



**LEVEL 2 FLORA AND VEGETATION ASSESSMENT AND TARGETED  
*THELYMITRA STELLATA* SURVEY**

**GREAT NORTHERN HIGHWAY, MUCHEA TO WUBIN UPGRADES,  
STAGE 2 – BINDOON OPTIONS**

**MAY 2017**

**ASJV**

**F**  **USED  
VISION**  
consulting

---

**COPYRIGHT STATEMENT**

Except as permitted under the Copyright Act 1968 (Cth), no part of or the whole of this document is permitted to be reproduced by any process, electronic or otherwise, without the specific written permission of Focused Vision Consulting Pty Ltd. This includes photocopying, scanning, microcopying, photocopying or recording of any parts of the document.

**Focused Vision Consulting Pty Ltd**  
**ABN 25 605 804 500**

**Please direct all inquiries to:**  
**Focused Vision Consulting Pty Ltd**  
**47 Riverina Parade, MUNSTER WA 6166**  
**M: 0408 766 346 E: admin@focusedvision.com.au**

**Document History**

Rev.	Author	Reviewed	Approved	Date
A	Kellie Bauer-Simpson Principal Ecologist  Senior Botanist/ Environmental Scientist  Udani Sirisena Botanist	Gabriela Martinez Senior Botanist/ Environmental Scientist		12/12/2016
B	Kellie Bauer-Simpson Principal Ecologist  Senior Botanist/ Environmental Scientist  Udani Sirisena Botanist	Gabriela Martinez Senior Botanist/ Environmental Scientist	Kellie Bauer-Simpson Principal Ecologist	21/02/2017
0	Kellie Bauer-Simpson Principal Ecologist  Senior Botanist/ Environmental Scientist  Udani Sirisena Botanist	Gabriela Martinez Senior Botanist/ Environmental Scientist	Kellie Bauer-Simpson Principal Ecologist	09/05/2017

## EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) is upgrading the 218 km section of Great Northern Highway between Muchea and Wubin. Jacobs and Arup have formed the joint venture, ASJV, for the delivery of the project. The improvements to be made include town bypasses, wider roads, more passing lanes, flattening crests and easing curves, safer roadsides, more rest stops and additional facilities for heavy vehicles.

At the time of the surveys reported in this document, there were the following three proposed route options for the Great Northern Highway to bypass the town of Bindoon, which were broken down into the following four survey areas (collectively the 'study area'):

- Common Area (common to the southern commencement of both Areas 1 and 2) – Area 1
- Western Bypass A – Area 2
- Western Bypass B – Area 3
- Eastern Bypass – Area 4.

Focused Vision Consulting Pty Ltd (FVC) was commissioned by ASJV to undertake flora, vegetation and fauna assessments for the four survey areas, with this report presenting the results relevant to flora and vegetation. The results of the assessments will enable an environmental impact assessment for the preferred bypass route.

During spring 2016, experienced botanists from FVC carried out a single-phase Level 2 flora and vegetation assessment, in accordance with EPA Guidance Statement 51 (EPA 2004), and the Technical Guide for Flora and Vegetation Surveys (EPA & DPaW 2015). The survey incorporated a total survey effort of 18 person days and was conducted during October 2016. A total of 46 pegged quadrats and two relevés were established and sampled, to define the floristic values and documented a total of 13 different vegetation communities across the combined study area.

Additionally, a targeted survey for *Thelymitra stellata* (Star Sun-orchid) was carried out within selected areas in intact remnant vegetation within the study area, in accordance with the Commonwealth of Australia (2013b) Guidelines for Detecting Orchids Listed as 'Threatened' Under the *Environment Protection and Biodiversity Conservation Act 1999*. The targeted surveys were carried out utilising a combination of various survey intensities, in accordance with the guidelines (Commonwealth of Australia 2013b), and were carried out during November 2016 by three senior, experienced botanists, with a total of 21-person days invested. The aim was to survey at least 50% of the areas of suitable habitat for the species within the study area. *Thelymitra stellata* was not recorded in any location within any of the areas surveyed.

The key results and conclusions from the Level 2 flora and vegetation assessment, and targeted *Thelymitra stellata* survey are as follows:

- Seven species listed as Priority Flora under the *Wildlife Conservation Act 1950*, *Synaphea panhesya* (P1), *Gastrolobium ?crispatum* (P1), *Drosera sewelliae* (with *Drosera ?sewelliae*) (P2), *Acacia drummondii* subsp. *affinis* (P2), *Adenanthos cygnorum* subsp. *chamaephyton* (P3), *Anigozanthos humilis* subsp. *chrysanthus* (P3) and *Hibbertia miniata* (P4) were recorded during the field studies.

- It is considered likely that the distribution and abundance of the Priority flora recorded within the study area is greater than the recorded population extents and sizes and that additional species of Priority flora occur that were not recorded, due to the approach of the Level 2 assessment, highlighting the need for further, more detailed surveys to target Priority flora.
- No species of Threatened flora, including *Thelymitra stellata* were recorded within the study area.
- One State-listed Threatened Ecological Community (TEC) and two Priority Ecological Communities (PECs) are known to occur (based on database search results) within or closely adjacent to the study area, with all three of these ecological communities representative of the Commonwealth-listed Banksia woodlands of the Swan Coastal Plan TEC.
- The spring assessment scope was developed prior to the Banksia Woodlands of the Swan Coastal Plain being announced as a Commonwealth-listed TEC, in September 2016. However, future assessments will focus on Banksia woodlands and will enable assessment against the key diagnostic characteristics (Threatened Species Committee 2016) for determination of the presence of the TEC with certainty.
- The total area of likely Banksia woodland TEC within the study area is 22.67 ha, consisting of occurrences of vegetation communities BaXpAn, EtBeAn (including ?EtBeAn) and EtEpAn, all occurring within the Western A (Area 2) study area.
- Further assessment work would be required to accurately characterise and map the extent of the Banksia woodlands (Commonwealth) TEC within the study area, due to the prescriptive requirements of its definition.
- All of the recorded vegetation communities have been determined to be of local, regional or national significance, or a combination of these levels of importance. Most are locally significant due to supporting populations of Priority flora or having a limited local representation. Other factors determining local significance are, being considered floristically diverse or locally uncommon. Vegetation communities have been determined to be regionally significant due to being represented by less than 30% of their pre-European extent in the local government area, being limited to specific landform types, or being regionally uncommon. Three vegetation communities (BaXpAn, EtBeAn (including ?EtBeAn) and EtEpAn) are of national significance due to likely being representative the Commonwealth-listed Banksia woodlands of the Swan Coastal Plan TEC.

## Table of Contents

Executive Summary .....	iii
1 Introduction .....	8
1.1 Background .....	8
1.2 Location .....	8
1.3 Scope of Work.....	10
2 Legislative Context .....	11
2.1 Threatened and Priority Flora.....	11
2.2 Threatened and Priority Ecological Communities .....	13
2.3 Locally or Regionally Significant Vegetation.....	14
2.4 Vegetation Clearing, Extent and Status.....	15
2.5 Environmentally Sensitive Areas.....	15
2.6 Introduced Flora .....	16
2.6.1 Weeds of National Significance.....	16
2.6.2 Declared Plants .....	16
2.6.3 Environmental Weeds.....	16
3 Existing Environment.....	17
3.1 IBRA Region .....	17
3.2 Climate .....	17
3.3 Geology and Soils .....	19
3.4 Vegetation .....	22
4 Biological Context.....	28
4.1 Threatened and Priority Flora.....	33
4.2 Threatened and Priority Ecological Communities .....	38
5 Methodology.....	41
5.1 Desktop Assessment and Literature Review.....	41
5.2 Field Assessment.....	41
5.3 Targeted <i>Thelymitra stellata</i> Survey .....	45
5.4 Data Processing and Analysis.....	54
5.5 Study Limitations.....	55
6 Results .....	57
6.1 Flora.....	57
6.1.1 Targeted <i>Thelymitra stellata</i> Survey.....	60
6.2 Vegetation Communities .....	60

---

6.3	Vegetation Condition .....	72
7	Discussion .....	80
7.1	Flora.....	80
7.1.1	Targeted Thelymitra stellata Survey.....	81
7.2	Vegetation .....	82
7.2.1	TECs and PECs .....	82
7.2.2	Local Representation and Significance.....	83
7.2.3	Regional Significance.....	85
7.2.4	National Significance .....	89
7.2.5	Summary of Vegetation Significance .....	89
8	Conclusions.....	91
9	List of Participants .....	92
10	References .....	93
Appendix A:	Threatened and Priority with the Potential to Occur within the Study Area .....	A1
Appendix B:	Quadrat Data.....	B1
Appendix C:	Flora Species Recorded within Each Quadrat .....	C1
Appendix D:	Flora Species Recorded within Each Vegetation Community.....	D1

## Tables

Table 1	Definitions of Threatened and Priority Flora Species .....	12
Table 2	Categories of EPBC Act Threatened Flora Species .....	13
Table 3	Summary of Soil-Landscape Systems within the Study Area (DAFWA 2016b) .....	20
Table 4	Regional Vegetation of the Study Area and Surrounds (Shepherd et al. 2002) .....	23
Table 5	Vegetation Complexes of the Study Area (Heddle et. al. 1980; Havel and Mattiske 2000)....	25
Table 6	Summary of Key Findings from Recent Relevant Surveys .....	29
Table 7	Summary of Threatened and Priority Flora Occurring or Likely to Occur within the Study Area 34	
Table 8	Study Limitations .....	55
Table 9	Recorded Priority Flora Locations .....	58
Table 10	Summary of Recorded Vegetation Communities .....	62
Table 11	Codes for Tree Species Present in Pasture Communities .....	71
Table 12	Areas of Varying Vegetation Communities .....	72
Table 13	Areas of Varying Vegetation Condition .....	73
Table 14	Extent of Each Vegetation Community in the Study Area .....	84
Table 15	Regional Extent of Vegetation Associations within the Shire of Chittering and Study Area, as Represented by Vegetation Communities Recorded .....	88
Table 16	Summary of Significant Vegetation Communities .....	90
Table 17	Project Team .....	92

## Figures

Figure 1	Study Area .....	9
Figure 2	IBRA Regions of the Study Area .....	18
Figure 3	Climate Data for Gingin Aero .....	19
Figure 4	Soil-Landscape Mapping of the Study Area .....	21
Figure 5	Regional Vegetation of the Study Area .....	26
Figure 6	Vegetation Complexes of the Study Area .....	27
Figure 7	Previously Recorded Threatened and Priority Flora .....	36
Figure 8	Known TECs and PECs .....	40
Figure 9	Quadrat Locations .....	44
Figure 10	Walked Tracks for <i>Thelymitra stellata</i> Survey .....	46
Figure 11	Recorded Locations of Priority Flora .....	59
Figure 12	Quadrat Cluster Analysis Dendrogram .....	61
Figure 13	Vegetation Communities of the Study Area .....	66
Figure 14	Vegetation Condition of the Study Area .....	75
Figure 15	Regional Vegetation Analysis Dendrogram .....	87

# 1 INTRODUCTION

## 1.1 BACKGROUND

Great Northern Highway is one of Western Australia's main land transport links and is the only sealed road connecting Perth with the Northern Territory. The highway forms part of the National Land Transport Network, which is defined as a national network of important road and rail infrastructure links (DoIRD 2015).

Main Roads Western Australia (Main Roads) is upgrading the 218 km section of Great Northern Highway between Muchea and Wubin. Jacobs and Arup together have formed a joint venture, ASJV, to partner with Main Roads for the delivery of the upgrade project. The integrated project team has completed a comprehensive planning review of the Muchea to Wubin section, and has prioritised a series of construction packages to be delivered between 2016 and 2019. The improvements to be made include town bypasses, wider roads, more passing lanes, flattening crests and easing curves, safer roadsides, more rest stops and additional facilities for heavy vehicles. These works will significantly improve safety and amenity and facilitate the future movement of road trains along this section of highway.

At the time of the surveys reported in this document, there were three proposed route options for the Great Northern Highway to bypass the town of Bindoon, which for the purpose of this scope were broken down into four survey areas (**Figure 1**). The four survey areas were:

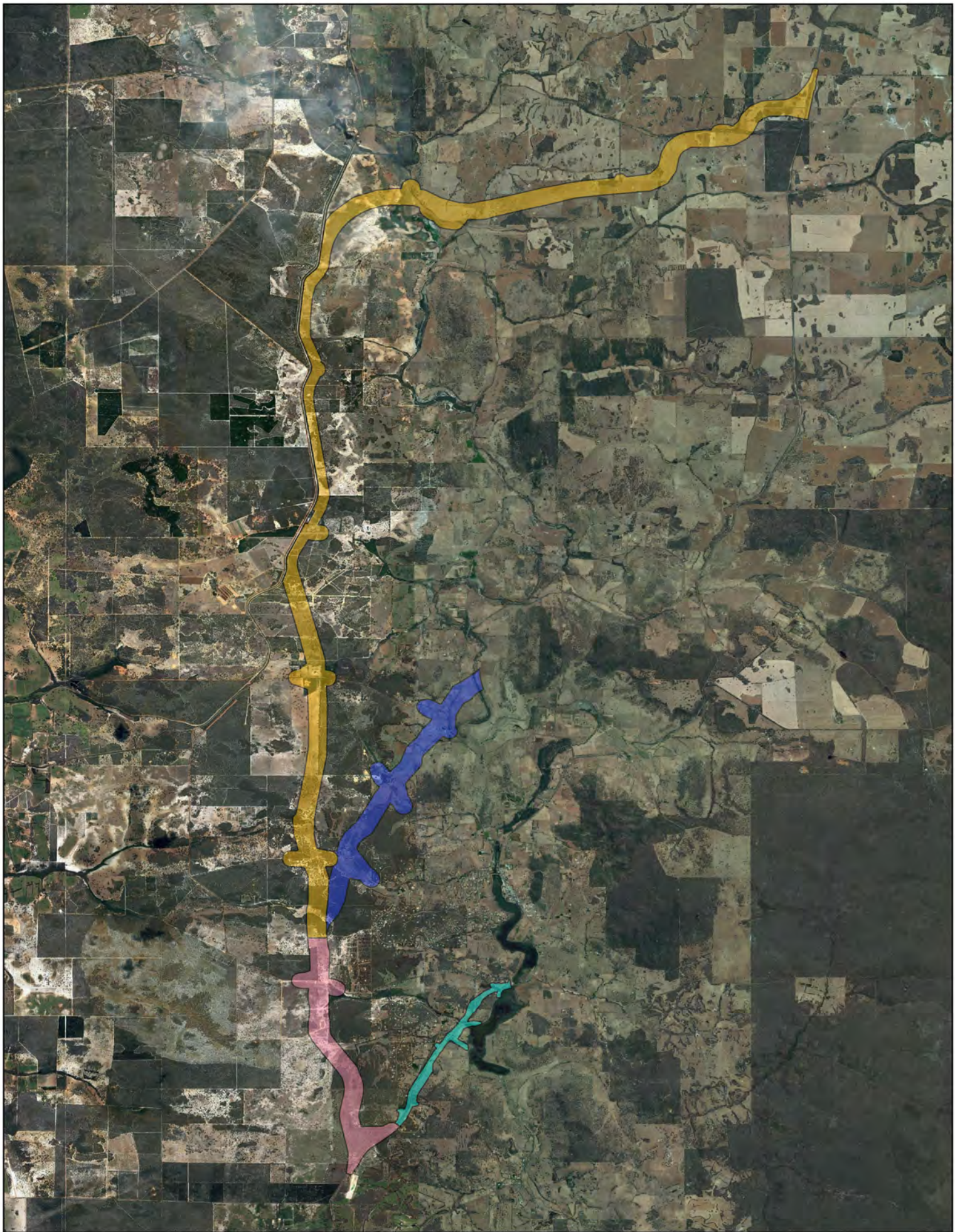
- Common Area (common to the southern commencement of both Areas 1 and 2) – Area 1
- Western Bypass A – Area 2
- Western Bypass B – Area 3
- Eastern Bypass – Area 4.

ASJV undertook a multi-criteria analysis (MCA) of the routes, to determine the preferred option for further investigation. Focused Vision Consulting Pty Ltd (FVC) was commissioned by ASJV to undertake flora, vegetation and fauna assessments for the four route options, with this report presenting the results relevant to flora and vegetation. The results of the assessments will enable an environmental impact assessment for the preferred route.

## 1.2 LOCATION

The study areas are located in the Shire of Chittering between Chittering in the south, to Wannamal in the north, along the existing Great Northern Highway in the east and out to Mooliabeenee and Moondah in the west (**Figure 1**).









0 1 2 3 4 km

Figure 1 - Study Area



**Legend**

-  Common Area - Area 1
-  Western Bypass A - Area 2
-  Western Bypass B - Area 3
-  Eastern Bypass - Area 4



### 1.3 SCOPE OF WORK

The scope of the project was to undertake a spring assessment for flora and vegetation, including a targeted threatened flora survey for the study areas encompassing the route options.

Specifically, the scope of work included:

- desktop assessments to gather relevant biological information on the study area
- site assessments to determine the flora and vegetation values, including targeted threatened flora (*Thelymitra stellata*) assessments associated with the study areas, conducted in a single phase during spring 2016
- preparation of a spring flora and vegetation assessment report.

The assessments and reporting was carried out in accordance with relevant guidance, as listed in **Section 5**.

## 2 LEGISLATIVE CONTEXT

The flora and vegetation assessment was conducted in accordance with the following legislation:

- Commonwealth EPBC Act
- Western Australian *Environmental Protection Act* 1986 (EP Act)
- Western Australian *Wildlife Conservation Act 1950* (WC Act).

The assessment complied with requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2000) Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia
- EPA (2002) Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection
- EPA (2008) Guidance Statement No. 33: Environmental Guidance for Planning and Development
- EPA (2004) Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessments in Western Australia
- EPA & DPaW (2015) Technical Guide for Flora and Vegetation Surveys for Environmental Impact Assessment
- Commonwealth of Australia (2013b) Guidelines for Detecting Orchids Listed as 'Threatened' Under the Environment Protection and Biodiversity Conservation Act 1999.

### 2.1 THREATENED AND PRIORITY FLORA

The Department of Parks and Wildlife (DPaW) assigns conservation status to endemic plant species that are geographically restricted to few known populations or threatened by local processes. Allocating conservation status to plant species assists in protecting populations and conserving species from potential threats (DPaW 2016b, 2015).

Threatened flora species are gazetted under subsection 2 of section 23F of the WC Act. It is an offence to "take" or damage Rare Flora without Ministerial approval. Section 23F of the WC Act defines "to take" as "to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Species designated as Priority Flora are under consideration for declaration as 'Threatened Flora' and are in urgent need of further survey (Priority 1 to 3) or require monitoring every 5-10 years (Priority 4). **Table 1** presents the definitions of Threatened and the four Priority ratings under the WC Act as extracted from DPaW (2015).

**Table 1 Definitions of Threatened and Priority Flora Species**

Conservation Code	Category
<b>T</b>	<p><b>Threatened Species</b></p> <p>Published as Specially Protected under the Wildlife Conservation Act, 1950 and listed under Schedules 1 to 4 of the Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p> <p>Flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(20) of the Wildlife Conservation Act.</p>
<b>P1</b>	<p><b>Priority 1 – Poorly Known Species</b></p> <p>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</p>
<b>P2</b>	<p><b>Priority 2 – Poorly Known Species</b></p> <p>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.</p>
<b>P3</b>	<p><b>Priority 3 – Poorly Known Species</b></p> <p>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.</p>
<b>P4</b>	<p><b>Priority 4 – Rare, Near Threatened and other species in need of monitoring</b></p> <p>(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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (NES) require approval from the Federal Minister for the Environment.

Species at risk of extinction are recognised as Threatened at a Commonwealth level and are categorised according to the EPBC Act as summarised in **Table 2**.

**Table 2 Categories of EPBC Act Threatened Flora Species**

Conservation Code	Category
<b>Ex</b>	<b>Extinct</b> Taxa not definitely located in the wild during the past 50 years
<b>ExW</b>	<b>Extinct in the Wild</b> Taxa known to survive only in captivity
<b>CR</b>	<b>Critically Endangered</b> Taxa facing an extremely high risk of extinction in the wild in the immediate future
<b>EN</b>	<b>Endangered</b> Taxa facing a very high risk of extinction in the wild in the near future
<b>VU</b>	<b>Vulnerable</b> Taxa facing a high risk of extinction in the wild in the medium term
<b>CD</b>	<b>Conservation Dependent</b> Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.

Any species listed in State and Commonwealth legislation as being of conservation significance is said to be a significant species. This incorporates species that are endangered, vulnerable and rare or covered by international conventions. Significance is not limited to species covered by State and Commonwealth legislation and also includes species of local significance and species showing significant range extensions or at the edge of their known range.

## 2.2 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat, which are subject to processes that threaten to destroy or significantly modify the assemblage across its range (DEC 2001).

Vegetation communities in Western Australia are described as 'TECs' if they have been defined by DPaW's Species and Communities Branch and found to be Presumed Destroyed (PD), Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). The categories and the criteria for defining TECs have been described by English and Blyth (1997). A publicly available database, listing TECs within Western Australia is maintained by DPaW.

There is currently no legislation covering the conservation of TECs in WA, however some are protected under the Commonwealth EPBC Act. The TECs on the Commonwealth register are also listed on the Department of the Environment and Energy (DotEE) register on the website, and in the Protected Matters Database. For those State TECs not listed on the Commonwealth register, land clearing legislation under the EP Act also provides protection. The EPA's position on TECs states that proposals resulting in the direct loss of TECs are likely to be formally assessed.

Additional to TECs, ecological communities that are considered potentially of conservation significance (and potentially TECs) that do not currently meet survey criteria or that are not adequately defined,

are rare but not threatened, have been recently removed from the TEC list or require regular monitoring are considered to be Priority Ecological Communities (PECs) (DEC 2013) and they are required to be taken into consideration during environmental impact assessments.

### 2.3 LOCALLY OR REGIONALLY SIGNIFICANT VEGETATION

Vegetation may be locally or regionally significant in addition to significance according to statutory listings.

Vegetation communities are referred to as locally significant where they:

- support populations of Priority Flora species
- extend the geographic range of particular taxa from previously recorded locations
- are restricted to only one or a few locations
- occur as small isolated communities
- exhibit unusually high structural and species diversity.

Vegetation communities are referred to as regionally significant where they:

- are limited to specific landform types
- are uncommon or restricted plant community types within the regional context
- support populations of threatened flora.

Vegetation communities are referred to as Nationally significant where they

- support populations of Threatened (EPBC listed) species
- support TECs listed as nationally (EPBC) significant.

Guidance Statement 51 (EPA 2004) also states that “vegetation may be significant for a range of reasons, other than a statutory listing as a TEC or because the extent is below threshold level” (described in the following section). According to Guidance Statement 51, other significant vegetation may include communities that:

- exhibit scarcity
- support unusual species
- support a novel combination of species
- have a role as a refuge
- have a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- are representative of the range of a unit (particularly, a good local and/or regional example of a unit in “prime” habitat, at the extremes of a range, recently discovered range extensions, or isolated outliers of the main range)
- have a restricted distribution.

## 2.4 VEGETATION CLEARING, EXTENT AND STATUS

Clearing of native vegetation is regulated in WA under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Any clearing of native vegetation is an offence, unless carried out under a clearing permit or if the clearing is for an exempt purpose (DER 2016). A clearing permit is required under Part V of the EP Act, whereby permit applications to clear native vegetation must be assessed against the '10 Clearing Principles' as outlined in the regulations.

Where clearing of native vegetation is proposed to occur, purely from a biodiversity perspective, there are several key criteria applied to the assessment of clearing permit applications. The criteria, as outlined in EPA's Position Statement No. 2 (EPA 2000) are used to help reverse the long-term decline in the quality and extent of Western Australia's native vegetation cover. The criteria are as follows:

- the "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-clearing extent of the vegetation type
- a level of 10% of the original extent is regarded as being a level representing "endangered"
- clearing which would put the threat level into the class below should be avoided
- from a biodiversity perspective, stream reserves should generally be in the order of at least 200 m wide.

The status of remaining vegetation can be delineated into five different classes:

- *Presumed extinct* - probably no longer present in the bioregion
- *Endangered* - <10% of pre-European extent remains\*
- *Vulnerable* - 10-30% of pre-European extent exists\*
- *Depleted* - >30% and up to 50% of pre-European extent exists\*
- *Least concern* - >50% pre-European extent exists and has been subject to little or no degradation over a majority of this area.

\* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.

## 2.5 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (ESAs) are areas that require special protection due to aspects such as landscape, wildlife of historical value and are generally considered to be areas of high conservation value. ESAs are declared in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005, which was gazetted on 8 April 2005.

There are several types of ESAs relating to flora and vegetation, declared under Part V of the EP Act, which include:

- a defined wetland and the area within 50 m of that wetland
- the area covered by vegetation within 50 m of rare (Threatened) flora, to the extent where the vegetation is continuous with the vegetation in which the rare (Threatened) flora is located
- the area covered by a TEC
- Bush Forever sites
- areas covered by the following policies:
  - *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*
  - *Environmental Protection (Western Swamp Tortoise) Policy 2002*

- *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*
- *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*
- areas of native fringing vegetation in the policy area as defined in *Environmental Protection (Swan and Canning Rivers) Policy 1998*.

## 2.6 INTRODUCED FLORA

To date, over 1,200 introduced (weed) species have been recognised to occur within Western Australia (EPA 2007). Introduced flora (weeds) are plants that are not indigenous to an area and have been introduced either directly or indirectly through human activity. They establish in natural ecosystems and adversely modify natural processes, resulting in the decline of the invaded community and the habitat value provided for native fauna. Weeds threaten the survival of many flora because of their rapid growth and the ability to out-compete native plants for available nutrients, water, space and sunlight.

### 2.6.1 Weeds of National Significance

Under the National Weed Strategy, there are currently 32 weed species listed as Weeds of National Significance (WONS). Each weed was considered for inclusion based on the following criteria; invasive tendencies, impacts, potential for spread and socioeconomic and environmental values.

### 2.6.2 Declared Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (DAFWA 2016a). Under the BAM Act, Declared Pests are listed under one of the following categories:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage.

### 2.6.3 Environmental Weeds

Introduced species have also been ranked by a number of attributes, including invasiveness, distribution and environmental impacts in the various DPaW regions in *An Environmental Weed Strategy* (CALM 1999). To advance the above categorisation, the Invasive Plant Prioritisation Process for DPaW was developed in 2011 (DEC 2011).



## 3 EXISTING ENVIRONMENT

### 3.1 IBRA REGION

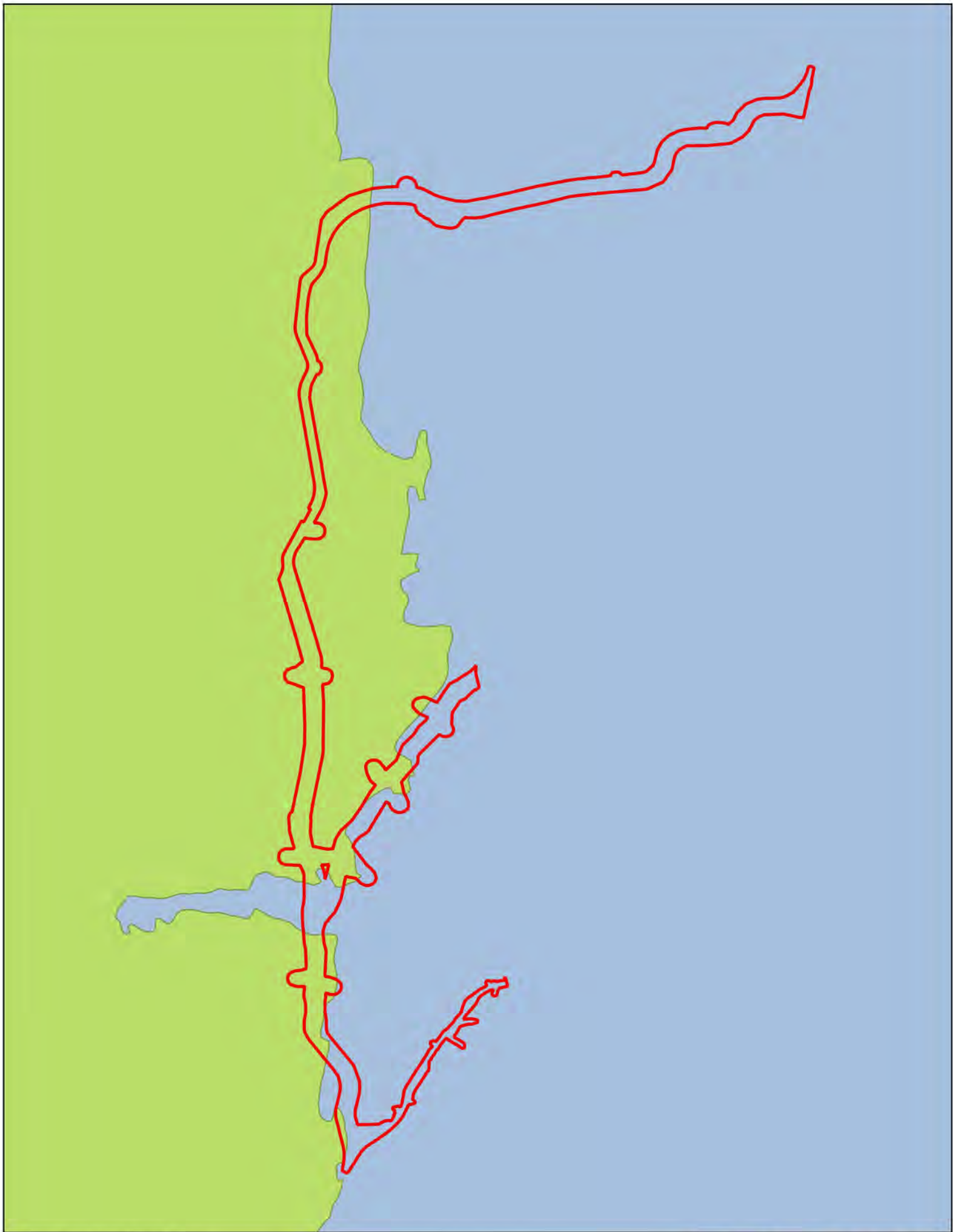
There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Commonwealth of Australia 2013a). The study area lies within the Swan Coastal Plain and Jarrah Forrest IBRA regions (**Figure 2**). At a finer scale, the study area falls within the Dandaragan Plateau and the Northern Jarrah Forrest subregions.

The Dandaragan Plateau subregion of the Swan Coastal Plain is bordered by the Derby and Dandaragan Faults with cretaceous marine sediments mantled by sands and laterites. Vegetation of this subregion is characterised by Banksia low woodland, Jarrah–Marri woodland, Marri woodland and scrub heaths on laterite pavement and on gravelly sandplains. Large numbers of Threatened flora have been recorded from the area (Desmond 2001).

The Northern Jarrah Forest subregion incorporates the area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks capped by an extensive lateritic duricrust (Williams & Mitchell 2001). Vegetation comprises Jarrah-Marri forest in the west with Bullich (*Eucalyptus megacarpa*) and Blackbutt (*E. patens*) in the valleys grading to Wandoo (*E. wandoo*) and Marri woodlands in the east with Powderbark (*E. accedens*) on breakaways. The extensive but localised sand sheets support Banksia low woodlands.

### 3.2 CLIMATE

The Bindoon area experiences a warm and temperate climate, where the winter months experience greater rainfall than the summer months (Climate data.org 2016). Gingin Aero (site number 9178) is the closest Bureau of Meteorology (BoM) recording station which has been recording since 1968 and has recorded an average annual rainfall of 620 mm. The annual mean maximum temperature ranges from 18.3°C in winter to 33.3°C in summer (BoM 2016) (**Figure 3**).






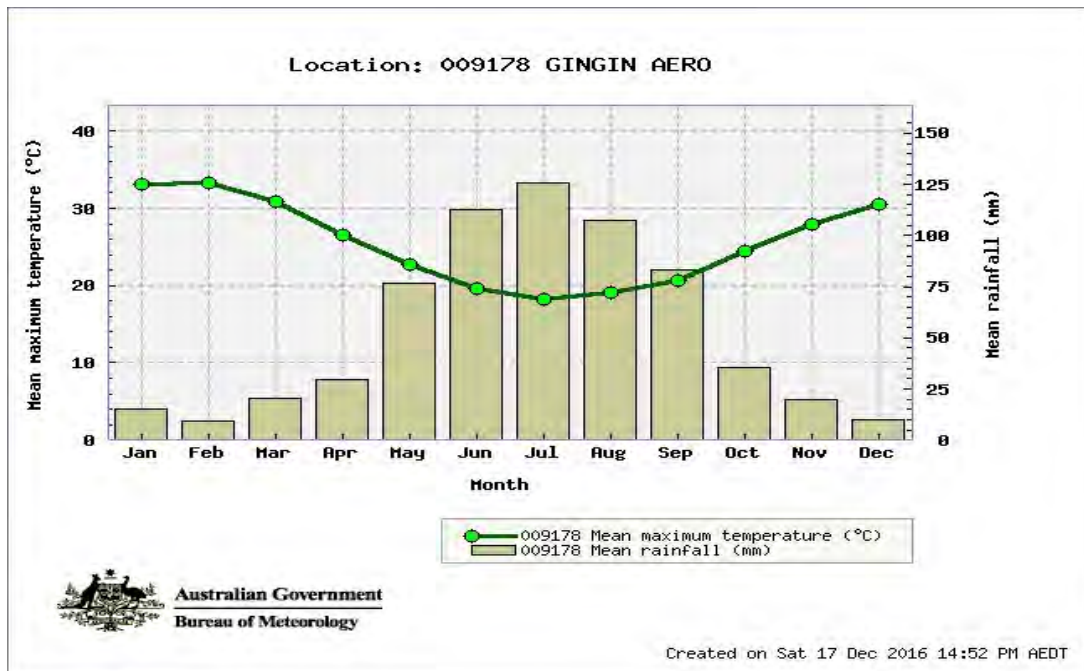
0 1 2 3 4 km

**Figure 2 - IBRA Regions of the Study Area**



**Legend**

-  Study Area
-  Jarrah Forest
-  Swan Coastal Plain



**Figure 3 Climate Data for Gingin Aero**

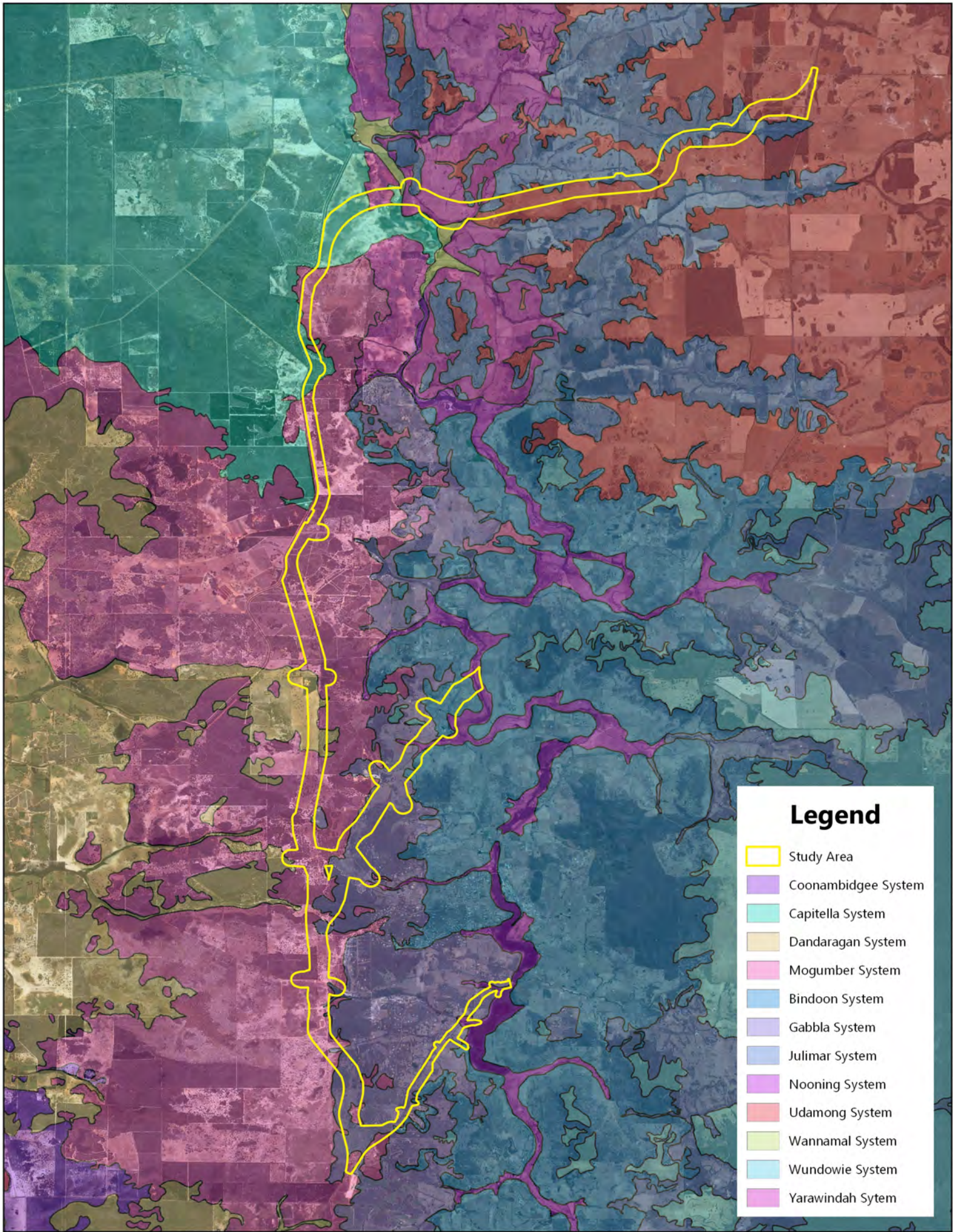
### 3.3 GEOLOGY AND SOILS

Soil-landscape mapping across Western Australia has been compiled by the Department of Agriculture and Food WA (DAFWA) (2016b) using various surveys at different scales varying between 1:20,000 and 1:3,000,000.

At the system scale, the study area traverses a number of regional soil-landscape mapping systems, as summarised in **Table 3**, with their extent in the study area shown in **Figure 4**.

**Table 3 Summary of Soil-Landscape Systems within the Study Area (DAFWA 2016b)**

Map Unit	Soil System	Description
222Cb	Coonambidgee System	Footslopes of sand, on the western margin of the Dandaragan Plateau. Low woodland and shrubland with occasional trees. Species include <i>Banksia prionotes</i> , low and occasional stunted <i>E. marginata</i> with <i>Adenanthos</i> spp..
222Cp	Capitella System	subdued stripped lateritic plateau, undulating to gently undulating low rises with gently undulating plain including dunes; pale and yellow deep sands, sandy gravels, some duplex; from sandstones plus alluvial and aeolian deposits.
222Da	Dandaragan System	Subdued dissected lateritic plateau, undulating low hills and rises with narrow alluvial plains. Variable deep sands and sandy gravels plus minor earths, duplexes and clays. Marri woodlands and shrublands.
222Mb	Mogumber System	Gentle to moderate sloping sandplain, varying from pale to yellow clayey sand with gravel and laterised ridges. Low woodland and shrubland of, <i>C. calophylla</i> , <i>Banksia</i> and <i>Acacia</i> spp.. Some tall <i>C. calophylla</i> and <i>E. marginata</i> .
253Bn	Bindoon System	Gentle to steep hills with gentle valleys on metamorphic gneiss and schist, and dolerite. Variable soils. Wandoo woodland with some <i>Casuarina huegeliana</i> in rocky areas and marri woodland on sandy areas, minor York gum woodland.
253Ga	Gabbla System	Western boundary of the Darling Pateau to the east of the Dandaragan plateau. Gently to moderately slopes. Yellow, red and grey loams and clays, with gravel common and sand pockets. <i>E. wandoo</i> and <i>E. loxophleba</i> on clay.
253Ju	Julimar System	Moderately dissected areas with gravelly slopes and ridges and minor rock outcrop on the eastern side of the Darling Plateau over weathered granite and granitic gneiss. loamy gravel, shallow duplexes and pale deep sand common. Wandoo woodland.
253Nn	Nooning System	Brockman river valley flattish valley floors of the upper that is prone to salinity. Loams, clays and gleyed salty sandy clays and gravelly soils are present. <i>E. rudis</i> , <i>E. camaldulensis</i> , <i>Melaleuca</i> and <i>Casuarina obesa</i> in the most salty areas.
253Ug	Udamong System	Northern Darling Range near New Norcia. Partially stripped lateritic plateau with undulating low hills to gently undulating rises. Loamy gravel, minor pale sand and clay; deep weathered granitic gneiss, gneiss and schist



**Figure 4 - Soil-Landscape Mapping of the Study Area**

### 3.4 VEGETATION

The vegetation within the study area has been broadly characterised as Banksia low woodland, Jarrah–Marri woodland, Marri woodland, Bullich (*Eucalyptus megacarpa*) and Blackbutt (*E. patens*) in the valleys and Wandoo (*E. wandoo*) and Marri woodlands with Powderbark (*E. accedens*) on breakaways (Desmond 2001, Mitchell & Williams, 2001). The study area traverses eight vegetation associations characterised by Shepherd *et al.* (2002), and the general vicinity of the study area supports 15 vegetation associations, as summarised in **Table 4**.

