

# Targeted Flora and Vegetation Assessment

Shelamar Station

Project No: EP17-068(02)

**Prepared for Shelamar Leasing Company Pty. Ltd.  
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# Targeted Flora and Vegetation Assessment

## Shelamar Station



## Executive Summary

Shelamar Leasing Company Pty. Ltd. (Shelamar) engaged Emerge Associates (Emerge) to undertake a targeted flora and vegetation assessment within a portion of Lot 46 Eighty Mile Beach in the Shire of Broome (referred to herein as 'the site'). The site comprises 2933.13 ha of land within Shelamar Station that is proposed for horticultural development. The purpose of the assessment was to provide sufficient information on the flora and vegetation values within the site to support a clearing permit application.

Two botanists from Emerge visited the site from 24<sup>th</sup> to 28<sup>th</sup> July 2017 to conduct the targeted flora and vegetation assessment. During the survey transects were traversed to search for 'threatened' and 'priority' flora and limited sampling was performed to characterize local plant community types. Threatened and priority flora, plant communities and vegetation condition were then mapped across the site.

Particular focus was applied to targeted searches for *Seringia* spp. to provide confirmation of the presence or absence of the threatened species *Seringia exastia* (T), which was suspected to be present within the site. Fine-scale examination of floral features is required to separate *Seringia exastia* (T) from the similar species *S. katatona* (P3) and *S. nephrosperma*, which are also present within the site. Specimens were collected from all flowering *Seringia* spp. plants observed during the survey and later identified by specialist taxonomists Udani Sirisena and Carolyn Wilkins.

The outcomes of the survey include:

- Relatively undisturbed remnant native vegetation is present across the majority of the site.
- A total of 89 native and 1 non-native (weed) species were recorded from sample locations and opportunistic observations.
- Two specimens of *S. exastia* (T) were collected in a localised area in the north western portion of the site. These specimens are likely to have come from the same patch and, due to the suspected clonal nature of *S. exastia*, may have come from a single plant.
- Nineteen (19) specimens of *S. katatona* (P3) were collected, primarily from the northern parts of the site. A further nineteen specimens were identified as *S. nephrosperma*.
- An additional 360 locations of sterile *Seringia* spp. plants were recorded, also primarily in the north of the site. Due to lack of floral features these plants could not be identified to species level. Based on the frequency of records for which species identity was confirmed, the unidentified *Seringia* sp. in the site are considered most likely to be *S. katatona* (P3) or *S. nephrosperma*.
- No other threatened or priority flora species were recorded or are considered likely to occur.
- Native vegetation was classified into two plant communities:
  - **CzT** comprises low open woodland vegetation located in the south-eastern corner.
  - **AmT** comprises acacia shrubland vegetation across the remainder of the site. The **AmT** community was further separated into 'open' and 'closed' forms based on fire age/structure.
- The majority of native vegetation was determined to be in 'very good' condition and a small portion is in 'good' condition
- The vegetation in the site does not represent a 'threatened' or 'priority' ecological community.

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## 1 Introduction

### 1.1 Project background

Shelamar Leasing Company Pty. Ltd. (Shelamar) currently manages a horticultural operation on Shelamar Station, approximately 200 km south of Broome. In February 2016 Shelamar lodged an application for a clearing permit (CPS692/1) over a portion of Lot 46 Eighty Mile Beach (deposited plan 93190) within Shelamar Station. Clearing was proposed in this area to allow for the expansion of the horticultural operation, including installation of additional pivot-irrigated and drip-irrigated vegetable plots. Subsequently, in October 2016, the Department of Environmental Regulation (DER) refused this application citing a lack of information in relation to identified environmental risks to threatened and priority flora and fauna.

Shelamar propose to resubmit a clearing permit application in December 2017. The portion of Lot 46 Eighty Mile Beach that the resubmitted clearing permit application relates to is hereafter referred to as 'the site'. The site is approximately 2933.13 hectares in size and comprises lease-hold crown land which is zoned 'rural' within the Shire of Broome. Great Northern Highway lies to the west of the site and native vegetation exists on all other sides. The location and extent of the site is shown in **Figure 1**.

### 1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Shelamar to undertake an assessment of flora and vegetation values within the site. The information obtained from this assessment will be used to support a clearing permit application.

Specifically the scope of work was to undertake a targeted flora assessment in accordance with the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- A field survey of the site to identify and locate any individuals of 'threatened' and 'priority' flora and to describe vegetation values.
- Compilation of a list of flora species recorded as part of the field survey.
- Mapping of broad vegetation types and vegetation condition.
- Identification of conservation significant flora and vegetation.
- Documentation of the desktop assessment, survey methodology and results into a report.

