensa Eneabba Mallee [56711]	Endangered	Species or species habitat likely to occur within area
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat known to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Hakea megalosperma Lesueur Hakea [10505]	Vulnerable	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat may occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat likely to occur within area
Paracaleana dixonii Sandplain Duck Orchid [86882]	Endangered	Species or species habitat known to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area
Wurmbea tubulosa Long-flowered Nancy [12739]	Endangered	Species or species habitat may occur within area
Reptiles		
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-29.43007 115.30901

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

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

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Appendix C: Definitions, Categories and Criteria for Threatened and Priority Ecological Communities (DBCA 2013)

1. GENERAL DEFINITIONS

Ecological Community: A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community** (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

Possible threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An **assemblage** is a defined group of biological entities.

Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (eg. substrate and topography), and the biotic factors.

Occurrence: a discrete example of an ecological community, separated from other examples of the same community by more than 20 metres of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

Adequately Surveyed is defined as follows:
"An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts."

Community structure is defined as follows:
"The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (eg. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, eg. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions of Modification and Destruction of an ecological community:
Modification: "changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result

of human activities. The level of damage involved could be ameliorated naturally or by human intervention."

Destruction: "modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention."

Note: Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgement. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be bought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising underground watertable away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

Threatening processes are defined as follows:
"Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community."

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced microorganisms; direct human exploitation and disturbance of ecological communities.

Restoration is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

Rehabilitation is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

2. DEFINITIONS AND CRITERIA FOR PRESUMED TOTALLY DESTROYED, CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE ECOLOGICAL COMMUNITIES

Presumed Totally Destroyed (PD)
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or**

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii):

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);

ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)
An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into

a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES PRIORITY ECOLOGICAL COMMUNITY LIST

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities:

Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities:

Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities:

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) Communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;

(iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities:

Communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.

(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities:

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Current as of January 2013