Vegetation complexes within the study area have also been defined by Heddle *et al.* (1980) and Havel and Mattiske (2000). These complexes are based on vegetation in association with landforms and underlying geology. A collective total of ten vegetation complexes occur within the study area. These are described as follows:

1. **Bindoon Complex.** This complex is broadly characterised by *Eucalyptus loxophleba* (York gum) on the lower valley slopes, flanked by Wandoo higher upslope.
2. **Coolakin Complex in low rainfall.** Comprises of Woodlands of *Eucalyptus wandoo* with mixtures of *Eucalyptus patens*, *Eucalyptus marginata* subsp. *thalassica* and *Corymbia calophylla* on the valley slopes in arid and perarid zones.
3. **Cullulla Complex.** Mixture of low open forest of Banksia spp. *Eucalyptus todtiana* and open woodland *Corymbia calophylla* with second storey of *Eucalyptus todtiana*, *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia*.
4. **Michibin Complex.** Open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones.
5. **Mogumber Complex–South.** Open woodland of *Corymbia calophylla* with some mixture of *Eucalyptus marginata* subsp. *thalassica* and a second storey of *Eucalyptus todtiana*, *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia* on sandy gravels on the uplands in arid and perarid zones.
6. **Moondah Complex.** Low closed to low open forest of *Banksia attenuata*, *Banksia menziesii*, *Eucalyptus todtiana* and *Banksia prionotes* on slopes, open woodland of *Corymbia calophylla* and *Banksia* spp. in valleys.
7. **Murray and Bindoon Complex in low to medium rainfall.** This complex is characterised by *Eucalyptus wandoo* woodland on the valley slopes and woodlands of *Eucalyptus rudis* (flooded gum) and *Melaleuca raphiophylla* (freshwater paperbark) on the fringes of watercourses.
8. **Nooning Complex.** This complex is restricted to the upper valley floors of the Brockman River. This complex is characterised by low open forest of *Casuarina obesa* (Swamp sheoak) and the presence of *Casuarina obesa*, *Eucalyptus rudis* and *Melaleuca raphiophylla* along streams.
9. **Wannamal Complex.** Low shrubland of the Dandaragan Plateau comprising of a mixture of low shrubland of *Melaleuca* spp. and open woodland of *Eucalyptus wandoo* and *Eucalyptus loxophleba*.
10. **Yalanbee Complex in low rainfall.** This complex is characterised by woodlands of *Eucalyptus wandoo*–*Eucalyptus accedens*, less consistently open forest of *Eucalyptus marginata* subsp. *thalassica*–*Corymbia calophylla* on lateritic uplands and breakaway landscapes in arid and perarid zones.

A summary of vegetation complexes occurring within the study area is presented in **Table 5**.

**Table 4 Regional Vegetation of the Study Area and Surrounds (Shepherd *et al.* 2002)**

Shepherd Code	Intersects with Study Area	Short Description	Broad Vegetation Description
3	Area 1 Area 2 Area 3 Area 4	Medium forest; jarrah-marri	U <i>Eucalyptus marginata</i> , ^ <i>Corymbia calophylla</i> , <i>Allocasuarina fraseriana</i> \tree\7c;M <i>Acacia urophylla</i> , <i>Bossiaea aquifolium</i> , <i>Hakea cyclocarpa</i> \shrub\4i;G <i>Macrozamia riedlei</i> , <i>Styphelia tenuiflora</i> , <i>Lepidosperma angustatum</i> \cycad,forb,shrub,sedge\2i
4	Area 1 Area 2 Area 3 Area 4	Medium woodland; marri & wandoo	U ^ <i>Corymbia calophylla</i> , ^ <i>Eucalyptus wandoo</i> \tree\7i;M <i>Acacia cyanophylla</i> , <i>Jacksonia sternbergiana</i> , <i>Xanthorrhoea preissii</i> \shrub, <i>Xanthorrhoea</i> \4i
			U ^ <i>Corymbia calophylla</i> , ^ <i>Eucalyptus wandoo</i> , <i>Nuytsia floribunda</i> \tree\7i;M <i>Daviesia horrida</i> , <i>Dryandra sessilis</i> , <i>Hakea cristata</i> \shrub\3i;G <i>Acacia pulchella</i> , <i>Dryandra nivea</i> , <i>Hibbertia hypericoides</i> \shrub,cycad, <i>Xanthorrhoea</i> \2i
37	-	Shrublands; teatree thicket	U <i>Banksia littoralis</i> , <i>Melaleuca preissiana</i> \tree\6r;M ^ <i>Melaleuca</i> sp., <i>Hakea</i> sp., <i>Beaufortia squarrosa</i> \shrub\3d
			U <i>Eucalyptus rudis</i> ^ <i>Melaleuca rhapsiophylla</i> \tree\7cG <i>Viminaria denudata</i> \sedge\2i
352	Area 3	Medium woodland; York gum	U ^ <i>Eucalyptus loxophleba</i> \tree\7i;M <i>Acacia acuminata</i> , <i>Acacia cyanophylla</i> \shrub\4i
949	Area 2	Low woodland; <i>banksia</i>	U ^ <i>Banksia attenuata</i> , <i>Banksia menziesii</i> , <i>Eucalyptus todtiana</i> \tree\6iG <i>Conospermum incurvum</i> , <i>Verticordia nitens</i> \shrub\4c
			U ^ <i>Banksia attenuata</i> , <i>Banksia menziesii</i> , <i>Eucalyptus todtiana</i> \tree\6i;M <i>Calothamnus sanguineus</i> , <i>Petrophile brevifolia</i> , <i>Eremaea pauciflora</i> \shrub\4i;G <i>Hibbertia hypericoides</i> , <i>Stirlingia latifolia</i> , <i>Synaphea polymorpha</i> \shrub,sedge\2c
965	-	Medium woodland; jarrah & marri	U ^ <i>Eucalyptus marginata</i> , ^ <i>Corymbia calophylla</i> \tree\7i
968	-	Medium woodland; jarrah, marri & wandoo	U ^ <i>Eucalyptus marginata</i> , <i>Banksia grandis</i> \tree\7i;M <i>Acacia varia</i> var. <i>affinis</i> , <i>Adenanthos cygnorum</i> , <i>Allocasuarina humilis</i> \shrub\4i;G <i>Anigozanthos humilis</i> , <i>Burchardia umbellata</i> , <i>Conostylis setosa</i> \forb,shrub,sedge\2i
973	Area 4	Low forest; paperbark ( <i>Melaleuca rhapsiophylla</i> )	U <i>Eucalyptus rudis</i> , ^ <i>Melaleuca preissiana</i> \tree\7c

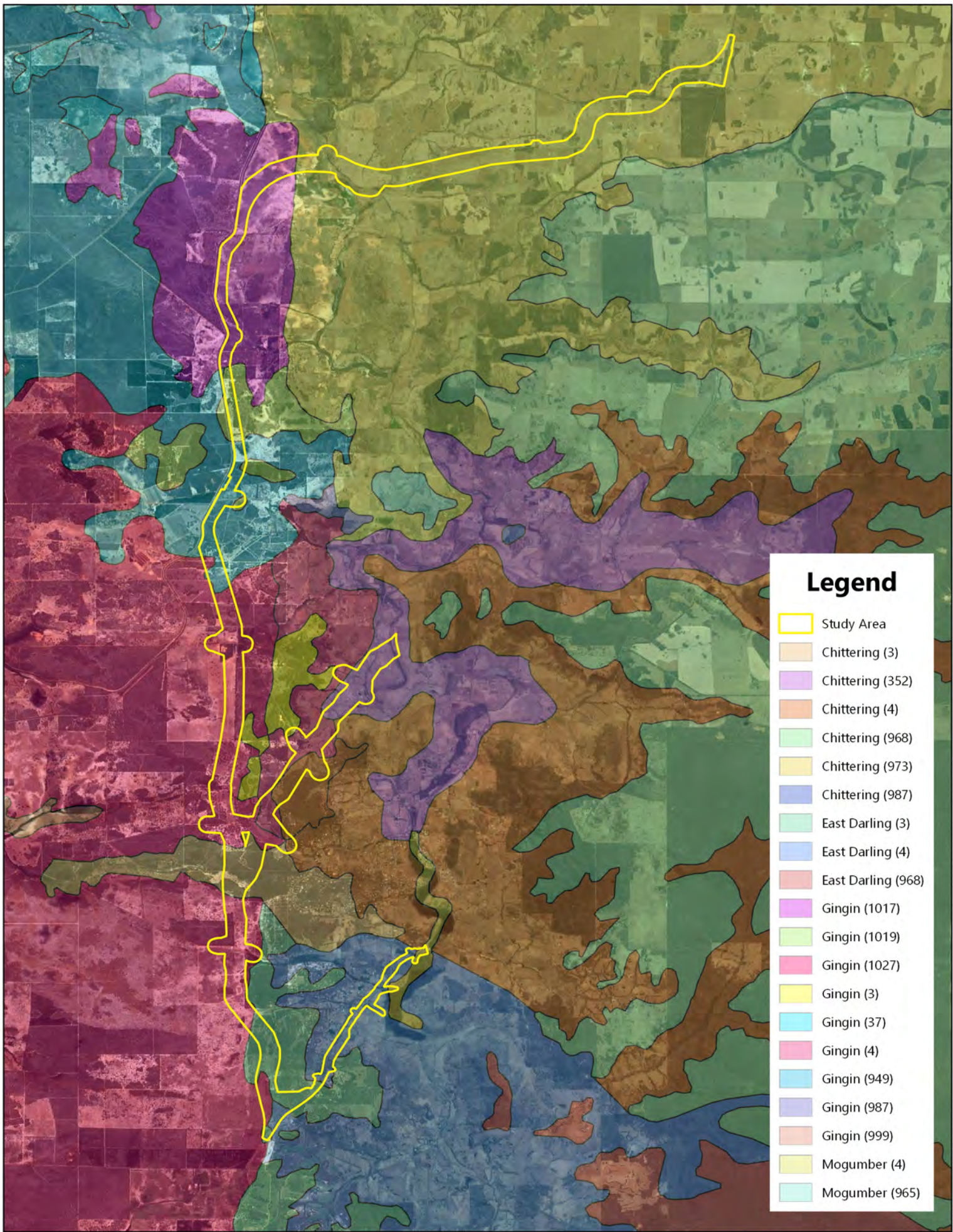
Shepherd Code	Intersects with Study Area	Short Description	Broad Vegetation Description
987	-	Medium woodland; jarrah & wandoo	U^ <i>Eucalyptus marginata</i> , ^ <i>Eucalyptus wandoo</i> \tree\7\i
999	-	Medium woodland; marri	U^ <i>Corymbia calophylla</i> , <i>Eucalyptus loxophleba</i> , <i>Acacia cyanophylla</i> \tree\7\i; M <i>Acacia pulchella</i> , <i>Boronia scabra</i> , <i>Bossiaea</i> sp. \shrub, cypad, <i>Xanthorrhoea</i> \4\i; G <i>Hibbertia hypericoides</i> , <i>Hybanthus calycinus</i> , <i>Lechenaultia biloba</i> \shrub, forb\2\i
1009	-	Medium woodland; marri & river gum	U^ <i>Corymbia calophylla</i> , ^ <i>Eucalyptus rudis</i> \tree\7\i
1017	Area 2	Medium open woodland; jarrah & marri, with low woodland; banksia	U <i>Eucalyptus marginata</i> , ^ <i>Corymbia calophylla</i> , <i>Banksia attenuata</i> \tree\7\i
1018	-	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree / Low woodland; <i>Casuarina obesa</i>	U^ <i>Eucalyptus marginata</i> , ^ <i>Corymbia calophylla</i> \tree\7\c; M <i>Melaleuca</i> sp., <i>Banksia</i> sp., <i>Casuarina obesa</i> \tree\6\c
1019	Area 2	Medium sparse woodland; jarrah & marri	U^ <i>Eucalyptus marginata</i> , ^ <i>Corymbia calophylla</i> \tree\7\r
1027	Area 1 Area 2 Area 3	Mosaic: Medium open woodland; jarrah & marri, with low woodland; banksia / Medium sparse woodland; jarrah & marri	U <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> , ^ ^ <i>Banksia attenuata</i> \tree\7\I



**Table 5 Vegetation Complexes of the Study Area (Heddl *et al.* 1980; Havel and Mattiske 2000)**

Survey Area	Vegetation Complex
Common Area – Area 1	Coolakin Complex in low rainfall
	Mogumber Complex - South
	Yalanbee Complex in low rainfall
Western Bypass A – Area 2	Bindoon Complex
	Coolakin Complex in low rainfall
	Mogumber Complex - South
	Moondah Complex
	Nooning Complex
	Yalanbee Complex in low rainfall
Western Bypass B – Area 3	Coolakin Complex in low rainfall
	Cullulla Complex
	Michibin Complex
	Mogumber Complex - South
	Moondah Complex
	Nooning Complex
	Wannamal Complex
	Yalanbee Complex in low rainfall
Eastern Bypass – Area 4	Bindoon Complex
	Nooning Complex
	Murray and Bindoon complex in low to medium rainfall
	Yalanbee complex in low rainfall

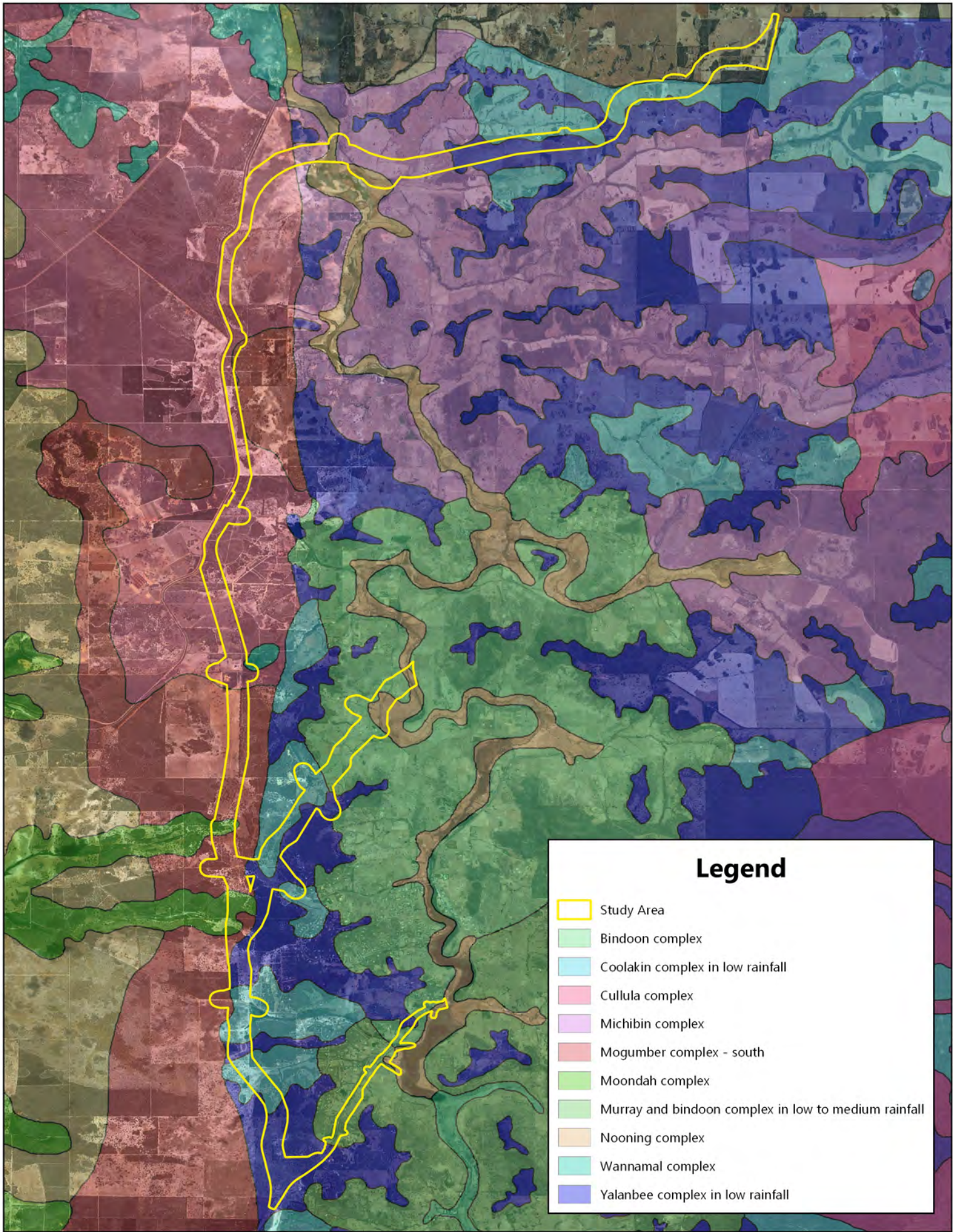
The extent of each of each vegetation associations (Shepherd *et al.* 2002) and vegetation complexes (Heddl *et al.* 1980) present within the study area is presented in **Figures 4** and **5**, respectively.



0 1 2 3 4 km



**Figure 5 - Regional Vegetation of the Study Area**



0 1 2 3 4 km



**Figure 6 - Vegetation Complexes of the Study Area**

## 4 BIOLOGICAL CONTEXT

Numerous relevant surveys have been previously conducted within the area between Chittering and Bindoon to Wannamal and surrounds. A review of the most recent available studies was undertaken to collate existing information on Threatened and Priority Flora and previously mapped vegetation communities. Detailed findings have been reported in the following:

- Phoenix Environmental Sciences (2015) Flora and fauna assessment for Muchea North and Chittering study area
- GHD (2011a) Report for Great Northern Highway Upgrade: Muchea to Bindoon Environmental Impact Assessment (SLK 33.13 – 65.31)
- GHD (2011b) Report for Great Northern Highway Upgrade: Muchea to Bindoon Flora and Fauna Assessment (SLK 33.13 – 65.31)
- ENV (2007) Great Northern Highway Flora and Vegetation Assessment – SLK 89 to SLK 114
- KBR (2006) Environmental Impact Assessment and Management Plan. Great Northern Highway – Bindoon South SLK 54.6 to SLK 62.1
- Western Botanical (2006) Flora for extension of proposed disturbances on Great Northern Highway road reserve
- KBR (2005) Preliminary Environmental Impact Assessment. Great Northern Highway – Muchea (SLK 36) to Wubin (SLK 253)
- Goble-Garratt (2005) Great Northern Highway Upgrade – Bindoon South Section (Hart Drive to Bindoon Townsite SLK 54.6 to 62.0)
- Ecologia Environment (2004) Great Northern Highway: assessment of flora and vegetation.

These surveys form the basis of the literature review component of the desktop assessment and the key findings from each are summarised in **Table 6**.

**Table 6 Summary of Key Findings from Recent Relevant Surveys**

Author, Area, Scope and Methodologies	Key Findings
<b>Phoenix Environmental Sciences (2015)</b>	
<ul style="list-style-type: none"> <li>-Level 2 Flora assessment of work package 1 (Muecha North – SLK 10.9 to SLK 46.44) and work package 2 (Chittering – SLK 46.44 to SLK 51.82) of Great Northern Highway Upgrade Area</li> <li>-Spring surveys conducted October 2014 (Phase 1) and September 2015 (Phase 2)</li> <li>-Additional targeted species searches where conducted in May 2015</li> <li>-Average width of study area was 200 m with an approximate total survey area of 302.6 ha</li> <li>-Included vegetation type/condition mapping, targeted searches for conservation significant flora, vegetation and declared pest plants (weeds)</li> <li>-A total of 32 quadrats and 17 relevés sampled</li> </ul>	<ul style="list-style-type: none"> <li>-Phoenix (2015) study area is approximately 600 m south of current study area at the closest point along Great Northern Highway</li> <li>-Database searches identified the potential for 17 Threatened Flora listed under the EPBC Act, 18 flora listed under the WC Act ,15 State Priority Flora and seven Declared Pest plants</li> <li>-A total of 273 taxa recorded, including seven conservation significant flora; <i>Darwinia foetida</i> (T; CE), <i>Stylidium squamellosum</i> (P2), <i>Acacia drummondii</i> subsp. <i>affinis</i> (P3), <i>Haemodorum loratum</i> (P3), <i>Verticordia serrata</i> var. <i>linearis</i> (P3), <i>Verticordia serrata</i> var. <i>linearis</i> (P4), <i>Eucalyptus caesia</i> (P4)</li> <li>-Targeted surveys conducted for <i>Darwinia foetida</i> (CE), <i>Trichocline</i> sp. <i>Treeton</i> (P2), <i>Daviesia debilior</i> subsp. <i>sinuans</i> (P3) and <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i> (P4)</li> <li>-No Commonwealth or State listed TECs or PECs recorded, however five TECs and three PECs occur between 200 m and 4.5 km from the study area</li> <li>-19 vegetation associations defined within the study area, none considered to be representative of known TECs or PECs</li> <li>-16 vegetation associations may be considered to be locally significant due to limited representation of the vegetation type within the study area or as they represent habitat for conservation significant flora recorded within the study area</li> <li>-Vegetation condition ranged from Completely Degraded to Pristine</li> </ul>
<b>GHD (2011a)</b>	
<ul style="list-style-type: none"> <li>-Preferred general corridor alignment for Great Northern Highway between Muecha and Bindoon (northern portion overlaps with FVC study area)</li> <li>-19 km by approximate width of 160m</li> <li>-EIA prepared through desktop assessments of relevant literature and databases; field assessments where appropriate</li> <li>-Included; Level 2 flora and vegetation, Level 1 fauna, dieback, contaminated sites, noise, ethnographic/indigenous/European heritage</li> </ul>	<ul style="list-style-type: none"> <li>-A number of impacts to flora and fauna were identified through EIA including; impact to Bindoon and Chittering Lakes and their associated vegetation, vegetation clearing of vegetation with less than 30% of pre-European extent remaining, potential impacts to listed Threatened fauna species such as Carnaby’s Black-cockatoos, dieback and weeds</li> <li>- No Commonwealth or State listed TECs or PECs identified to occur within the study area through database searches or field assessment</li> <li>-Database searches identified 12 Threatened Flora and 32 Priority Flora likely to occur within 10 km of the study area</li> <li>-Three Priority flora species recorded; <i>Millotia tenuifolia</i> var. <i>laevis</i> (P2), <i>Acacia drummondii</i> subsp. <i>affinis</i> (P3) and <i>Persoonia sulcata</i> (P4)</li> <li>-Vegetation clearing is considered to be at or may be at variance with Principles (b), (e), (f), (h) and (i) of the ten clearing principles</li> <li>-Three Nature Reserves (A Class: Bindoon and Chittering Lakes Nature Reserve, Barracca Nature Reserve and C Class; Burroloo Well Nature Reserve) occur within the vicinity of the study area. Small area of Bindoon and Chittering Nature Reserve likely to be impacted</li> </ul>
<b>GHD (2011b)</b>	

Author, Area, Scope and Methodologies	Key Findings
<p>-Flora and fauna assessment of corridor alignment for upgrades and realignment of Great Northern Highway between Muchea and Bindoon, extends 19 km (northern portion overlaps with FVC study area)</p> <p>-Level 2 Flora and vegetation assessment in September 2010</p>	<p>-Approximately 119 ha of vegetation ranging from Pristine to Completely Degraded. Predominately considered to be in Degraded to Completely Degraded condition</p> <p>-A total of 277 taxa were recorded and 13 vegetation types described within the study area</p> <p>-Database search results identified two PECs within 10 km of the study area; Banksia Woodlands of the Gingin area restricted to soils dominated by yellow to orange sands (Priority 2) and Northern <i>Banksia attenuata</i>–<i>Banksia menziesii</i> woodlands (SCP23b) (Priority 3).</p> <p>-Two vegetation types (CcAcXpCaLs and AcCsMp) reported to exhibit similarities to (at the time) Endangered ecological community – <i>Banksia attenuata</i> woodland over species rich dense shrublands (SCP 20a) and Priority 3 ecological community – Northern <i>Banksia attenuata</i>-<i>Banksia menziesii</i> woodlands (SCP 23b). Both of which now correspond to Commonwealth-listed Banksia Woodlands of the Swan Coastal Plain TEC. However, advice from DEC confirmed that neither is representative of these communities based on location, soil type and species richness</p> <p>-Two vegetation types are represented by less than 30% of their pre-European extent and are considered Vulnerable</p> <p>-Three new Priority flora species populations were recorded by GHD (2011b); <i>Millotia tenuifolia</i> var. <i>laevis</i> (P2), <i>Acacia drummondii</i> subsp. <i>affinis</i> (P3) and <i>Persoonia sulcata</i> (P4). <i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i> (P3) was located within the current study area and <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i> (P4) was recorded within the A Class Barracca Nature Reserve</p>
<b>ENV (2007)</b>	
<p>-Great Northern Highway south of New Norcia SLK 89 to SLK 114</p> <p>-Occurs to the north-east of the FVC study area, approximately 30 km north of Bindoon township along Great Northern Highway</p> <p>-Total survey length of 24 km</p> <p>-Level 2 Spring Flora and Vegetation survey conducted in November 2006</p> <p>-A total of 48 quadrats sampled</p>	<p>-A total of 357 taxa recorded, including eight current Priority flora</p> <p>-Priority flora recorded were; <i>Hemigenia curvifolia</i> (P2), <i>Synaphea rangiferops</i> (P2), <i>Acacia anarthros</i> (P3), <i>Acacia drummondii</i> subsp. <i>affinis</i> (P3), <i>Grevillea florida</i> (P3), <i>Hakea lasiocarpa</i> (P3), <i>Persoonia rudis</i> (P3) and <i>Grevillea drummondii</i> (P4)</p> <p>-No Threatened flora recorded</p> <p>-18 vegetation types described.</p> <p>-At the time of reporting there were no TECs listed for the study area</p> <p>-Declared Pest plants; <i>Asparagus asparagoides</i> and <i>Echium plantagineum</i> recorded</p> <p>-The vegetation condition varied from Completely Degraded to Excellent, however the majority of the road verge vegetation was found to be in Very Good or Excellent condition</p>

Author, Area, Scope and Methodologies	Key Findings
<b>Western Botanical (2006)</b>	
<p>-Flora and vegetation survey of eight work packages along Great Northern Highway from Brand Highway to Bindi Bindi-Toodyay Road</p> <p>-Work packages ranging in length from 3.49 km to 13.02 km; total survey length of 68.5 km</p> <p>-Level 1 spring flora and vegetation and an intensive Threatened and Priority flora survey, conducted between September and November 2005</p>	<p>-290 native species and 26 introduced flora species recorded</p> <p>-A total of 10 current Priority flora species recorded</p> <p>-34 vegetation types delineated; with those in the southern work packages predominantly consisting of Marri/Jarra/Wandoo/Powderbark woodlands, Banksia Woodlands, Casuarina Woodlands and creekline and swamp vegetation; and the northern work packages predominately consisting of York Gum/Salmon Gum/Wandoo/Powderbark Woodlands, Banksia Woodlands, Casuarina Woodlands, Mallee shrublands and succulent steppes with samphire</p> <p>-No determination of TECs or PECs made</p> <p>-Conservation significance of the vegetation within the road reserve was considered to be high due to the excellent condition, low weed invasion, the high number of Priority flora present and the extent of existing clearing that has occurred within the agricultural landscape</p>
<b>KBR (2006)</b>	
<p>-Great Northern Highway Bindoon South SLK 54.6 to SLK 62.1</p> <p>-EIA documented significant environmental aspects and management commitments of the GNH upgrade</p> <p>-Flora assessment undertaken as part of the EIA (Goble-Garret 2005) in late spring to early summer 2004/2005, encompassing roadsides of highway and areas immediately adjacent to footprint</p>	<p>-Close proximity to FVC study area along Great Northern Highway between Hart Drive and Bindoon townsite</p> <p>-A total project footprint of 15 ha (7 ha native vegetation and 8 ha of agricultural land)</p> <p>-EIA identified impacts pertaining to flora including disturbance to the Chittering Lakes Nature Reserve, dieback, weeds and presence of two Priority flora species; <i>Acacia drummondii</i> subsp. <i>affinis</i> and <i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i></p> <p>-Consultation with the DPaW (formerly CALM) regarding the presence of Priority flora concluded that; while both populations of Priority flora would be significantly impacted, both populations would be retained with reasonable numbers of plants and each taxa is well represented in the local area</p> <p>-Dieback assessment conducted in 2004 identified the majority of the project area to be dieback infected or at high risk of being infected</p> <p>-No TECs recorded</p>
<b>Goble-Garratt (2005)</b>	
<p>-Hart Drive to Bindoon Townsite SLK 54.6 to 62.0</p> <p>-General flora survey in November 2004. Follow-up survey during September 2005 targeting Priority flora</p>	<p>-Project area considered to be a floristically rich area</p> <p>-A total of 117 taxa recorded, considered to be low in comparison with the region survey due to small size of the survey area and mostly disturbed condition of remnant vegetation present</p> <p>-Two P3 flora species recorded within the study area (<i>Acacia drummondii</i> subsp. <i>affinis</i> and <i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>)</p> <p>-Seven vegetation units determined, none are considered to be comparable to TECs</p>

Author, Area, Scope and Methodologies	Key Findings
<b>KBR (2005)</b>	
<p>-Great Northern Highway – Muchea (SLK 36) to Wubin (SLK 253), 217 km in length</p> <p>-PEIA documented environmental aspects that are likely to be of concern and aimed to identify whether the project would be required to be referred to the EPA</p>	<p>-Numerous Threatened and Priority Flora identified through DPaW database searches. Two Threatened flora, <i>Banksia serratulooides</i> subsp. <i>serratulooides</i> (Vulnerable) and <i>Stylidium semaphorum</i> (Critically Endangered) identified within the road reserve</p> <p>-The section between SLK 79.17 and SLK 105.42 was considered particularly important due to 64% of Threatened or Priority flora species recorded falling within this area</p> <p>-One TEC (Coomberdale Chert) identified to occur near existing Great Northern Highway</p> <p>-Three A Class Nature Reserves and numerous C Class Reserves identified</p>
<b>Ecologia Environment (2004)</b>	
<p>-Great Northern Highway – Muchea (SLK 36) to Wubin (SLK 253) 217 km in length</p> <p>-Numerous vegetation surveys previously conducted however considered outdated; therefore desktop flora assessment was undertaken as part of PEIA and included DPaW Threatened and Priority Flora and TEC database searches</p>	<p>-Literature review of Ninox Wildlife Consulting (1989) identified a total of 300 flora taxa from 22 quadrats between SLK 37 and 149.</p> <p>-A total of 50 vegetation assemblages described.</p> <p>-DPaW database searches identified Threatened and Priority flora 28 species to occur between SLK 36 to SLK 253 within 1 km of the road centerline. Of these 11 are known to occur within the road reserve, although the Threatened and Priority flora assessment conducted by Sinclair Knight Mertz (2003) did not identify the presence of any conservation significant flora</p> <p>-DPaW database search identified the Coomberdale Chert TEC to occur near the existing Great Northern Highway, however, due to the absence of characteristic dominant flora species, it was determined that none of the communities described during the survey were representative of this TEC</p> <p>-Five additional WA TECs were identified outside the 500 m corridor. These were:</p> <ul style="list-style-type: none"> <li>• <i>Corymbia calophylla</i>-<i>Xanthorrhoea preissii</i> woodlands and shrublands, (SCP 3c) – Critically Endangered</li> <li>• Perth to Gingin Ironstone Association (NTHIRON) – Critically Endangered</li> <li>• Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain) (Mound Springs SCP) – Critically Endangered</li> <li>• <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands on the eastern side of the Swan Coastal Plain (SCP 20b) - Endangered</li> <li>• Herb rich saline shrublands in clay pans (SCP 07) – Vulnerable</li> </ul>



#### 4.1 THREATENED AND PRIORITY FLORA

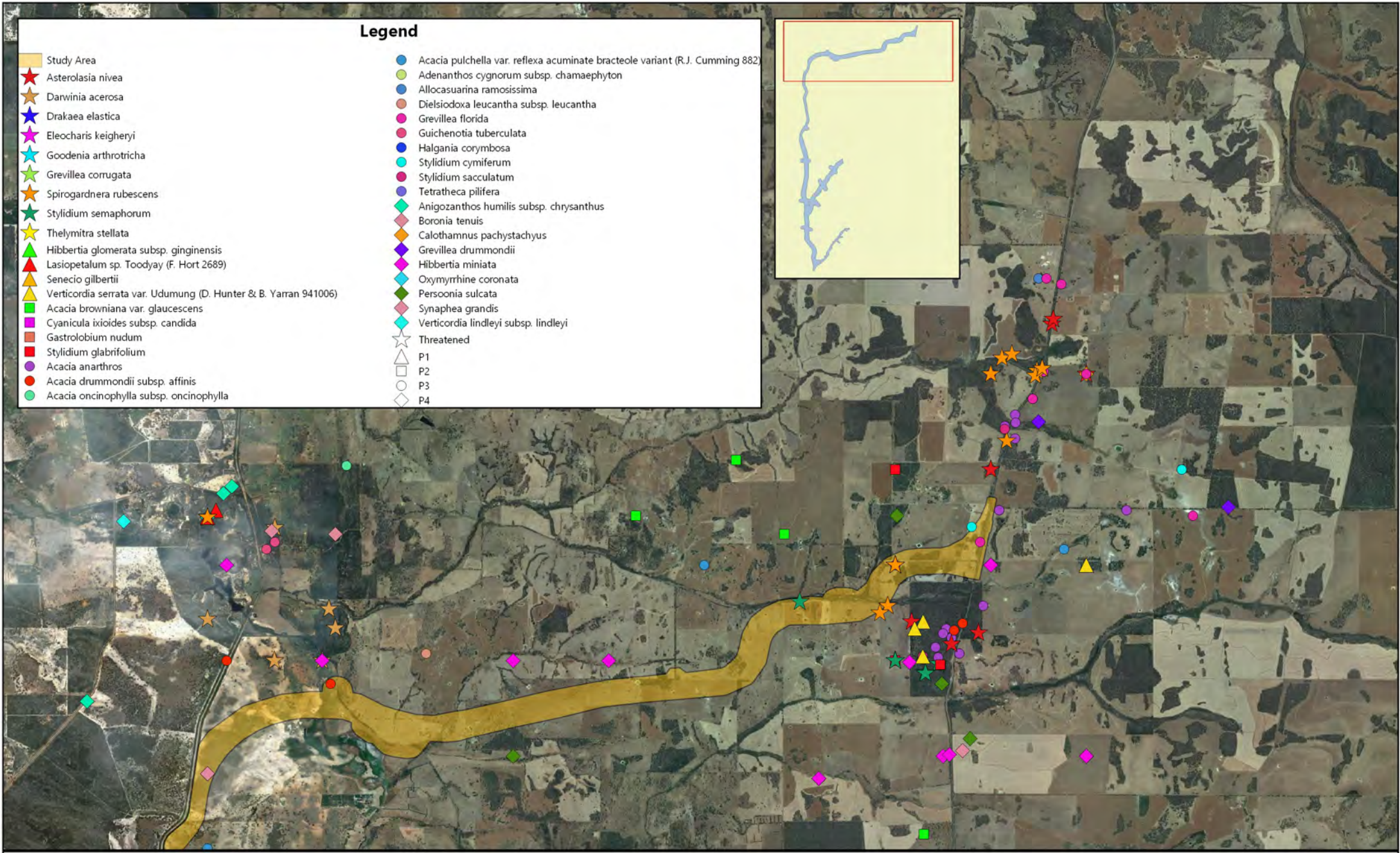
A desktop review for Threatened and Priority Flora was conducted using the EPBC Matters of National Environmental Significance (MNES) Protected Matters Search Tool, DPaW's NatureMap, DPaW database searches and a review of all literature reviewed as part of the desktop assessment. The review identified the presence or potential presence of 94 Threatened or Priority flora within the study area. This included 27 species protected under the EPBC Act, 29 WA Threatened flora (including the 27 EPBC-listed species), nine Priority 1, 12 Priority 2, 27 Priority 3 and 17 Priority 4 species. This complete list of previously recorded or potentially occurring Threatened and Priority flora relevant to the study area is presented in **Appendix A**.

Of the 94 flora species of conservation significance potentially relevant to the study area, it was determined (based on habitat preference, current distribution and known records) that three species are known to occur and have been previously recorded within the study area, eight are considered likely to occur and 35 species may occur, with the remaining 46 considered unlikely to occur (**Appendix A**). Species that have been previously recorded within the study area, those that were recorded during the current study and those that are likely to occur are summarised in **Table 7**. The distribution of known Threatened and Priority flora occurring in the region of the study area (based on desktop assessment results only) is spatially presented in **Figure 7**.

**Table 7 Summary of Threatened and Priority Flora Occurring or Likely to Occur within the Study Area**

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Drakaea elastica</i>	Endangered	Critically Endangered	Tuberous, perennial, herb, 0.12-0.3 m high. Flowers red & green & yellow, October to November	White or grey sand. Low-lying situations adjoining winter-wet swamps	Likely to occur; previously recorded within Area 2	DPaW (2016) NatureMap
<i>Gastrolobium crispatum</i>		Priority 1	Tall shrub, to 2.5 m high. Flowers yellow and orange and red, September to October	Yellow or brown sandy loam, red laterite soils. Steep gullies, slopes, ridges, breakaways	Likely to occur, previously recorded from Bindoon area. Recorded plant identified as possibly this species.	DPaW (2016)
<i>Synaphea panhesya</i>		Priority 1	Erect shrub, 0.3-0.6 m high. Flowers yellow, August to September	Gravelly loam & sandy gravel	Recorded during current study	DPaW (2016)
<i>Drosera sewelliae</i>		Priority 2	Fibrous-rooted, rosetted perennial, herb, to 0.06 m high, to 0.025 m wide. Flowers orange, October	Laterite & silica sand soils	Recorded during current study	DPaW (2016)
<i>Stylidium squamellosum</i>		Priority 2	Caespitose perennial, herb, 0.12-0.35 m high. Inflorescence racemose. Flowers yellow, October to November	Brown to red-brown clay loam. Winter-wet habitats and depressions, open woodland, shrubland	Likely to occur, recorded by Phoenix (2015)	Phoenix (2015)
<i>Acacia drummondii</i> subsp. <i>affinis</i>		Priority 3	Erect shrub, 0.3-1 m high. Flowers yellow, July to August	Jarraah woodland. Plateau, laterite. Lateritic gravelly soils	Likely to occur, closest known record occurs within 900 m of Area 2. Recorded plant identified as possibly this species.	DPaW (2016) NatureMap Phoenix (2015) GHD (2010) Western Botanical (2006) KBR (2006) Ecologia (2004)
<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>		Priority 3	Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Flowers white-cream-pink-green/green, July or September to December or January	Low Heath with <i>Allocasuarina humilis</i> , <i>Calothamnus sanguineus</i> , <i>Hibbertia hypericoides</i> . Grey sand, lateritic gravel	Recorded and previously recorded within Area 2	DPaW (2016) NatureMap KBR (2006)
<i>Grevillea florida</i>		Priority 3	Erect shrub, to 0.9 m high. Flowers cream-yellow, July to September	In open low woodland of <i>Eucalyptus drummondii</i> , and <i>E. calophylla</i> . Sandy clay, gravel, laterite. Sandplain, slopes, road verges	Likely to occur; previously recorded within Area 2	DPaW (2016)
<i>Haemodorum loratum</i>		Priority 3	Bulbaceous, perennial, herb, 0.45-1.2(-2) m high. Flowers black/brown-black/green, November	Grey or yellow sand, gravel	Likely to occur, recorded by Phoenix (2015)	Phoenix (2015)

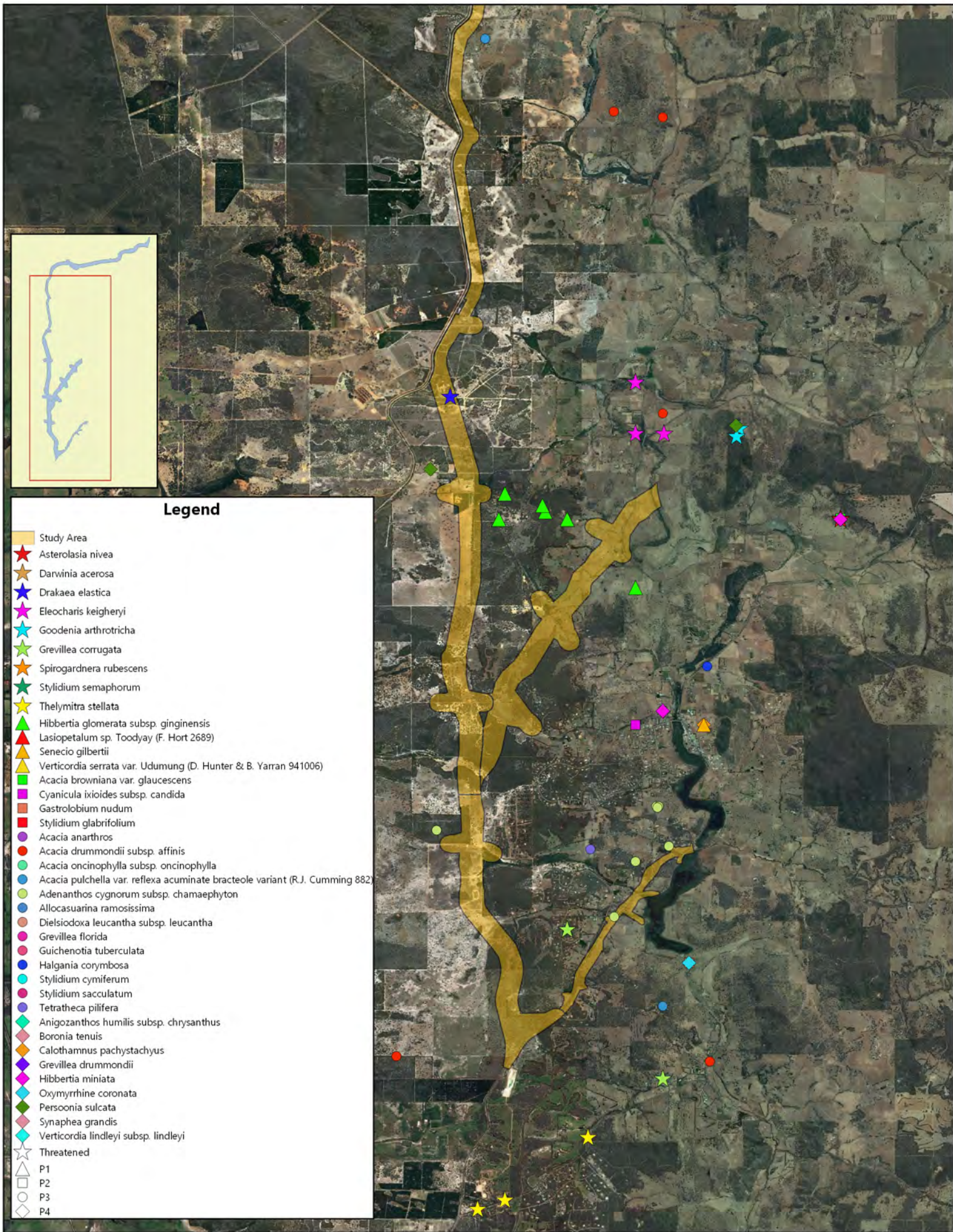
Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Stylidium cymiferum</i>		Priority 3	Perennial herb. Flowers yellow, laterally paired. Juvenile buds pendulous. Flowers October to November	In open Wandoo forest with <i>Stylidium caricifolium</i> . Loam and lateritic soils	Likely to occur, recorded Caligiri - Wongan Hills Road within 25 m of study area boundary	DPaW (2016)
<i>Verticordia serrata</i> var. <i>linearis</i>		Priority 3	Shrub, to 1 m high, Flowers September to October	White sand, gravel. Open woodland	Likely to occur, recorded by Phoenix (2015)	Phoenix (2015) Ecologia (2004)
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>		Priority 4	Rhizomatous, perennial, herb, 0.2-0.4 (-0.8) m high. Flowers yellow, July to October	Banksia Woodland. Grey or yellow sand	Recorded during current study	DPaW (2016)
<i>Hibbertia miniata</i>		Priority 4	Decumbent or erect shrub, 0.1-1 m high. Flowers orange/orange-red, August to November	Open Woodland of <i>Corymbia calophylla</i> . Lateritic gravelly soils	Recorded during current study, known records within 300 m of study area	DPaW (2016) NatureMap Ecologia (2005)



0 1 2 3 4 km



**Figure 7a - Previously Recorded Threatened and Priority Flora**



**Figure 7b - Previously Recorded Threatened and Priority Flora**

## 4.2 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The DPaW database search results reveal that at a State level, the study area and the immediate surrounds are known to support the following TEC and two PECs:

- TEC:
  - SCP 20a – *Banksia attenuata* woodlands over species rich dense shrublands (EN)
- PECs:
  - Banksia woodlands of the Gingin area restricted to soils dominated by yellow to orange sands (P2)
  - SCP 23b – Northern Swan Coastal Plain *Banksia attenuata* – *Banksia menziesii* woodlands (P3).