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## 2 Background

### 2.1 Environmental context

#### 2.1.1 Climate

Climate has a strong influence on the types of vegetation that grow in a region and the life cycles of the flora present. It is therefore critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify. The site is located in the Kimberley region of Western Australia which experiences a hot, dry tropical climate of a short rainy ('wet') season in summer (approximately December to March) and a hot dry season the remainder of the year. The standard timing for vegetation surveys in this region is during the wet season (January to March) or post wet season (variable timing).

Long-term climate data was obtained from multiple nearby weather stations (BOM 2017). An average of 776.7 millimetres (mm) of rainfall is recorded annually from the Shelamar weather station, which is the closest weather station. The majority of this rainfall is received between the months of December and March. Mean maximum temperatures at the Bidadanga weather station, which is the nearest temperature recording station approximately 34 km north-east of the site, range from 29.5°C in July to 35.7°C in April. Mean minimum temperatures at this station range from 14.1°C in July to 26.0°C in January (BoM 2017).

No records during the 2016/2017 wet season are available for Shelamar weather station. However, Nita Downs weather station, adjacent to the site, recorded a total of 440.7 mm of rain from December 2016 to February 2017. This was followed by 122.2 mm of rainfall in March and April, indicating an ending of the wet season.

#### 2.1.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs in the Kimberley region which is underlain by the pre-Cambrian rocks of the Canning Basin (Beard 1990). The rocks of the Canning Basin are mainly coarser sediments and topography is described as being generally flat.

The main soil type of the Dampierland region comprises red sand which developed during the Quaternary period. The term 'pindan' refers to this soil and its associated vegetation. Pindan soils comprise fine-textured sand sheets with subdued dunes. There is little organised surface drainage, with sheet flooding being widespread and common.

#### 2.1.3 Topography

The elevation of the site ranges from 50 m in relation to the Australian height datum (mAHD) in the south-eastern corner side of the site to 20 mAHD in the north-western portion of the site (WALIA 2017).

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### 2.1.4 Hydrology and wetlands

Wetlands include “areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries” (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance (DSEWPaC 2013)*
- *A Directory of Important Wetlands in Australia (Environment Australia 2001a)*.

No Ramsar or listed ‘important wetlands’ are located within the site. The closest Ramsar listed wetland is located approximately 20 km west of the site at Eighty Mile Beach. The closest ‘important wetland’ is located approximately 83 km south of the site, associated with the Mandora Salt Marsh.

Examination of the Department of Water’s (DOW) hydrography dataset shows no wetland or water related features occur in the site.

### 2.1.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) places the site into the Dampierland bioregion. The Dampierland bioregion is divided into two subregions: Fitzroy Trough (DAL01) and Pindanland (DAL02). The site is contained entirely within the Pindanland subregion.

This subregion primarily comprises sandplains of the Dampier Peninsular which support vegetation described as ‘pindan’. Pindan consists of grassland with a sparse upper layer of trees and a dense thicket-forming middle layer of *Acacia* spp. (Beard 1990). Fire is common in pindan vegetation and periodically removes the ground and middle layers, often leaving the trees intact.

Variations in native vegetation within the site can be further classified based on regional vegetation associations. Beard *et al.* (2013) mapping shows the site as comprising vegetation association ‘Dampierland 699.1’. This association is described as ‘pindan with low trees’ (Beard *et al.* 2013). ‘Dampierland 699.1’ association has 99.93% of its pre-European extent remaining with 79.88% protected for conservation purposes (Government of Western Australia 2015).

Studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). The national objectives and targets for biodiversity conservation (Environment Australia 2001b) established an objective of retaining 30% of the original extent of each vegetation complex. The percentage protected for conservation of the ‘Dampierland 699.1’ association falls above this retention objective.

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### 2.1.6 Land systems

The land systems of the Kimberley region have been mapped and incorporate landscape, soil, geology and vegetation mapping (Schoknecht and Payne 2011). A total of 111 mapped land systems occur in the Kimberley of which two, Yeeda and Nita, are mapped as occurring in the site. Both of these land systems are composed of Quaternary Aeolian sand. The Yeeda land system comprises sandplains of deep yellow and red sands with occasional dunes, with shrubby spinifex (*Triodia* sp.) grasslands or pindan woodlands. The Nita land system comprises sandplains and dunes with acacia shrublands and spinifex (*Triodia* sp.) (Schoknecht and Payne 2011).

### 2.1.7 Historic land use

Review of historical images available from 1984 onwards (Google Earth 2017), shows that the site was undeveloped until approximately 2004, when multiple rectangle drip-irrigated and one pivot-irrigated vegetable plot are visible. The four pivot-irrigated plots that are currently present are visible on the aerial image from 2011.

## 2.2 Significant flora and vegetation

### 2.2.1 Threatened and priority flora

Certain flora species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora species may be listed as 'threatened' pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a species listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment and Energy.

In Western Australia flora species may also be classed as 'threatened' or 'priority' species under the *Wildlife Conservation Act 1950* (WC Act). Threatened flora species are gazetted under subsection 2 of section 23F of the WC Act and it is an offence to "take" or damage rare ('threatened' or 'priority') flora without Ministerial approval. Priority flora species are potentially rare or under threat and are considered during State approval processes. Further information on threatened and priority species and their categories is provided in **Appendix A**.

A search was conducted for threatened and priority flora within a 50 km radius of the site (or 40 km if 50 km was unavailable) using the *Protected Matters Search Tool* (DoEE 2017a), *NatureMap* (DBCA 2017) and DBCA's threatened and priority flora database (reference no. 29-0717FL). One threatened and nine priority flora species were identified as potentially occurring in the wider local area as listed in **Table 1**.

Of the flora species potentially occurring in the local area, only those with habitat preferences of red sandplains and/or pindan were deemed likely to occur in the site. No wet areas, saline depressions or clay soil are known to occur in the site. On this basis one threatened flora species (*Seringia exastia*) and seven priority flora species (*Acacia glaucocaesia*, *Dasymalla chorisepala*, *Phyllanthus eremicus*, *Pterocaulon intermedium*, *Seringia katatona*, *Terminalia kumpaja* and *Tribulopsis marliesiae*) were identified as having the potential to occur within the site (shaded green in **Table 1**).



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Table 1: Significant flora species known or likely to occur within 50 km of the site

Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
<i>Seringia exastia</i>	T	CE	P	Red sand in relict desert dune swales in pindan vegetation	Apr-Dec	<b>Possible</b>
<i>Nicotiana heterantha</i>	P1	-	P	Black clay on seasonally wet flats.	Mar-Jun/Sep	Unlikely
<i>Acacia glaucocaesia</i>	P3	-	P	Red loam, sandy loam and clay on floodplains.	Jul-Sep	<b>Possible</b>
<i>Dasymalla chorisepala</i>	P3	-	P	Brown/red sand, ironstone gravel.	Jul-Sep	<b>Possible</b>
<i>Lawrenzia</i> sp. Anna Plains	P3	-	P	Flats and margin of semi-saline drainage depression on coastal plains.	Aug	Unlikely
<i>Phyllanthus eremicus</i>	P3	-	P	Rocky outcrops or on red sandplains with low shrubs.	May-Aug	<b>Possible</b>
<i>Pterocaulon intermedium</i>	P3	-	A	Sandy soil in swales or dunes near the coast or inland in eucalypt woodland.	Apr-Oct	<b>Possible</b>
<i>Seringia katatona</i>	P3	-	P	Red sand in desert dunes in pindan vegetation (open shrubland to 3 m high)	Mar-Aug	<b>Possible</b>
<i>Terminalia kumpaja</i>	P3	-	P	Red pindan sands near the coast on dunes or flats in open pindan woodland.	Jun-Nov	<b>Possible</b>
<i>Tribulopsis marliesiae</i>	P3	-	P	Red sands in heath and low pindan vegetation.	Aug-Nov	<b>Possible</b>

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Communities considered to potentially be present within the site shaded green.

### 2.2.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are determined by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DoEE 2017b). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment and Energy. TECs are also

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listed within Western Australia by DBCA, but are currently are not afforded direct statutory protection at a state level. Nonetheless their significance is acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. A plant community that is under consideration for listing as a TEC in Western Australia, but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during state approval processes. Further information on categories of TECs and PECs is provided in **Appendix A**.

Known locations of TECs and PECs within 50 km of the site were searched for using the publicly available *Protected Matters Search Tool* (DoEE 2017) and DBCA's threatened and priority ecological communities' database (reference no. 29-0717DBCA). These search results indicate that no TECs or PECs are known to occur within the site, but that four PECs occur within 50 km of the site as listed in **Table 2**.

Table 2: TECs and PECs known to occur within 10 km of the site.