All three of these vegetation types are also classified as likely to be equivalent to the Commonwealth listed TEC, *Banksia Woodlands of the Swan Coastal Plain ecological community* (Threatened Species Scientific Committee 2016), which was further supported by the results of the EPBC Act MNES database search. However, at the time that the database search was conducted, DPaW's dataset had not yet been updated to reflect the State-listed TEC and PECs and their equivalence to the Commonwealth-listed Banksia woodlands TEC.

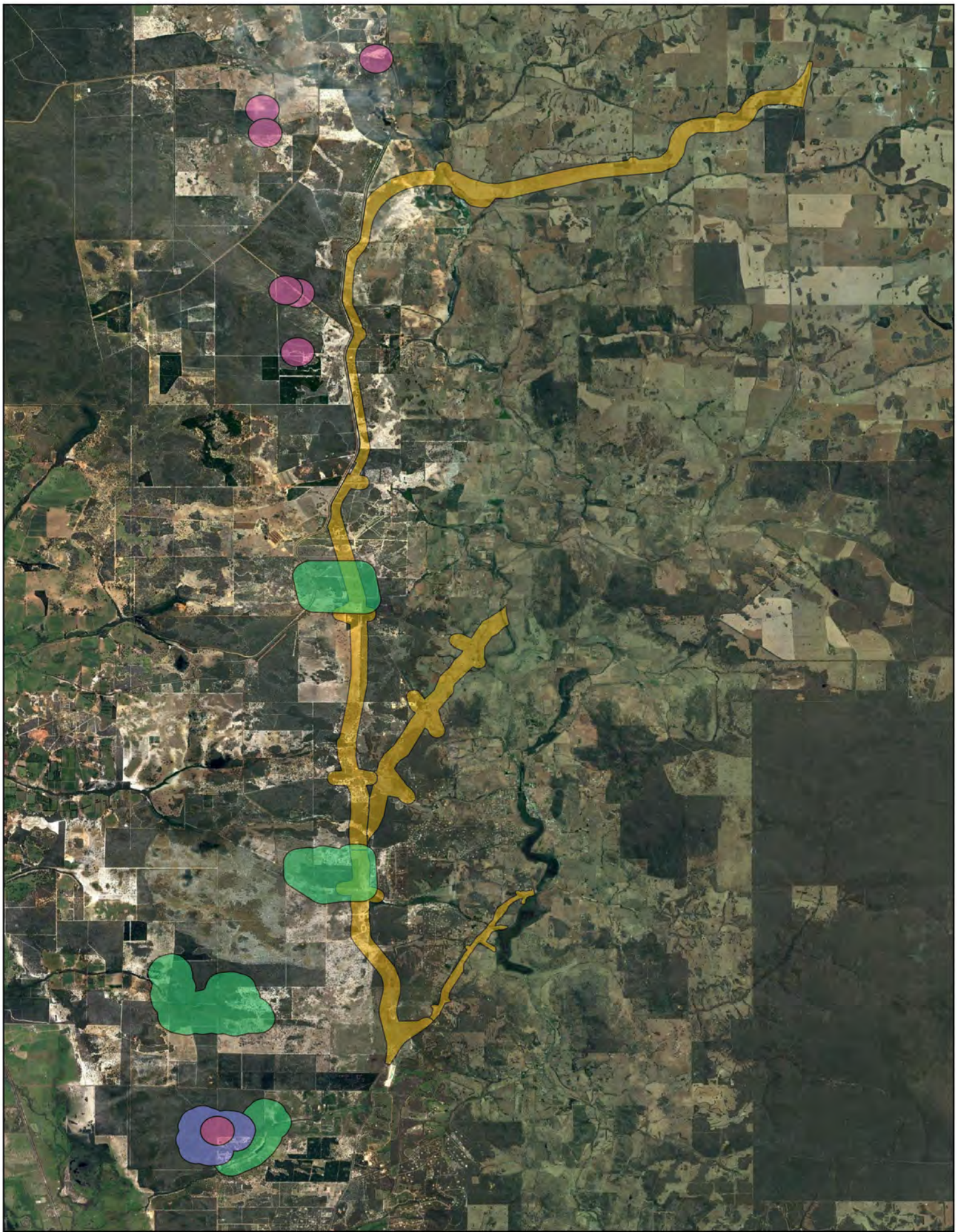
The known extent of these TECs/PECs, in accordance with results of the DPaW database search results is presented in **Figure 8**, showing that two occurrences of the 'Banksia woodlands of the Gingin area restricted to soils dominated by yellow to orange sands' or their buffers intersect with the Area 2 section of the study area. **Figure 8** also shows that there are occurrences of both of the other ecological communities listed above, or their buffers:

- SCP 23b – Northern Swan Coastal Plain *Banksia attenuata* – *Banksia menziesii* woodlands, within 1 km of the boundary of the Area 2 section of the study area, but not intersecting the study area
- Banksia woodlands of the Gingin area restricted to soils dominated by yellow to orange sands, within 4.5 km of the southern terminus of the Area 1 section of the study area, but not intersecting the study area.

The *Banksia Woodlands of the Swan Coastal Plain Ecological Community* was approved for inclusion as an Endangered TEC under the EPBC Act on 16 September 2016. This ecological community is woodland associated with the Swan Coastal Plain with a prominent tree layer of Banksia with scattered Eucalypts and other tree species among or emerging above the Banksia canopy. The understorey is comprised of a species rich mix of sclerophyllous shrubs, graminoids and forbs (Threatened Species Scientific Committee 2016).

The Banksia woodland Commonwealth-listed TEC is largely restricted to the Swan Coastal Plain IBRA bioregion, within the Perth (SWA02) and Dandaragan (SWA01) sub-regions. It extends into the adjacent Jarrah Forrest IBRA bioregion (JA01 and JA02 sub-regions) areas of the Whicher and Darling escarpments where pockets of Banksia Woodland may occur. This TEC mainly occurs on deep Bassendean and Spearwood sands or occasionally on Quindalup sands at the eastern edge (Threatened Species Scientific Committee 2016).

Twenty-one Floristic Community Types (FCTs) described by Gibson *et al.* (1994), Government of Western Australia (2000), Keighery *et al.* (2008) and the Urban Bushland Council (2011) best correspond to the Banksia woodland TEC. This includes a number of FCTs known to be supported by the study area (Gibson *et al.* 1994). The State-listed P2 PEC (Banksia woodlands of the Gingin area restricted to soils dominated by yellow to orange sands) is also considered a representation of the Banksia woodland TEC (Threatened Species Scientific Committee 2016).



0 1 2 3 4 km

Figure 8 - Known TECs and PECs



**Legend**

- Study Area
- Banksia attenuata* woodlands over species rich dense shrublands
- Banksia* woodland of the Gingin area (yellow to orange sands)
- Swan Coastal Plain *Banksia attenuata* - *Banksia menziesii* woodlands



## 5 METHODOLOGY

All survey and reporting for the spring 2016 Level 2 flora and vegetation assessment of the Bindoon study area was carried out in accordance with the following:

- EPA (2004) Guidance Statement 51, Guidance for Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia
- EPA & DPaW (2015) Technical Guide for Flora and Vegetation Surveys for Environmental Impact Assessment
- Commonwealth of Australia (2013b) Guidelines for Detecting Orchids Listed as 'Threatened' Under the *Environment Protection and Biodiversity Conservation Act 1999*.

### 5.1 DESKTOP ASSESSMENT AND LITERATURE REVIEW

As part of the desktop assessment, a literature review was undertaken of all available, relevant published and unpublished reports and documents. Database searches for Threatened and Priority flora and ecological communities were also requested from DPaW for the study area and surrounds. The Threatened and Priority flora search was conducted for the study area extent plus a 4 km buffer (search reference 40-1016FL). The Threatened and Priority ecological community database search was conducted for a geographical bounding box, as defined by DPaW within the following corners:

- north - -14.788854
- south - -35.005719
- east - 128.870214
- west - 113.765525.

The collective information from the desktop assessment and literature review was used to generate potential species lists for the study area, with a focus on Threatened and Priority flora and ecological communities.

The sources consulted included the following:

- Department of the Environment and Energy (DotEE) MNES search tool
- DPaW NatureMap search
- Threatened and Priority taxa listed under the WC Act and listed by DPaW
- TECs PECs listed by DPaW
- Declared Pests listed under the BAM Act.

The results of the desktop assessment are presented in **Section 4** of this report.

### 5.2 FIELD ASSESSMENT

The Level 2 flora and vegetation field assessment was carried out by Principal Ecologist, Kellie Bauer-Simpson and Senior Botanist, Gabriela Martinez on 10–14 and 17–20 October 2016, with a total survey effort of 18 person days.

Field data from quadrats and opportunistic observations and spatial mapping between was collected using electronic tablets equipped with the mobile mapping software, MAPPT™. This methodology

allowed in-field spatial mapping of boundaries for vegetation communities and condition, as well as the collection of spatial point data where other observations or photographs were captured. Physical data from each quadrat was also recorded electronically in the software, with species recorded by hand for later entry with identified collected specimens.

Vegetation mapping was conducted in the field and refined afterwards by defining the different plant communities based on vegetation structure, dominant species and species composition, and extrapolated based on the appearance in aerial imagery.

Field data was collected from 46 pegged 10 m x 10 m quadrats and two relevés (**Figure 9**). A single permanent peg was installed at the north-west corner of each quadrat and marked with quadrat number. Measuring tapes and temporary pegs marked the quadrat boundary during sampling, but were then removed, leaving only the north-west corner peg, to minimise impact on the landscape.

Quadrats were established and sampled in areas of good or better condition vegetation, in accordance with the requirements of EPA Guidance Statement 51. Detailed data collection points (relevés) were utilised in locations where land access permission had not been granted, but where vegetation was observable from outside property boundaries. This aided in defining vegetation types as much as possible for inaccessible locations. Observations and opportunistic data collection was also carried out continuously throughout assessment of the study areas, in order to draft maps for the extent of vegetation communities and condition, as well as other relevant features.

The following information was collected from within each quadrat sampled:

- date
- botanist name
- quadrat or relevé and dimensions
- location (GPS co-ordinates of the north-west corner peg in GDA94)
- digital photograph taken from the north-west corner peg
- habitat or landscape position
- topography/slope
- surface features
- soil type/texture and colour
- rock presence, type, size and abundance
- vegetation condition/degradation/disturbances (e.g. weed invasion, fire)
- time since fire (estimated)
- leaf litter distribution and abundance
- flora inventory, and for each species:
  - average height
  - total projected foliage cover within quadrat
  - dominance
- vegetation community, described in accordance with Level V of the National Vegetation Information System (NVIS)\*
- vegetation condition, assessed against the currently accepted scale as required by EPA & DPaw (2015); an adaptation of the Keighery (1994) and Trudgen (1991) condition scales.

Once the floristic data for each quadrat was analysed and classified, with clusters (groups of similar types) defined via PATN™ analysis, they were rationalised into vegetation communities and described at NVIS Level III and VI. Each local scale vegetation community was then rationalised with regional vegetation associations as per Shepherd *et al.* (2002).

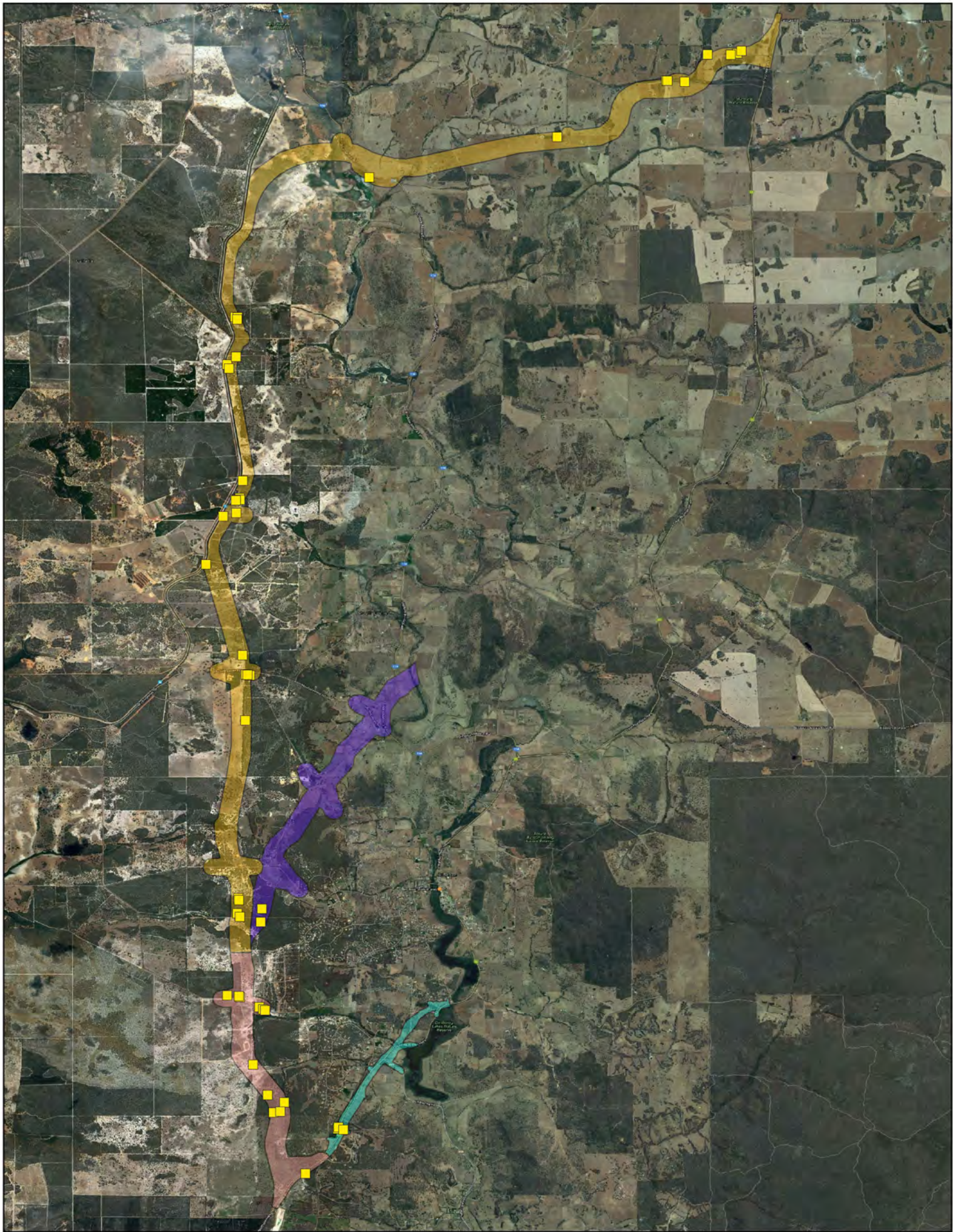
Description of the vegetation communities to NVIS Level VI has enabled conclusions regarding the TEC and PEC status of each of the recorded vegetation types. Rationalisation of the vegetation communities with the associations of Shepherd *et al.* (2002) enabled analysis of the remaining representation of pre-European extents, and determination of the regional significance of each of the vegetation types.

The flora data collected from the combination of quadrats and continuous opportunistic observations contributed to the flora inventory for the site.

In accordance with the guidance and as is typical for first phase Level 2 flora and vegetation assessments, a proportion of the field assessment effort was dedicated to selective and opportunistic searches Threatened and Priority flora, using the results of the desktop assessment as a basis. These searches were conducted in areas of better quality vegetation, along disturbance areas such as tracks and firebreaks (to target disturbance opportunists), when traversing to and between quadrats, and whilst carrying out the dedicated targeted survey for the Threatened orchid species, *Thelymitra stellata*, described in more detail in **Section 5.3**. The main focus of these targeted surveys was within quadrats and immediately surrounding quadrats once established and sampled. Further targeted surveys are well-suited to phases of assessment subsequent to the first phase, once some of the occurring species are known and detailed vegetation information is available for determination of suitable habitats for conservation significant flora.

The varying vegetation condition within the study area was documented continuously throughout the survey, as well as from within quadrats, which was then mapped in accordance with the Keighery (1994) scale (using qualitative and descriptive terms) and an adaptation of the Keighery (1994) and Trudgen (1991) condition scales (as per EPA & DPaW (2015) (using quantitative number scores in accordance with the qualitative scale).

Flora specimens were collected, pressed, dried and fumigated in accordance with the protocols of the Western Australian Herbarium, for later identification.



0 1 2 3 4 km  
**Figure 9 - Quadrat Locations**



**Legend**

- Common Area - Area 1
- Western Bypass A - Area 2
- Western Bypass B - Area 3
- Eastern Bypass - Area 4

### 5.3 TARGETED THELYMITRA STELLATA SURVEY

A NatureMap search of the general study region identified the potential occurrence of a Threatened orchid species, *Thelymitra stellata* (Star Sun-orchid), within the study area. *Thelymitra stellata* is known to flower mostly between October and late November. In order to target *Thelymitra stellata* at the suitable flowering time, communication was maintained with DPaW's orchid specialist, Dr Andrew Brown, regarding field observations for spring 2016. It was anticipated that there was the potential for early flowering due to high rainfall in July and August, and observations of Spider Orchids in the Perth region flowering early (in the first week of August). Dr Brown's specialist knowledge and field observations contributed to the determination to mobilise to site during mid-November to conduct targeted surveys for the species along with guidance advice described in the Orchid Detection Guidelines (2013b).

The targeted *Thelymitra stellata* (Star Sun-orchid) survey was conducted between 14–18 and 22–23 November 2016 by Principal Ecologist, Kellie Bauer-Simpson and Senior Botanists, Gabriela Martinez and Lisa Chappell. A total survey effort of 21 person-days was invested.

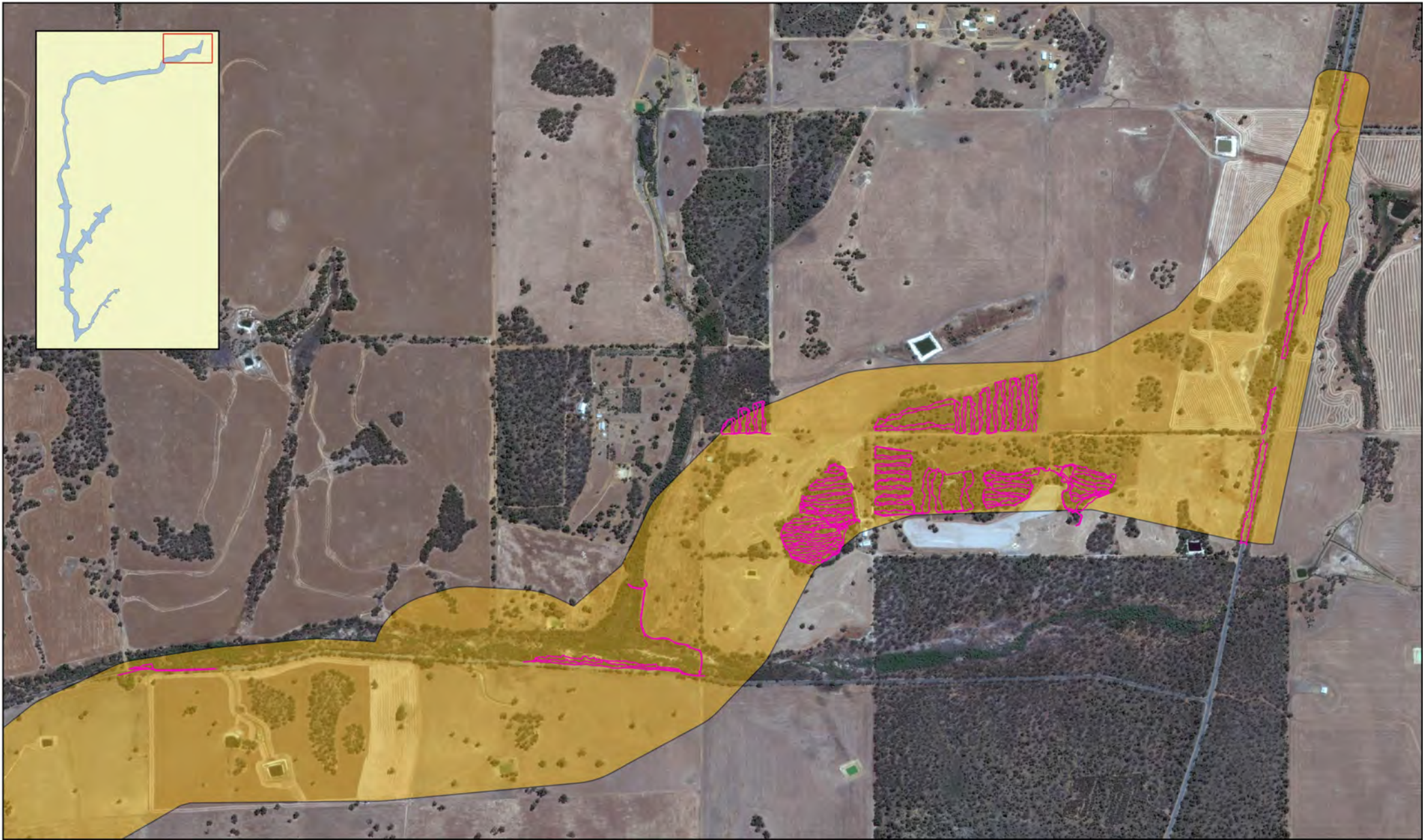
During the Level 2 flora and vegetation assessment conducted in September, a targeted reconnaissance of habitats suitable for *Thelymitra stellata* was carried out, which enabled the most suitable habitats to be targeted with greater survey effort during November. A sampling design to specifically target *Thelymitra stellata* was prepared. Methodologies for the targeted survey for *Thelymitra stellata* were conducted in accordance with the Department of the Environment's *Guidelines for Detecting Orchids Listed as 'Threatened'*.

A combination of the following four survey techniques were adopted to record potential *Thelymitra stellata* populations:

1. Chance finds (opportunistic records) whilst recording quadrat or relevé data or undertaking other aspects of the field survey.
2. Meandering searches in defined areas of suitable habitat, with meandering transects spaced 40-100 m apart.
3. Area searches, with more intensive meandering searches in defined areas considered likely suitable habitat, with meandering transects spaced 20-40 m apart
4. Systematic targeted searches in parallel transects, spaced 10 m apart, with visibility ranging from 2 m to 4 m either side of a centerline, thus covering up to 80% of the designated search areas.

The total survey effort aimed to search at least 50% of the intact vegetation remnants considered to provide suitable habitat within the study area.

All walked transects were tracked on GPS to verify and present the locations and extent of traversed and searched areas. The combined walked tracks for the targeted *Thelymitra stellata* searches are presented in **Figure 10**.





0 0.25 0.5 0.75 1 km

**Figure 10a - Walked Tracks for Thelymitra stellata Survey**



**Legend**



-  Walked Tracks
-  Study Area



0 0.25 0.5 0.75 1 km



**Legend**

-  Walked Tracks
-  Study Area

**Figure 10b - Walked Tracks for *Thelymitra stellata* Survey**





0 0.25 0.5 0.75 1 km

Figure 10c - Walked Tracks for *Thelymitra stellata* Survey



Legend

- Walked Tracks
- Study Area





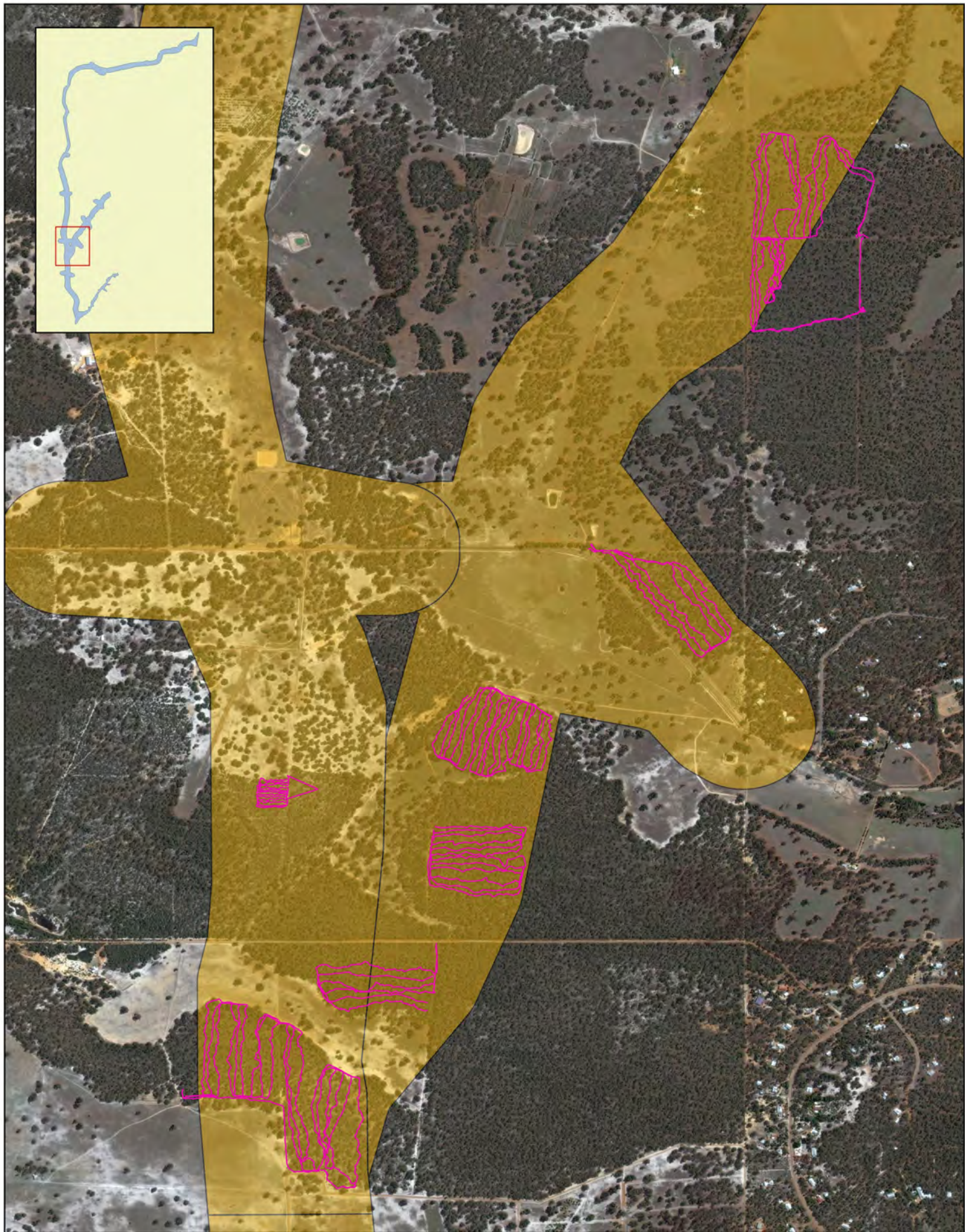
0 0.25 0.5 0.75 1 km

**Figure 10d - Walked Tracks for *Thelymitra stellata* Survey**



**Legend**

- Walked Tracks
- Study Area



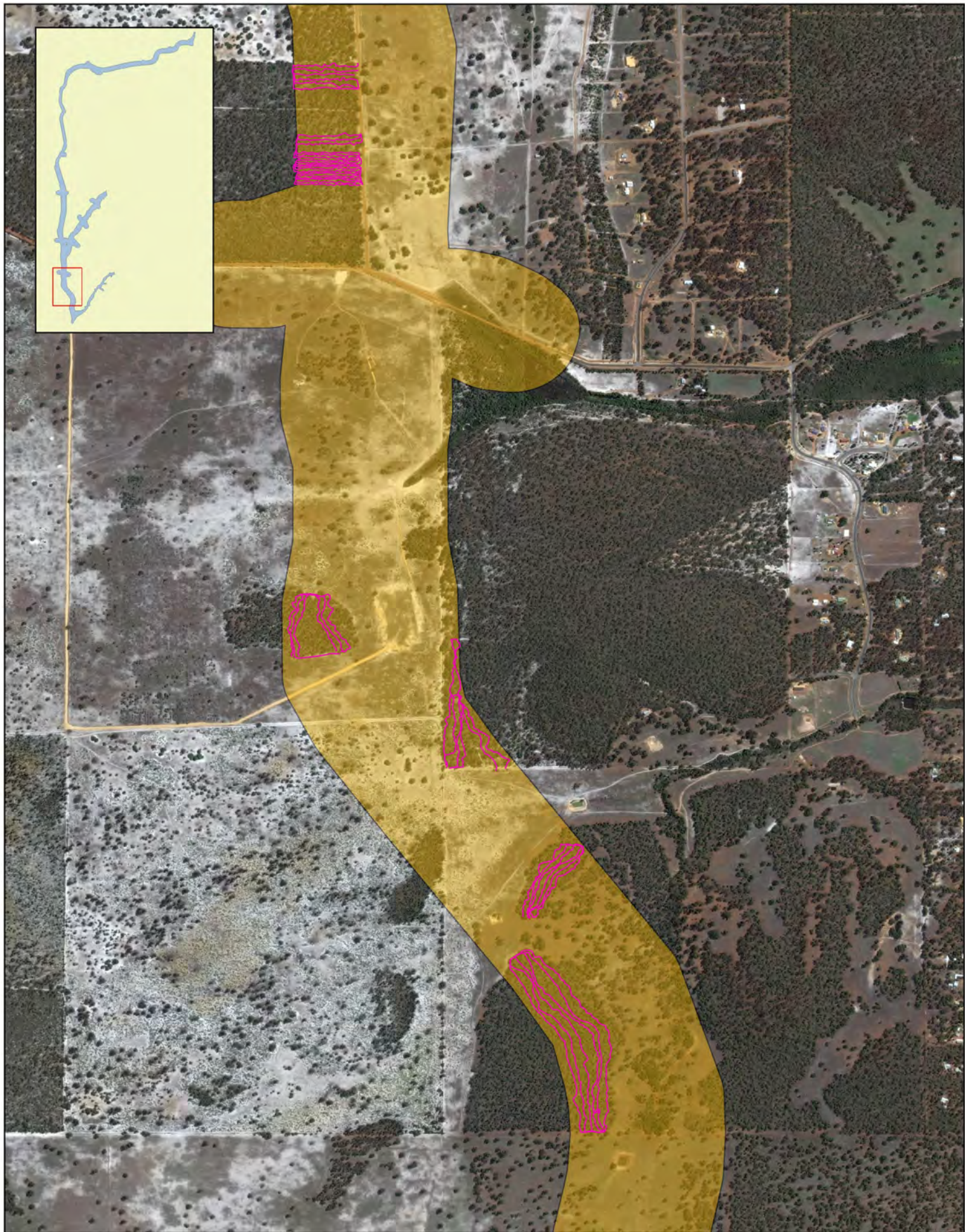
0 0.25 0.5 0.75 1 km

**Figure 10e - Walked Tracks for *Thelymitra stellata* Survey**



**Legend**

- Walked Tracks
- Study Area



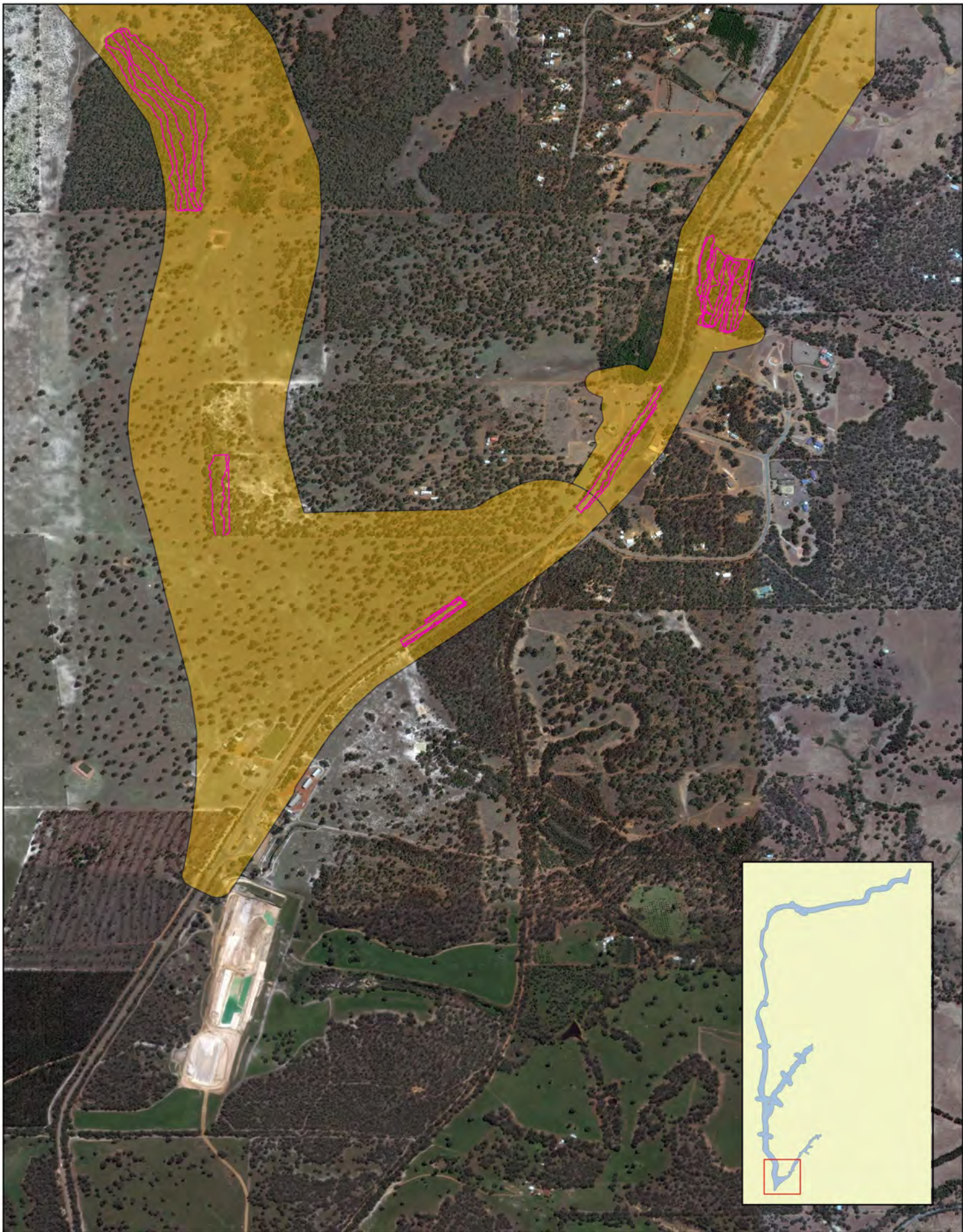
0 0.25 0.5 0.75 1 km

**Figure 10f - Walked Tracks for *Thelymitra stellata* Survey**



**Legend**

- Walked Tracks
- Study Area



0 0.25 0.5 0.75 1 km

**Figure 10g - Walked Tracks for Thelymitra stellata Survey**



**Legend**

- Walked Tracks
- Study Area



0 0.25 0.5 0.75 1 km

Figure 10h - Walked Tracks for Thelymitra stellata Survey



Legend

- Walked Tracks
- Study Area

If *Thelymitra stellata* individuals or suspected individuals were observed, the following data was to be recorded:

- GPS location of each individual plant
- vegetation type and condition at the recorded location
- condition of plants/populations recorded
- life-cycle stage (e.g. budding, flowering, fruiting)
- high resolution digital photographs of plants/populations encountered and the surrounding vegetation.

#### 5.4 DATA PROCESSING AND ANALYSIS

Flora identifications were undertaken by specialist taxonomist, Dr Udani Sirisena. Plant group specialist taxonomists were consulted where required for challenging identifications. Taxonomy and nomenclature follows current protocols of the WA Herbarium.

Field data collected on tablets within the mobile mapping software program, MAPPT™ within customised data forms and spatial mapping shapefiles were downloaded for collation for the report. Quadrat species lists and flora identifications were entered into a customised Microsoft Access™ database called FloraData, which contains the WA flora inventory. The data was then able to be loaded into the PATN™ software (Belbin 2013) for floristic analysis.

Data was prepared for analysis including the grouping of some taxa to minimise or exclude ambiguity that could possibly be due to the identification of plants rather than a true difference in species composition. For example, removing infra-specific epithets and using only the specific epithet, considering uncertain species identification (indicated with '?') as the proper identification (e.g. *Drosera ?sewelliae* treated as *Drosera sewelliae*).

Data analysis carried out for flora quadrat data utilising PATN™ involves multivariate cluster analysis of species presence/absence. An association matrix of the Bray-Curtis coefficient was generated from the presence and absence site by species matrix using the software. The resultant dendrogram was used to identify the vegetation units, which were described at NVIS Levels III and VI.

Grouping of site data and the characterisation and description to NVIS Level VI enabled determination of floristic communities and potential TECs and PECs across the site. Rationalisation of recorded vegetation communities with regional vegetation associations as documented in Shepherd *et al.* (2002) enabled an analysis of regional extent and representation, and therefore regional significance.

Vegetation datasets from recent and relevant studies in the surrounding region were analysed with collected field data to determine similarities between vegetation units recorded and enable an analysis of regional representation of the vegetation. The most recent and relevant dataset was that of Phoenix (2015) for the Muchea North and Chittering study area for the Great Northern Highway project.

The local and regional vegetation analysis again used multivariate cluster analysis of species presence/absence using PATN™ (Belbin 2013), with data from each quadrat of the current FVC survey and Phoenix (2015), providing a total of 77 sampling points. The resultant dendrogram was used to

determine the similarity between the described vegetation units of the current survey and those from Phoenix (2015) to enable interpretation of the local distribution of vegetation communities.

In order to understand the more broadly regional distribution of vegetation units within the study area, vegetation types recorded during the current FVC survey were matched with the vegetation associations of Shepherd *et al.* (2002), as well as the vegetation units described by Phoenix (2015). The resultant dendrogram was used to determine the similarity between the described vegetation units of the current survey plus those of Phoenix (2015) in comparison to the regional extent and distribution of the Shepherd *et al.* (2002) vegetation types.

## 5.5 STUDY LIMITATIONS

The limitations of the flora and vegetation assessment have been considered in accordance with Guidance Statement 51 (EPA 2004) and these are summarised in **Table 8**.

**Table 8 Study Limitations**

Aspect	Constraint?	Commentary
Availability of regional data	No	A number of studies have been previously completed within the local study area and wider region, reflected in the broad range of previous study reports reviewed and summarised in <b>Section 5.1</b> .
Scope (detail)	No	A single-phase, Level 2 flora and vegetation assessment was carried out in accordance with Guidance Statement 51, which included the sampling of 46 separate sampling points (quadrats and relevés). Survey effort was also invested in selective targeted surveys for Threatened and Priority flora, as well as a separate intensive survey dedicated to searching for one species of Threatened flora, <i>Thelymitra stellata</i> .
Experience of personnel	No	All of the personnel undertaking the field assessment, flora identifications, data analysis, vegetation mapping and reporting are experienced botanists, with specialist skills in their respective fields. All botanists have a minimum of seven and up to 18 year' experience. Field botanists are all experienced in undertaking surveys in the region, and in undertaking targeted significant flora surveys. Taxonomic identifications were undertaken by specifically trained taxonomists, including specialists on relevant groups, where required.
Survey effort/detail/intensity	No	A total survey effort of 18 and 21 person days was invested in the Level 2 flora and vegetation assessment and the targeted <i>Thelymitra stellata</i> survey, respectively. These studies included the sampling of 44 quadrats and two relevés across 13 vegetation communities, with at least three quadrats per type (besides two which resulted from unexpected splits in the branching of the dendrogram during statistical analysis), and more than 150 km of transect lines covering approximately 75 hectares of searched ground, within more than 220 hectares of search areas (62% of suitable habitat area within the study area).
Seasonal timing and climatic conditions	No	The field assessment was conducted during the optimal spring season, with the Level 2 assessment undertaken during mid-October and the targeted <i>Thelymitra stellata</i> survey conducted during mid-November. Following unseasonably high rainfall in July and August, the regions experienced a favourable spring season and field timing was considered suitable. One <i>Thelymitra stellata</i> from a known population nearby to the study area was past peak flowering period, but still visible and distinguishable at the start and end of the targeted survey, despite high temperature on the second and third days of the field searches.

Aspect	Constraint?	Commentary
Access	Somewhat	The majority of the study area is easily accessible and being linear corridors, most areas are accessible at least on foot from nearby roads or properties. One significantly sized property just east of Cullulla Road, between just north of Mooliabeenee Road and Barn Road was not able to be accessed. This property supports intact native vegetation, including areas expected to be representative of the Banksia woodland TEC. This gap in the data is considered a constraint for the study and will limit the environmental impact assessment process unless it is able to be filled.
Mapping reliability	No	The mapping has been prepared at a scale based on mostly ground-truthed areas, with limited extrapolation given the good accessibility for most of the study area (besides inaccessible properties). Therefore, mapping reliability based on scale is considered high.
Disturbances	No	The majority (75.35%) of the total study area supports pasture with occasional trees, or planted areas which include plantations and some small areas of rehabilitated vegetation. Only 18.73% of the study area was mapped to be in Good condition or better. However, significant areas were found to be in Very Good to Excellent and Excellent condition. The higher quality vegetation in a regional context of largely cleared vegetation is of greater significance in terms of conservation. Dieback infestations are apparent in some areas and weed invasion adjacent to pastoral areas are evident, however, within intact remnants, disturbance if mostly limited and was not considered to affect collected data.
Survey completeness	Somewhat	Most areas were easily accessible and despite those areas that were not, the Level 2 assessment is considered to be a suitably complete first phase survey. Quadrat sampling is considered adequate for a phase 1, Level 2 assessment, with 44 quadrats and two relevés across 13 vegetation communities. Quadrat frequency provided at least three quadrats per type (besides two vegetation communities which resulted from unexpected splits in the branching of the dendrogram during statistical analysis). The two vegetation communities sampled from only two quadrats will require additional quadrat sampling during subsequent phases of assessment.