Community name	Community description	TEC/ PEC	Level of significance	
			State	EPBC Act
Eighty Mile Land System	Beach foredunes, coastal dunes and sandy plains supporting buffel grass grasslands and soft spinifex grasslands (Schoknecht and Payne 2011).	PEC	P3	-
Kimberley Vegetation Association 37	Beard vegetation associations 'Madora Coastal Plain 37' and 'Dampierland 37' (thicket of acacia, casuarina, melaleuca) (Beard 1990).	PEC	P3	-
Parada Land System	Conical hills, stony ring plains, alluvial plains and shallow valleys supporting spinifex grassland with sparse shrubs and trees (Schoknecht and Payne 2011).	PEC	P3	-
Roebuck Land System	Saline coastal flats with broad plains of salt water couch grasslands, samphire, and bare mud flats (Schoknecht and Payne 2011).	PEC	P3	-

The site is not located in any of the above three land systems or Vegetation Association 37. Therefore, no TECs or PECs are considered likely to occur in the site.

### 2.2.3 Weeds and declared pests

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds. A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Further information on categories of declared pests is provided in **Appendix A**.

No declared pests are known to occur in the site. Some weed cover is expected in the site due to previous adjacent ground disturbance.

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### 2.3 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. However, exemptions under Schedule 6 of the EP Act still apply, including any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the EP Act).

No ESAs are located within the site. The nearest ESA is located approximately 12 km west of the site at Eighty Mile Beach.

### 2.4 Previous flora surveys

No previous flora and vegetation surveys are known to have been undertaken in the site. As part of the previous clearing permit application assessment process, officers from the Department of Water and Environmental Regulation (DWER) and DBCA (then DPaW) undertook an inspection of the site on 19<sup>th</sup> April 2016. During this inspection a flora specimen was collected that DBCA suspected to be *Seringia exastia* (T). However, this specimen was not confirmed and the status of this species in the site remained unknown. The similar species *Seringia katatona* (P3) was recorded within the site during the inspection by DWER and DBCA. Communications between Emerge and DBCA prior to the field survey informed Emerge that the potential *S. exastia* (T) specimen was collected from the north-western portion of the proposed clearing permit area, near the boundary vehicle track (pers. comm. Tracy Sonneman, DBCA-West Kimberly District, July 2017).

The Department of Agriculture and Water Resources (previously Department of Agriculture) undertook a survey of rangelands in the vicinity of the site, including Shelamar Station during 1989-1990 (Cotching 2005). The resulting report outlined the pastoral history, land systems and vegetation of the region. Minimal information on Shelamar Station and the site was provided in this report.

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### 3 Methods

#### 3.1 Field survey

Two botanists from Emerge visited the site from 24<sup>th</sup> to 28<sup>th</sup> July 2017 to conduct the flora and vegetation assessment.

##### 3.1.1 Targeted flora

The site was traversed on foot to search for threatened and priority flora species. Traverses were conducted along transects which were strategically located in areas of suitable habitat for species listed in **Section 2.2.1**, with particular focus on *Seringia* species as they were considered likely to occur in the site. Areas where *Seringia* sp. were recorded were searched in more detail. The locations of *Seringia* plants were recorded with a hand-held GPS unit and, photos and specimens were collected of flowering *Seringia* plants. The GPS track logs recording the locations searched by botanists in the site are shown in **Figure 2**.

##### 3.1.2 Vegetation

As botanists traversed the site a combination of opportunistic photographs and detailed vegetation sampling was undertaken to describe and map vegetation. Georeferenced photographs were recorded to assist in broad delineation of vegetation community boundaries. Detailed sampling was undertaken at five locations using non-permanent relevés. The relevés were completed over an approximate 50 m x 50 m area as determined from GPS receiver and temporarily marked with flagging tape. The sample locations were selected according to observations of changes in vegetation across the site. The position of each relevé was recorded with a hand-held GPS unit, as shown on **Figure 32**.

The data recorded within each sample location included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, degree of disturbance and species present).

Vegetation condition was assigned at each sample location and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using methods from Trudgen (EPA 2016) as outlined in **Table 3**.

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Table 3: Vegetation condition scale applied during the field assessment

Condition category	Definition (EPA 2016)
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Additional plant taxa not observed within sampling points were recorded opportunistically as the botanists traversed the site. Photographs were taken throughout the field visit to show particular site conditions. All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Specimen identification was undertaken by Emerge botanist Rachel Omodei, excepting *Seringia* spp. specimens collected. All *Seringia* spp. specimens were identified by specialist taxonomist Udani Sirisena with confirmation by Carolyn Wilkins who is the author of the latest *Seringia* spp. taxonomic key. Flora species not native to Western Australia are denoted by an asterisk ('\*') in text and raw data.

## 3.2 Mapping and data analysis

### 3.2.1 Plant community identification and description

Plant communities were delineated using sample data and photo location details. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System (NVIS)* (ESCAVI 2003). The identified plant communities were then mapped on aerial photography (1:15,000) from the sample points and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography (1:20,000) based on the locations recorded during the field survey to define areas with differing condition.

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### 3.2.2 Species accumulation curve

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. Primer-6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jackknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

### 3.3 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 4**.

*Table 4: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	Generally, the broad scale contextual information described in <b>Section 2</b> is adequate to place the site and vegetation in context.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by two qualified botanists with nine and 15 years of botanical experience in Western Australia. Identification of plant specimens were undertaken by a qualified botanist with nine years' botanical experience. Identification of <i>Seringia</i> spp. specimens was undertaken by specialist taxonomists Udani Sirisena who has over 12 years' botanical experience and Carolyn Wilkins who is an expert on <i>Seringia</i> sp. identification. Wilkins has published numerous scientific papers on <i>Seringia</i> and the Malvaceae family. Technical review was undertaken by a senior environmental consultant with 15 years' experience in environmental science in Western Australia.
Suitability of timing / temporal coverage	Minor limitation (targeted flora)	The survey was conducted in late July and thus within the flowering season of the majority of the targeted flora species. The recorded flowering season for these species is broad due to the reliance on seasonal rainfall and temperature. Although many flora species were flowering during the survey, some vegetation appeared to be beginning to desiccate in preparation for the dry season. Most <i>Seringia</i> spp. recorded in the site did not have flowers and had leaves that appeared wrinkled and dry. However, 38 <i>Seringia</i> sp. plants were recorded flowering and had plump leaves and were subsequently sampled. Therefore the survey timing was determined to be suitable but not optimal.
	No limitation (vegetation)	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. As the primary purpose of this survey was to search for threatened and priority flora species, the survey timing was dependent on flowering season. As such, numerous native flora taxa were flowering during the survey and available to provide adequate information in vegetation samples.

# Targeted Flora and Vegetation Assessment

## Shelamar Station



Constraint	Degree of limitation	Details
Spatial coverage / sampling intensity	Minor limitation (targeted flora)	Site coverage was extensive (track logged), but limited due to the large size of the site.
	No limitation (vegetation)	A total of 80 species were recorded, of which 70 were recorded from five sample locations and 10 were recorded opportunistically. Minimum species richness within site is estimated at between 89 (Jackknife1) and 90 (Chao2) species (refer species accumulation curve and estimates shown in <b>Plate 4</b> ). Survey effort was adequate to prepare a sufficient species inventory for the site for the purpose of the assessment.
Influence of disturbance	No limitation (targeted flora)	The site has been subject to prescribed mosaic burns resulting in disturbance to vegetation structure. <i>Seringia</i> spp. did not appear confined to vegetation with a particular fire history, being recorded in open and closed shrubland. Therefore, disturbance from fire is not considered a limiting factor to the survey.
	Minor limitation (vegetation)	The prescribed burning has produced differences in vegetation structure, with vegetation appearing to have been burnt more recently consisting of a more open structure. Over time as the vegetation grows back, and potentially with new fires, the structure of the 'open' and 'closed' acacia shrubland community mapped is likely to change. Therefore, while not a limitation to vegetation sampling during the survey, the boundaries of plant communities (particularly the acacia shrubland) are likely to change over time.
Adequacy of resources	No limitation	All resources required to perform the survey were available.
Access problems	No limitation	All parts of the site could be accessed as required.

## Targeted Flora and Vegetation Assessment Shelamar Station



## 4 Results

### 4.1 General site conditions

The site is contiguous with adjacent Shelamar Station which is actively used for fruit and vegetable farming. Fencing exists along Great Northern Highway on the western side of the site and on the eastern side on the boundary of Shelamar and Nita Downs stations. The site is not actively grazed and appears largely undisturbed, with a few vehicle tracks present.

The site is primarily flat with some low rises and sandy red soils typical of pindan. No drainage systems were observed in the site during the survey. Native vegetation is present across the majority of the site and comprises open eucalypt woodland in the south-eastern portion and acacia shrubland across the remainder. Some pivot or drip-irrigated vegetable plots, cleared areas and non-native vegetation is present in the north-western and north-central portions of the site.

Evidence of previous fires was visible during the survey, with the most recent fire estimated to have been within the last three to four years. Vegetation with different fire history and resulting differences in vegetation structure occur in the site. Areas that appeared long unburnt contained a tall dense layer of *Acacia monticola* (gawar) over a moderately dense cover of *Triodia* spp. (hummock grass). In contrast, vegetation that appeared more recently burnt lacked the mature gawar and was more open, with a low open shrub layer (including gawar shrubs germinated from seed) and open hummock grass layer.

At the time of the survey many flora species were flowering (e.g. *Calytrix carinata*, *Grevillea wickhamii* and *Ptilotus calophylla*). However, as a community the vegetation appeared to be drying and senescing as the dry season commences.