## 6 RESULTS

### 6.1 FLORA

The desktop assessment determined that a total of 94 flora species of conservation significance have the potential to occur within the study area, based on previous records within or in the vicinity (**Appendix A**). Of these, five Priority flora species were recorded during the spring survey, with a further two species not able to be certainly identified, but expected to also be Priority flora species. Eleven of the 94 species resulting from the desktop assessment have been determined to be 'likely to occur' in the study area, with 30 classified as 'may occur' and 48 considered 'unlikely to occur, based on the proximity of previous records, currency of the data, and whether suitable habitat is provided in the study area.

A total of 350 flora taxa from 183 genera and 56 families were recorded during the field survey. The total includes 311 (88.6%) native species and 40 (11.4%) introduced (weed) species. The most dominant families recorded were Fabaceae (47 (13.4%) species), Myrtaceae (36 (10.3%) species) and Proteaceae (35 (10.0%) species). The full list of vascular flora species recorded is presented in **Appendix B**, with the quadrats and vegetation communities in which they were recorded to occur presented in **Appendices C and D**, respectively.

None of the Threatened flora resulting for the desktop assessment (**Appendix A**) were recorded during the spring 2016 survey and none of the recorded flora species are listed as Threatened under the WC Act or under the EPBC Act.

The seven species listed as Priority Flora under the WC Act which were recorded during the field studies, their conservation status and the survey areas, quadrats and vegetation communities in which they occur are presented below in **Table 9** and these recorded locations (quadrats) are presented in **Figure 11**. No Priority flora were recorded within Area 3.

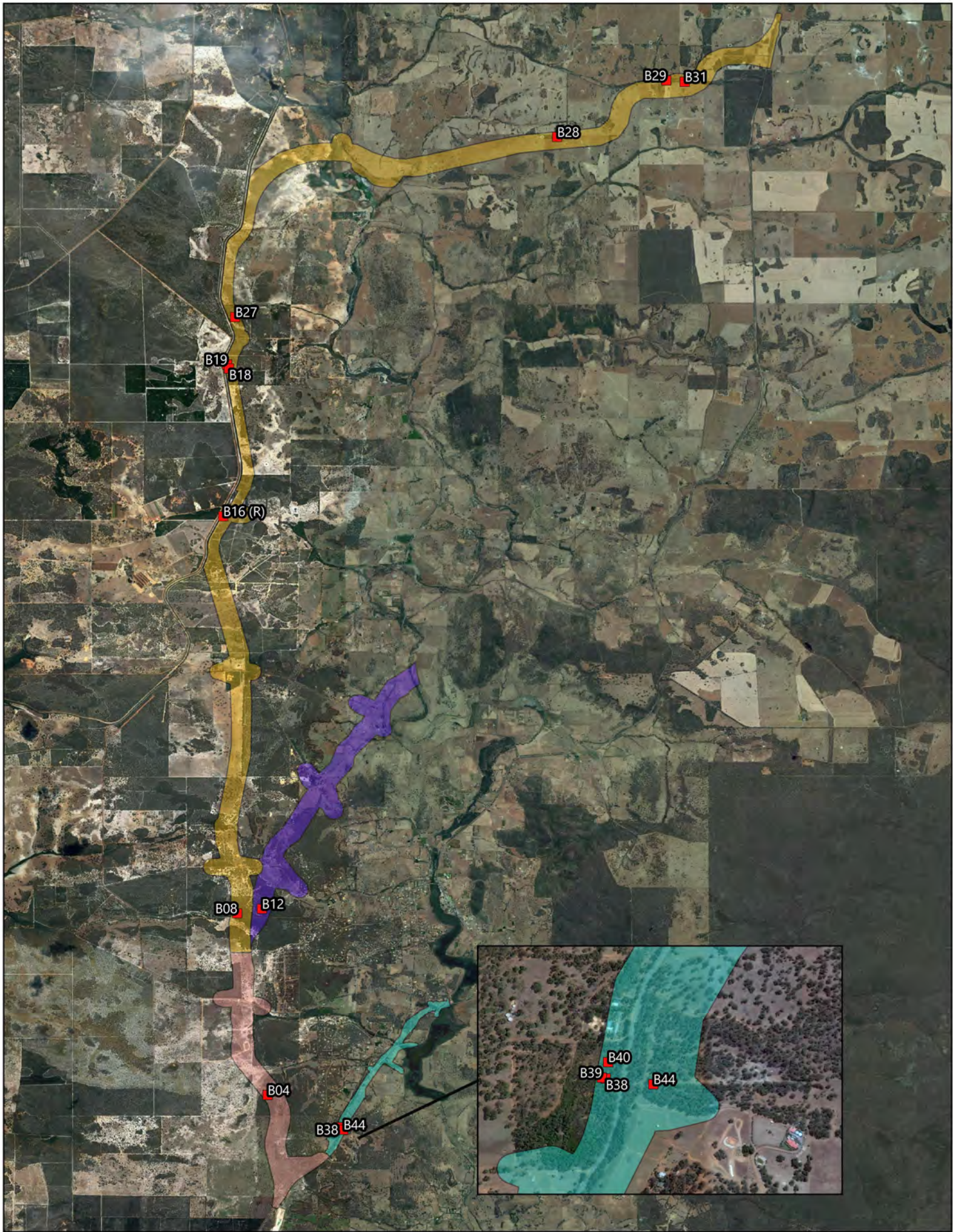
None of the recorded flora were found to be occurring outside their known range, based on distributions from Western Australian Herbarium records.

None of the recorded introduced (weed) species are listed as Declared Pest plants under the BAM Act within the districts of the study area. *Moraea flaccida* (One-leaf Cape-tulip) is listed as a Declared Pest plant with C3 (management) control requirements for a number of districts in the south-west and the Yilgarn, but not for the districts of the study area.

**Table 9 Recorded Priority Flora Locations**

Species	WA Conservation Status	Recorded from Quadrat/s	Recorded within Vegetation Community/ies
<b>Area 1</b>			
<i>Gastrolobium ?crispatum*</i>	P1	40	CcXpBe
<i>Synaphea panhesya</i>	P1	4, 40	EmXpHh, CcXpBe
<i>Drosera sewelliae</i>	P2	28	EmBsHh
<i>Drosera ?sewelliae*</i>	P2	4	EmXpHh
<i>Acacia drummondii</i> subsp. <i>affinis</i>	P2	28	EmBsHh
<b>Area 2</b>			
<i>Synaphea panhesya</i>	P1	12	EmBsHh
<i>Drosera ?sewelliae*</i>	P2	16R, 18, 19, 27	EtBeAn, ErXpLt
<i>Hibbertia miniata</i>	P4	28	EmBsHh
<b>Area 4</b>			
<i>Drosera ?sewelliae*</i>	P2	8, 31	EmBsHh, EwBeNa
<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>	P3	44	EmBsHh
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>	P3	38, 39, 40	CcXpBe

\*from specimen collections unable to be identified with certainty due to lack of identifiable material



0 1 2 3 4 km

Figure 9 - Quadrat Locations



**Legend**

- Common Area - Area 1
- Western Bypass A - Area 2
- Western Bypass B - Area 3
- Eastern Bypass - Area 4

### 6.1.1 Targeted *Thelymitra stellata* Survey

More than 150 km of transects totalling approximately 75 ha of searched ground over more than 200 ha of searched sites was included in the targeted searches for *Thelymitra stellata* during November 2016. Despite the intensive surveys which focused on areas of optimal habitat, no individuals were recorded.

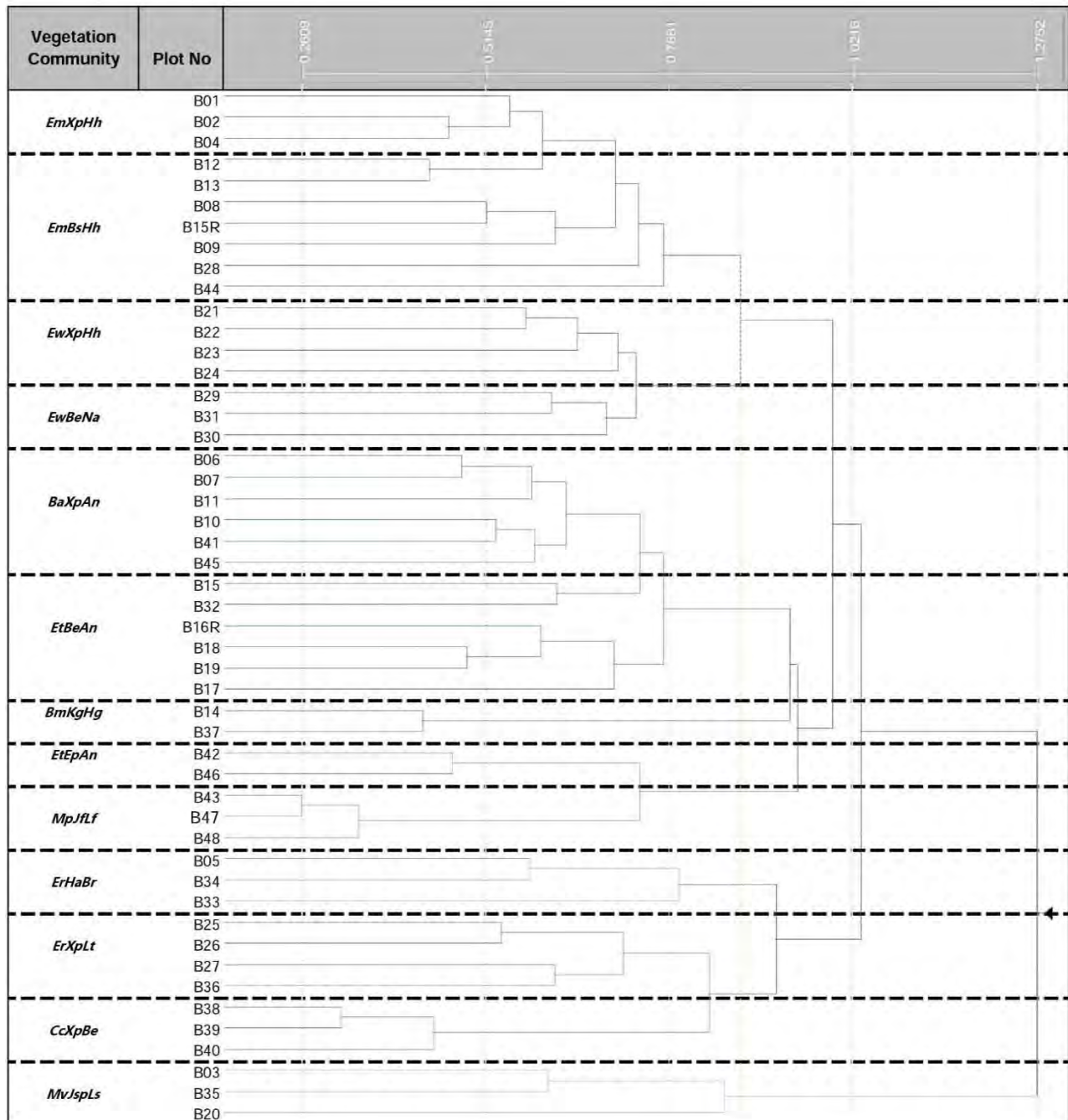
During the Level 2 quadrat-focused survey conducted in October 2016, a number of single leafed orchids were observed (e.g. **Plate 1**), with locations of those considered to potentially represent *Thelymitra* plants recorded to enable verification during the *Thelymitra stellata* flowering period. None of these locations revisited during November 2016 confirmed the presence of this species. In these locations, no orchid was observed (likely had finished flowering and senesced (died off), or plants were identified as orchid species other than *Thelymitra stellata* (i.e. *Thelymitra crinita* and *Eliochilus dilatatus*).



**Plate 1** Single-leaf orchids recorded during October and revisited to verify identity during November 2016

## 6.2 VEGETATION COMMUNITIES

The vegetation of the study area found to be in 'Good' or better condition was defined from a total of 46 quadrats and two relevés (**Figure 9**). Floristic analysis of the quadrat data using multivariate cluster analysis of species presence/absence in PATN™ resulted in the dendrogram presented below in **Figure 12**.



**Figure 12** Quadrat Cluster Analysis Dendrogram

The clusters of quadrats resulting from the dendrogram produced 13 separate vegetation communities, and the recorded quadrat data was then used to describe each community to NVIS Levels III and VI. In a broad sense, the vegetation units comprise Eucalypt woodlands (Jarrah, Marri, Wandoo and Flooded Gum), Banksia woodlands and Melaleuca woodlands and shrublands. The recorded vegetation communities are described in **Table 10**. The structure and floristic composition of each quadrat is detailed in **Appendix E** and species composition of each of the quadrats/sites and intact vegetation communities is provided in **Appendices C** and **D**, respectively. The spatial extent of the various vegetation communities is presented in **Figure 13**.

**Table 10 Summary of Recorded Vegetation Communities**

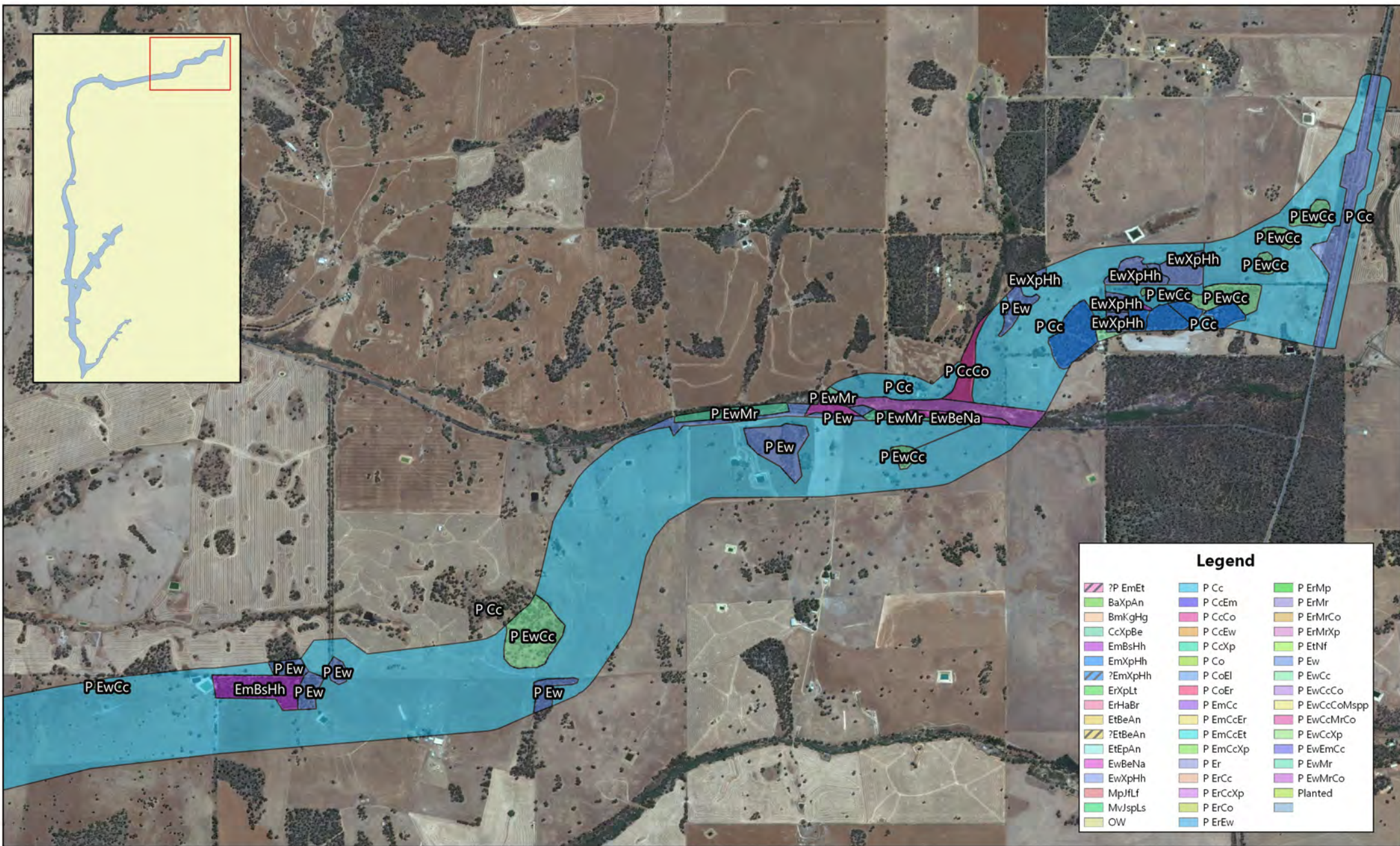
Vegetation Community and Description	Representative Quadrats	Represented within Survey Area/s	Corresponding Shepherd <i>et.al.</i> code	Equivalent Phoenix Quadrat/s
<p><b><i>EmXpHh</i></b></p> <p><i>Eucalyptus marginata</i> sparse woodland</p> <p><i>Eucalyptus marginata</i> low sparse woodland over <i>Xanthorrhoea preissii</i> mid sparse shrubland over <i>Hibbertia hypericoides</i>, <i>Bossiaea eriocarpa</i> and <i>Banksia dallanneyi</i> low isolated shrubs over <i>Conostylis setosa</i>, <i>Xanthosia huegelii</i> and <i>Philothea spicata</i> isolated herbs</p> <p><b>Average species richness: 39 ± 3.51</b></p>	B01, B02, B04	Area 1 Area 2 Area 3 Area 4	1019	MNP2012
<p><b><i>EmBsHh</i></b></p> <p><i>Eucalyptus marginata</i> and <i>Banksia sessilis</i> sparse woodland</p> <p><i>Eucalyptus marginata</i> low sparse woodland over <i>Banksia sessilis</i> and <i>Xanthorrhoea preissii</i> tall to mid sparse shrubland over <i>Hibbertia hypericoides</i> and <i>Bossiaea eriocarpa</i> low isolated to sparse shrubland over <i>Hypochaeris glabra</i> and <i>Ursinia anthemoides</i> isolated herbs</p> <p><b>Average species richness: 35.42 ± 2.35</b></p>	B08, B09, B12, B13, B15R, B28, B44	Area 2 Area 3	1019	MNP2012
<p><b><i>EwXpHh</i></b></p> <p><i>Eucalyptus wandoo</i> sparse woodland</p> <p><i>Eucalyptus wandoo</i> mid sparse woodland over <i>Xanthorrhoea preissii</i> mid isolated shrubs over <i>Hibbertia hypericoides</i>, <i>Bossiaea eriocarpa</i> and <i>Banksia dallanneyi</i> low isolated shrubs over <i>Conostylis setosa</i>, <i>Hypochaeris glabra</i> and <i>Drosera menziesii</i> isolated herbs</p> <p><b>Average species richness: 39 ± 2.34</b></p>	B21, B22, B23, B24	Area 1 Area 2	4	MNP2014
<p><b><i>EwBeNa</i></b></p> <p><i>Eucalyptus wandoo</i> and <i>Casuarina obesa</i> sparse woodland</p> <p><i>Eucalyptus wandoo</i> and <i>Casuarina obesa</i> mid to low sparse woodland over <i>Bossiaea eriocarpa</i> and <i>Gastrolobium calycinum</i> and <i>Hakea lissocarpha</i> low isolated shrubs over <i>Neurachne alopecuroidea</i> and <i>Lepidosperma tenue</i> isolated grasses and sedges</p> <p><b>Average species richness: 33 ± 5.50</b></p>	B29, B30, B31	Area 2	1018	Not represented

Vegetation Community and Description	Representative Quadrats	Represented within Survey Area/s	Corresponding Shepherd <i>et.al.</i> code	Equivalent Phoenix Quadrat/s
<p><b>BaXpAn</b></p> <p><i>Banksia</i> spp. sparse woodland</p> <p><i>Banksia attenuata</i> and <i>Banksia menziesii</i> low sparse woodland over <i>Xanthorrhoea preissii</i> mid isolated to sparse shrubs over <i>Bossiaea eriocarpa</i> and <i>Petrophile linearis</i> low isolated shrubs over <i>Alexgeorgea nitens</i> and <i>Lyginia imberbis</i> sparse sedges</p> <p><b>Average species richness: 40 ± 2.50</b></p>	B06, B07, B10, B11, B41, B45	Area 1 Area 2	1027	MNP2013
<p><b>EtBeAn</b></p> <p><i>Eucalyptus todtiana</i> sparse woodland</p> <p><i>Eucalyptus todtiana</i> and <i>Banksia attenuata</i> low sparse woodland over <i>Bossiaea eriocarpa</i> and <i>Hibbertia hypericoides</i> low isolated shrubs over <i>Trachymene pilosa</i> and <i>Gladiolus caryphyllaceus</i> isolated herbs and <i>Alexgeorgea nitens</i> and <i>Mesomelaena pseudostygia</i> sedges</p> <p><b>Average species richness: 38.50 ± 3.95</b></p>	B15, B16R, B17, B18, B19, B32	Area 2	949	MNP2002
<p><b>BmKgHg</b></p> <p><i>Kunzea glabrescens</i> shrubland</p> <p><i>Banksia menziesii</i> and <i>Banksia</i> spp low sparse to open woodland over <i>Kunzea glabrescens</i> and <i>Xanthorrhoea preissii</i> mid shrubland over <i>Hypochaeris glabra</i> and <i>Drosera erythrorhiza</i> isolated herbs</p> <p><b>Average species richness: 14 ± 1.00</b></p>	B14, B37	Area 2	Regionally not represented, locally distributed vegetation unit	NA
<p><b>EtEpAn</b></p> <p><i>Eucalyptus todtiana</i> sparse woodland</p> <p><i>Eucalyptus todtiana</i> and <i>Banksia</i> spp. low sparse woodland over <i>Adenathos cygnorum</i> tall sparse shrubland over <i>Eremaea pauciflora</i> and <i>Stirlingia latifolia</i> mid sparse to isolated shrubland over <i>Bossiaea eriocarpa</i> and <i>Conostephium pendulum</i> low isolated shrubs over <i>Austrostipa hemipogon</i> and <i>Briza maxima</i> grasses and <i>Alexgeorgea nitens</i> sedges</p> <p><b>Average species richness: 24.50 ± 0.70</b></p>	B42, B46	Area 2	949	MNP2002

Vegetation Community and Description	Representative Quadrats	Represented within Survey Area/s	Corresponding Shepherd <i>et.al.</i> code	Equivalent Phoenix Quadrat/s
<p><b>MpRcLf</b></p> <p><i>Melaleuca preissiana</i> sparse woodland</p> <p><i>Melaleuca preissiana</i> and <i>Banksia attenuata</i> low sparse woodland over <i>Regelia ciliata</i> and <i>Jacksonia furcellata</i> mid shrubland over <i>Lechenaultia floribunda</i> low isolated shrubs over <i>Hypochaeris glabra</i> and <i>Ursinia anthemoides</i> isolated herbs and <i>Austrostipa hemipogon</i>, <i>Ehrharta calycina</i> and <i>Pentameris airoides</i> isolated grasses</p> <p><b>Average species richness: 21.67 ± 1.45</b></p>	B43, B47, B48	Area 2	37	M1.31
<p><b>ErHaBr</b></p> <p><i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> sparse woodland</p> <p><i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> low sparse woodland over <i>Aotus gracillima</i> and <i>Xanthorrhoea preissii</i> mid isolated shrubs over <i>Hypocalymma angustifolium</i> low shrubland over <i>Baumea rubiginosa</i> and <i>Cyperus polystachyos</i> sedgeland</p> <p><b>Average species richness: 17.33 ± 8.25</b></p>	B05, B33, B34	Area 1	973	Not represented
<p><b>ErXpLt</b></p> <p><i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> sparse woodland</p> <p><i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> low to mid sparse woodland over <i>Xanthorrhoea preissii</i> and <i>Hakea varia</i> mid isolated shrubs over <i>Lepidosperma tenue</i> and <i>Lepidosperma ?squamatum</i> sparse sedgeland over <i>Hypochaeris glabra</i> and <i>Ursinia anthemoides</i> isolated herbs and <i>Briza maxima</i> isolated grass</p> <p><b>Average species richness: 22.25 ± 2.81</b></p>	B25, B26, B27, B36	Area 2	1009 (or 4)	Not represented



Vegetation Community and Description	Representative Quadrats	Represented within Survey Area/s	Corresponding Shepherd <i>et.al.</i> code	Equivalent Phoenix Quadrat/s
<p><b>CcXpBe</b></p> <p><i>Corymbia calophylla</i> sparse woodland</p> <p><i>Corymbia calophylla</i> mid to low sparse woodland over <i>Xanthorrhoea preissii</i> and <i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i> mid sparse shrubland over <i>Bossiaea eriocarpa</i>, <i>Phyllanthus calycinus</i> and <i>Hypocalymma angustifolium</i> low open shrubland over <i>Hypochoaeris glabra</i>, <i>Lysimachia arvensis</i> and <i>Haemodorum laxum</i> isolated herbs and <i>Briza maxima</i> and <i>Neurachne alopecuroidea</i> isolated grasses</p> <p><b>Average species richness: 36.33 ± 3.18</b></p>	B38, B39, B40	Area 4	999	M1.14a M1.23
<p><b>MvJspLs</b></p> <p><i>Melaleuca viminea</i> shrubland</p> <p><i>Melaleuca viminea</i> tall shrubland over <i>Juncus</i> spp. and <i>Isolepis</i> spp. sparse sedgeland and <i>Cotula cornopifolia</i>, <i>Lotus</i> spp. and <i>Utricularia multifida</i> isolated herbs</p> <p><b>Average species richness: 8.00 ± 1.00</b></p>	B03, B20, B35	Area 1 Area 2	37	M1.31

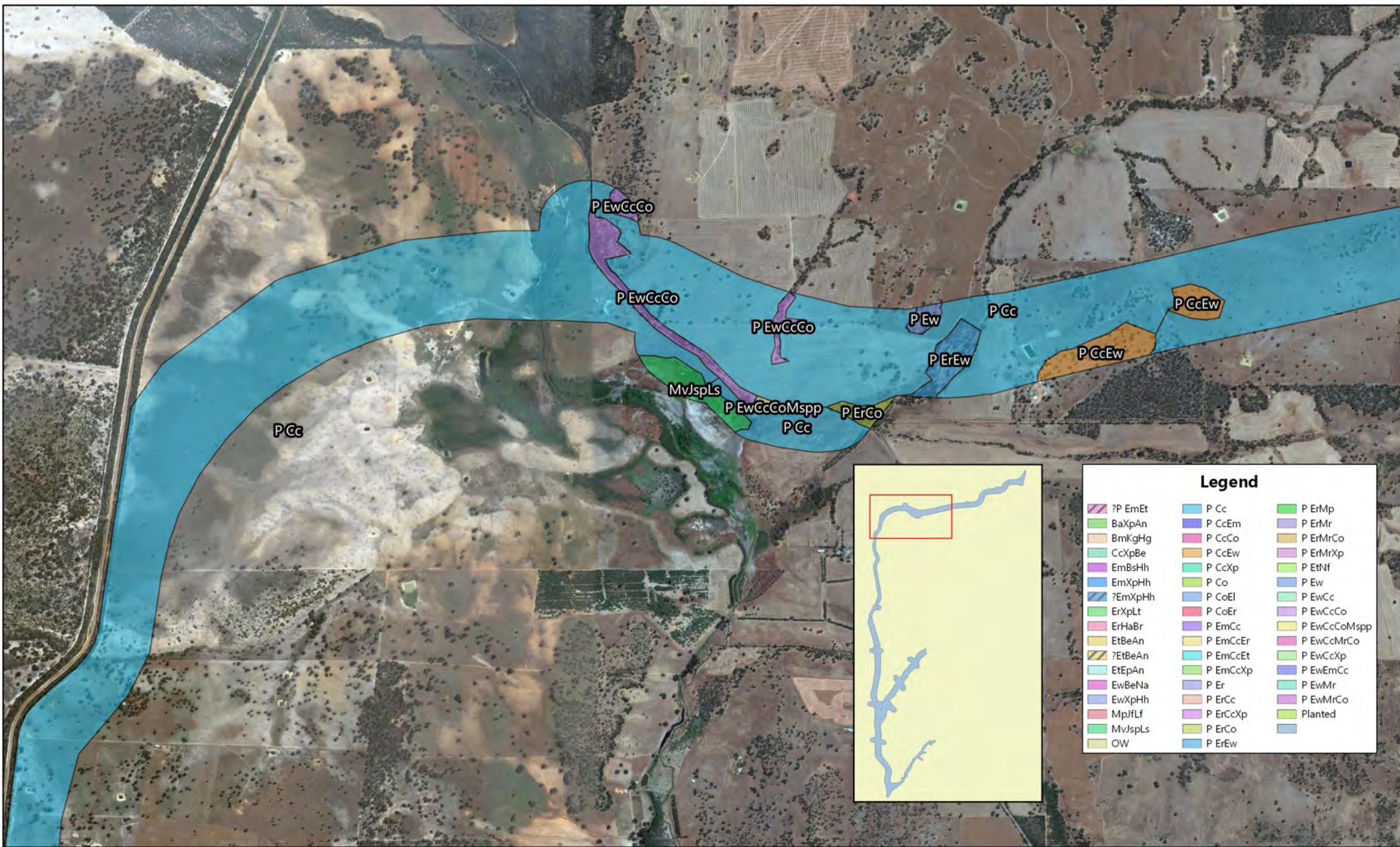


Legend					
	?P EmEt		P Cc		P ErMp
	BaXpAn		P CcEm		P ErMr
	BmKgHg		P CcCo		P ErMrCo
	CcXpBe		P CcEw		P ErMrXp
	EmBsHh		P CcXp		P EtNf
	EmXpHh		P Co		P Ew
	?EmXpHh		P CoEl		P EwCc
	ErXpLt		P CoEr		P EwCcCo
	ErHaBr		P EmCc		P EwCcCoMssp
	EtBeAn		P EmCcEr		P EwCcMrCo
	?EtBeAn		P EmCcEt		P EwCcXp
	EtEpAn		P EmCcXp		P EwEmCc
	EwBeNa		P Er		P EwMr
	EwXpHh		P ErCc		P EwMrCo
	MpJfLf		P ErCcXp		Planted
	MVJspLs		P ErCo		
	OW		P ErEw		

0 0.25 0.5 0.75 1 km

Figure 13a - Vegetation Communities of the Study Area

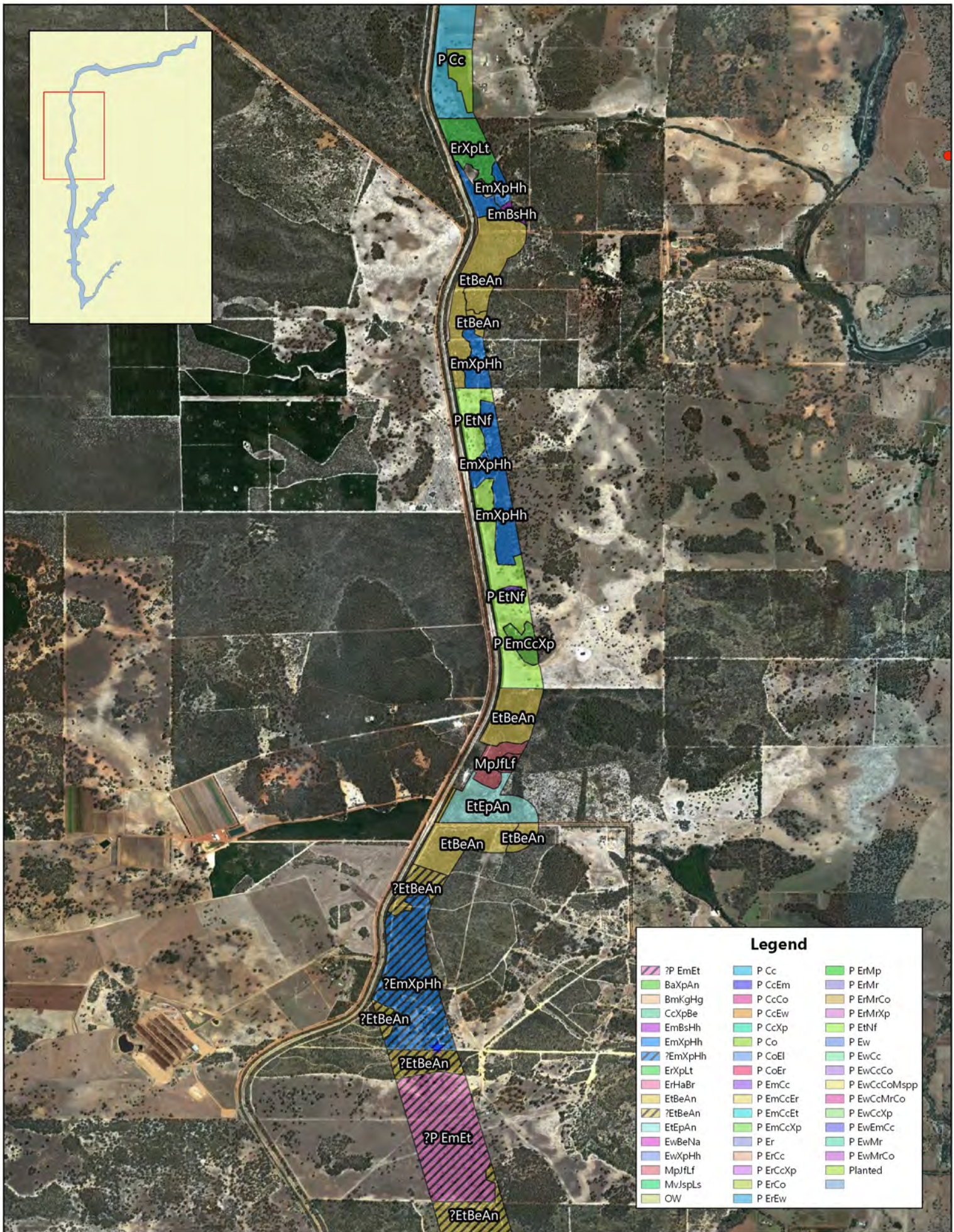




0 0.25 0.5 0.75 1 km

**Figure 13b - Vegetation  
Communities of the Study Area**



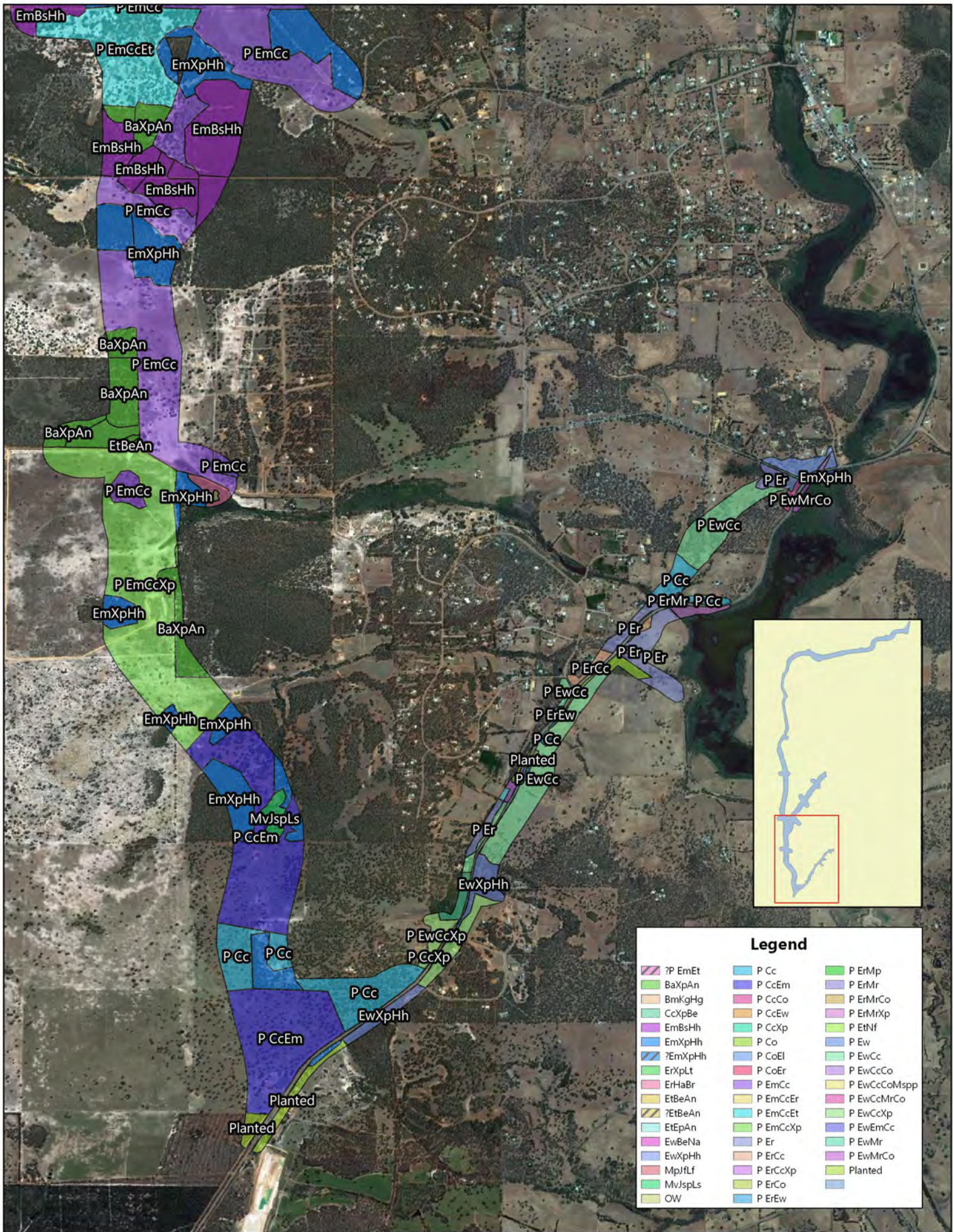


0 0.25 0.5 0.75 1 km

**Figure 13c - Vegetation Communities of the Study Area**







0 0.25 0.5 0.75 1 km



**Figure 13e - Vegetation Communities of the Study Area**

A large proportion of the study area comprises cleared land/pasture, mostly cleared or degraded areas, usually supporting native trees in varying densities. Where native understorey is completely lacking or almost so, and the ground cover is entirely pasture grasses and/or other weeds, areas have been mapped as 'Pasture' (P) communities. In the vegetation mapping, such areas are designated a 'P' before a two-letter code for the genus and species of the trees present in that area of pasture. For example, an area of pasture or completely degraded understorey with Marri (*Corymbia calophylla*) is coded 'P Cc'. A number of areas were found to support multiple tree species and therefore, the mapping codes indicate this also. The species of trees as present in the pasture communities of the study area are listed in **Table 11**.

**Table 11 Codes for Tree Species Present in Pasture Communities**

Code	Species
Cc	<i>Corymbia calophylla</i>
Co	<i>Casuarina obesa</i>
El	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>
Em	<i>Eucalyptus marginata</i>
Er	<i>Eucalyptus rudis</i>
Et	<i>Eucalyptus todtiana</i>
Ew	<i>Eucalyptus wandoo</i>
Mp	<i>Melaleuca preissiana</i>
Mr	<i>Melaleuca rhapsiophylla</i>
Msp	<i>Melaleuca</i> species
Mv	<i>Melaleuca viminea</i>
Nf	<i>Nuytsia floribunda</i>
Xp	<i>Xanthorrhoea preissii</i>

Most of the vegetation communities recorded relatively high average species richness values (with at least 20-30 taxa per quadrat). The most floristically diverse vegetation units were BaXpAn (*Banksia* spp. sparse woodland), EmXpHh (*Eucalyptus marginata* sparse woodland) and EwXpHh (*Eucalyptus wandoo* sparse woodland), recording average species richness values of 40, 39 and 39 taxa, respectively. The lowest average species richness of eight species was recorded from the vegetation unit MvJspLs (*Melaleuca viminea* shrubland), a wetland vegetation type.

The total area occupied by each of the intact vegetation communities, the combined degraded 'pasture' communities, planted areas and other areas such as those completely cleared and supporting open water, within each of the survey areas is presented in **Table 12**.

**Table 12** Areas of Varying Vegetation Communities

Vegetation Community/ Area Type	Area (ha)				
	Area 1	Area 2	Area 3	Area 4	Total
BaXpAn	42.54	35.29	-	-	<b>77.83</b>
BmKgHg	-	13.02	-	-	<b>13.02</b>
CcXpBe	-	-	-	3.55	<b>3.55</b>
EmBsHh	-	62.8	79.99	-	<b>142.79</b>
EmXpHh	48.82	147.12	77.31	18.27	<b>291.52</b>
?EmXpHh	-	48.93	-	-	<b>48.93</b>
ErHaBr	4.06	-	-	-	<b>4.06</b>
ErXpLt	-	16.37	-	-	<b>16.37</b>
EtBeAn	0.95	102.62	-	-	<b>103.57</b>
?EtBeAn	-	48.67	-	-	<b>48.67</b>
EtEpAn	-	19.43	-	-	<b>19.43</b>
EwBeNa	-	3.43	-	-	<b>3.43</b>
EwXpHh	6.76	22.71	-	-	<b>29.47</b>
MpRcLf	-	9.48	-	-	<b>9.48</b>
MvJspLs	4.99	7.66	-	-	<b>12.65</b>
Open water	0.34	-	-	-	<b>0.34</b>
Pasture	384.23	1,490.18	639.11	211.26	<b>2,724.78</b>
Planted	12.45	26.69	12.64	18.66	<b>70.44</b>
Cleared	-	3.18	-	-	<b>3.18</b>
<b>Total</b>	<b>505.14</b>	<b>2,057.58</b>	<b>809.05</b>	<b>251.74</b>	<b>3,623.51</b>

### 6.3 VEGETATION CONDITION

The vegetation of the study area was found to range from Completely Degraded (CD) to Excellent (Ex) (7 to 2 in accordance with the quantitative scale), with most areas found to be in 'Degraded to Completely Degraded' (D-CD) condition. The spatial extent of the varying vegetation condition across the study area is presented in **Figure 14**, and the areas of each condition category are presented in **Table 13**.



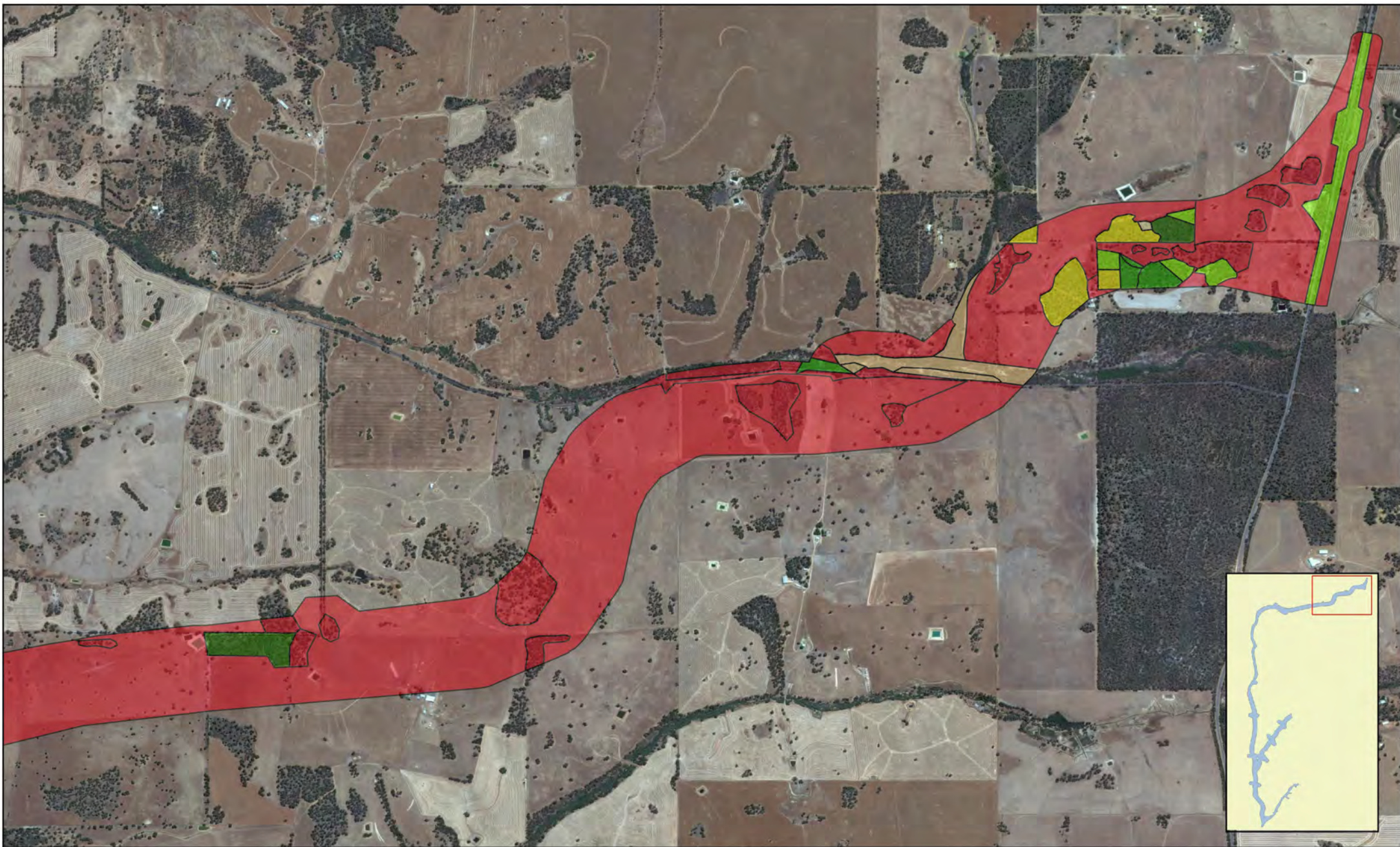
**Table 13**      **Areas of Varying Vegetation Condition**

Qualitative Vegetation Condition Rating	Quantitative Vegetation Condition Rating	Area 1 (ha)	Area 2 (ha)	Area 3 (ha)	Area 4 (ha)	Total Area (ha)	Proportion of Total Study Area (%)
Pristine (P)	1	0	0	0	0	0	<b>0</b>
Excellent (Ex)	2	16.50	11.30	36.13	NA	63.93	<b>1.76</b>
Very Good to Excellent (VG-Ex)	2-3	24.23	36.46	17.55	NA	78.24	<b>2.16</b>
Very Good (VG)	3	23.42	215.60	27.98	3.55	270.55	<b>7.47</b>
Good to Very Good (G-VG)	3-4	0.77	195.23	13.46	NA	209.46	<b>5.78</b>
Good (G)	4	7.69	56.33	6.42	NA	70.44	<b>1.94</b>
Degraded to Good (D-G)	4-6*	16.89	12.12	NA	25.79	54.80	<b>1.51</b>
Degraded (D)	6	27.54	21.58	62.46	12.08	123.66	<b>3.41</b>
Degraded to Completely Degraded (D-CD)	6-7	384.23	1479.09	632.41	206.45	2702.18	<b>74.57</b>
Completely Degraded (CD)	7	3.87	29.87	12.64	3.87	50.25	<b>1.39</b>
<b>Total</b>		505.14	2057.58	809.05	251.74	3623.51	<b>100</b>

\*No rating score of 5 applies to the South-West and Interzone regions (EPA & DPaW 2015)

A large proportion of the study area (74.57%, 2,702.18 ha) is in 'Degraded to Completely Degraded' condition and is represented by cleared pasture with occasional trees or stands of trees, usually native Eucalypts. The presence and condition of native understorey is a key factor in determining vegetation condition and therefore most areas of pasture supporting native trees but with no understorey, even if in relatively dense proportions, are classified as 'Degraded to Completely Degraded'. Such pasture areas dominate the study area and the general landscape of the region.

A total of 692.62 ha (19.11%) of the study area was recorded to be in 'Good' condition or better, with 63.93 ha (1.76%) in 'Excellent' condition, but 2,930.89 ha (80.89%) in poorer than 'Good' condition. Across all for survey areas, the majority of the vegetation condition was found to be 'Degraded to Completely Degraded', with relatively small proportions of each survey area supporting vegetation in 'Very Good' or 'Excellent' condition. There are significant areas of vegetation in 'Very Good' or better condition within Areas 1, 2 and 3, however, these areas are proportionate to the size of each survey area (e.g. Area 2 occupies a significantly larger area, and also supports greater area of better quality vegetation).



0 0.25 0.5 0.75 1 km

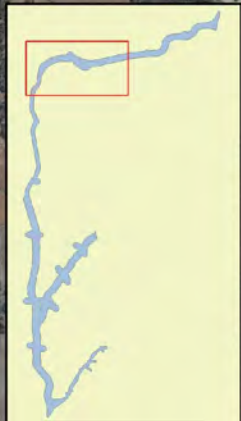
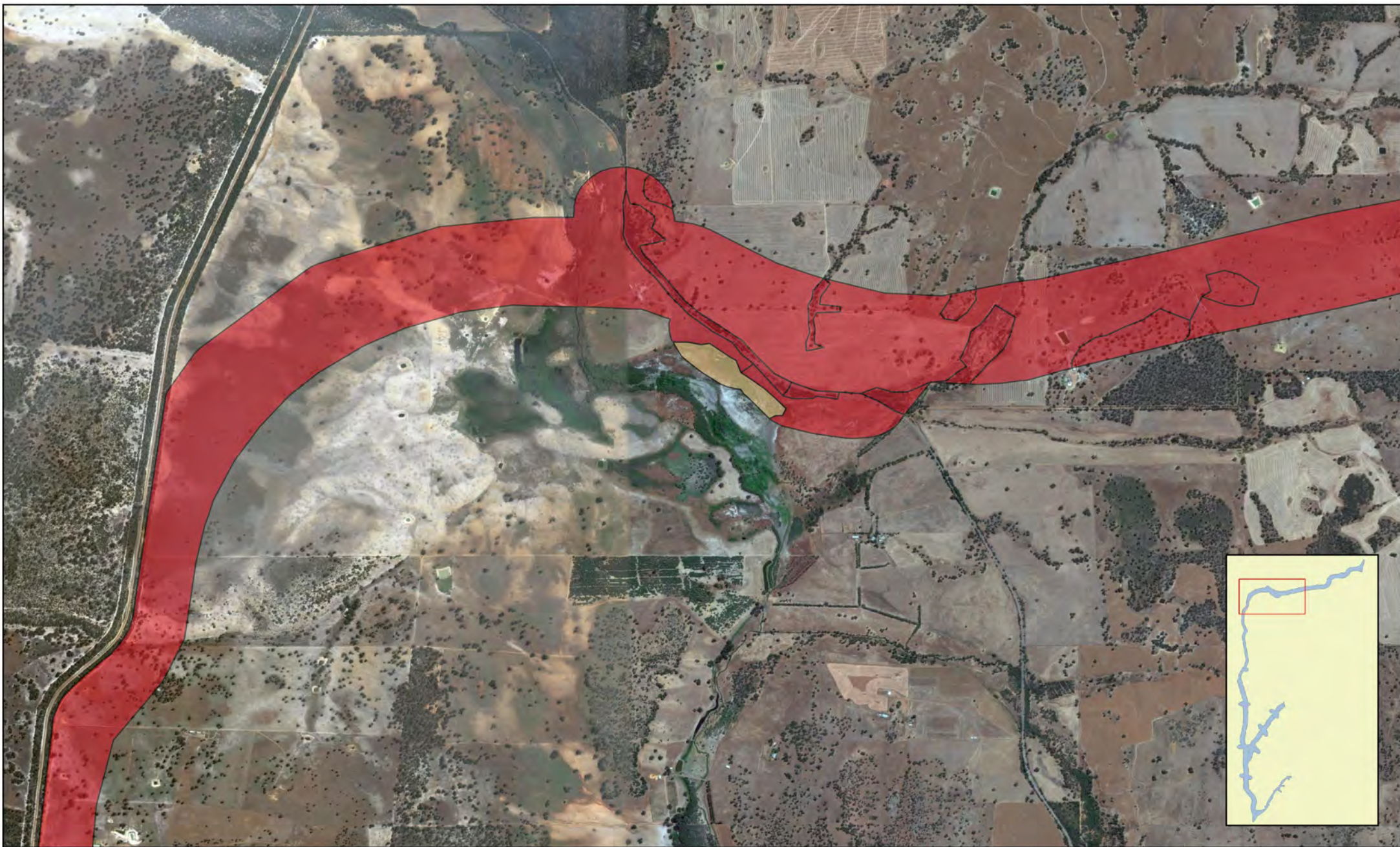


**Figure 14a - Vegetation  
Communities of the Study Area**



**Legend**

- |      |       |       |
|------|-------|-------|
| CD   | G     | ?VG   |
| D-CD | G-VG  | VG-Ex |
| D    | ?G-VG | Ex    |
| G-D  | VG    |       |



0 0.25 0.5 0.75 1 km

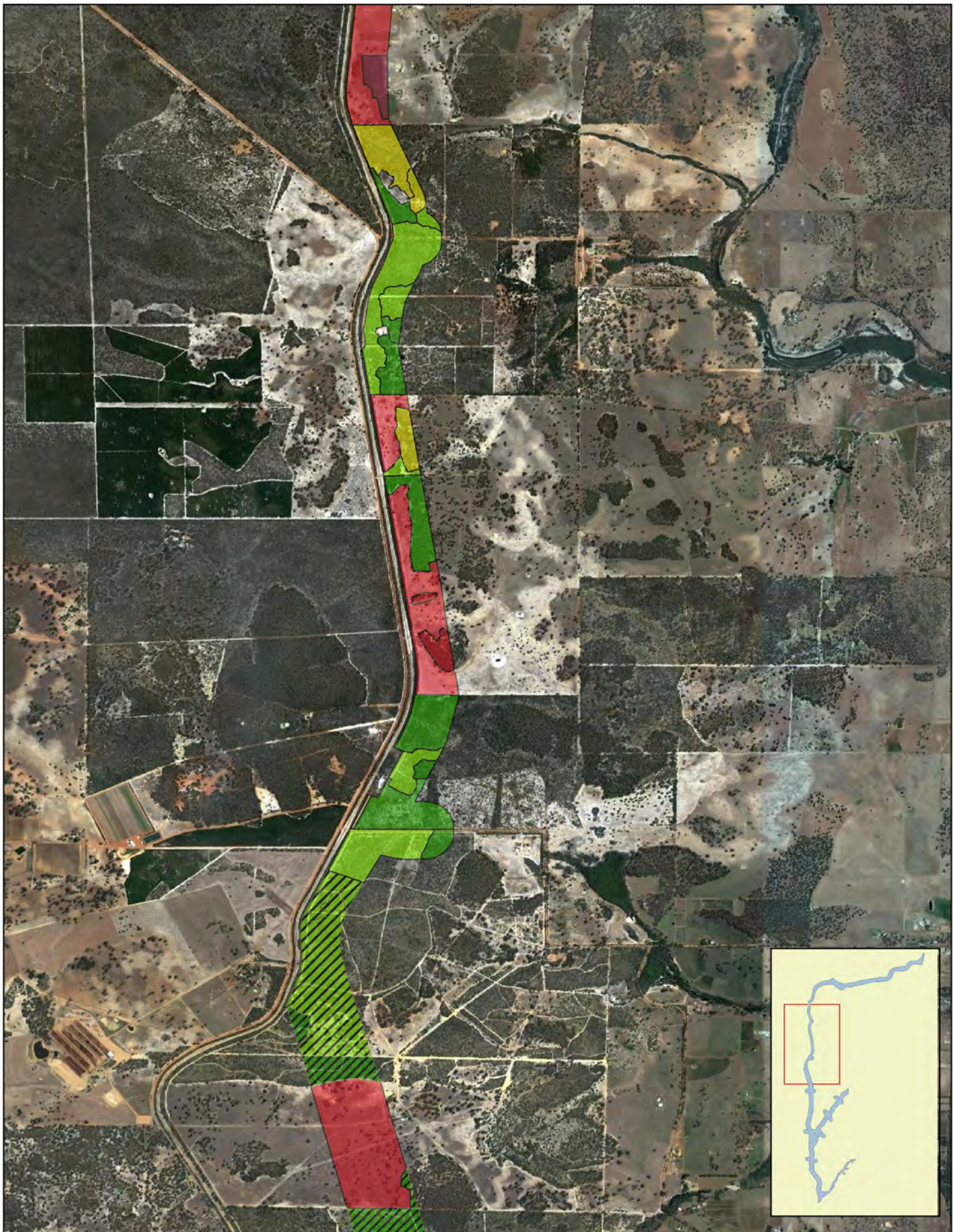


**Figure 14b - Vegetation  
Communities of the Study Area**



**Legend**

- |      |       |       |
|------|-------|-------|
| CD   | G     | ?VG   |
| D-CD | G-VG  | VG-Ex |
| D    | ?G-VG | Ex    |
| G-D  | VG    |       |



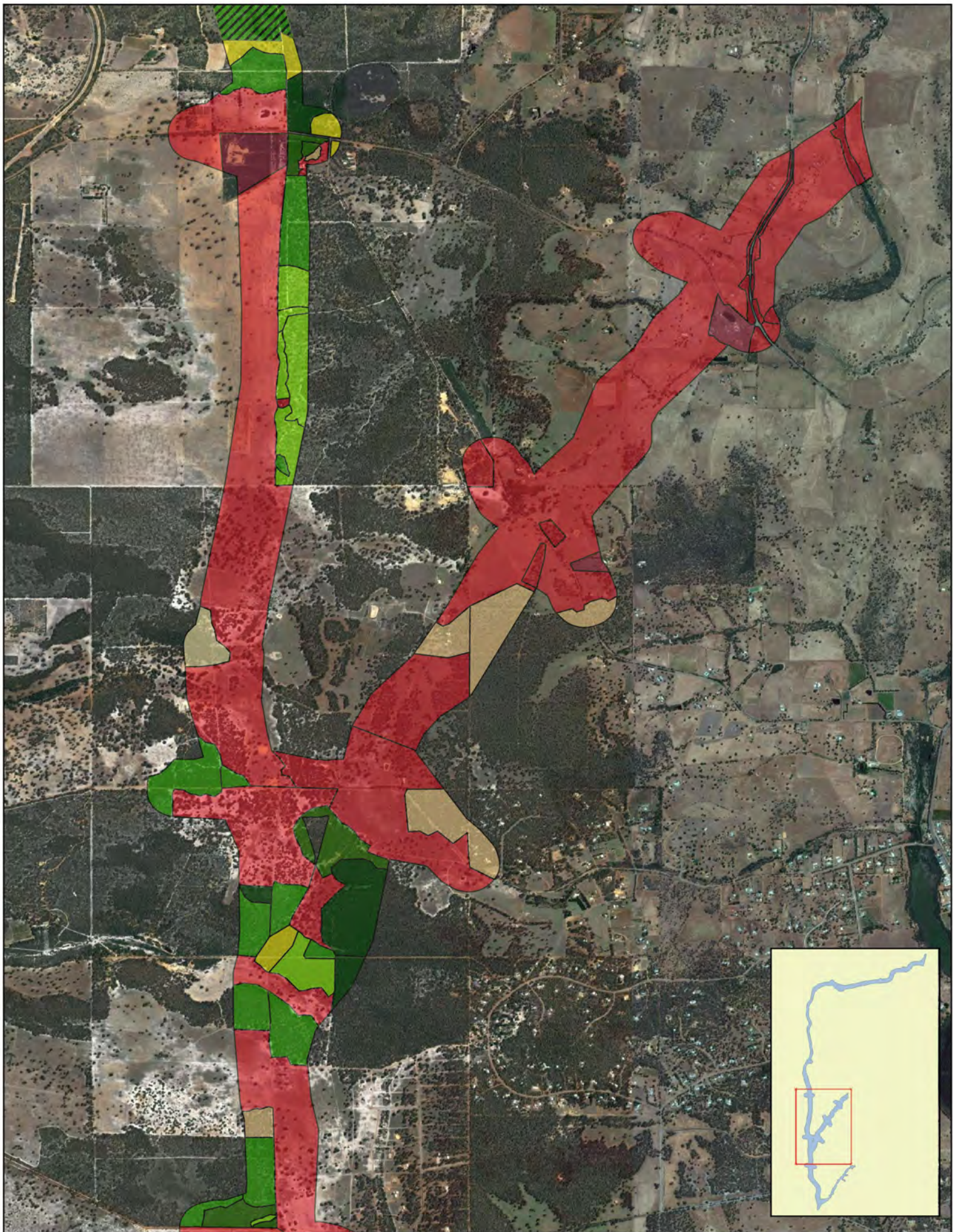
0 0.25 0.5 0.75 1 km



**Figure 14c - Vegetation Communities of the Study Area**

**Legend**

- |      |       |       |
|------|-------|-------|
| CD   | G     | ?VG   |
| D-CD | G-VG  | VG-Ex |
| D    | ?G-VG | Ex    |
| G-D  | VG    |       |



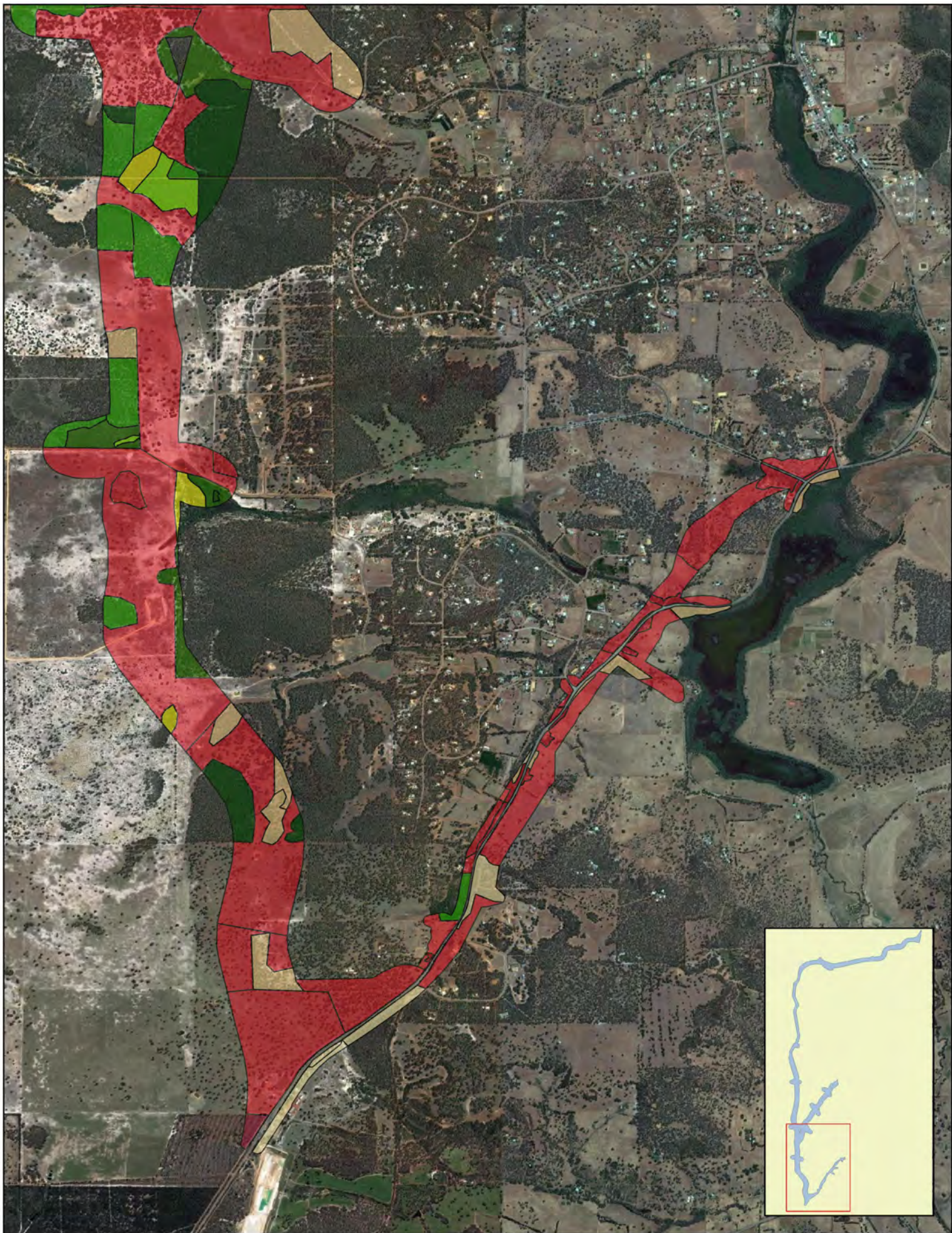
0 0.25 0.5 0.75 1 km



**Figure 14d - Vegetation Communities of the Study Area**

**Legend**

- |      |       |       |
|------|-------|-------|
| CD   | G     | ?VG   |
| D-CD | G-VG  | VG-Ex |
| D    | ?G-VG | Ex    |
| G-D  | VG    |       |



0 0.25 0.5 0.75 1 km



**Figure 14e - Vegetation Communities of the Study Area**

**Legend**

- |      |       |       |
|------|-------|-------|
| CD   | G     | ?VG   |
| D-CD | G-VG  | VG-Ex |
| D    | ?G-VG | Ex    |
| G-D  | VG    |       |

## 7 DISCUSSION

### 7.1 FLORA

The 350 flora taxa recorded from 183 genera and 56 families is considered relatively high species diversity, but is also reflective of the diversity of landform types, geology/soils and vegetation types across the study area, where two botanical and IBRA regions are traversed and where the scarp and Dandaragan Plateau of the Northern Jarrah Forest transitions to the deep sands of the Swan Coastal Plain.

The most dominant families represented are Fabaceae, Myrtaceae, Proteaceae and Asteraceae, which is typical of flora of the region and the south-west botanical province.

No species of flora listed as Threatened under the WC Act or under the EPBC Act, nor any species exhibiting range extensions were recorded.

Seven species of Priority Flora, listed under the WC Act were recorded, from 13 different locations and all of the survey areas, and spanning six of the 13 recorded vegetation types (**Table 9**). Two species, *Gastrolobium ?crispatum* and *Drosera ?sewelliae* are uncertain in their identification to species level, due to inadequate material for identification purposes. However, both collections are considered to likely be the queried Priority flora, and one collection certainly identified as *Drosera sewelliae* was also made.

All seven of the Priority flora species recorded resulted from the desktop assessment (**Appendix A**). A further 87 species of conservation significance resulted from the desktop assessment, with 11 of these 94 considered 'likely to occur' within the study area, 30 classified as 'may occur' and 48 considered 'unlikely to occur'. Of the further 87 flora species of conservation significance presented in **Appendix A**, 29 are listed as Threatened, with 27 of these of Commonwealth (EPBC) significance. All 27 species are considered 'unlikely to occur' (20 species) or have been classified as 'may occur' (nine species), with none considered 'likely to occur' based on the proximity of previous records, currency of the data, and whether or not suitable habitat is provided in the study area.

It is considered likely that the distribution and abundance of the Priority flora recorded within the study area is more vast and abundant than the assessment results would suggest. It is also possible that additional species of Priority flora occur that were not recorded. This is due to the fact that as per the scope of the project, and as part of a typical Level 2 assessment approach (which focuses on the assessment of quadrats), only selective and opportunistic searches were conducted for Threatened and Priority flora (besides *Thelymitra stellata*, for which significant targeted effort was invested) and dedicated targeted surveys for Priority flora have not yet been carried out within the study area. In this regard, now that a suite of certainly occurring species is known and detailed data is available for determination of suitable habitats for other conservation significant flora, a dedicated targeted survey of the relevant route could be carried out as part of future phases of assessment.

None of the recorded introduced (weed) species are listed as Declared Pest plants under the BAM Act within the districts of the study area.



The timing of the field survey was considered optimal for the majority of flora, with only 15 of the 351 recorded taxa unable to be identified with certainty to species or infra-species level.

### 7.1.1 Targeted *Thelymitra stellata* Survey

Despite the intensive targeted surveys that systematically searched for *Thelymitra stellata* in areas of optimal or potential habitat, no individuals were recorded. The survey encompassed more than 150 km of walked transect lines covering approximately 75 ha of searched ground (assumes an average visibility of 2.5 m either side of walked centrelines), within more than 220 hectares of search areas included. Four of the recorded vegetation communities, EmXpHh, EwXpHh, EwBeNa and CcXpBe are considered suitable habitat for *Thelymitra stellata*, and these areas total 376.9 ha within the study area. Therefore approximately 58% of suitable habitat was searched, which exceeds the target of 50%.

The timing of the survey which was carried out between 14-23 November 2016 was considered suitable for the identification of the species. Verification of the flowering status of a known *Thelymitra stellata* plant in a location in Chittering, nearby to the study area was carried out before the commencement at following the completion of the targeted surveys (**Plate 2**). Observations of this plant indicated that the peak flowering time of the species in the region may have already passed before the field survey commenced, however, identification of the correct species was still considered possible. This is considered primarily based on the distinctive appearance of the large flowers/fruit, the colour and glabrous (non-hairy) nature of the stem and fruits and the taller height in comparison to similar species of orchid. However, it is recommended that any future surveys consider the potential suitability for the survey conducted earlier in November if similar climatic conditions (particularly rainfall volumes and timing and day-time temperatures) are experienced to those of late winter and early spring 2016, to optimise chances of accurate detection, should populations exist in the study area.



**Plate 2** *Thelymitra stellata* individual from a known location outside the study area, photographed on 14 November (left) and 23 November (right) 2016

## 7.2 VEGETATION

### 7.2.1 TECs and PECs

The State-listed TEC and two PECs of the study area, as revealed by the DPaW database search results are; 'SCP 20a – *Banksia attenuata* woodlands over species rich dense shrublands' (EN TEC), 'Banksia woodlands of the Gingin area restricted to soils dominated by yellow to orange sands' (P2 PEC) and 'SCP 23b – Northern Swan Coastal Plain *Banksia attenuata* – *Banksia menziesii* woodlands' (P3 PEC). All three of these ecological community types are also classified as likely to be equivalent to the Commonwealth listed Banksia woodland TEC.

The Banksia woodlands of the Gingin area ecological community or its buffer is known to occur within the Western A (Area 2) survey area (**Figure 8**) and in this location, corresponds with vegetation community BaXpAn and an area of vegetation expected to more than likely represent vegetation community EtBeEn (**Figure 13**). However, the vegetation supported by the section of the study area thought to represent EtBeAn (designated as ?EtBeAn) was not able to be confirmed via survey due to access restrictions. A very pronounced occurrence of sudden yellow to orange sands was also

observed immediately north of Barn Road (approximately half way along Area 2), where vegetation community EtBeAn has been mapped.

Based on species composition and other characteristics of the Banksia woodlands TEC, vegetation community EtEpAn is also considered to be a likely representation of the Commonwealth-listed TEC.

The total area of likely Banksia woodland TEC within the study area is 22.67 ha, consisting of occurrences of vegetation communities BaXpAn, EtBeAn (including ?EtBeAn) and EtEpAn, all occurring within the Western A (Area 2) study area.

The spring flora and vegetation assessment scope was developed prior to the Banksia Woodlands of the Swan Coastal Plain being announced as a Commonwealth-listed TEC, in Spetmeber 2016. However, future assessments will focus on Banksia woodlands and incorporate methodologies that will enable assessment against the key diagnostic characteristics (Threatened Species Committee 2016) for determination of the presence of the TEC. Further assessment work, including the establishment and scoring of replicate plots (quadrats) will accurately characterise and map the extent of the Banksia woodlands (Commonwealth-listed) TEC within the study area, based on the prescriptive requirements of its definition (Threatened Species Scientific Committee 2016). Importantly, confirmation of the potential presence of this TEC within the previously inaccessible property would also be required to accurately define the extent and quality of this significant vegetation.

### 7.2.2 Local Representation and Significance

The local significance of the vegetation communities was assessed based on:

- presence of Priority Flora
- presence of flora exhibiting range extensions
- unusually high structural and species diversity
- restricted, small or isolated distribution and/or area.

Six of the thirteen mapped vegetation communities, CcXpBe, EmXpHh, EmBsHh, EtBeAn, ErXpLt, EwBeNa recorded Priority flora, and are therefore considered to be of local significance.

None of the recorded flora species were found to be exhibiting range extensions, and therefore none of the vegetation types are considered locally significant due to this factor.

None of the recorded vegetation communities were found to exhibit unusually high structural diversity, although most of the intact vegetation types of the Swan Coastal Plain are considered to be structurally and floristically diverse. Additionally, four of the recorded vegetation communities, EmXpHh, EwXpHh, BaXpAn and EtBeAn recorded species richness averages of 38 taxa or more per 100 m<sup>2</sup> from quadrats assessed as part of this study in 2016. Therefore, these vegetation types are considered locally significant due to high species diversity and their relatively high structural diversity is also notable.

The representation of each of the recorded vegetation communities within the study area is presented in **Table 14**, which shows that communities EwBeNa, BmKgHg, EtEpAn, MpRcLf, ErHaBr, ErXpLt and MvJspLs are limited in their local extent and are therefore considered to be locally significant.

**Table 14**      **Extent of Each Vegetation Community in the Study Area**

Vegetation Community	Area (ha)	Proportion of Study Area (%)
EmXpHh - <i>Eucalyptus marginata</i> sparse woodland (including ?EmXpHh)	269.68	7.54
EmBsHh - <i>Eucalyptus marginata</i> and <i>Banksia sessilis</i> sparse woodland	140.49	3.93
EwXpHh - <i>Eucalyptus wandoo</i> sparse woodland	41.92	1.17
EwBeNa - <i>Eucalyptus wandoo</i> and <i>Casuarina obesa</i> sparse woodland	4.00	0.11
BaXpAn - <i>Banksia</i> spp. sparse woodland	90.86	2.54
EtBeAn - <i>Eucalyptus todtiana</i> sparse woodland (including ?EtBeAn)	175.27	4.90
BmKgHg - <i>Kunzea glabrescens</i> shrubland	14.75	0.41
EtEpAn - <i>Eucalyptus todtiana</i> sparse woodland	22.67	0.63
MpRcLf - <i>Melaleuca preissiana</i> sparse woodland	11.07	0.31
ErHaBr - <i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> sparse woodland	4.74	0.13
ErXpLt - <i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> sparse woodland	19.09	0.53
CcXpBe - <i>Corymbia calophylla</i> sparse woodland	40.33	1.13
MvJspLs - <i>Melaleuca viminea</i> shrubland	15.26	0.43
Pasture communities and planted areas	2,764.09	77.25%

### 7.2.3 Regional Significance

The regional significance of the vegetation communities was assessed based on:

- presence of Threatened flora
- extents limited to specific landform types
- regionally uncommon or restricted plant community types.

No Threatened flora species were recorded within the study area, and therefore, none of the vegetation types are considered regionally significant due to this factor.

The study area supports three broad landforms:

- woodlands and forests on lateritic hills of the Northern Jarrah Forest
- woodlands and heaths on sands of the Swan Coastal Plain
- wetlands and surrounding low-lying/wet vegetation associated with both the Northern Jarrah Forest and Swan Coastal Plain vegetation.

The wetland landforms and associated vegetation types are relatively less represented in the study area than the other two key landforms listed above. The vegetation types associated with such landforms are EwBeNa, BmKgHg, MpRcLf, ErHaBr, ErXpLt and MvJspLs, which may therefore be considered to be of regional significance.

#### 7.2.3.1 Regional Representation and Extent Remaining

Native vegetation significance can be determined based on a range of factors such as isolation, vegetation supporting conservation significant flora or fauna or representing an unusual landform type, as discussed above. However, the most important factor in consideration of community significance is the representation of the vegetation type in the region. Vegetation communities are considered significant if they are poorly represented.

In order to analyse the regional representation and therefore significance of the vegetation types recorded in the study area, comparisons were made between data from this study and that of regional data available in published work, focused on Shepherd *et al.* (2002), as well as the most recent relevant survey in the region, carried out by Phoenix Environmental Sciences for the Great Northern Highway upgrades at Muchea North and Chittering (Phoenix 2015).

This regional vegetation analysis initially used multivariate cluster analysis of species presence/absence using PATN™ (Belbin 2013), and was performed with data from each quadrat of the current (FVC spring 2016) survey and that of Phoenix (2015) providing a total of 77 sampling points. The presence and absence data were consolidated with some adjustments to the species matrices to update synonyms to currently accepted nomenclature (Western Australian Herbarium 1998-2017) to maintain consistency across the surveys. An association matrix of the Bray-Curtis coefficient was generated from the presence and absence of site by species matrix using the software.

The resultant dendrogram is presented in **Figure 15** and was used to determine the similarity between the described vegetation units of the 2016 FVC survey and those from the nearby survey by Phoenix (2015).

In order to gain a wider context for assessing the regional representation of the vegetation units of the current study, the vegetation types recorded were also aligned with the broad, regional vegetation

associations of Shepherd *et al.* (2002), relevant to the region of the study area. These alignments are also presented in **Figure 15**. Where regional vegetation associations had been aligned by Phoenix (2015) to recorded vegetation types, or where the aligned regional associations were part of the suite considered for this Bindoon bypass assessment, these are also presented in **Figure 15**.

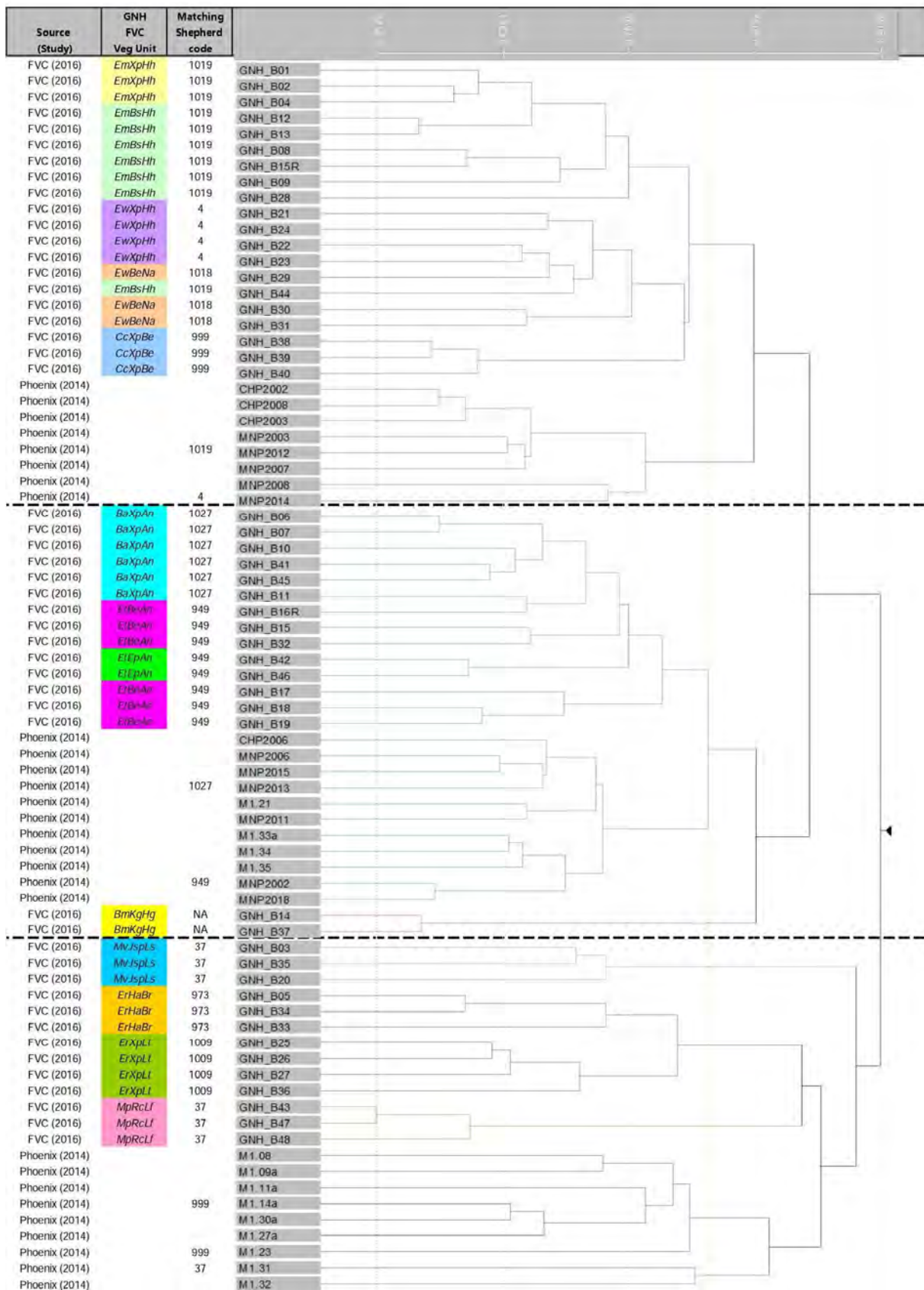
Given that data is available pertaining to the representation of the regional (Shepherd *et. a/* 2002) vegetation associations within the relevant Local Government (Shire of Chittering), conclusions as to regional representation, extent remaining and therefore significance are able to be made. The results of this analysis are presented in **Table 15**.

EPA Position Statement No. 2 (EPA 2000) identifies a series of constraints in relation to biodiversity. One of which is to protect at least 30% of the original extent of vegetation complexes in unconstrained areas and 10% in constrained areas such as urban zones in accordance with the principles of Bush Forever (Government of Western Australia 2000). The study area is considered to be an unconstrained area and as such the minimum retention target of 30% applies.

Within the Shire of Chittering three of the vegetation associations represented by vegetation communities within the study area (4, 999 and 1018) are represented by less than 30% of their pre-European extent remaining (**Table 15**). Therefore, these vegetation associations and the vegetation communities that align with them (EwXpHh, CcXpBe and EwBeNa) are considered to be regionally significant.

One vegetation community, BmKgHg was not found to be representative of any of the regional (Shepherd *et. a/* 2002) vegetation associations (as defined by Shepherd *et. a/* 2002). This community type was also observed to be locally restricted to two locations in the study area, associated with a wetland, with the two locations separated only by Mooliabeenee Road. This vegetation community is therefore considered to be locally and regionally significant, due to limited local and regional representation, as well as being limited to specific landform type (wetland).

Two mapped vegetation communities, ErXpLt and EwBeNa were found to be representative of vegetation associations present in the wider region (1009 and 1018), both of which are not regionally mapped as occurring in the immediate vicinity of the study area. These vegetation types are therefore considered to be of further regional significance.



**Figure 15 Regional Vegetation Analysis Dendrogram**

**Table 15 Regional Extent of Vegetation Associations within the Shire of Chittering and Study Area, as Represented by Vegetation Communities Recorded**

Shepherd <i>et.al.</i> (2002) Association	Description	Corresponding Vegetation Community/ies	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	Extent in the Study Region	% of the Extent in Study Region
4	Medium woodland; marri & wandoo	EwXpHh	54,209.81	15,314.37	28.25	21,458.48	16.80
37	Shrublands; teatree thicket	MpRcLf, MvJspLs	139.52	104.10	74.62	608.48	0.48
949	Low woodland; <i>banksia</i>	EtBeAn, EtEpAn,	13,749.46	12,749.33	92.73	8,057.08	6.31
973	Low forest; paperbark ( <i>Melaleuca raphiophylla</i> )	ErHaBr	242.04	108.87	44.98	284.48	0.22
999	Medium woodland; marri	CcXpBe	222.11	41.02	18.47	135.11	0.11
1009*	Medium woodland; marri & river gum	ErXpLt	6,839.88	2,169.17	31.71	0	0
1018	Mosaic: Medium forest; jarrah-marri/Low woodland; banksia/Low forest; teatree/Low woodland; <i>Casuarina obesa</i>	EwBeNa	2,861.34	629.63	22.00	0	0
1019	Medium sparse woodland; jarrah & marri	EmXpHh, EmBsHh	511.19	192.11	37.58	944.04	0.74
1027	Mosaic: Medium open woodland; jarrah & marri, with low woodland; banksia/Medium sparse woodland; jarrah & marri	BaXpAn	12,176.15	5,626.35	46.21	16,722.21	13.09

\*Not documented as represented in Shire of Chittering, therefore values presented are for Shire of Gingin



#### 7.2.4 National Significance

The national significance of the vegetation communities was assessed based on:

- presence of Threatened flora
- presence of national (EPBC) listed TECs.

No species of Threatened flora were recorded within the study area, and therefore none of the vegetation types are considered nationally significant due to this factor.

As discussed in **Section 7.2.1**, three of the recorded vegetation communities, BaXpAn, EtBeAn (including ?EtBeAn) and EtEpAn are considered likely to be representative of the Commonwealth-listed TEC, Banksia woodlands of the Swan Coastal Plain and, therefore, these areas of vegetation are considered to be of national significance (**Figure 14**).

#### 7.2.5 Summary of Vegetation Significance

The significant vegetation communities of the study area, along with the factors determining their significance are summarised in **Table 16**.