### 4.2 Flora

A total of 89 native and one non-native (weed) species were recorded within the site during the field survey, representing 27 families and 66 genera. The dominant families containing native taxa were Fabaceae (17 native taxa) and Poaceae (15 native and one non-native taxa). The most common genus was *Acacia* with nine taxa. Of the species recorded 70 were recorded in sample locations and 10 were recorded opportunistically. A complete species list is provided in **Appendix B** and sampled data in **Appendix C**.

#### 4.2.1 Threatened and priority flora

One threatened (T) species, *Seringia exastia*, and one priority (P3) species, *Seringia katatona*, were recorded in the site.

A total of 398 locations of *Seringia* sp. were recorded in the site. Of these, 38 plants were flowering and specimens collected. The *Seringia* sp. plants at the remaining locations were sterile and lacking the floral features required for identification to species level. Two of the 38 specimens collected were determined to be *S. exastia* (T). These specimens were collected in the same location in the north-eastern portion of the site, along the side of a vehicular track.



## Targeted Flora and Vegetation Assessment

### Shelamar Station



Nineteen of the 38 specimens were determined to be *S. katatona* (P3). These specimens were recorded in the north-eastern and north-western portions of the site. Some of these specimens were identified as *S. ?katatona* as though they lacked the full suite of identification features they were determined to be most similar to *S. katatona*. One specimen was determined to be either *S. katatona* or *S. nephrosperma*, but the material was insufficient to confirm species identification. All remaining specimens were determined to be *S. nephrosperma*.

The locations of all *Seringia* spp. recorded in the site, including the locations of confirmed specimens are shown in **Figure 3**.

#### 4.2.2 Weeds and declared pests

No flora species listed as declared pests pursuant to the BAM Act were recorded within the site.

One non-native flora species, \**Cenchrus ciliaris* (buffel grass), was recorded in the site. Although not a declared pest, buffel grass is a serious environmental weed that can displace native species. Multiple rectangular shaped areas comprising a monoculture of buffel grass were recorded in the north-western portion of the site, in what appeared to be previously irrigated plots. Buffel grass individuals were otherwise infrequently observed across the site.

### 4.3 Vegetation

#### 4.3.1 Plant communities

Two native plant communities were identified within the site. The remainder of the site supports non-native vegetation, cleared land and planted horticultural vegetation.

Plant community **CzT** occurs in the south-eastern corner of the site and extends over 1064.46 ha. Plant community **AmTsp** occurs across the remainder of the site (1582.67 ha) and is present in two forms due to differing fire history. The 'open' form of **AmT** has been burnt more recently and lacks the tall thicket shrub layer that is present in the 'closed' form of **AmT**. A description and the area of each plant community is provided in **Table 5** and representative photographs of each are provided in **Plate 1** to **Plate 3**. The location of each plant community is shown on **Figure 3**.

Table 5: Plant communities identified within the site

Plant community		Description	Area (ha)
<b>CzT</b>		Low open woodland <i>Corymbia zygomorpha</i> (with occasional other <i>Corymbia</i> spp. and <i>Terminalia</i> sp.) over open shrubland <i>Acacia monticola</i> over forbland <i>Ptilotus calostachyus</i> and <i>Triodia ?schinzii</i> . ( <b>Plate 1</b> ).	1074.12
<b>AmT</b>	<b>Open</b>	Open shrubland <i>Acacia monticola</i> over open herbland <i>Trianthema pilosum</i> over hummock grassland <i>Triodia ?schinzii</i> . ( <b>Plate 2</b> ).	857.00
	<b>Closed</b>	Tall closed shrubland <i>Acacia monticola</i> over hummock grassland <i>Triodia ?schinzii</i> over open herbland <i>Halgania solanacea</i> . ( <b>Plate 3</b> ).	889.16
<b>Non-native</b>		Non-native vegetation.	22.29
<b>Planted</b>		Planted with agricultural crops such as corn and beans.	70.29

# Targeted Flora and Vegetation Assessment Shelamar Station



*Plate 1: Plant community CzT in very good condition*



*Plate 2: 'Open' form of plant community AmT in very good condition.*

## Targeted Flora and Vegetation Assessment Shelamar Station



Plate 3: 'Closed' form of plant community **AmT** in very good condition.

### 4.3.2 Vegetation condition

The majority of the native vegetation in the site was mapped as being in 'very good' condition according to the Trudgen scale (EPA 2016). The vegetation comprises the diversity and structure expected of largely undisturbed pindan vegetation. Disturbance in the site is generally low and comprises a few vehicle tracks and occasional non-native flora species. Evidence of fire and subsequent changes to vegetation structure resulting from fire were visible in the site. Although the fire within the site is known to be (at least partly) a result of land management practices, the occurrence of fire is a natural phenomenon in pindan landscapes.

A small area of vegetation in the north-eastern portion of the site was mapped as being in 'good' condition according to the Trudgen scale (EPA 2016). This area appears to have been previously cleared and sown with buffel grass (as detailed in **Section 4.2.2**), but now contains moderately high cover of native vegetation. The extent of vegetation by condition category is detailed in **Table 6** and shown on **Figure 5**.

Table 6: Size of vegetation condition categories within the site

Condition category	Size (ha)
Excellent	0
Very Good	2933.1
Good	6.73
Poor	0
Degraded	0
Completely Degraded	42.56 (+ 70.29 planted vegetation)

## Targeted Flora and Vegetation Assessment Shelamar Station



### 4.3.3 Threatened and priority ecological communities

No TECs or PECs occur within the site.

### 4.4 Species richness and sampling adequacy

A total of 70 species were recorded from five sample locations. A species accumulation curve derived from sample data is presented in **Plate 4**. After five samples the curve is still increasing and has not reached its asymptote. This indicates that a proportion of species likely remain undetected by sampling.

Species richness was estimated in Primer-6 to be between 89 (Jackknife1) and 90 (Chao2). Based on the trend of the species accumulation curve approximately 15 to 20 samples would be required to capture that many species. Including the 10 additional species recorded opportunistically, a total of 80 species were recorded in the site. This indicates that between 89 and 90 % of the estimated 89-90 species in the site were recorded. Considering that detailed vegetation sampling was not the primary purpose of this assessment, the survey effort was therefore considered to be adequate to prepare a representative species inventory.

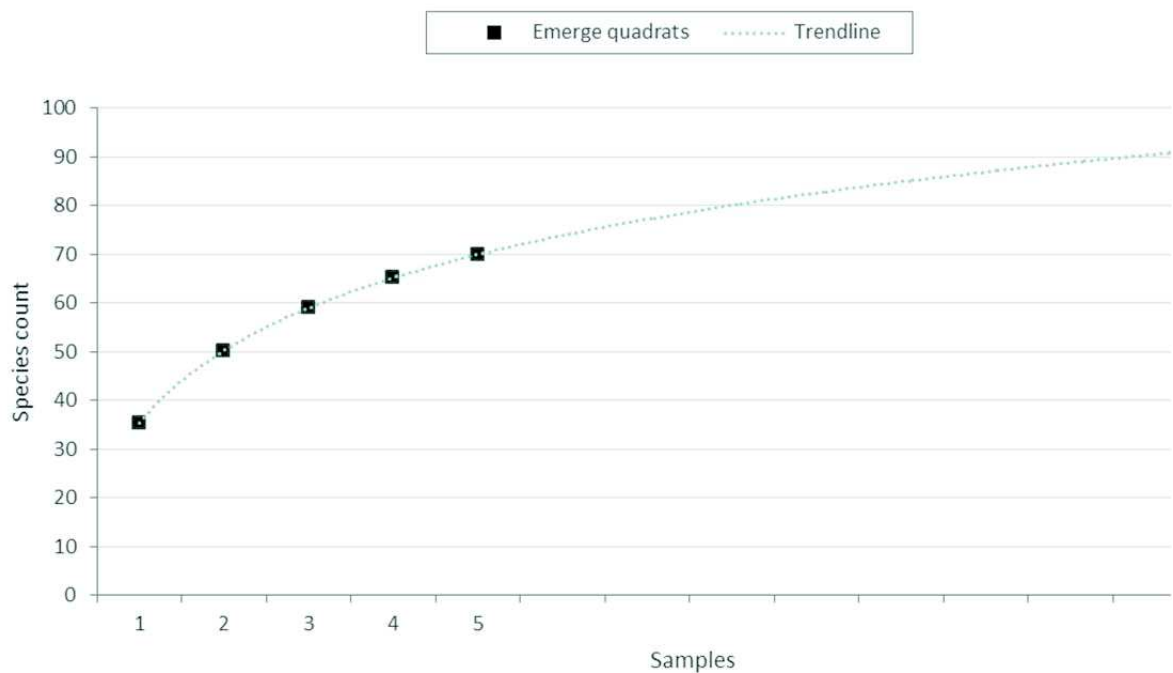


Plate 4: Species accumulation curve derived from sample data ( $y = 21.529 \ln(x) + 35.326$ ,  $R^2 = 1$ )

## Targeted Flora and Vegetation Assessment Shelamar Station



### 5 Discussion

#### 5.1 Threatened and priority flora

*S. exastia* (T) and *S. katatona* (P3) were the only threatened and priority flora species recorded in the site. *Seringia*, or fire-bushes, are perennial shrubs that are relatively easy to detect due to their unique form and leaf colour. As some individuals of *Seringia* spp. recorded during the survey were flowering it was possible to then identify them and it was determined that along with *S. exastia* (T), both *S. katatona* (P3) and the less conservation significant species *S. nephrosperma* are present in the site.