**Table 16 Summary of Significant Vegetation Communities**

Vegetation Community	Represented in Survey Area/s	Significance
EmXpHh - <i>Eucalyptus marginata</i> sparse woodland (including ?EmXpHh)	1, 2, 3 & 4	Locally significant (supports Priority flora) Locally significant (floristically diverse) Regionally significant (represented by <30% of pre-European extent)
EmBsHh - <i>Eucalyptus marginata</i> and <i>Banksia sessilis</i> sparse woodland	2 & 3	Locally significant (supports Priority flora)
EwXpHh - <i>Eucalyptus wandoo</i> sparse woodland	1 & 2	Locally significant (floristically diverse)
EwBeNa - <i>Eucalyptus wandoo</i> and <i>Casuarina obesa</i> sparse woodland	2	Locally significant (supports Priority flora) Locally significant (limited local extent) Regionally significant (limited to specific landforms) Regionally significant (represented by <30% of pre-European extent) Regionally significant (not locally represented by regional vegetation associations)
BaXpAn - <i>Banksia</i> spp. sparse woodland	1 & 2	Locally significant (floristically diverse) Nationally significant (likely represents a Commonwealth TEC)
EtBeAn - <i>Eucalyptus todtiana</i> sparse woodland (including ?EtBeAn)	1 & 2	Locally significant (supports Priority flora) Locally significant (floristically diverse) Nationally significant (likely represents a Commonwealth TEC)
BmKgHg - <i>Kunzea glabrescens</i> shrubland	2	Locally significant (limited local extent) Locally significant (locally uncommon) Regionally significant (limited to specific landforms) Regionally significant (regionally uncommon)
EtEpAn - <i>Eucalyptus todtiana</i> sparse woodland	2	Locally significant (limited local extent) Nationally significant (likely represents a Commonwealth TEC)
MpRcLf - <i>Melaleuca preissiana</i> sparse woodland	2	Locally significant (limited local extent) Regionally significant (limited to specific landforms)
ErHaBr - <i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> sparse woodland	1	Locally significant (limited local extent) Regionally significant (limited to specific landforms)
ErXpLt - <i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> sparse woodland	2	Locally significant (supports Priority flora) Locally significant (limited local extent) Regionally significant (limited to specific landforms) Regionally significant (not locally represented by regional vegetation associations)
CcXpBe - <i>Corymbia calophylla</i> sparse woodland	4	Locally significant (supports Priority flora) Regionally significant (represented by <30% of pre-European extent)
MvJspLs - <i>Melaleuca viminea</i> shrubland	1 & 2	Locally significant (limited local extent) Regionally significant (limited to specific landforms)

## 8 CONCLUSIONS

The key results and conclusions from the Level 2 flora and vegetation assessment, and targeted *Thelymitra stellata* survey are as follows:

- Seven species listed as Priority Flora under the *Wildlife Conservation Act 1950*, *Synaphea panhesya* (P1), *Gastrolobium ?crispatum* (P1), *Drosera sewelliae* (with *Drosera ?sewelliae*) (P2), *Acacia drummondii* subsp. *affinis* (P2), *Adenanthos cygnorum* subsp. *chamaephyton* (P3), *Anigozanthos humilis* subsp. *chrysanthus* (P3) and *Hibbertia miniata* (P4) were recorded during the field studies.
- It is considered very likely that the distribution and abundance of the Priority flora recorded within the study area is greater than the assessment results would suggest and that additional species of Priority flora occur that were not recorded, due to the approach of the Level 2 assessment, highlighting the need for further, more detailed surveys to target Priority flora.
- No species of Threatened flora, including *Thelymitra stellata* were recorded within the study area.
- One State-listed TEC and two PECs are known to occur within or closely adjacent to the study area, with all three of these community types representative of the Commonwealth-listed Banksia woodlands of the Swan Coastal Plan TEC.
- The total area of likely Banksia woodland TEC within the study area is 22.67 ha, consisting of occurrences of vegetation communities BaXpAn, EtBeAn (including ?EtBeAn) and EtEpAn, all occurring within the Western A (Area 2) study area.
- Further assessment work would be required to accurately characterise and map the extent of the Banksia woodlands (Commonwealth) TEC within the study area, due to the prescriptive requirements of its definition.
- All of the recorded vegetation communities have been determined to be of local, regional or national significance, or a combination of these levels of importance. Most are locally significant due to supporting populations of Priority flora or having a limited local representation. Other factors determining local significance are, being considered floristically diverse or locally uncommon. Vegetation communities have been determined to be regionally significant due to being represented by less than 30% of their pre-European extent in the local government area, being limited to specific landform types, or being regionally uncommon. Three vegetation communities (BaXpAn, EtBeAn (including ?EtBeAn) and EtEpAn) are of national significance due to likely representing a TEC of Commonwealth significance.

## 9 LIST OF PARTICIPANTS

**Table 17** summarises the FVC personnel who contributed to the project.

**Table 17 Project Team**

Name	Qualification	Years of Relevant Experience	Role
Kellie Bauer – Simpson Principal Ecologist/Botanist	BSc. (Biological Science)	18	Project manager, flora, vegetation and targeted flora field assessment, data analysis, report preparation
Gabriela Martinez Senior Botanist/Environmental Scientist	BEnvSc. (Hons) (Conservation Biology)	16	Flora, vegetation and targeted flora field assessment; report technical review
Lisa Chappell Senior Botanist/Environmental Scientist	BEnvSc. (Hons) (Conservation Biology)	15	Targeted flora field assessment, report preparation
Udani Sirisena Botanist/Taxonomist	PhD Bsc. (Botany and Chemistry)	7	Plant identifications, data and PATN analysis, report preparation
Will Bauer – Simpson Advisor	Cert IV (Health and Safety)	6	Field safety and logistics planning, GIS and mapping
Simon Crofts Senior Spatial Analyst	NA	20	GIS, mapping, spatial data management

## 10 REFERENCES

- Beard, J.S. (1981) *The vegetation of the Swan Area*. 1: 1 000 000 Vegetation Series - Explanatory Notes to Sheet 7, Vegetation Survey of Western Australia. University of Western Australia Press
- Beard, J.S. (1990) *Plant Life of Western Australia*. Kangaroo Press, Kenthurst NSW.
- Beard, J.S., Beeston, G.R., Harvy, 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* Volume 9: 1 - 152
- Belbin, L. (2013) PATN© software <http://www.patn.com.au>
- Bureau of Meteorology (BoM) (2016) *Climate statistics for Australian locations*. Monthly climate statistic. Gingin Aero (Site Number 009178) [http://www.bom.gov.au/climate/averages/tables/cw\\_009178.shtml](http://www.bom.gov.au/climate/averages/tables/cw_009178.shtml) Accessed 17<sup>th</sup> December 2016
- ClimateData.org (2016) *Climate: Bindoon*. <http://en.climate-data.org/location/12593/> Accessed 16<sup>th</sup> December 2016
- Commonwealth of Australia (2013a) *Australia's Bioregions (IBRA)* <http://www.environment.gov.au/land/nrs/science/ibra> Accessed 16<sup>th</sup> December 2016
- Commonwealth of Australia (2013b) Guidelines for detecting orchids listed as 'Threatened' under the *Environment Protection and Biodiversity Conservation Act 1999*
- Department of Agriculture and Food Western Australia (DAFWA) (2016a) *Western Australian Organism List (WAOL)*. <https://www.agric.wa.gov.au/organisms> Accessed 15<sup>th</sup> December 2016
- Department of Agriculture and Food Western Australia (DAFWA) (2016b) *WA Soil Landscape Zone Mapping*. Soil Landscape zones created from all available SW surveys. 1:1000000
- Department of Conservation and Land Management (CALM) (1999), *Environmental Weed Strategy for Western Australia*, CALM, Como, Western Australia.
- Department of Environment and Conservation (DEC) (2011), *Invasive Plant Prioritization Process for DEC - An integrated approach to Environmental Weed Management in WA*.
- Department of Environment and Conservation (DEC) (2013) *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*. Publicly available list prepared by the Department of Environment and Conservation. Western Australia. [https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions\\_categories\\_and\\_criteria\\_for\\_threatened\\_and\\_priority\\_ecological\\_communities.pdf](https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf) Accessed 14<sup>th</sup> December 2016
- Department of Environment and Conservation (DEC) (2001). *Conserving Threatened Ecological Communities*. Publicly available brochure prepared by the Department of Environment and Conservation in conjunction with National Heritage Trust

Department of the Environment (2016) Banksia Woodlands of the Swan Coastal Plain - Draft description and threats

Department of Environment Regulation (DER) (2016) *Clearing permits*. Framework for regulation of clearing of native vegetation. <https://www.der.wa.gov.au/our-work/clearing-permits> Accessed 15th December 2016

Department of Environment Water Heritage and the Arts (DEWHA) (2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*.

Department of Parks and Wildlife (DPaW) (2015) Threatened and Priority Flora List. 11<sup>th</sup> November 2015. Publicly available list prepared by Department of Parks and Wildlife Western Australia. <https://www.DPaW.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants>

Department of Parks and Wildlife (DPaW) (2016a) *FloraBase* [www.florabase.DPaW.wa.gov.au](http://www.florabase.DPaW.wa.gov.au)

Department of Parks and Wildlife (DPaW)(2016b) Threatened and Priority Flora Databases Search Results for Bindoon and Wannamal Area (Search No. 40-1016FL). 17 October 2016

Department of Infrastructure and Regional Development (DOIRD) (2015) *The National Land transport Network*. <http://investment.infrastructure.gov.au/whatis/network/> Accessed 13<sup>th</sup> December 2016

Desmond A (2001) *Swan Coastal Plain 1 (SWA1 – Dandaragan Plateau subregion)* in A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Collaboration between the Department of Conservation and Land Management and the Western Australian Museum

*ecologia* Environment (2004) *Great Northern Highway : assessment of flora and vegetation*. Ecologia Environment Pty Ltd, West Perth WA. Unpublished report prepared for Kellogg Brown and Root (KBR) on behalf of Main Roads Western Australia

English, V. and Blyth, J. (1997) *Identifying and Conserving Threatened Ecological Communities (TECs) in the South West Botanical Province*. ANCA National Reserves System Cooperative Program: Project Number N702. Department of Conservation and Land Management, Wanneroo

ENV. 2007. *Great Northern Highway flora and vegetation assessment – SLK 89 to SLK 114*. ENV. Australia Pty Ltd, Perth, WA. Unpublished Report prepared for Sinclair Knight Merz

Environmental Protection Authority (EPA) (2000) *Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia : Clearing Native Vegetation with Particular Reference to Agricultural Areas*

Environmental Protection Authority (EPA) (2002) Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity

Environmental Protection Authority (EPA) (2004) Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia

Environmental Protection Authority (EPA) (2007) *State of the Environment Report: Western Australia 2007*, Department of Environment and Conservation Perth, Western Australia.

Environmental Protection Authority (EPA) (2008) *Guidance Statement No. 33: Environmental Guidance for Planning and Development*

Environmental Protection Authority (EPA) & Department of Parks and Wildlife (DPaW) (2015) *Technical Guide: Flora and Vegetation Surveys for Environmental Impact Assessment*

GHD (2011a) Report for Great Northern Highway Upgrade: Muchea to Bindoon Environmental Impact Assessment. GHD Pty Ltd, WA. Unpublished report prepared for Main Roads Western Australia

GHD (2011b) *Report for Great Northern Highway Upgrade: Muchea to Bindoon Flora and Fauna Assessment* GHD Pty Ltd, WA. Unpublished report prepared for Main Roads Western Australia

Gibson N, Keighery B, Keighery G, Burbidge A and Lyons M (1994). *A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission, prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Goble-Garratt, E.M. (2005) *Great Northern Highway Upgrade – Bindoon South Section (Hart Drive to Bindoon Townsite SLK 54.6 to 62.0)*. Flora and Vegetation Survey. Unpublished report prepared for Kellogg Brown and Root (KBR)

Government of Western Australia (2000) *Bush Forever, Volume 2: Directory of Bush Forever sites*. Department of Environmental Protection, Perth, Western Australia.

Government of Western Australia (2013). 2012 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis, current as of October 2012. WA Department of Environment and Conservation, Perth. <https://www2.landgate.wa.gov.au/web/guest/downloader>

Havel, J.J. and Mattiske, E.M. (2000), *Vegetation mapping of South West Forest Regions of Western Australia*. Department of Conservation and Land Management, Perth.

Heddle, E. M., Loneragan, O. W., and Havel, J. J (1980) *Vegetation Complexes of the Darling System, Western Australia*. In :*Atlas of Natural Resources*. Western Australia Department of Conservation and Environment

KBR (2005) Preliminary Environmental Impact Assessment. Great Northern Highway, Muchea (SLK 36) to Wubin (SLK 253). Unpublished report prepared for Main Roads Western Wheatbelt North Region

KBR (2006) Environmental Impact Assessment and Management Plan. Great Northern Highway – Bindoon South SLK 54.6 to SLK 62.1. Unpublished report prepared for Main Roads Western Australia Wheatbelt North Region

Keighery BJ, Keighery GJ, Webb A, Longman VM and Griffin EA (2008). *A floristic survey of the Whicher Scarp*. Department of the Environment and Conservation, Perth. 272p

- Keighery, BJ (1994) *Bushland Plant Survey: a Guide to Plant Community Survey for the Community*, Nedlands, Wildflower Society of WA (Inc.).
- Muir, B.G. (1977) *Biological Survey of the Western Australian Wheatbelt - Part II*. Records of the Western Australian Museum, Supplement No 3
- NatureMap (2016) *NatureMap Species Report*. Collaborative project of the Department of Parks and Wildlife and the Western Australian Museum. <https://naturemap.DPaW.wa.gov.au/> Accessed 28<sup>th</sup> December 2016
- Ninox Wildlife Consulting (1989) *Biological Survey – Great Northern Highway: Muchea to Walebing*, Unpublished report prepared for Main Roads, Western Australia
- Phoenix Environmental Services (2015) *Flora and fauna assessment for Muchea North and Chittering study area*. Great Northern Highway, Muchea to Wubin Upgrade Stage 2 Project. Unpublished report prepared for Muchea to Wubin Integrated Project Team (Main Roads WA, Jacobs and Arup)
- Shepherd, DP, Beeston, GR, and Hopkins, AJM (2002), *Native Vegetation in Western Australia – Extent, Type and Status*, Resource Management Technical Report 249, Perth, Department of Agriculture, Western Australia
- Sinclair Knight Mertz (SKM)(2003) *Survey for Significant Flora – Great Northern Highway Road Widening: Walebing to Dalwallinu*. Unpublished report prepared for Western Botanical
- Threatened Species Scientific Committee (2016). Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain Ecological Community. Canberra: Department of the Environment and Energy. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/131-conservation-advice.pdf>. Accessed 6<sup>th</sup> January 2017
- Trudgen, M. E. (1991) *Vegetation Condition Scale*. In : *National Trust (WA) 1993 Urban Bushland Policy*. National Trust of Australia (WA), Wildflower Society of WA (Inc.) and the Tree Society (Inc), Perth, Western Australia.
- Urban Bushland Council (2011). *Perth's Banksia Woodlands, Precious and Under Threat*. Proceedings of a symposium on the ecology of these ancient woodlands and their need for protection from neglect and destruction, 25 March 2011
- Western Botanical (2006) *Flora for extension of proposed disturbances on Great Northern Highway road reserves*. Western Botanical Pty Ltd, Mundaring, WA. Unpublished report prepared for Sinclair Knight Mertz
- Williams, K. & Mitchell, D. (2001). *Jarrah Forest 1 (JF1—Northern Jarrah Forest subregion)*. In: May, J. E. & McKenzie, N. L. (eds) *A biodiversity audit of Western Australia's biogeographical subregions in 2002*. Department of Conservation and Land Management, Perth, WA, pp. 369– 381.



## APPENDIX A: THREATENED AND PRIORITY WITH THE POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Darwinia foetida</i>	Critically Endangered	Endangered	Erect, or spreading, shrub to 0.7 m high. Green flowers in spring	Grey-white sand on swampy, seasonally wet sites	May occur, recorded by Phoenix (2015)	Phoenix (2015)
<i>Caladenia huegelii</i>	Endangered	Critically Endangered	Tuberous, perennial, herb, 0.25-0.6 m high. Flowers green & cream & red, September to October	Grey or brown sand, clay loam	Unlikely to occur, not previously recorded from within Shire of Chittering	EPBC Phoenix (2015)
<i>Drakaea elastica</i>	Endangered	Critically Endangered	Tuberous, perennial, herb, 0.12-0.3 m high. Flowers red & green & yellow, October to November	White or grey sand. Low-lying situations adjoining winter-wet swamps	May occur; previously recorded within Area 2	DPaW (2016) NatureMap
<i>Eremophila scaberula</i>	Endangered	Critically Endangered	Low compact or sprawling to upright shrub, 0.15-0.7(-1.5) m high. Flowers purple-blue, August to October	Clay, sandy clay or loam. Winter-wet plains, inundated areas	Unlikely to occur, known to occur in Moora district	EPBC
<i>Eucalyptus x balanites</i>	Endangered	Critically Endangered	(Mallee), to 5 m high, bark rough, flaky. Flowers white, October to December or January to February	Sandy soils with lateritic gravel	Unlikely to occur, known records occur a significant distance from the study area	EPBC Phoenix (2015)
<i>Gastrolobium hamulosum</i>	Endangered	Critically Endangered	Low shrub, 0.2-0.45 m high. Flowers yellow and orange and red and purple, August to October	Sandy, often gravelly soils or clay. Flats, slopes, ridges	Unlikely to occur, known to occur in Geraldton Sandplains and Avon Wheatbelt IBRA Regions	EPBC
<i>Grevillea althoferorum</i> subsp. <i>fragilis</i>	Endangered	Critically Endangered	Bluish green, lignotuberous shrub. Flowers yellow with reddish to reddish-brown buds, in spring	Base of the Darling Scarp in greyish-yellow colluvial sand. Banksia woodland	May occur, known to occur within the Shire of Chittering	Phoenix (2015)
<i>Grevillea pythara</i>	Endangered	Critically Endangered	Suckering shrub, 0.06-0.3 m high. Flowers orange and red and blue, May to October	Sand or sandy loam with gravel	Unlikely to occur, known to occur in Geraldton sandplains and Avon Wheatbelt IBRA Regions	EPBC
<i>Jacksonia pungens</i>	Endangered	Critically Endangered	Rounded shrub, 0.45-0.8 m high. Flowers orange, November to December	Yellow sand, gravelly lateritic soils. Undulating areas	Unlikely to occur, known to occur in Geraldton sandplains and Avon Wheatbelt IBRA Regions	Phoenix (2015)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Thelymitra dedmaniarum</i>	Endangered	Critically Endangered	Tuberous, perennial, herb, to 0.8 m high. Flowers yellow, November to December or January	Granite	Unlikely to occur, suitable habitat not present within study area	EPBC DPaW (2016) Phoenix (2015)
<i>Conospermum densiflorum</i> subsp. <i>unicephalatum</i>	Endangered	Endangered	Erect, much-branched shrub, 0.3-0.6 m high, inflorescence a spike. Flowers cream/white & blue, September to November	Clay soils. Low-lying areas	Unlikely to occur, no previously known records within the Shire of Chittering	EPBC Phoenix (2015)
<i>Darwinia acerosa</i>	Endangered	Endangered	Prostrate shrub 20 cm high.	Granite rocks and outcrop. Orange - brown gravelly soil. Very Open Woodland	Unlikely occur, closest known record from 1975 occurs 600m of the study area. Historic collection	EPBC DPaW (2016)
<i>Eucalyptus leprophloia</i>	Endangered	Endangered	(Mallee), 2-5(-8) m high, bark rough loose & flaky to 1 m. Flowers cream-white, August to October	White or grey sand over laterite. Valley slopes	Unlikely to occur, known to occur in Geraldton Sandplains IBRA Region	EPBC Phoenix (2015)
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Endangered	Endangered	Prostrate to erect shrub, 0.1-2.5 m high. Flowers white-cream, August to September	Sand, sandy loam. Winter-wet heath	Unlikely to occur, study area unlikely to support suitable habitat	EPBC Phoenix (2015)
<i>Melaleuca sciotostyla</i>	Endangered	Endangered	Spreading shrub, 0.6-1.5 m high. Flowers August	Orange clayey sand with lateritic pebbles. Scree slopes	Unlikely to occur, distributed to the east within Avon Wheatbelt region	EPBC
<i>Thelymitra stellata</i>	Endangered	Endangered	Tuberous, perennial, herb, 0.15-0.25 m high. Flowers yellow & brown, October to November	Sand, gravel, lateritic loam. Marri, wandoo open woodland	May occur, suitable habitat is present within study area	EPBC DPaW (2016) Phoenix (2015)
<i>Andersonia gracilis</i>	Endangered	Vulnerable	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Flowers white-pink-purple, September to November	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps	Unlikely to occur, no known records within close proximity to study area	Phoenix (2015)
<i>Chamelaucium</i> sp. Gingin (N.G. Marchant 6)	Endangered	Vulnerable	Open straggly shrub 1-2 m high, slender, stiff branches with numerous axillary shoots. Flowers pale pinkish-white, buds tinged deeper pink. Flowers September to December.	White/yellow sand supporting open low banksia woodland	May occur, known to occur in Bindoon and Chittering area	EPBC
<i>Eucalyptus recta</i>	Endangered	Vulnerable	Tree, to 15 m high, bark smooth	Sandy laterite	Unlikely to occur, known to occur in Avon Wheatbelt IBRA Region	EPBC

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Grevillea corrugata</i>	Endangered	Vulnerable	Robust shrub 2-5 m high, white flowers August to September	In gravelly loam <i>Eucalyptus</i> forest. Disturbed road verge	May occur, known to occur approximately 800 m from study area	EPBC DPaW (2016) NatureMap Phoenix (2016)
<i>Spirogardnera rubescens</i>	Endangered	Vulnerable	Spindly leafless shrub, to 1.6 m high. Flowers white, August to December	Wandoo Low Open Woodland. laterite, sand over laterite, loam	May occur, recorded along Hay Flat road within 20 m of survey boundary	EPBC DPaW (2016)
<i>Acacia anomala</i>	Vulnerable	Vulnerable	Slender, rush-like shrub, 0.2-0.5 m high. Flowers yellow, August to September	Lateritic soils. Slopes	Unlikely to occur, study area is outside range distribution	Phoenix (2015)
<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	Vulnerable	Vulnerable	Rhizomatous, perennial, herb, 0.05-0.2 m high. Flowers green/yellow-green, August to September	Grey sand, clay loam. Winter-wet depressions	Unlikely to occur, not previously recorded within Shire of Chittering	Phoenix (2015)
<i>Asterolasia nivea</i>	Vulnerable	Vulnerable	Low open shrub to 0.5 m. Flowers white.	Open Eucalyptus woodland	May occur, closest known record occurs 500 m north of Area 2 within road reserve along GNH	EPBC DPaW (2016) Ecologia (2005)
<i>Banksia serratuloides</i> subsp. <i>serratuloides</i>	Vulnerable	Vulnerable	Low, bushy, lignotuberous shrub, 0.3-1 m high. Fl. yellow, Jul to Sep	Loam or clay loam over laterite, sandy gravel.	Unlikely to occur, not known to occur in Shire of Chittering	KBR (2005)
<i>Diuris micrantha</i>	Vulnerable	Vulnerable	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, September to October	Brown loamy clay. Winter-wet swamps, in shallow water	Unlikely to occur, known populations occur south of Perth	Phoenix (2015)
<i>Eleocharis keigheryi</i>	Vulnerable	Vulnerable	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Flowers green, August to November	On creekline. In <i>Casuarina</i> woodland swampy area. Clay, sandy loam. Emergent in freshwater: creeks, claypans	Unlikely occur, closest known record occurs 1.5 km from study area. Study area unlikely to support suitable habitat	EPBC DPaW (2016) NatureMap
<i>Stylidium semaphorum</i>		Critically Endangered	Erect perennial, herb, 0.15-0.2 m high, Flowers white/pink, September to October	Lateritic gravelly soils. Hill summits. Low Scrub with <i>Banksia sessilis</i>	Unlikely to occur, previously recorded within study area however is an old historic collection from 1966	DPaW (2016)
<i>Goodenia arthrotricha</i>		Endangered	Erect perennial, herb, to 0.4 m high. Flowers blue, October to November	Granitic soil. Scattered low forest over mixed scrub.	May occur, closest record occurs 2.5 km east of study area; study area may support suitable habitat	DPaW (2016)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Androcalva fragifolia</i>		Priority 1	Small prostrate shrub with dark green crenate or serrate, stellately hairy leaves. Flowers white, January, February, October, November or December.	Avon Wheatbelt or Jarrah Forest	May occur, closest record is within 300 m of study area	DPaW (2016)
<i>Conostylis caricina</i> subsp. <i>elachys</i>		Priority 1	Rhizomatous, tufted perennial, grass-like or herb, 0.05-0.1 m high. Flowers cream-yellow, July to August	Gravel, clayey loam, sand	May occur, previously recorded from Bindoon area	DPaW (2016)
<i>Daviesia localis</i>		Priority 1	No available information	No available information	May occur, previously recorded from Bindoon area	DPaW (2016)
<i>Gastrolobium crispatum</i>		Priority 1	Tall shrub, to 2.5 m high. Flowers yellow and orange and red, September to October	Yellow or brown sandy loam, red laterite soils. Steep gullies, slopes, ridges, breakaways	Likely to occur, previously recorded from Bindoon area. Recorded plant identified as possibly this species.	DPaW (2016)
<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>		Priority 1	Erect shrub, to 0.5 m high. Flowers yellow, July to September	In <i>Eucalyptus-Dryandra-Xanthorrhoea</i> woodland. Sand, brown clay, laterite. Near roadsides	May occur, previously recorded within 300 m of study area	DPaW (2016) NatureMap Phoenix (2015)
<i>Lasiopetalum</i> sp. Toodyay (F. Hort 2689)		Priority 1	No available information	No available information	Unlikely to occur, closest record occurs 3 km north of Area 2	DPaW (2016)
<i>Lechenaultia magnifica</i>		Priority 1	Erect perennial, herb or shrub (subshrub), to 0.6 m high	Brown, grey, yellow or white sand, brown sandy loam, laterite. Slopes and flats	Unlikely to occur, closest known occurrence is in Gingin area	DPaW (2016)
<i>Senecio gilbertii</i>		Priority 1	Erect, slender perennial, herb, to 1.5 m high. Flowers yellow, September to November	Peaty sand. Swamps, slopes	Unlikely to occur, one record over 3 km from study area	DPaW (2016)
<i>Synaphea panhesya</i>		Priority 1	Erect shrub, 0.3-0.6 m high. Flowers yellow, August to September	Gravelly loam & sandy gravel	Recorded during current study	DPaW (2016)
<i>Acacia browniana</i> var. <i>glaucescens</i>		Priority 2	Multi-stemmed shrub, 0.2-0.5 m high, spreading by subterranean runners. Flowers yellow, August	Lateritic gravelly soils. In Wandoo	Unlikely to occur, closest known record is approximately 2.7 km north of Area 2	DPaW (2016)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Cyanicula ixiooides</i> subsp. <i>candida</i>		Priority 2	Tuberous, perennial, herb, 0.04-0.12 m high. Flowers white, August to October	<i>Eucalyptus wandoo</i> and <i>E. calophylla</i> woodland over formerly mid-dense <i>Hakea</i> . Sand, Laterite	Unlikely to occur, old historic collection	DPaW (2016) NatureMap
<i>Drosera sewelliae</i>		Priority 2	Fibrous-rooted, rosetted perennial, herb, to 0.06 m high, to 0.025 m wide. Flowers orange, October	Laterite & silica sand soils	Recorded during current study	DPaW (2016)
<i>Gastrolobium nudum</i>		Priority 2	Spreading, twiggy shrub, to 0.8 m high. Flowers orange and red, February	Red-brown clay, brown loam, gravel, laterite, granite. Flats, slopes, hilltops, ridges, valleys, breakaways	Unlikely to occur, Historic collection from 1956	DPaW (2016) NatureMap
<i>Grevillea</i> sp. Toodyay West (F. Hort et al. 3296)		Priority 2	No available information	No available information	Unlikely to occur, known to occur in Toodyay area	DPaW (2016)
<i>Leucopogon cymbiformis</i>		Priority 2	Dense, erect or spreading shrub, 0.1-0.6(-0.8) m high. Flowers white, July to November or February to March	White/grey or yellow sand, lateritic gravelly soils. Sandplains, wet flats, foothills	Unlikely to occur, Species is distributed around Albany	Phoenix (2016)
<i>Leucopogon</i> sp. Bindoon (F. Hort 2766)		Priority 2	Erect, spreading shrub, to 2 m high	Brown, yellow, white grey sandy clay, brown sandy clay loam, yellow clay, gravel, laterite. Rock outcrops, breakaways, scree slopes drainage lines, gullies	Unlikely to occur, closest known occurrence is in Toodyay area	DPaW (2016)
<i>Millotia tenuifolia</i> var. <i>laevis</i>		Priority 2	Ascending to erect annual, herb, 0.02-0.1 m high. Flowers yellow, September to October	Granite or laterite soils	Unlikely to occur, closest known occurrence is in Toodyay area	Phoenix (2015)
<i>Stylidium glabrifolium</i>		Priority 2	Rosetted perennial, herb, 0.2-0.3 m high, Flowers yellow, October to November	Grey brown clay loam over laterite. Hillslopes or gullies. <i>Eucalyptus wandoo</i> forest	Unlikely to occur, known records 1.5km from study area	DPaW (2016)
<i>Stylidium squamellosum</i>		Priority 2	Caespitose perennial, herb, 0.12-0.35 m high. Inflorescence racemose. Flowers yellow, October to November	Brown to red-brown clay loam. Winter-wet habitats and depressions, open woodland, shrubland	Likely to occur, recorded by Phoenix (2015)	Phoenix (2015)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Tetradlea spartea</i>		Priority 2	No available information	No available information	Unlikely to occur, known populations from Julimar area	DPaW (2016)
<i>Verticordia serrata</i> var. <i>udumung</i> (D. Hunter & B. Yarran 941006)		Priority 2	Shrub	Open jarrah/marri woodland and open shrub understorey	May occur, closest record occurs 700 m from the study area	DPaW (2016)
<i>Acacia anarthros</i>		Priority 3	Erect or prostrate, spinose shrub, 0.1-0.5 m high. Flowers yellow, June to September	Lateritic gravelly soils. Slopes. Marri/Wandoo Woodland	Unlikely to occur, previously recorded within study area however is old historic collection from 1963	DPaW (2016) NatureMap Ecologia (2005)
<i>Acacia cummingiana</i>		Priority 3	Sprawling, straggly, rush-like shrub, 0.3-0.5 m high. Flowers yellow, May to June or August	Grey or yellow sand, lateritic gravel. Sandplains, lateritic breakaways	May occur, suitable habitat may be present in study area	DPaW (2016)
<i>Acacia drummondii</i> subsp. <i>affinis</i>		Priority 3	Erect shrub, 0.3-1 m high. Flowers yellow, July to August	Jarrah woodland. Plateau, laterite. Lateritic gravelly soils	Likely to occur, closest known record occurs within 900 m of Area 2. Recorded plant identified as possibly this species.	DPaW (2016) NatureMap Phoenix (2015) GHD (2010) Western Botanical (2006) KBR (2006) Ecologia (2004)
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>		Priority 3	Shrub, 0.9-2.5 m high, 'minni-ritchi' bark, phyllodes mostly 8-13 cm long, 1-2 mm wide. Flowers yellow, August to October	Low Forest B over Scrub over Dwarf Scrub D	Unlikely to occur, closest know record occurs 4km north of study area	DPaW (2016)
<i>Acacia pulchella</i> var. <i>reflexa</i> acuminate bracteole variant (R.J. Cumming 882)		Priority 3	Shrub, 0.3-1 m high. Flowers yellow, July to September	Sandy loam or sandy clay over laterite. Woodland. Eucalyptus calophylla-wandoo woodland	May occur, previously recorded within area however old historic collection from 1970	DPaW (2016) NatureMap Phoenix (2015) Western Botanical (2006)
<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>		Priority 3	Prostrate, mat-forming, non-lignotuberous shrub, to 0.3 m high. Flowers white-cream-pink-green/green, July or September to December or January	Low Heath C over Low Heath D; Allocasuarina humilis, Calothamnus sanguineus, Hibbertia hypericoides. Grey sand, lateritic gravel	Recorded during the current study and previously recorded within Area 2	DPaW (2016) NatureMap KBR (2006)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Allocasuarina ramosissima</i>		Priority 3	Erect, compact, dwarf shrub. Dioecious, somewhat divaricate shrub, 0.3-1.2 m high	Road verge. Grey-red lateritic soil	May occur, closet record occurs 4km north of area 2 along road reserve on lateritic soil	DPaW (2016)
<i>Asteridea gracilis</i>		Priority 3	Annual, herb, 0.15-0.35 m high. Flowers white-pink, September to December	Sand, clay, gravelly soils	May occur, suitable habitat may be present in study area	DPaW (2016)
<i>Banksia kippistiana</i> var. <i>paenepeccata</i>		Priority 3	Erect, prickly, lignotuberous shrub, 0.3-1.2 m high. Flowers yellow-cream, October to November	Lateritic gravelly soils	May occur, closest known record from Gingin and Wannamal	DPaW (2016)
<i>Banksia pteridifolia</i> subsp. <i>vernalis</i>		Priority 3	Prostrate, lignotuberous shrub, to 0.4 m high. Flowers cream-white/yellow, September to October	White/grey sand over laterite	May occur, suitable habitat may be present in study area	DPaW (2016)
<i>Chamaescilla gibsonii</i>		Priority 3	Clumped tuberous, herb. Flowers blue, September	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans	May occur, suitable habitat may be present in study area	Phoenix (2015)
<i>Cyathochaeta teretifolia</i>		Priority 3	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Flowers brown	Grey sand, sandy clay. Swamps, creek edges	Unlikely to occur, no suitable habitat	Phoenix (2015)
<i>Daviesia debilior</i> subsp. <i>sinuans</i>		Priority 3	Straggling shrub, to 0.8 m high. Flowers yellow & red/purple, May to July	Gravelly lateritic clay	May occur, previously recorded from Bindoon area	Phoenix (2015) Western Botanical (2006)
<i>Dielsiodoxa leucantha</i> subsp. <i>leucantha</i>		Priority 3	No available information	1.2km north of Area 2	May occur, closest record occurs 1.2km north of Area 2	DPaW (2016)
<i>Grevillea florida</i>		Priority 3	Erect shrub, to 0.9 m high. Flowers cream-yellow, July to September	In open low woodland of <i>Eucalyptus drummondii</i> , and <i>E. calophylla</i> . Sandy clay, gravel, laterite. Sandplain, slopes, road verges	Likely to occur; previously recorded within Area 2	DPaW (2016)
<i>Guichenotia tuberculata</i>		Priority 3	Erect, open shrub, (0.25-)0.6-0.9 m high. Flowers purple-pink, August to October	<i>Eucalyptus</i> woodland with <i>Hakea trifurcata</i> , Sand clay over laterite, sand	May occur, occurs 2 km north of Area 2	DPaW (2016)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Haemodorum loratum</i>		Priority 3	Bulbaceous, perennial, herb, 0.45-1.2(-2) m high. Flowers black/brown-black/green, November	Grey or yellow sand, gravel	Likely to occur, recorded by Phoenix (2015)	Phoenix (2015)
<i>Halgania corymbosa</i>		Priority 3	Erect shrub, 0.35-1 m high. Flowers blue-purple, August to November	Gravelly soils, soils over granite	Unlikely to occur, historic collection from 1947 3 km east of survey boundary	DPaW (2016)
<i>Johnsonia inconspicua</i>		Priority 3	Rhizomatous, tufted perennial, grass-like or herb, 0.1-0.3 m high, to 0.2 m wide. Flowers green-white/pink, October to November	White-grey or black sand. Low dunes, winter-wet flats	Unlikely to occur, closest known occurrence is in Toodyay area	DPaW (2016)
<i>Lasiopetalum venustum</i>		Priority 3	No available information	No available information	Unlikely to occur, known record from Boonanarring NR	DPaW (2016)
<i>Petrophile plumosa</i>		Priority 3	Erect, compact shrub, 0.3-1.3 m high. Flowers yellow, July to November	Red/brown laterite, loam. Sandplains, hills	May occur, previously recorded from Bindoon area	DPaW (2016)
<i>Platysace ramosissima</i>		Priority 3	Perennial, herb, to 0.3 m high. Flowers white-cream, October to November	Sandy soils	Unlikely to occur, known record from Boonanarring NR	DPaW (2016)
<i>Stylidium cymiferum</i>		Priority 3	Perennial herb. Flowers yellow, laterally paired, throat appendages eight. Juvenile buds pendulous. Flowers October to November	In open Wandoo forest with <i>Stylidium caricifolium</i> . Loam and lateritic soils	Likely to occur, recorded Caligiri - Wongan Hills Road within 25 m of study area boundary	DPaW (2016)
<i>Stylidium sacculatum</i>		Priority 3	Creeping, matted plant with white/pink flowers - laterally paired petals - and red throat markings. Ca 12 cm high	Wandoo open woodland. Jarrah/Marri Woodlands	May occur, known records 1.5 km from study area	DPaW (2016)
<i>Tetradlea pilifera</i>		Priority 3	Spreading shrub, 0.1-0.3 m high. Flowers purple, August to October	Gravelly soils. Slope, breakaway. Eucalyptus wandoo fringing shrubland	May occur, previously recorded from Bindoon area	NatureMap
<i>Tetradlea similis</i>		Priority 3	Spreading shrub, to 0.3 m high. Flowers pink, August to September	Sandy clay with lateritic	Unlikely to occur, all known populations occur east of study area	DPaW (2016)
<i>Verticordia serrata</i> var. <i>linearis</i>		Priority 3	Shrub, to 1 m high, Flowers September to October	White sand, gravel. Open woodland	Likely to occur, recorded by Phoenix (2015)	Phoenix (2015) Ecologia (2004)



Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Acacia alata</i> var. <i>platyptera</i>		Priority 4	Dense shrub, 0.5-1 m high. Flowers yellow, June to August	Clay, gravelly sandy clay. Lateritic ridges, clay flats. Marri/Wandoo Woodland	Unlikely to occur, study area unlikely to support suitable habitat	NatureMap
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>		Priority 4	Rhizomatous, perennial, herb, 0.2-0.4 (-0.8) m high. Flowers yellow, July to October	Banksia Woodland. Grey or yellow sand	Recorded during current study	DPaW (2016)
<i>Banksia chamaephyton</i>		Priority 4	Low, lignotuberous shrub, to 0.4 m high, up to 2 m wide. Flowers cream & brown, October to December	Grey or white sand over laterite	Unlikely to occur, known from populations north of the study area	DPaW (2016)
<i>Boronia tenuis</i>		Priority 4	Procumbent or erect & slender shrub, 0.1-0.5 m high. Flowers blue/pink-white, August to November	Laterite, stony soils, granite. Pale orange sandy gravelly loam. Dense Heath C over Dwarf Scrub D	Unlikely to occur, closest know record occurs 3km north of study area	DPaW (2016)
<i>Calothamnus pachystachyus</i>		Priority 4	Shrub 1 - 2 ft, stems and young inflorescences grey ribbons. Erect, much-branched, often straggly shrub, (0.3-)0.6-1.7 m high. Flowers red-brown-black, August to October	In red clay loam. Granite. Lateritic soils, often gravelly. Ridges, road verges	Unlikely to occur, old historic collection	DPaW (2016)
<i>Eucalyptus caesia</i>		Priority 4	(Mallee), 1.8-14 m high, bark 'minni-ritchi'. Flowers pink-red, May to September	Loam. Granite outcrops	Unlikely to occur, Phoenix (2015) recorded one planted specimen all other records occur east of Jarrah Forest IBRA region	Phoenix (2015)
<i>Eucalyptus exilis</i>		Priority 4	(Whipstick mallee), 2-6 m high, bark smooth. Flowers white, August to October	Grey sand, gravelly loam. Lateritic ridges	May occur, previously recorded from Bindoon area	DPaW (2016)
<i>Grevillea drummondii</i>		Priority 4	Flowers red, June to December. Compact bushy shrub, 1 - 2 m tall.	Gravelly loam	May occur, previously recorded within road reserve	DPaW (2016) Ecologia (2005)
<i>Hibbertia miniata</i>		Priority 4	Decumbent or erect shrub, 0.1-1 m high. Flowers orange/orange-red, August to November	Open Woodland of <i>Corymbia calophylla</i> . Lateritic gravelly soils	Recorded within the study, previous known records within 300 m of study area	DPaW (2016) NatureMap Ecologia (2005)
<i>Hypolaena robusta</i>		Priority 4	Dioecious rhizomatous, perennial, herb, ca 0.5 m high. Flowers September to October	White sand. Sandplains	May occur, suitable habitat may be present in study area	Phoenix (2015)

Species	EPBC Act Cons. Status	WA Cons. Status	Description	Preferred Habitat	Likelihood of occurrence	Source
<i>Oxymyrrhine coronata</i>		Priority 4	Erect open shrub 40 cm high, flowers pink and white	Lateritic gravel. Marginal Jarrah/Wandoo forest	May occur, closest record occurs 2 km east of study area	NatureMap
<i>Persoonia sulcata</i>		Priority 4	Much-branched shrub 40 cm tall; fruit green with a few longitudinal brown streaks, white-spotted	In open woodland	May occur, recorded 500 m west of study area	DPaW (2016) NatureMap Phoenix (2015) GHD (2010)
<i>Stylidium longitubum</i>		Priority 4	Erect annual (ephemeral), herb, 0.05-0.12 m high. Flowers pink, October to December	Sandy clay, clay. Seasonal wetlands	Unlikely to occur, little suitable habitat	DPaW (2016)
<i>Stylidium striatum</i>		Priority 4	Rosetted perennial, herb, 0.15-0.55 m high, Inflorescence racemose. Flowers yellow, October to November	Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland	May occur, study area may support suitable habitat	Phoenix (2015)
<i>Synaphea grandis</i>		Priority 4	Tufted shrub, ca 0.3 m high. Flowers Yellow, October to November	Wandoo/Marri Woodland Laterite	May occur, previously recorded within study area from historic record (1949)	DPaW (2016) NatureMap (2016) Phoenix (2015)
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		Priority 4	Erect shrub, 0.2-0.75 m high. Flowers pink, May or November to December or January	Sand, sandy clay. Winter-wet depressions. <i>Banksia</i> and <i>Melaleuca</i> winter wetland	Likely to occur, recorded by Phoenix (2015), study area supports suitable habitat	Phoenix (2015) Western Botanical (2006) KBR (2005) Ecologia (2004)
<i>Verticordia paludosa</i>		Priority 4	Erect shrub, 0.3-0.9 m high. Flowers pink-white, January to May	White/grey sand. Winter-wet flats	May occur, study area supports suitable habitat	DPaW (2016)

---

## APPENDIX B: QUADRAT DATA

## Site B01

<b>Date</b>	10/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	410672mE 6519240mN
<b>Habitat and Waterway</b>	Uphill
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	Drought, few weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 60%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	10	6
<i>Eucalyptus wandoo</i>	outside q	16
<i>Xanthorrhoea preissii</i>	15	1.5
<i>Hibbertia hypericoides</i>	2	0.4
<i>Lechenaultia biloba</i>	5	0.3
<i>Acacia squamata</i>	+	
<i>Arctotheca calendula</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Boronia ramosa subsp. anethifolia</i>	+	
<i>Bossiaea eriocarpa</i>	+	

Species	Cover (%)	Height (m)
<i>Bossiaea ornata</i>	+	
<i>Briza maxima</i>	+	
<i>Caesia occidentalis</i>	+	
<i>Chamaescilla corymbosa</i>	+	
<i>Conostylis setosa</i>	+	
<i>Daviesia divaricata</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Kennedia stirlingii</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Petrophile serruriae</i>	+	
<i>Philothea spicata</i>	+	
<i>Stylidium amoenum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Tetralix octandra</i>	+	
<i>Tetralix hirsuta</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Trichocline spathulata</i>	+	
<i>Xanthosia candida</i>	+	
<i>Xanthosia huegelii</i>	+	

## Site B02

<b>Date</b>	11/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409860mE 6521002mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam, Gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	Fire, some weeds
<b>Time since Fire</b>	<2 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 15%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	15	9
<i>Calothamnus sanguineus</i>	25	0.8
<i>Xanthorrhoea preissii</i>	8	1.5
<i>Hibbertia hypericoides</i>	10	0.5
<i>Anigozanthos humilis</i>	+	
<i>Austrostipa scabra</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Banksia sessilis</i>	+	
<i>Banksia telmatiaea</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Burchardia congesta</i>	+	

Species	Cover (%)	Height (m)
<i>Caesia occidentalis</i>	+	
<i>Cassytha racemosa</i>	+	
<i>Conostylis setosa</i>	+	
<i>Crassula colorata</i>	+	
<i>Daviesia preissii</i>	+	
<i>Desmocladus fasciculatus</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium marginatum</i>	+	
<i>Grevillea synapheae</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hakea stenocarpa</i>	+	
<i>Hakea stenocarpa</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Laxmannia ramosa subsp. ramosa</i>	+	
<i>Lechenaultia floribunda</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrorhagia dubia</i>	+	
<i>Philothea spicata</i>	+	
<i>Podotrochea gnaphalioides</i>	+	
<i>Pyrorchis nigricans</i>	+	
<i>Rhodanthe citrina</i>	+	
<i>Schoenus brevisetis</i>	+	
<i>Tetralix octandra</i>	+	
<i>Thelymitra crinita</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Vulpia myuros</i>	+	
<i>Xanthosia huegelii</i>	+	

### Site B03

<b>Date</b>	11/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	410030mE 6521030mN
<b>Habitat and Waterway</b>	Swamp (Stream)
<b>Slope</b>	Valley (Flat)
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 8%



Species	Cover (%)	Height (m)
<i>Melaleuca viminea</i>	70	5
<i>Drosera neesii</i> subsp. <i>neesii</i>	1	0.10
<i>Utricularia multifida</i>	1	0.50
<i>Briza minor</i>	+	
<i>Isolepis cernua</i>	+	
<i>Juncus bufonius</i>	+	
<i>Lotus angustissimus</i>	+	
<i>Stachys arvensis</i>	+	
<i>Watsonia meriana</i>	+	



## Site B04

<b>Date</b>	11/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409710mE 6521508mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	Minimal, weeds, tracks etc.
<b>Time since Fire</b>	<5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 50%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	25	12
<i>Xanthorrhoea preissii</i>	20	2.2
<i>Hibbertia hypericoides</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Calothamnus sanguineus</i>	+	
<i>Calytrix variabilis</i>	+	
<i>Cassytha racemosa</i>	+	
<i>Chamaescilla corymbosa</i>	+	

Species	Cover (%)	Height (m)
<i>Conostylis setosa</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Gonocarpus pithyoides</i>	+	
<i>Goodenia berardiana</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lechenaultia floribunda</i>	+	
<i>Millotia tenuifolia var. tenuifolia</i>	+	
<i>Pentameris airoides</i>	+	
<i>Philothea spicata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Stenanthemum coronatum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Styphelia tenuiflora</i>	+	
<i>Synaphea panhesya</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Tetragia octandra</i>	+	
<i>Tetratheca hirsuta</i>	+	
<i>Thelymitra ?benthamiana</i>	+	
<i>Thelymitra crinita</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Xanthosia huegelii</i>	+	

## Site B05

<b>Date</b>	11/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409627mE 6523963mN
<b>Habitat and Waterway</b>	Wetland
<b>Slope</b>	Valley (Flat)
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Black
<b>Soil Texture</b>	Sandy loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good-Excellent
<b>Disturbance Type</b>	Recent fire, weeds
<b>Time since Fire</b>	<2 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 25%



Species	Cover (%)	Height (m)
<i>Eucalyptus rudis</i>	6	10
<i>Melaleuca preissiana</i>	3	8
<i>Xanthorrhoea preissii</i>	15	2.2
<i>Hypocalymma angustifolium</i>	80	0.7
<i>Lepidosperma striatum</i>	10	1.8
<i>Aotus gracillima</i>	+	
<i>Baumea rubiginosa</i>	+	
<i>Briza maxima</i>	+	
<i>Cyperus polystachyos</i>	+	
<i>Gastrolobium capitatum</i>	+	

---

Species	Cover (%)	Height (m)
<i>Jacksonia furcellata</i>	+	
<i>Juncus pallidus</i>	+	
<i>Lotus subbiflorus</i>	+	
<i>Patersonia occidentalis</i>	+	

## Site B06

<b>Date</b>	11/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408681mE 6524387mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle-Moderate
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good-Excellent
<b>Disturbance Type</b>	Drought or dieback, weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 60%



Species	Cover (%)	Height (m)
<i>Eucalyptus todtiana</i>	20	5
<i>Banksia attenuata</i>	10	4
<i>Banksia menziesii</i>	8	4
<i>Allocasuarina humilis</i>	2	2
<i>Stirlingia latifolia</i>	2	0.8
<i>Hibbertia hypericoides</i>	2	0.5
<i>Lepidosperma squamatum</i>	3	0.2
<i>Lyginia imberbis</i>	2	0.4
<i>Acacia pulchella</i>	+	
<i>Alexgeorgea nitens</i>	+	

Species	Cover (%)	Height (m)
<i>Alexgeorgea nitens</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Burchardia congesta</i>	+	
<i>Calothamnus sanguineus</i>	+	
<i>Calytrix flavescens</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Conostylis juncea</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypolaena exsulca</i>	+	
<i>Hypolaena pubescens</i>	+	
<i>Lepidosperma squamatum</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Petrophile linearis</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Synaphea sp.</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Thysanotus manglesianus</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B07

<b>Date</b>	11/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408970mE 6524368mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	?Dieback, weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 6%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	10	12
<i>Banksia attenuata</i>	10	5
<i>Banksia grandis</i>	4	3
<i>Banksia menziesii</i>	6	5
<i>Xanthorrhoea preissii</i>	15	2
<i>Hibbertia hypericoides</i>	15	0.8
<i>Alexgeorgea nitens</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Briza maxima</i>	+	

Species	Cover (%)	Height (m)
<i>Calandrinia liniflora</i>	+	
<i>Calytrix flavescens</i>	+	
<i>Calytrix sylvana</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Conostylis juncea</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Corynotheca micrantha</i>	+	
<i>Crassula colorata</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hemiandra pungens</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Hypolaena exsulca</i>	+	
<i>Hypolaena pubescens</i>	+	
<i>Lepidosperma squamatum</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lomandra preissii</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Macrozamia riedlei</i>	+	
<i>Microlaena stipoides</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrophile linearis</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Poranthera microphylla</i>	+	
<i>Pyrorchis nigricans</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium neurophyllum</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Trachymene pilosa</i>	+	



---

Species	Cover (%)	Height (m)
<i>Ursinia anthemoides</i>	+	

### Site B08

**Date** 12/10/2016  
**Botanist** Kellie Bauer-Simpson, Gabriela Martinez  
**Quadrat Size** 10 x 10 m  
**NW Corner Coordinates** 408910mE 6526768mN  
**Habitat and Waterway** Valley  
**Slope** Flat  
**Surface Layer** Loose Soil  
**Soil Colour** Pale yellow  
**Soil Texture** Sand  
**Rock Type** No Rocks  
**Rock Size and Abundance** No Rocks - N/A  
**Vegetation Condition** Good-Very Good  
**Disturbance Type** ?Dieback  
**Time since Fire** >5 years  
**Leaf Litter Distribution and Cover** Scattered; 40%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	5	12
<i>Eucalyptus marginata</i>	10	9
<i>Banksia grandis</i>	2	3
<i>Banksia sessilis</i>	25	4
<i>Xanthorrhoea preissii</i>	3	2
<i>Hibbertia hypericoides</i>	1.5	0.8
<i>Stirlingia latifolia</i>	1	1
<i>Alexgeorgea nitens</i>	+	
<i>Anigozanthos manglesii</i>	+	

Species	Cover (%)	Height (m)
<i>Banksia dallanneyi</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Bossiaea ornata</i>	+	
<i>Burchardia congesta</i>	+	
<i>Caladenia flava</i>	+	
<i>Calytrix sylvana</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Crassula colorata</i>	+	
<i>Desmocladus fasciculatus</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Grevillea synapheae</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lomandra sericea</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Pentameris airoides</i>	+	
<i>Pericalymma ellipticum</i>	+	
<i>Petrophile linearis</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Poa drummondiana</i>	+	
<i>Stylidium neurophyllum</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B09

<b>Date</b>	12/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408976mE 6526668mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	?Dieback
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 25%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	1	4
<i>Banksia sessilis</i>	35	3
<i>Xanthorrhoea preissii</i>	4	1
<i>Hibbertia hypericoides</i>	3	0.7
<i>Bossiaea eriocarpa</i>	+	
<i>Burchardia congesta</i>	+	
<i>Caladenia flava</i>	+	
<i>Chamaescilla corymbosa</i>	+	

Species	Cover (%)	Height (m)
<i>Conostephium pendulum</i>	+	
<i>Conostylis setigera</i>	+	
<i>Daviesia decurrens</i>	+	
<i>Dillwynia laxiflora</i>	+	
<i>Drosera macrantha subsp. macrantha</i>	+	
<i>Eremaea pauciflora</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium knightianum</i>	+	
<i>Gompholobium preissii</i>	+	
<i>Grevillea synapheae</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra preissii</i>	+	
<i>Lomandra sericea</i>	+	
<i>Lomandra sericea</i>	+	
<i>Millotia tenuifolia var. tenuifolia</i>	+	
<i>Pentameris airoides</i>	+	
<i>Pentapeltis peltigera</i>	+	
<i>Poa drummondiana</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Stylidium neurophyllum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Styphelia tenuiflora</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Tetragia octandra</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Xanthosia huegelii</i>	+	

## Site B10

<b>Date</b>	12/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408947mE 6527153mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good-Excellent
<b>Disturbance Type</b>	?Dieback
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 50%



Species	Cover (%)	Height (m)
<i>Eucalyptus todtiana</i>	6	6
<i>Banksia attenuata</i>	8	6
<i>Beaufortia elegans</i>	10	1.5
<i>Scholtzia involucreta</i>	15	0.4
<i>Anigozanthos humilis</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Briza maxima</i>	+	
<i>Calytrix variabilis</i>	+	
<i>Cassytha racemosa</i>	+	
<i>Conostephium minus</i>	+	

Species	Cover (%)	Height (m)
<i>Conostephium pendulum</i>	+	
<i>Conostylis juncea</i>	+	
<i>Desmodcladus fasciculatus</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Drosera macrantha subsp. macrantha</i>	+	
<i>Eremaea pauciflora</i>	+	
<i>Gastrolobium pauciflorum</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lechenaultia biloba</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Melaleuca trichophylla</i>	+	
<i>Nuytsia floribunda</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrophile linearis</i>	+	
<i>Poa drummondiana</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Poranthera microphylla</i>	+	
<i>Schoenus sp.</i>	+	
<i>Scholtzia involucreta</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Stylidium repens</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B11

<b>Date</b>	12/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408930mE 6527206mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate-Steep
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	No disturbance
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Sparse; 3%



Species	Cover (%)	Height (m)
<i>Allocasuarina humilis</i>	6	2.5
<i>Xanthorrhoea preissii</i>	1	1.5
<i>Schoenus sp.</i>	15	0.7
<i>Hibbertia hypericoides</i>	15	0.8
<i>Alexgeorgea nitens</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Bossiaea ornata</i>	+	
<i>Briza maxima</i>	+	
<i>Calothamnus sanguineus</i>	+	
<i>Calytrix sylvana</i>	+	



Species	Cover (%)	Height (m)
<i>Cassytha racemosa</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Drosera menziesii</i>	+	
<i>Eremaea pauciflora</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Hypolaena exsulca</i>	+	
<i>Jacksonia floribunda</i>	+	
<i>Johnsonia pubescens subsp. pubescens</i>	+	
<i>Lomandra sericea</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Lysinema pentapetalum</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Mesomelaena tetragona</i>	+	
<i>Petrophile linearis</i>	+	
<i>Philothea spicata</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Schoenus brevisetis</i>	+	
<i>Schoenus curvifolius</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium schoenoides</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B12

<b>Date</b>	12/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409521mE 6526905mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	No disturbance
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 12%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	7	6
<i>Banksia sessilis</i>	1	3
<i>Xanthorrhoea preissii</i>	4	1.5
<i>Hibbertia hypericoides</i>	25	0.4
<i>Anigozanthos humilis</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Calothamnus sanguineus</i>	+	
<i>Cassytha racemosa</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Crassula colorata</i>	+	
<i>Drosera menziesii</i>	+	

Species	Cover (%)	Height (m)
<i>Hakea lissocarpa</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Laxmannia ramosa subsp. ramosa</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Leucopogon sp.</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrophile striata</i>	+	
<i>Philothea spicata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Pterochaeta paniculata</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Stylidium sp. Bindoon (K.F. Kenneally 11405)</i>	+	
<i>Synaphea panhesya</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Vulpia myuros</i>	+	
<i>Xanthosia huegelii</i>	+	

### Site B13

<b>Date</b>	12/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409496mE 6526521mE
<b>Habitat and Waterway</b>	Up slope
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	?Dieback
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 30%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	4	8
<i>Eucalyptus marginata</i>	20	6
<i>Banksia sessilis</i>	5	3
<i>Xanthorrhoea preissii</i>	4	1
<i>Hibbertia hypericoides</i>	30	0.5
<i>Banksia bipinnatifida</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Briza maxima</i>	+	
<i>Briza maxima</i>	+	
<i>Dampiera alata</i>	+	
<i>Desmodcladus fasciculatus</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Drosera glanduligera</i>	+	

Species	Cover (%)	Height (m)
<i>Drosera menziesii</i>	+	
<i>Gompholobium knightianum</i>	+	
<i>Gompholobium preissii</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea lissocarpa</i>	+	
<i>Hemigenia sericea</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Laxmannia ramosa subsp. ramosa</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Leucopogon propinquus</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lomandra sericea</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrophile striata</i>	+	
<i>Philothea spicata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium neurophyllum</i>	+	
<i>Synaphea sp.</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Xanthorrhoea gracilis</i>	+	
<i>Xanthosia huegelii</i>	+	

## Site B14

<b>Date</b>	12/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409104mE 6533675mN
<b>Habitat and Waterway</b>	Swamp
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	No disturbance
<b>Time since Fire</b>	> 10 years
<b>Leaf Litter Distribution and Cover</b>	Covered; 90%



Species	Cover (%)	Height (m)
<i>Banksia littoralis</i>	25	7
<i>Banksia menziesii</i>	10	6
<i>Kunzea glabrescens</i>	85	7
<i>Xanthorrhoea preissii</i>	5	1
<i>Bossiaea ornata</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Drosera macrantha subsp. macrantha</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Labichea punctata</i>	+	
<i>Petrophile linearis</i>	+	
<i>Poa drummondiana</i>	+	
<i>Pterostylis glebosa</i>	+	
<i>Schoenus sp.</i>	+	

---

Species	Cover (%)	Height (m)
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	

### Site B15

**Date** 12/10/2016  
**Botanist** Kellie Bauer-Simpson, Gabriela Martinez  
**Quadrat Size** 10 x 10 m  
**NW Corner Coordinates** 408975mE 6534240mN  
**Habitat and Waterway** Up slope  
**Slope** Gentle  
**Surface Layer** Loose Soil  
**Soil Colour** White  
**Soil Texture** Sand  
**Rock Type** No Rocks  
**Rock Size and Abundance** No Rocks - N/A  
**Vegetation Condition** Very Good  
**Disturbance Type** Weeds, fire  
**Time since Fire** <3 years  
**Leaf Litter Distribution and Cover** Scattered; 15%



Species	Cover (%)	Height (m)
<i>Eucalyptus todtiana</i>	15	5
<i>Banksia attenuata</i>	0.2	0.5
<i>Eremaea pauciflora</i>	10	0.7
<i>Jacksonia sternbergiana</i>	2	1.5
<i>Conostylis aculeata</i>	2	0.4
<i>Corynotheca micrantha</i>	60	0.6
<i>Alexgeorgea nitens</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Burchardia congesta</i>	+	



Species	Cover (%)	Height (m)
<i>Caladenia flava</i>	+	
<i>Crassula colorata</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Isolepis marginata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lyginia barbata</i>	+	
<i>Macarthuria australis</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Wahlenbergia capensis</i>	+	

## Site B15R

<b>Date</b>	13/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408043mE 6536864mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Weeds, tracks
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 60%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	15	13
<i>Eucalyptus marginata</i>	25	12
<i>Banksia sessilis</i>	10	3
<i>Xanthorrhoea preissii</i>	18	1.5
<i>Hibbertia hypericoides</i>	6	0.8
<i>Acacia applanata</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Daviesia decurrens</i>	+	
<i>Desmodcladus fasciculatus</i>	+	
<i>Gompholobium knightianum</i>	+	
<i>Gompholobium preissii</i>	+	

Species	Cover (%)	Height (m)
<i>Gompholobium tomentosum</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Leporella fimbriata</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Poa drummondiana</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tripterococcus brunonis</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B16R

<b>Date</b>	13/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408459mE 6538264mN
<b>Habitat and Waterway</b>	Plain
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Fire, weeds, drought
<b>Time since Fire</b>	<5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 10%



Species	Cover (%)	Height (m)
<i>Eucalyptus todtiana</i>	5	6
<i>Banksia attenuata</i>	10	4
<i>Banksia ilicifolia</i>	20	8
<i>Calytrix fraseri</i>	30	1
<i>Stirlingia latifolia</i>	6	1.2
<i>Xanthorrhoea preissii</i>	4	1
<i>Alexgeorgea nitens</i>	15	0.1
<i>Alexgeorgea nitens</i>	+	
<i>Amphipogon turbinatus</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Beaufortia elegans</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Conospermum acerosum subsp. acerosum</i>	+	

Species	Cover (%)	Height (m)
<i>Conostephium pendulum</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Crassula colorata</i>	+	
<i>Daviesia triflora</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera menziesii</i>	+	
<i>Eremaea purpurea</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Hibbertia aurea</i>	+	
<i>Isotropis cuneifolia subsp. cuneifolia</i>	+	
<i>Jacksonia floribunda</i>	+	
<i>Leucopogon sprengelioides</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Lysinema pentapetalum</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Monotaxis grandiflora</i>	+	
<i>Petrophile linearis</i>	+	
<i>Petrophile macrostachya</i>	+	
<i>Philothea spicata</i>	+	
<i>Philothea spicata</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Poa drummondiana</i>	+	
<i>Poranthera microphylla</i>	+	
<i>Pterochaeta paniculata</i>	+	
<i>Pyrorchis nigricans</i>	+	
<i>Schoenus brevisetis</i>	+	
<i>Schoenus curvifolius</i>	+	
<i>Stylidium araeophyllum</i>	+	
<i>Stylidium neurophyllum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Stylidium repens</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Wahlenbergia capensis</i>	+	
<i>Xanthosia huegelii</i>	+	

## Site B17

<b>Date</b>	13/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408741mE 6542889mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Drought, some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Sparse; 5%



Species	Cover (%)	Height (m)
<i>Allocasuarina humilis</i>	30	2.5
<i>Hibbertia hypericoides</i>	30	0.5
<i>Lyginia barbata</i>	15	0.2
<i>Amphipogon turbinatus</i>	+	
<i>Anigozanthos humilis</i>	+	
<i>Brachyscome pusilla</i>	+	
<i>Calytrix depressa</i>	+	
<i>Caustis dioica</i>	+	
<i>Conospermum stoechadis subsp. stoechadis</i>	+	
<i>Conostylis teretifolia</i>	+	

Species	Cover (%)	Height (m)
<i>Drosera ?stolonifera</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lepidobolus preissianus</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Mesomelaena tetragona</i>	+	
<i>Opercularia vaginata</i>	+	
<i>Pimelea suaveolens subsp. suaveolens</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Stackhousia pubescens</i>	+	
<i>Stylidium albolilacinum</i>	+	
<i>Stylidium repens</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Verticordia nobilis</i>	+	
<i>Waitzia suaveolens var. suaveolens</i>	+	

## Site B18

<b>Date</b>	13/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408567mE 6542548mN
<b>Habitat and Waterway</b>	Plain
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Drought, some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Sparse; 15%



Species	Cover (%)	Height (m)
<i>Banksia attenuata</i>	10	5
<i>Allocasuarina humilis</i>	40	2
<i>Acacia pulchella</i>	+	
<i>Anigozanthos humilis</i>	+	
<i>Beaufortia elegans</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Brachyscome pusilla</i>	+	
<i>Calytrix depressa</i>	+	



Species	Cover (%)	Height (m)
<i>Calytrix depressa</i>	+	
<i>Conospermum stoechadis</i> subsp. <i>stoechadis</i>	+	
<i>Conostylis setosa</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium aristatum</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hibbertia acerosa</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lepidobolus preissianus</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Mesomelaena tetragona</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Pterochaeta paniculata</i>	+	
<i>Schoenus curvifolius</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Siloxerus humifusus</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Stylidium albolilacinum</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Verticordia nobilis</i>	+	
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>	+	

## Site B19

<b>Date</b>	13/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408521mE 6542663mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	?Dieback or drought
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 70%



Species	Cover (%)	Height (m)
<i>Eucalyptus tottiana</i>	35	7
<i>Banksia attenuata</i>	3	4
<i>Banksia menziesii</i>	5	3
<i>Macrozamia riedlei</i>	4	3
<i>Stirlingia latifolia</i>	2	1.5
<i>Hibbertia hypericoides</i>	6	0.4
<i>Acacia huegelii</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Anigozanthos humilis</i>	+	
<i>Austrostipa elegantissima</i>	+	

Species	Cover (%)	Height (m)
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Brachyscome pusilla</i>	+	
<i>Calytrix depressa</i>	+	
<i>Conospermum stoechadis</i> subsp. <i>stoechadis</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Conostylis teretifolia</i>	+	
<i>Daviesia triflora</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	
<i>Drosera menziesii</i>	+	
<i>Gompholobium aristatum</i>	+	
<i>Gonocarpus pithyoides</i>	+	
<i>Hibbertia acerosa</i>	+	
<i>Isolepis marginata</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Melaleuca trichophylla</i>	+	
<i>Mesomelaena pseudostygia</i>	+	
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Petrophile linearis</i>	+	
<i>Philothea spicata</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Poranthera microphylla</i>	+	
<i>Pterochaeta paniculata</i>	+	
<i>Pyrorchis nigricans</i>	+	
<i>Schoenus curvifolius</i>	+	
<i>Stylidium albolilacinum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Wahlenbergia capensis</i>	+	

## Site B20

<b>Date</b>	13/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	412012mE 6548117mN
<b>Habitat and Waterway</b>	Creek
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loamy clay
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Degraded
<b>Disturbance Type</b>	Weeds, Grazing
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	No litter; 0%



Species	Cover (%)	Height (m)
<i>Melaleuca teretifolia</i>	16	4
<i>Melaleuca viminea</i>	20	3
<i>Juncus acutus</i>	0.5	1
<i>Cotula coronopifolia</i>	2	0.1
<i>Hordeum leporinum</i>	20	0.3
<i>Isolepis marginata</i>	5	0.05
<i>Briza minor</i>	+	
<i>Lolium rigidum</i>	+	
<i>Lotus subbiflorus</i>	+	

## Site B21

<b>Date</b>	14/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	421264mE 6551857mN
<b>Habitat and Waterway</b>	Up slope
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loam, gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Sparse; 10%



Species	Cover (%)	Height (m)
<i>Banksia sessilis</i>	3	3
<i>Macrozamia riedlei</i>	4	1.2
<i>Xanthorrhoea preissii</i>	2	1.2
<i>Acacia huegelii</i>	6	0.4
<i>Banksia dallaneyi</i>	8	0.3
<i>Hibbertia hypericoides</i>	10	0.5
<i>Acanthocarpus preissii</i>	+	
<i>Astroloma pallidum</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Briza maxima</i>	+	
<i>Comesperma scoparium</i>	+	

Species	Cover (%)	Height (m)
<i>Crassula colorata</i>	+	
<i>Desmodium fasciculatum</i>	+	
<i>Drosera ?stolonifera</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Drosera menziesii</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Grevillea pilulifera</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Isolepis marginata</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Opercularia vaginata</i>	+	
<i>Parentucellia latifolia</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrorhagia dubia</i>	+	
<i>Poa drummondiana</i>	+	
<i>Podolepis lessonii</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Stackhousia pubescens</i>	+	
<i>Tetralix octandra</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B22

<b>Date</b>	14/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	421159mE 6551783mN
<b>Habitat and Waterway</b>	Mid slope-Up slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose soil-gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam, Gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good-Excellent
<b>Disturbance Type</b>	Some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 50%



Species	Cover (%)	Height (m)
<i>Eucalyptus wandoo</i>	20	14
<i>Macrozamia riedlei</i>	3	1.5
<i>Bossiaea eriocarpa</i>	6	0.8
<i>Hibbertia hypericoides</i>	3	0.4
?Iridaceae sp.	+	
<i>Acacia pulchella</i> var. <i>reflexa</i>	+	
<i>Acanthocarpus preissii</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Banksia bipinnatifida</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Conostylis setosa</i>	+	

Species	Cover (%)	Height (m)
<i>Dianella revoluta</i>	+	
<i>Drosera menziesii</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Grevillea synapheae</i>	+	
<i>Hakea undulata</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Lepidosperma squamatum</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lobelia rhombifolia</i>	+	
<i>Lomandra sericea</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Petrophile striata</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Phyllanthus calycinus</i>	+	
<i>Podolepis aristata</i>	+	
<i>Podolepis lessonii</i>	+	
<i>Pterostylis sp.</i>	+	
<i>Stylidium affine</i>	+	
<i>Thysanotus patersonii</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	



## Site B23

<b>Date</b>	14/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	420997mE 6551744mN
<b>Habitat and Waterway</b>	Up slope
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose soil-gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam, Gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Some weeds, senescing Banksias
<b>Time since Fire</b>	<5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 40%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	3	14
<i>Eucalyptus wandoo</i>	10	15
<i>Banksia sessilis</i>	3	4
<i>Xanthorrhoea preissii</i>	4	1.5
<i>Bossiaea eriocarpa</i>	4	0.8
<i>Hibbertia hypericoides</i>	2	0.4
<i>Acacia pulchella</i>	+	
<i>Boronia ramosa</i>	+	
<i>Calytrix variabilis</i>	+	
<i>Cassytha racemosa</i>	+	
<i>Chamaescilla corymbosa</i>	+	

Species	Cover (%)	Height (m)
<i>Conostylis setosa</i>	+	
<i>Desmocladius fasciculatus</i>	+	
<i>Drosera menziesii</i>	+	
<i>Gompholobium knightianum</i>	+	
<i>Grevillea synapheae</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypochoeris glabra</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Leucopogon polymorphus</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Petrophile serruriae</i>	+	
<i>Phyllanthus calycinus</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Pterostylis sp.</i>	+	
<i>Stylidium brunonianum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Thysanotus patersonii</i>	+	
<i>Trachymene pilosa</i>	+	

## Site B24

<b>Date</b>	14/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	420420mE 6551747mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loam, gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Fire, Weeds
<b>Time since Fire</b>	<3 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 30%



Species	Cover (%)	Height (m)
<i>Eucalyptus wandoo</i>	20	12
<i>Xanthorrhoea preissii</i>	4	1.5
<i>Hibbertia hypericoides</i>	3	0.2
<i>Acacia sphacelata</i> subsp. <i>sphacelata</i>	+	
<i>Allocasuarina fraseriana</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Babingtonia camphorosmae</i>	+	
<i>Banksia fraseri</i> var. <i>fraseri</i>	+	
<i>Banksia dallaneyi</i>	+	

Species	Cover (%)	Height (m)
<i>Comesperma scoparium</i>	+	
<i>Conostylis setosa</i>	+	
<i>Daviesia preissii</i>	+	
<i>Drosera ?stolonifera</i>	+	
<i>Elythranthera brunonis</i>	+	
<i>Gompholobium aristatum</i>	+	
<i>Grevillea bipinnatifida subsp. bipinnatifida</i>	+	
<i>Grevillea synapheae</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea undulata</i>	+	
<i>Hakea undulata</i>	+	
<i>Hemigenia sericea</i>	+	
<i>Hibbertia acerosa</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lechenaultia biloba</i>	+	
<i>Lepidobolus preissianus</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra sericea</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Opercularia vaginata</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Pericalymma ellipticum</i>	+	
<i>Pterostylis glebosa</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Schoenus clandestinus</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Stackhousia pubescens</i>	+	
<i>Stylidium ?bulbiferum</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Stylidium brunonianum</i>	+	

## Site B25

<b>Date</b>	17/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408760mE 6543972mN
<b>Habitat and Waterway</b>	Creek
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Weeds, erosion
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 35%



Species	Cover (%)	Height (m)
<i>Eucalyptus rudis</i>	35	14
<i>Acacia saligna</i>	3	2
<i>Hakea varia</i>	2	2
<i>Xanthorrhoea preissii</i>	1	1.5
<i>Lepidosperma ?squamatum</i>	35	0.6
<i>Lepidosperma tenue</i>	20	0.6
<i>Briza minor</i>	+	
<i>Conyza bonariensis</i>	+	
<i>Ehrharta longiflora</i>	+	
<i>Hypochaeris glabra</i>	+	

Species	Cover (%)	Height (m)
<i>Isolepis marginata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B26

<b>Date</b>	17/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408769mE 6544036mN
<b>Habitat and Waterway</b>	Creek
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 25%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	5	9
<i>Eucalyptus rudis</i>	15	14
<i>Hakea varia</i>	25	4
<i>Lepidosperma ?squamatum</i>	20	0.4
<i>Lepidosperma tenue</i>	15	0.5
<i>Gonocarpus nodulosus</i>	15	0.1
<i>Acacia saligna</i>	+	
<i>Anigozanthos viridis subsp. viridis</i>	+	

Species	Cover (%)	Height (m)
<i>Arctotheca calendula</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Briza maxima</i>	+	
<i>Caesia occidentalis</i>	+	
<i>Drosera gigantea subsp. gigantea</i>	+	
<i>Hibbertia stellaris</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Isolepis marginata</i>	+	
<i>Jacksonia floribunda</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lomandra sericea</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Parentucellia latifolia</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Verticordia densiflora</i>	+	



## Site B27

<b>Date</b>	17/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408708mE 6544041mN
<b>Habitat and Waterway</b>	Creek
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Sparse; 3%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	2	5
<i>Eucalyptus rudis</i>	5	8
<i>Hakea varia</i>	3	2
<i>Jacksonia furcellata</i>	2	2
<i>Hypocalymma angustifolium</i>	2	1
<i>Lepidosperma ?squamatum</i>	2	0.3
<i>Lepidosperma tenue</i>	1	0.3
<i>Briza maxima</i>	+	
<i>Caesia occidentalis</i>	+	

Species	Cover (%)	Height (m)
<i>Crassula colorata</i>	+	
<i>Dianella revoluta</i>	+	
<i>Dischisma capitatum</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypocalymma angustifolium</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Millotia myosotidifolia</i>	+	
<i>Ornithopus pinnatus</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Pterostylis sp.</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Verticordia densiflora</i>	+	
<i>Xanthorrhoea preissii</i>	+	

## Site B28

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	416688mE 6549328mN
<b>Habitat and Waterway</b>	Mid-Up slope
<b>Slope</b>	Flat
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam, Gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good-Excellent
<b>Disturbance Type</b>	some weeds
<b>Time since Fire</b>	> 10 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Eucalyptus marginata</i>	5	16
<i>Banksia sessilis</i>	3	4
<i>Calothamnus sanguineus</i>	3	1
<i>Hibbertia hypericoides</i>	4	0.6
<i>Neurachne alopecuroidea</i>	4	0.5
<i>Acacia pulchella</i> var. <i>pulchella</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Babingtonia camphorosmae</i>	+	
<i>Banksia armata</i>	+	
<i>Banksia dallaneyi</i>	+	

Species	Cover (%)	Height (m)
<i>Banksia polycephala</i>	+	
<i>Calytrix flavescens</i>	+	
<i>Calytrix variabilis</i>	+	
<i>Chamaescilla corymbosa</i>	+	
<i>Drosera macrantha subsp. macrantha</i>	+	
<i>Drosera sewelliae</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia hibbertioides var. hibbertioides</i>	+	
<i>Hibbertia miniata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Hypolaena pubescens</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Leucopogon pulchellus</i>	+	
<i>Levenhookia octomaculata</i>	+	
<i>Lobelia rhombifolia</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra sericea</i>	+	
<i>Pentameris airoides</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Stylidium albolilacinum</i>	+	
<i>Stylidium repens</i>	+	
<i>Tetralix octandra</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Verticordia bifimbriata</i>	+	
<i>Verticordia serrata var. ciliata</i>	+	
<i>Vulpia bromoides</i>	+	
<i>Xanthorrhoea gracilis</i>	+	

## Site B29

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	419396mE 6550986mN
<b>Habitat and Waterway</b>	Lower slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loam, gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Patchy; 15%



Species	Cover (%)	Height (m)
<i>Eucalyptus wandoo</i>	20	14
<i>Casuarina obesa</i>	15	5
<i>Gastrolobium calycinum</i>	15	1.5
<i>Bossiaea eriocarpa</i>	2	0.4
<i>Neurachne alopecuroidea</i>	18	0.4
<i>Opercularia vaginata</i>	4	0.3
<i>Acacia pulchella</i> var. <i>pulchella</i>	+	
<i>Briza maxima</i>	+	
<i>Chamaescilla corymbosa</i>	+	

Species	Cover (%)	Height (m)
<i>Dianella revoluta</i>	+	
<i>Drosera menziesii</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium shuttleworthii</i>	+	
<i>Goodenia berardiana</i>	+	
<i>Goodenia coerulea</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Hypolaena pubescens</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Romulea rosea</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Stylidium ?bulbiferum</i>	+	
<i>Stylidium affine</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Stypandra glauca</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Trifolium campestre</i>	+	
<i>Trymalium angustifolium</i>	+	
<i>Xanthorrhoea preissii</i>	+	

## Site B30

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	419426mE 6550979mN
<b>Habitat and Waterway</b>	Lower slope
<b>Slope</b>	Moderate
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loam, gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 45%



Species	Cover (%)	Height (m)
<i>Eucalyptus wandoo</i>	18	12
<i>Casuarina obesa</i>	3	3
<i>Gastrolobium calycinum</i>	1	0.8
<i>Neurachne alopecuroidea</i>	7	0.4
<i>Borya sphaerocephala</i>	+	
<i>Burchardia congesta</i>	+	
<i>Drosera ?stolonifera</i>	+	
<i>Drosera macrantha subsp. macrantha</i>	+	
<i>Drosera subhirtella</i>	+	

Species	Cover (%)	Height (m)
<i>Ericomyrtus tenuior</i>	+	
<i>Gompholobium shuttleworthii</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Isolepis marginata</i>	+	
<i>Laxmannia squarrosa</i>	+	
<i>Lepidobolus preissianus</i>	+	
<i>Lepidosperma squamatum</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Opercularia vaginata</i>	+	
<i>Podolepis lessonii</i>	+	
<i>Pterostylis glebosa</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	



### Site B31

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	419858mE 6550951mN
<b>Habitat and Waterway</b>	Lower slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 20%



Species	Cover (%)	Height (m)
<i>Eucalyptus wandoo</i>	15	10
<i>Casuarina obesa</i>	25	8
<i>Hakea lissocarpha</i>	2	1.2
<i>Hypocalymma angustifolium</i>	2	1
<i>Verticordia chrysanthella</i>	4	1.2
<i>Neurachne alopecuroidea</i>	2	0.4
<i>Borya sphaerocephala</i>	1	0.1
<i>Astroloma pallidum</i>	+	

Species	Cover (%)	Height (m)
<i>Banksia fraseri</i> var. <i>fraseri</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Brachyscome pusilla</i>	+	
<i>Briza maxima</i>	+	
<i>Chamaescilla corymbosa</i>	+	
<i>Conostylis setosa</i>	+	
<i>Daviesia physodes</i>	+	
<i>Dianella revoluta</i>	+	
<i>Disa bracteata</i>	+	
<i>Drosera ?sewelliae</i>	+	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	
<i>Drosera menziesii</i>	+	
<i>Drosera subhirtella</i>	+	
<i>Ericomyrtus tenuior</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium knightianum</i>	+	
<i>Gompholobium marginatum</i>	+	
<i>Goodenia coerulea</i>	+	
<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>	+	
<i>Grevillea pilulifera</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Jacksonia sternbergiana</i>	+	
<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>	+	
<i>Lepidobolus preissianus</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Pterostylis glebosa</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Stylidium androsaceum</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Wurmbea dioica</i> subsp. <i>alba</i>	+	

## Site B32

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408997mE 6524339mN
<b>Habitat and Waterway</b>	Lower slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sandy loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Excellent
<b>Disturbance Type</b>	Some weeds
<b>Time since Fire</b>	> 10 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 45%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	5	14
<i>Eucalyptus marginata</i>	40	14
<i>Banksia attenuata</i>	10	5
<i>Banksia grandis</i>	3	4
<i>Macrozamia riedlei</i>	3	1
<i>Xanthorrhoea preissii</i>	4	1.5
<i>Hibbertia hypericoides</i>	4	0.8
<i>Alexgeorgea nitens</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Austrostipa elegantissima</i>	+	

Species	Cover (%)	Height (m)
<i>Banksia dallaneyi</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Briza maxima</i>	+	
<i>Caladenia flava</i>	+	
<i>Chamaescilla corymbosa</i>	+	
<i>Corynotheca micrantha</i>	+	
<i>Daviesia nudiflora</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Freesia alba x leichtlinii</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Hypolaena exsulca</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Philothea spicata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Pyrorchis nigricans</i>	+	
<i>Styphelia tenuiflora</i>	+	
<i>Tetrarrhena laevis</i>	+	
<i>Thysanotus manglesianus</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	

### Site B33

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409481mE 6524055mN
<b>Habitat and Waterway</b>	Swamp
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Fire
<b>Time since Fire</b>	<2 years
<b>Leaf Litter Distribution and Cover</b>	No litter; 0%



Species	Cover (%)	Height (m)
<i>Eucalyptus rudis</i>	2	4
<i>Melaleuca preissiana</i>	15	6
<i>Baumea articulata</i>	85	2
<i>Baumea rubiginosa</i>	40	1.5
<i>Typha sp.</i>	2	1.5

### Site B34

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409578mE 6523992mN
<b>Habitat and Waterway</b>	Swamp (Creek)
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Fire, some weeds
<b>Time since Fire</b>	<2 years
<b>Leaf Litter Distribution and Cover</b>	Patchy; 0%



Species	Cover (%)	Height (m)
<i>Banksia littoralis</i>	6	6
<i>Eucalyptus rudis</i>	1	3
<i>Aotus gracillima</i>	2	2
<i>Xanthorrhoea preissii</i>	2	1.5
<i>Hypocalymma angustifolium</i>	80	0.8
<i>Alexgeorgea nitens</i>	+	
<i>Astartea scoparia</i>	+	
<i>Baumea rubiginosa</i>	+	
<i>Briza minor</i>	+	

Species	Cover (%)	Height (m)
<i>Crassula colorata</i>	+	
<i>Cyperus polystachyos</i>	+	
<i>Drosera ?stolonifera</i>	+	
<i>Drosera gigantea subsp. gigantea</i>	+	
<i>Drosera glanduligera</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Helichrysum luteoalbum</i>	+	
<i>Hypochoeris glabra</i>	+	
<i>Hypolaena exsulca</i>	+	
<i>Isolepis marginata</i>	+	
<i>Jacksonia furcellata</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lotus subbiflorus</i>	+	
<i>Melaleuca preissiana</i>	+	
<i>Mesomelaena tetragona</i>	+	
<i>Patersonia occidentalis</i>	+	
<i>Pentameris airoides</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Romulea rosea</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Trifolium dubium</i>	+	
<i>Ursinia anthemoides</i>	+	

### Site B35

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	410127mE 6521299mN
<b>Habitat and Waterway</b>	Creek (Creek)
<b>Slope</b>	Valley floor
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Grazing, weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 25%



Species	Cover (%)	Height (m)
<i>Kunzea glabrescens</i>	25	4
<i>Melaleuca viminea</i>	5	4
<i>Haemodorum simplex</i>	+	
<i>Hydrocotyle alata</i>	+	
<i>Isolepis cernua</i>	+	
<i>Utricularia multifida</i>	+	



## Site B36

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409166mE 6533657mN
<b>Habitat and Waterway</b>	Swamp
<b>Slope</b>	Flat
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	White
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	> 10 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 65%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	20	12
<i>Eucalyptus rudis</i>	10	10
<i>Banksia grandis</i>	1	3
<i>Kunzea glabrescens</i>	40	5
<i>Melaleuca preissiana</i>	6	4
<i>Xanthorrhoea preissii</i>	1	0.8
<i>Lepidosperma tenue</i>	3	0.4
<i>Baumea rubiginosa</i>	+	
<i>Briza maxima</i>	+	

<i>Caladenia flava</i>	+	
Species	Cover (%)	Height (m)
<i>Crassula colorata</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Drosera subhirtella</i>	+	
<i>Eriochilus dilatatus</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Jacksonia sternbergiana</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lepidosperma ?squamatum</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Schoenus efoliatus</i>	+	
<i>Trachymene pilosa</i>	+	

## Site B37

<b>Date</b>	18/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409060mE 6533684mN
<b>Habitat and Waterway</b>	Swamp
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Moist Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Loamy sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good-Excellent
<b>Disturbance Type</b>	Fallen trees, some weeds
<b>Time since Fire</b>	> 10 years
<b>Leaf Litter Distribution and Cover</b>	Evenly spread; 85%



Species	Cover (%)	Height (m)
<i>Banksia attenuata</i>	3	9
<i>Banksia ilicifolia</i>	4	9
<i>Banksia menziesii</i>	6	7
<i>Kunzea glabrescens</i>	80	6
<i>Xanthorrhoea preissii</i>	5	1
? <i>Philothea spicata</i>	+	
<i>Calytrix flavescens</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Hypochoeris glabra</i>	+	
<i>Labichea punctata</i>	+	
<i>Phyllangium divergens</i>	+	
<i>Poa drummondiana</i>	+	
<i>Ursinia anthemoides</i>	+	

### Site B38

<b>Date</b>	19/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	411474mE 6520537mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Fire, weeds
<b>Time since Fire</b>	<3 years
<b>Leaf Litter Distribution and Cover</b>	Sparse; 3%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	4	5
<i>Eucalyptus marginata</i>	1	1
<i>Xanthorrhoea preissii</i>	15	2
<i>Bossiaea eriocarpa</i>	30	1
<i>Phyllanthus calycinus</i>	30	0.4
<i>Acacia saligna</i>	+	
<i>Adenanthos cygnorum subsp. chamaephyton</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Briza maxima</i>	+	
<i>Briza minor</i>	+	
<i>Crassula colorata</i>	+	
<i>Drosera erythrorhiza</i>	+	

Species	Cover (%)	Height (m)
<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>	+	
<i>Grevillea vestita</i> subsp. <i>vestita</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hakea lissocarpha</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hydrocotyle alata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Jacksonia furcellata</i>	+	
<i>Kennedia coccinea</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lagenophora huegelii</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Moraea flaccida</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Orobanche minor</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrorhagia dubia</i>	+	
<i>Poa drummondiana</i>	+	
<i>Podolepis aristata</i>	+	
<i>Podotrochea gnaphalioides</i>	+	
<i>Stackhousia pubescens</i>	+	
<i>Tetraria octandra</i>	+	
<i>Thomasia grandiflora</i>	+	
<i>Thysanotus manglesianus</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Trifolium hirtum</i>	+	
<i>Ursinia anthemoides</i>	+	

### Site B39

<b>Date</b>	19/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	411463mE 6520540mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Fire, weeds
<b>Time since Fire</b>	<3 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 5%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	20	6
<i>Xanthorrhoea preissii</i>	30	2
<i>Bossiaea eriocarpa</i>	35	1.2
<i>Hypocalymma angustifolium</i>	12	1
<i>Phyllanthus calycinus</i>	10	1
<i>Adenanthos cygnorum subsp. chamaephyton</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Briza maxima</i>	+	
<i>Briza minor</i>	+	

Species	Cover (%)	Height (m)
<i>Burchardia congesta</i>	+	
<i>Crassula colorata</i>	+	
<i>Erodium botrys</i>	+	
<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Hydrocotyle alata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Kennedia prostrata</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrorhagia dubia</i>	+	
<i>Poa drummondiana</i>	+	
<i>Podolepis aristata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Tetragia octandra</i>	+	
<i>Thomasia grandiflora</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Trifolium dubium</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B40

<b>Date</b>	19/10/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	411480mE 6520589mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Clay loam
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Fire, weeds
<b>Time since Fire</b>	<3 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 10%



Species	Cover (%)	Height (m)
<i>Corymbia calophylla</i>	15	18
<i>Jacksonia sternbergiana</i>	12	3
<i>Xanthorrhoea preissii</i>	3	1.5
<i>Bossiaea eriocarpa</i>	30	0.8
<i>Hypocalymma angustifolium</i>	60	0.7
<i>Acacia iteaphylla</i>	+	
<i>Acacia saligna</i>	+	
<i>Adenanthos cygnorum subsp. chamaephyton</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Austrostipa elegantissima</i>	+	
<i>Briza maxima</i>	+	
<i>Burchardia congesta</i>	+	



Species	Cover (%)	Height (m)
<i>Caladenia longicauda</i> subsp. <i>Longicauda</i>	+	
<i>Comesperma calymega</i>	+	
<i>Daviesia physodes</i>	+	
<i>Gastrolobium ?crispatum</i>	+	
<i>Gastrolobium capitatum</i>	+	
<i>Gompholobium knightianum</i>	+	
<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Hyalosperma cotula</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Labichea punctata</i>	+	
<i>Lysimachia arvensis</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Pentameris airoides</i>	+	
<i>Phyllanthus calycinus</i>	+	
<i>Podolepis aristata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Ptilotus manglesii</i>	+	
<i>Romulea rosea</i>	+	
<i>Sowerbaea laxiflora</i>	+	
<i>Synaphea panhesya</i>	+	
<i>Thomasia grandiflora</i>	+	
<i>Thysanotus manglesianus</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B41

<b>Date</b>	22/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	409062mE 6532363mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Pale grey
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	?Dieback, some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Banksia attenuata</i>	20	5
<i>Banksia menziesii</i>	5	3
<i>Nuytsia floribunda</i>	15	4
<i>Xanthorrhoea preissii</i>	10	1.5
<i>Lyginia imberbis</i>	3	0.5
<i>Melaleuca seriata</i>	15	0.5
<i>Mesomelaena pseudostygia</i>	5	0.5

Species	Cover (%)	Height (m)
<i>?Philotheca spicata</i>	+	
<i>Acacia huegelii</i>	+	
<i>Alexgeorgea nitens</i>	+	
<i>Amphipogon strictus</i>	+	
<i>Anigozanthos humilis</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Beaufortia elegans</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Calytrix flavescens</i>	+	
<i>Cassytha racemosa</i>	+	
<i>Caustis dioica</i>	+	
<i>Chamaescilla corymbosa</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Conostylis prolifera</i>	+	
<i>Desmocladius fasciculatus</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia huegelii</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Jacksonia eremodendron</i>	+	
<i>Lepidosperma tenue</i>	+	
<i>Levenhookia pusilla</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Orchidaceae sp.</i>	+	
<i>Petrophile linearis</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Schoenus curvifolius</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Stylidium brunonianum</i>	+	
<i>Stylidium piliferum</i>	+	
<i>Stylidium repens</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Thysanotus manglesianus</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Trifolium dubium</i>	+	

---

Species	Cover (%)	Height (m)
<i>Ursinia anthemoides</i>	+	

## Site B42

<b>Date</b>	22/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408784mE 6538363mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Pale grey
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Eucalyptus todtiana</i>	20	6
<i>Banksia attenuata</i>	8	4
<i>Eremaea pauciflora</i>	5	1.2
<i>Alexgeorgea nitens</i>	60	0.1
<i>Bossiaea eriocarpa</i>	2	0.3
<i>Austrostipa hemipogon</i>	+	
<i>Banksia dallaneyi</i>	+	
<i>Briza maxima</i>	+	
<i>Calytrix fraseri</i>	+	

Species	Cover (%)	Height (m)
<i>Conostephium pendulum</i>	+	
<i>Dampiera linearis</i>	+	
<i>Daviesia nudiflora</i>	+	
<i>Daviesia physodes</i>	+	
<i>Disa bracteata</i>	+	
<i>Ehrharta calycina</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Hypolaena exsulca</i>	+	
<i>Jacksonia furcellata</i>	+	
<i>Pentameris airoides</i>	+	
<i>Petrophile linearis</i>	+	
<i>Phlebocarya ciliata</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Ursinia anthemoides</i>	+	

### Site B43

<b>Date</b>	22/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408867mE 6538795mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Pale grey
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Senescence
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Melaleuca preissiana</i>	4	7
<i>Banksia attenuata</i>	8	5
<i>Adenanthos cygnorum</i>	5	2
<i>Regelia ciliata</i>	65	1.6
<i>Lyginia imberbis</i>	2	1
<i>Phlebocarya ciliata</i>	3	0.6
<i>Austrostipa hemipogon</i>	+	
<i>Briza maxima</i>	+	
<i>Crassula colorata</i>	+	
<i>Dampiera linearis</i>	+	

Species	Cover (%)	Height (m)
<i>Ehrharta calycina</i>	+	
<i>Gnephosis angianthoides</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Jacksonia furcellata</i>	+	
<i>Lechenaultia floribunda</i>	+	
<i>Pentameris airoides</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Stylidium repens</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Tricostularia neesii</i>	+	
<i>Ursinia anthemoides</i>	+	



## Site B44

<b>Date</b>	17/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Lisa Chappel
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	411604mE 6520520mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sand, Gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Eucalyptus wandoo</i>	25	1.5
<i>Hakea lissocarpha</i>	3	1.5
<i>Xanthorrhoea preissii</i>	5	1.5
<i>Lepidosperma squamatum</i>	5	0.3
<i>Acacia barbinervis</i> subsp. <i>barbinervis</i>	+	
<i>Acacia drummondii</i> subsp. <i>affinis</i>	+	
<i>Austrostipa hemipogon</i>	+	
<i>Avena barbata</i>	+	
<i>Banksia bipinnatifida</i>	+	
<i>Banksia dallaneyi</i>	+	

Species	Cover (%)	Height (m)
<i>Bossiaea eriocarpa</i>	+	
<i>Conostylis setigera</i>	+	
<i>Dianella revoluta</i>	+	
<i>Ehrharta calycina</i>	+	
<i>Ehrharta longiflora</i>	+	
<i>Gompholobium marginatum</i>	+	
<i>Haemodorum laxum</i>	+	
<i>Hibbertia commutata</i>	+	
<i>Hibbertia hypericoides</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Kennedia coccinea</i>	+	
<i>Labichea punctata</i>	+	
<i>Lomandra sericea</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Trifolium dubium</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B45

<b>Date</b>	17/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Lisa Chappel
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	411604mE 6520520mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Gravel
<b>Soil Colour</b>	Brown
<b>Soil Texture</b>	Sand, Gravel
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Some weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%

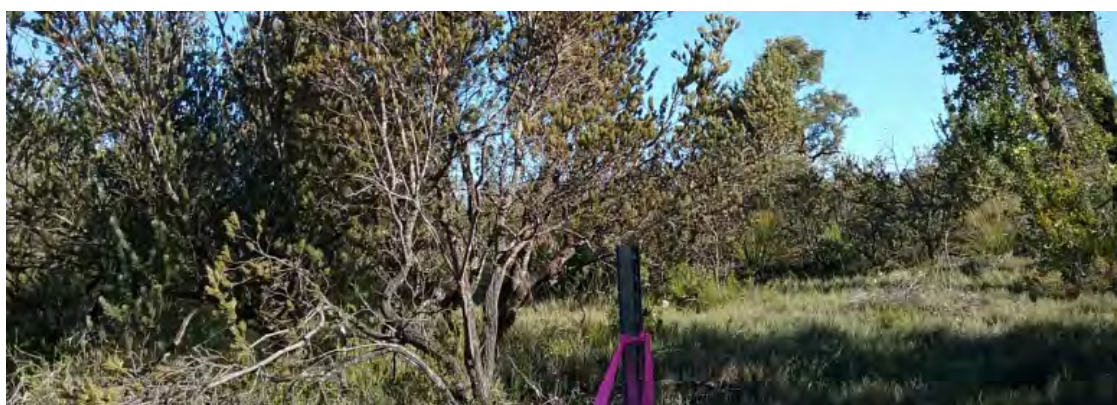


Species	Cover (%)	Height (m)
<i>Banksia attenuata</i>	16	5
<i>Banksia menziesii</i>	3	4
<i>Nuytsia floribunda</i>	2	5
<i>Xanthorrhoea preissii</i>	4	1.2
<i>Eremaea pauciflora</i>	10	0.8
<i>Stirlingia latifolia</i>	5	1
<i>Acacia pulchella</i>	+	
<i>Austrostipa hemipogon</i>	+	
<i>Calytrix flavescens</i>	+	
<i>Calytrix fraseri</i>	+	

Species	Cover (%)	Height (m)
<i>Cassytha racemosa</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Conostylis juncea</i>	+	
<i>Drosera erythrorhiza</i>	+	
<i>Gompholobium tomentosum</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Lechenaultia floribunda</i>	+	
<i>Lepidosperma squamatum</i>	+	
<i>Lomandra caespitosa</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lomandra micrantha</i>	+	
<i>Lyginia barbata</i>	+	
<i>Melaleuca seriata</i>	+	
<i>Petrophile linearis</i>	+	
<i>Philothea spicata</i>	+	
<i>Pterostylis sp.</i>	+	
<i>Scholtzia involucrata</i>	+	
<i>Stylidium brunonianum</i>	+	
<i>Synaphea spinulosa</i>	+	
<i>Tricoryne elatior</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B46

<b>Date</b>	22/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	408937mE 6539299mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Pale grey
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good
<b>Disturbance Type</b>	Some weeds, Adenanthos colonisation
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Eucalyptus todtiana</i>	6	8
<i>Banksia ilicifolia</i>	3	6
<i>Banksia menziesii</i>	5	5
<i>Adenanthos cygnorum</i>	20	3
<i>Xanthorrhoea preissii</i>	3	1
<i>Alexgeorgea nitens</i>	85	0.1
<i>Austrostipa hemipogon</i>	+	
<i>Bossiaea eriocarpa</i>	+	
<i>Briza maxima</i>	+	
<i>Conostephium pendulum</i>	+	
<i>Dampiera linearis</i>	+	
<i>Ehrharta calycina</i>	+	
<i>Eremaea pauciflora</i>	+	
<i>Gladiolus caryophyllaceus</i>	+	

Species	Cover (%)	Height (m)
<i>Hibbertia subvaginata</i>	+	
<i>Lomandra hermaphrodita</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Neurachne alopecuroidea</i>	+	
<i>Petrophile linearis</i>	+	
<i>Phlebocarya ciliata</i>	+	
<i>Schoenus sp.</i>	+	
<i>Stirlingia latifolia</i>	+	
<i>Ursinia anthemoides</i>	+	

## Site B47

<b>Date</b>	22/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	40887mE 66538747mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Pale grey
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Very Good
<b>Disturbance Type</b>	Weeds
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



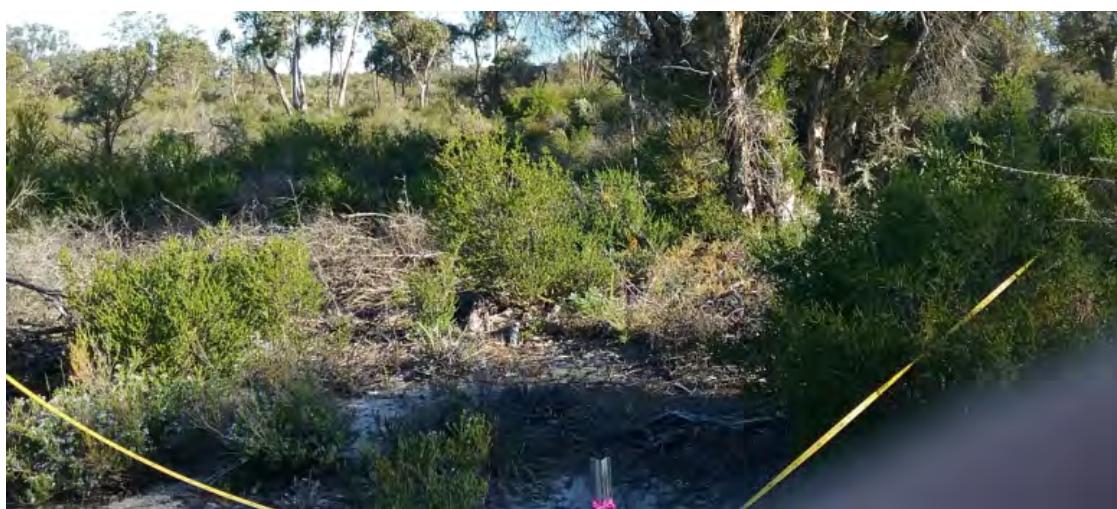
Species	Cover (%)	Height (m)
<i>Eucalyptus camaldulensis</i>	15	9
<i>Nuytsia floribunda</i>	20	7
<i>Banksia attenuata</i>	25	4
<i>Melaleuca preissiana</i>	4	4
<i>Alexgeorgea nitens</i>	6	0.1
<i>Calytrix sylvana</i>	2	1
<i>Phlebocarya ciliata</i>	5	0.6
<i>Adenanthos cygnorum</i>	+	
<i>Austrostipa hemipogon</i>	+	
<i>Conostylis aculeata</i>	+	
<i>Corynotheca micrantha</i>	+	

Species	Cover (%)	Height (m)
<i>Crassula colorata</i>	+	
<i>Ehrharta calycina</i>	+	
<i>Gnephosis angianthoides</i>	+	
<i>Hibbertia subvaginata</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Lechenaultia floribunda</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Pentameris airoides</i>	+	
<i>Podotheca gnaphalioides</i>	+	
<i>Regelia ciliata</i>	+	
<i>Siloxerus humifusus</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Ursinia anthemoides</i>	+	



## Site B48

<b>Date</b>	22/11/2016
<b>Botanist</b>	Kellie Bauer-Simpson, Gabriela Martinez
<b>Quadrat Size</b>	10 x 10 m
<b>NW Corner Coordinates</b>	4087670mE 6538729mN
<b>Habitat and Waterway</b>	Mid slope
<b>Slope</b>	Gentle
<b>Surface Layer</b>	Loose Soil
<b>Soil Colour</b>	Pale grey
<b>Soil Texture</b>	Sand
<b>Rock Type</b>	No Rocks
<b>Rock Size and Abundance</b>	No Rocks - N/A
<b>Vegetation Condition</b>	Good-Very Good
<b>Disturbance Type</b>	Some weeds and senescence
<b>Time since Fire</b>	>5 years
<b>Leaf Litter Distribution and Cover</b>	Scattered; 0%



Species	Cover (%)	Height (m)
<i>Melaleuca preissiana</i>	10	5
<i>Regelia ciliata</i>	65	1.2
<i>Jacksonia furcellata</i>	2	2
<i>Lechenaultia floribunda</i>	3	0.6
<i>Patersonia occidentalis</i>	3	0.4
<i>Hibbertia subvaginata</i>	+	
<i>Carpobrotus edulis</i>	+	
<i>Ursinia anthemoides</i>	+	
<i>Briza maxima</i>	+	
<i>Austrostipa hemipogon</i>	+	
<i>Crassula colorata</i>	+	

Species	Cover (%)	Height (m)
<i>Podotheca gnaphalioides</i>	+	
<i>Gnephosis angianthoides</i>	+	
<i>Lyginia imberbis</i>	+	
<i>Hypochaeris glabra</i>	+	
<i>Pentameris airoides</i>	+	
<i>Trachymene pilosa</i>	+	
<i>Chamaescilla corymbosa</i>	+	
<i>Arnocrinum preissii</i>	+	

---

## APPENDIX C: FLORA SPECIES RECORDED WITHIN EACH QUADRAT







\*denotes introduced (weed) species

Family	Species	B01	B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	B14	B15	B15R	B16R	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32	B33	B34	B35	B36	B37	B38	B39	B40	B41	B42	B43	B44	B45	B46	B47	B48								
Fabaceae (continued)	<i>Gompholobium aristatum</i>									+																																																
	<i>Gompholobium knightianum</i>		+																																																							
	<i>Gompholobium marquinatum</i>																																																									
	<i>Gompholobium preissii</i>																																																									
	<i>Gompholobium shuttleworthii</i>																																																									
	<i>Gompholobium tomentosum</i>							+	+																																																	
	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>																																																									
	<i>Jacksonia eremodendron</i>																																																									
	<i>Jacksonia floribunda</i>																																																									
	<i>Jacksonia furcellata</i>							+																																																		
	<i>Jacksonia stembergiana</i>																																																									
	<i>Kennedia coccinea</i>																																																									
	<i>Kennedia prostrata</i>																																																									
	<i>Kennedia stirlingii</i>																																																									
	<i>Labichea punctata</i>		+																																																							
	* <i>Lotus angustissimus</i>																																																									
	* <i>Lotus subbiflorus</i>																																																									
	* <i>Ornithopus pinnatus</i>																																																									
	* <i>Trifolium campestre</i>																																																									
	* <i>Trifolium dubium</i>																																																									
* <i>Trifolium hirtum</i>																																																										
Geraniaceae	* <i>Erodium botrys</i>																																																									
Rutaceae	<i>Boronia ramosa</i>		+																																																							
	<i>Boronia ramosa</i> subsp. <i>anethifolia</i>		+																																																							
	<i>Philotheca spicata</i>		+	+																																																						
<i>?Philotheca spicata</i>																																																										
Polygalaceae	<i>Comesperma calymega</i>																																																									
Phyllanthaceae	<i>Comesperma scoparium</i>																																																									
	<i>Phyllanthus calycinus</i>																																																									
<i>Poranthera microphylla</i>																																																										
Euphorbiaceae	<i>Monotaxis grandiflora</i>																																																									
Celastraceae	<i>Stackhousia pubescens</i>																																																									
	<i>Tripterococcus brunonis</i>																																																									
Rhamnaceae	<i>Stenanthemum coronatum</i>																																																									
	<i>Trymalium angustifolium</i>																																																									
Elaeocarpaceae	<i>Tetratheca hirsuta</i>		+																																																							
Malvaceae	<i>Thomasia grandiflora</i>																																																									
Dilleniaceae	<i>Hibbertia acerosa</i>																																																									
	<i>Hibbertia aurea</i>																																																									
	<i>Hibbertia commutata</i>		+	+																																																						







## APPENDIX D: FLORA SPECIES RECORDED WITHIN EACH VEGETATION COMMUNITY

\*denotes introduced (weed) species

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Zamiaceae	<i>Macrozamia riedlei</i>	+							+			+		
Typhaceae	<i>Typha</i> sp.						+							
Poaceae	<i>Amphipogon strictus</i>	+												
	<i>Amphipogon turbinatus</i>								+					
	<i>Austrostipa elegantissima</i>			+				+	+			+		
	<i>Austrostipa hemipogon</i>	+			+					+			+	
	<i>Austrostipa scabra</i>					+								
	* <i>Avena barbata</i>				+									
	* <i>Briza maxima</i>	+		+	+	+	+	+	+	+	+	+	+	
	* <i>Briza minor</i>			+			+	+						+
	* <i>Ehrharta calycina</i>				+					+			+	
	* <i>Ehrharta longiflora</i>				+				+					
	* <i>Hordeum leporinum</i>													+
	* <i>Lolium rigidum</i>													+
	<i>Microlaena stipoides</i>	+												
	<i>Neurachne alopecuroidea</i>	+		+	+	+			+		+	+		
	* <i>Pentameris airoides</i>	+		+	+	+	+	+		+			+	
	<i>Poa drummondiana</i>	+	+	+	+					+			+	
	<i>Tetrarrhena laevis</i>									+				
* <i>Vulpia bromoides</i>				+										
* <i>Vulpia myuros</i>				+	+									
Cyperaceae	<i>Baumea articulata</i>						+							
	<i>Baumea rubiginosa</i>						+	+						
	<i>Caustis dioica</i>	+							+					
	* <i>Cyperus polystachyos</i>						+							
	<i>Isolepis cernua</i>													+
* <i>Isolepis marginata</i>						+	+	+		+	+		+	

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Cyperaceae	<i>Lepidosperma squamatum</i>	+			+						+	+		
	<i>Lepidosperma ? squamatum</i>				+	+		+	+			+		
	<i>Lepidosperma striatum</i>						+							
	<i>Lepidosperma tenue</i>	+			+			+	+		+	+		
	<i>Mesomelaena pseudostygia</i>	+			+				+					
	<i>Mesomelaena tetragona</i>	+					+		+					
	<i>Schoenus brevisetis</i>	+				+			+					
	<i>Schoenus clandestinus</i>												+	
	<i>Schoenus curvifolius</i>	+							+					
	<i>Schoenus efoliatus</i>							+						
	<i>Schoenus sp.</i>	+	+							+				
	<i>Tetraria octandra</i>				+	+	+						+	
<i>Tricostularia neesii</i>													+	
Restionaceae	<i>Alexgeorgea nitens</i>	+		+	+	+	+		+	+			+	
	<i>Desmocladius fasciculatus</i>	+			+	+						+		
	<i>Hypolaena exsulca</i>	+					+		+	+				
	<i>Hypolaena pubescens</i>	+			+						+			
	<i>Lepidobolus preissianus</i>								+		+	+		
	<i>Lyginia barbata</i>	+							+					
	<i>Lyginia imberbis</i>	+			+				+	+			+	
Juncaceae	* <i>Juncus acutus</i>													+
Juncaceae	* <i>Juncus bufonius</i>													+
Juncaceae	<i>Juncus pallidus</i>						+							
Asparagaceae	<i>Acanthocarpus preissii</i>											+		
	<i>Chamaescilla corymbosa</i>	+			+	+			+		+	+	+	
	<i>Dianella revoluta</i>				+			+			+	+		
	<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>				+	+					+	+		
	<i>Laxmannia squarrosa</i>				+				+		+	+		
	<i>Lomandra caespitosa</i>	+			+	+			+			+		
	<i>Lomandra hermaphrodita</i>	+			+	+			+	+		+		
	<i>Lomandra micrantha</i>	+								+				
	<i>Lomandra preissii</i>	+			+									

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Asparagaceae	<i>Lomandra sericea</i>	+			+			+				+		
	<i>Sowerbaea laxiflora</i>	+		+				+	+		+	+		
	<i>Thysanotus manglesianus</i>	+		+					+					
	<i>Thysanotus patersonii</i>											+		
Xanthorrhoeaceae	<i>Xanthorrhoea gracilis</i>	+	+	+	+	+	+	+	+	+	+	+		
	<i>Xanthorrhoea preissii</i>													
Colchicaceae	<i>Burchardia congesta</i>	+		+	+	+			+		+			
	<i>Wurmbea dioica</i> subsp. <i>alba</i>										+			
Boryaceae	<i>Borya sphaerocephala</i>										+			
Hemerocallidaceae	<i>Amocrinum preissii</i>												+	
	<i>Caesia occidentalis</i>					+		+						
	<i>Corynotheca micrantha</i>	+							+				+	
	<i>Stypandra glauca</i>										+			
	<i>Tricoryne elatior</i>	+		+	+		+	+	+		+	+		
Haemodoraceae	<i>Anigozanthos humilis</i>	+			+	+			+					
	<i>Anigozanthos manglesii</i>				+									
	<i>Anigozanthos viridis</i> subsp. <i>viridis</i>							+						
	<i>Conostylis aculeata</i>	+			+				+				+	
	<i>Conostylis juncea</i>	+												
	<i>Conostylis prolifera</i>	+												
	<i>Conostylis setigera</i>				+									
	<i>Conostylis setosa</i>					+			+		+	+		
	<i>Conostylis teretifolia</i>	+			+				+					
	<i>Haemodorum laxum</i>	+		+	+	+			+	+		+		
	<i>Haemodorum simplex</i>													+
	<i>Phlebocarya ciliata</i>									+			+	
Iridaceae	* <i>Freesia alba x leichtlinii</i>								+					
	* <i>Gladiolus caryophyllaceus</i>	+			+	+			+	+	+	+		
	* <i>Moraea flaccida</i>			+										

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Iridaceae	<i>Patersonia occidentalis</i>	+			+		+	+	+			+	+	
	* <i>Romulea rosea</i>			+			+				+			
	* <i>Watsonia meriana</i>											+		+
	?Iridaceae sp.											+		
Orchidaceae	<i>Caladenia flava</i>				+			+	+					
	* <i>Disa bracteata</i>									+	+			
	<i>Elythranthera brunonis</i>											+		
	<i>Eriochilus dilatatus</i>							+						
	<i>Leporella fimbriata</i>				+									
	<i>Pterostylis glebosa</i>		+								+	+		
	<i>Pterostylis</i> sp.	+						+				+		
	<i>Pyrorchis nigricans</i>	+				+			+					
	<i>Thelymitra crinita</i>					+								
Orchidaceae sp.	+													
Casuarinaceae	<i>Allocasuarina fraseriana</i>											+		
	<i>Allocasuarina humilis</i>	+							+					
	<i>Casuarina obesa</i>										+			
Proteaceae	<i>Adenanthos cygnorum</i>									+			+	
	<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i> (P3)			+										
	<i>Banksia armata</i>				+									
	<i>Banksia attenuata</i>	+	+						+	+			+	
	<i>Banksia bipinnatifida</i>				+							+		
	<i>Banksia dallanneyi</i>	+			+	+			+	+		+	+	
	<i>Banksia fraseri</i> var. <i>fraseri</i>										+	+		
	<i>Banksia grandis</i>	+			+			+	+					
	<i>Banksia ilicifolia</i>		+						+	+				
	<i>Banksia littoralis</i>		+				+		+	+				
	<i>Banksia menziesii</i>	+	+						+	+				
	<i>Banksia polycephala</i>				+									
	<i>Banksia sessilis</i>				+	+						+		
<i>Banksia telmatiaea</i>					+									
<i>Conospermum acerosum</i> subsp. <i>acerosum</i>						+			+					

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJsplS
Proteaceae	<i>Conospermum stoechadis</i> subsp. <i>stoechadis</i>								+					
	<i>Conospermum teretifolium</i>	+												
	<i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>			+							+	+		
	<i>Grevillea pilulifera</i>										+	+		
	<i>Grevillea synapheae</i>				+	+						+		
	<i>Grevillea vestita</i> subsp. <i>vestita</i>			+										
	<i>Hakea lissocarpha</i>			+	+	+					+	+		
	<i>Hakea stenocarpa</i>					+								
	<i>Hakea undulata</i>											+		
	<i>Hakea varia</i>								+					
	<i>Petrophile linearis</i>	+	+		+					+	+			
	<i>Petrophile macrostachya</i>									+				
	<i>Petrophile serruriae</i>					+						+		
	<i>Petrophile striata</i>				+							+		
	* <i>Petrophragma dubia</i>				+	+						+		
	<i>Stirlingia latifolia</i>	+			+	+				+	+			
	<i>Synaphea panhesya</i> (P1)				+	+	+							
<i>Synaphea spinulosa</i>	+			+	+				+					
<i>Synaphea</i> sp.	+			+										
Loranthaceae	<i>Nuytsia floribunda</i>	+											+	
Amaranthaceae	<i>Ptilotus manglesii</i>			+	+						+	+		
Molluginaceae	<i>Macarthuria australis</i>								+					
Aizoaceae	* <i>Carpobrotus edulis</i>												+	
Portulacaceae	<i>Calandrinia liniflora</i>	+												
Lauraceae	<i>Cassytha racemosa</i>	+			+	+						+		
Droseraceae	<i>Drosera erythrorhiza</i>	+	+	+	+	+		+	+					
	<i>Drosera gigantea</i> subsp. <i>gigantea</i>						+	+						
	<i>Drosera glanduligera</i>	+			+		+	+				+		

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Droseraceae	<i>Drosera macrantha</i> subsp. <i>macrantha</i>	+	+		+				+		+			
	<i>Drosera menziesii</i>	+			+				+		+	+		
	<i>Drosera neesii</i> subsp. <i>neesii</i>													+
	<i>Drosera sewelliae</i> (P2)				+									
	<i>Drosera ?sewelliae</i> (P2)				+	+		+	+		+	+		
	<i>Drosera ?stolonifera</i>						+		+		+	+		
	<i>Drosera subhirtella</i>							+			+	+		
Crassulaceae	<i>Crassula colorata</i>	+		+	+	+	+	+	+			+	+	
Fabaceae	<i>Acacia applanata</i>				+									
	<i>Acacia barbinervis</i> subsp. <i>barbinervis</i>				+									
	<i>Acacia drummondii</i> subsp. <i>affinis</i> (P3)				+									
	<i>Acacia huegelii</i>	+							+			+		
	* <i>Acacia iteaphylla</i>			+										
	<i>Acacia pulchella</i>	+							+			+		
	<i>Acacia pulchella</i> var. <i>pulchella</i>				+						+			
	<i>Acacia pulchella</i> var. <i>reflexa</i>											+		
	<i>Acacia saligna</i>			+				+						
	<i>Acacia sphacelata</i> subsp. <i>sphacelata</i>											+		
	<i>Acacia squamata</i>					+								
	<i>Aotus gracillima</i>						+							
	<i>Bossiaea eriocarpa</i>	+		+	+	+			+	+	+	+		
	<i>Bossiaea ornata</i>	+	+		+	+								
	<i>Daviesia decurrens</i>				+									
	<i>Daviesia divaricata</i>						+							
	<i>Daviesia nudiflora</i>								+	+				
	<i>Daviesia physodes</i>			+						+	+			
	<i>Daviesia preissii</i>						+					+		
<i>Daviesia triflora</i>								+						
<i>Dillwynia laxiflora</i>				+										
<i>Gastrolobium ?crispatum</i> (P1)			+											
<i>Gastrolobium calycinum</i>											+			
<i>Gastrolobium capitatum</i>			+				+							
<i>Gastrolobium pauciflorum</i>	+													

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Fabaceae	<i>Gompholobium aristatum</i>								+			+		
	<i>Gompholobium knightianum</i>			+	+						+	+		
	<i>Gompholobium marginatum</i>				+	+					+			
	<i>Gompholobium preissii</i>				+									
	<i>Gompholobium shuttleworthii</i>										+			
	<i>Gompholobium tomentosum</i>	+			+		+		+					
	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>								+					
	<i>Jacksonia eremodendron</i>	+												
	<i>Jacksonia floribunda</i>	+						+	+					
	<i>Jacksonia furcellata</i>				+			+	+	+			+	
	<i>Jacksonia sternbergiana</i>				+				+		+			
	<i>Johnsonia pubescens</i> subsp. <i>pubescens</i>	+												
	<i>Kennedia coccinea</i>				+	+								
	<i>Kennedia prostrata</i>				+			+	+	+		+		
	<i>Kennedia stirlingii</i>						+							
	<i>Labichea punctata</i>			+	+	+								
	* <i>Lotus angustissimus</i>													+
	* <i>Lotus subbiflorus</i>							+						+
* <i>Ornithopus pinnatus</i>								+						
* <i>Trifolium campestre</i>										+				
* <i>Trifolium dubium</i>	+			+	+		+							
* <i>Trifolium hirtum</i>				+										
Geraniaceae	* <i>Erodium botrys</i>			+										
Rutaceae	<i>Boronia ramosa</i>											+		
	<i>Boronia ramosa</i> subsp. <i>anethifolia</i>					+			+					
	<i>Philothea spicata</i>	+			+	+			+					
	? <i>Philothea spicata</i>	+	+											
Polygalaceae	<i>Comesperma calymega</i>			+										
	<i>Comesperma scoparium</i>											+		
Phyllanthaceae	<i>Phyllanthus calycinus</i>			+								+		
	<i>Poranthera microphylla</i>	+							+					



Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Euphorbiaceae	<i>Monotaxis grandiflora</i>								+					
Celastraceae	<i>Stackhousia pubescens</i>			+					+			+		
	<i>Tripterococcus brunonis</i>				+									
Rhamnaceae	<i>Stenanthemum coronatum</i>					+								
	<i>Trymalium angustifolium</i>										+			
Elaeocarpaceae	<i>Tetratheca hirsuta</i>					+								
Malvaceae	<i>Thomasia grandiflora</i>			+										
Dilleniaceae	<i>Hibbertia acerosa</i>								+			+		
	<i>Hibbertia aurea</i>								+					
	<i>Hibbertia commutata</i>			+	+	+					+	+		
	<i>Hibbertia hibbertioides</i> var. <i>hibbertioides</i>				+									
	<i>Hibbertia huegelii</i>	+			+	+			+					
	<i>Hibbertia hypericoides</i>	+		+	+	+			+		+	+		
	<i>Hibbertia miniata</i> (P4)				+									
	<i>Hibbertia stellaris</i>							+						
	<i>Hibbertia subvaginata</i>	+								+			+	
Thymelaeaceae	<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>								+					
Myrtaceae	<i>Astartea scoparia</i>						+							
	<i>Babingtonia camphorosmae</i>				+							+		
	<i>Beaufortia elegans</i>	+							+					
	<i>Calothamnus sanguineus</i>	+			+	+								
	<i>Calytrix depressa</i>								+					
	<i>Calytrix flavescens</i>	+	+		+									
	<i>Calytrix fraseri</i>	+							+	+				
	<i>Calytrix sylvana</i>	+			+								+	
	<i>Calytrix variabilis</i>	+			+	+						+		
	<i>Corymbia calophylla</i>			+	+			+	+			+		
	<i>Eremaea pauciflora</i>	+			+				+	+				

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Myrtaceae	<i>Eremaea purpurea</i>								+					
	<i>Ericomyrtus tenuior</i>										+			
	<i>Eucalyptus camaldulensis</i>												+	
	<i>Eucalyptus marginata</i>	+		+	+	+			+					
	<i>Eucalyptus rudis</i>						+	+						
	<i>Eucalyptus todtiana</i>	+							+	+				
	<i>Eucalyptus wandoo</i>				+	+					+	+		
	<i>Hypocalymma angustifolium</i>			+			+	+			+			
	<i>Kunzea glabrescens</i>		+					+						+
	<i>Melaleuca preissiana</i>						+	+					+	
	<i>Melaleuca seriata</i>	+												
	<i>Melaleuca teretifolia</i>													+
	<i>Melaleuca trichophylla</i>	+								+				
	<i>Melaleuca viminea</i>													+
	<i>Pericalymma ellipticum</i>					+						+		
	<i>Regelia ciliata</i>												+	
	<i>Scholtzia involucrata</i>	+				+				+				
	<i>Verticordia bifimbriata</i>					+								
	<i>Verticordia chrysanthella</i>										+			
<i>Verticordia densiflora</i>								+						
<i>Verticordia nobilis</i>									+					
<i>Verticordia serrata</i> var. <i>ciliata</i>					+									
Haloragaceae	<i>Gonocarpus nodulosus</i>							+						
	<i>Gonocarpus pithyoides</i>					+			+					
Araliaceae	<i>Hydrocotyle alata</i>			+										+
	<i>Trachymene pilbarensis</i>	+			+									
	<i>Trachymene pilosa</i>	+	+	+	+	+		+	+		+	+		
Apiaceae	<i>Pentapeltis peltigera</i>				+									
	<i>Xanthosia candida</i>					+								
	<i>Xanthosia huegelii</i>				+	+			+					
Ericaceae	<i>Astroloma pallidum</i>										+	+		
	<i>Conostephium minus</i>	+												

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRclF	MvJspLs
Ericaceae	<i>Conostephium pendulum</i>	+			+				+	+				
	<i>Leucopogon polymorphus</i>											+		
	<i>Leucopogon propinquus</i>				+									
	<i>Leucopogon pulchellus</i>	+			+							+		
	<i>Leucopogon sprengelioides</i>								+					
	<i>Leucopogon</i> sp.				+					+				
	<i>Lysinema</i> sp.									+				
	<i>Styphelia tenuiflora</i>				+	+			+					
Primulaceae	<i>Lysimachia arvensis</i>			+				+			+	+		
Loganiaceae	<i>Phyllangium divergens</i>	+	+		+		+	+	+			+		
Lamiaceae	<i>Hemiandra pungens</i>	+												
	<i>Hemigenia sericea</i>				+							+		
	* <i>Stachys arvensis</i>													+
Scrophulariaceae	* <i>Dischisma capitatum</i>							+						
Orobanchaceae	* <i>Orobanche minor</i>			+										
	* <i>Parentucellia latifolia</i>							+				+		
Lentibulariaceae	<i>Utricularia multifida</i>													+
Rubiaceae	<i>Opercularia vaginata</i>								+		+	+		
Campanulaceae	<i>Lobelia rhombifolia</i>				+							+		
	* <i>Wahlenbergia capensis</i>								+					
Goodeniaceae	<i>Dampiera alata</i>				+									
	<i>Dampiera linearis</i>									+			+	
	<i>Goodenia berardiana</i>					+					+			
	<i>Goodenia coerulea</i>										+			
	<i>Lechenaultia biloba</i>	+				+						+		
	<i>Lechenaultia floribunda</i>	+				+							+	

Family	Species	BaXpAn	BmKgH	CcXpBe	EmBsHh	EmXpHh	ErHaBr	ErXpLt	EtBeAn	EtEpAn	EwBeNa	EwXpHh	MpRcLf	MvJspLs
Stylidiaceae	<i>Levenhookia octomaculata</i>				+									
	<i>Levenhookia pusilla</i>	+			+		+		+		+	+		
	<i>Stylidium affine</i>										+	+		
	<i>Stylidium albolilacinum</i>				+				+					
	<i>Stylidium amoenum</i>					+								
	<i>Stylidium androsaceum</i>	+			+				+		+	+		
	<i>Stylidium araeophyllum</i>								+					
	<i>Stylidium brunonianum</i>	+										+	+	
	<i>Stylidium ?bulbiferum</i>										+	+		
	<i>Stylidium neurophyllum</i>	+			+				+					
	<i>Stylidium piliferum</i>	+			+	+	+		+		+	+		
	<i>Stylidium repens</i>	+				+			+				+	
	<i>Stylidium schoenoides</i>	+												
	<i>Stylidium</i> sp. Bindoon (K.F. Kenneally 11405)					+								
	Asteraceae	* <i>Arctotheca calendula</i>					+		+					
<i>Brachyscome pusilla</i>									+		+			
* <i>Conyza bonariensis</i>								+						
* <i>Cotula coronopifolia</i>														+
<i>Gnephosis angianthoides</i>													+	
<i>Helichrysum luteoalbum</i>							+							
<i>Hyalosperma cotula</i>		+		+	+			+	+		+	+		
* <i>Hypochaeris glabra</i>		+	+	+	+	+	+	+	+	+	+	+	+	
<i>Lagenophora huegelii</i>		+		+		+	+	+	+		+	+		
<i>Millotia myosotidifolia</i>								+						
<i>Millotia tenuifolia</i> var. <i>tenuifolia</i>						+	+		+					
<i>Podolepis aristata</i>				+								+		
<i>Podolepis lessonii</i>											+	+		
<i>Podotheca gnaphalioides</i>		+		+	+	+	+		+	+		+	+	
<i>Pterochaeta paniculata</i>					+				+					
<i>Rhodanthe citrina</i>							+							
<i>Siloxerus humifusus</i>										+				+
<i>Trichocline spathulata</i>							+							
* <i>Ursinia anthemoides</i>		+	+	+	+	+	+	+	+	+	+	+	+	
<i>Waitzia suaveolens</i> var. <i>suaveolens</i>										+				