Regarding the other threatened or priority flora that had potential to occur within the site, the survey timing and effort should have been sufficient to detect them if they were present. The survey was conducted within the flowering season for the majority of these species, albeit at the end of the optimal post wet season period. Most of these species are also shrubs, which, like the fire-bushes, would have been reasonably distinct even without the presence of flowers or fruits. One herb species, *Tribulopsis marliesiae* (P3), would have been nearing flowering at the time of the survey and therefore, if present, should at least have been actively growing such that it would have been discernible.

As is typical, some of the flora encountered during the survey were sterile (i.e. lacking flowers or fruits), making identification more difficult. However, along with the aforementioned *Seringia* spp. a few sterile *Terminalia* sp. shrubs/trees were the only plants that were considered to potentially represent a threatened or priority species that did not have flowers or fruits to aid identification. Despite lacking flowers and fruit, these shrubs/trees were ruled out as being *T. kumpaja* (P3) due to the presence of wide leaves. Therefore, given the suitable timing and extensive effort of the survey it is considered unlikely that other threatened or priority flora species occur in the site.

*Seringia* spp. were recorded across the entire site, but were most frequently recorded in the northern portions. This pattern of distribution might indicate a preference for acacia shrubland (plant community **AmT**) habitat. The *Seringia* spp. plants observed ranged from healthy looking and flowering shrubs, to spindly desiccated non-flowering shrubs and no plants had fruits. None of the *Seringia* sp. plants recorded in the south of the site were flowering, which potentially further indicates these areas were drier, less favorable habitat. Fewer *Seringia* sp. plants were recorded along transects towards the south and south-western parts of the site and subsequently survey effort was focused in the north.

Due to the shrub form and grey leaf colouring of *Seringia* spp., they were relatively easy to locate in the field and were often present in patches of what appeared to be multiple plants. It has been suggested that *Seringia* spp. are clonal (Broome Botanical Society 1995) and so what appeared to be multiple plants may very likely have been the stems of one plant connected underground. However, this was not assessed or confirmed during the survey.

The *S. exastia* (T), *S. katatona* (P3) and *S. nephrosperma* plants recorded within the site all have a similar appearance. Fine scale assessment of floral features is required to separate them to a species level. To further complicate things all three species are known to flower in July and August, but factors such as variation in local rainfall and microclimate are likely to influence the time of flowering

## Targeted Flora and Vegetation Assessment Shelamar Station



of individual plants, including individual plants of the same species. Only 10% of the *Seringia* sp. plants observed were flowering during the survey. This limited the ability for species identification and as a result most records were labelled as *Seringia* sp.

To identify *S. exastia* (T), *S. katatona* (P3) and *S. nephrosperma* using floral features requires experience, microscopic examination and comparison with confirmed specimens. In order to provide certainty in identification the *Seringia* spp. specimens collected in the site were examined by specialist plant taxonomist Udani Sirisena and then checked by Carolyn Wilkins (who has published keys on *Seringia* spp.). The specimens were adequate to provide species confirmation. However, Ms. Wilkins advised that, given their taxonomic similarity, genetic analysis is currently being undertaken to determine if species such as *S. exastia*, *S. katatona* and *S. nephrosperma* are in fact genetically distinct or just different phenotypes of the same species.

The two specimens determined to be *Seringia exastia* (T) during the survey were located in the same area as the potential *S. exastia* specimen collected during a site visit by DWER and DBCA in 2016. The GPS locations of the *Seringia exastia* specimens, which were collected independently by each Emerge botanist, are located within eight metres of each other. Taking into account GPS receiver spatial error (usually approximately  $\pm 5$  m) it is likely that these specimens were both taken from the same patch and therefore may be from the same plant.

Consequently, of the flowering *Seringia* spp. plants that could be identified only one individual or patch was determined to be *S. exastia*. This individual or patch is located in a small area in the northwest of the site near the Great Northern Highway. Based on the frequency of records, if other *S. exastia* plants are present within the site, they are likely to be uncommon (<3%). It is most likely that the unidentified *Seringia* sp. or undetected *Seringia* spp. in the site are *S. katatona* (P3) or *S. nephrosperma*.

## 5.2 Vegetation

While three native plant communities with structural differences were mapped within the site, essentially there are only two communities present based on differences in flora species composition. The structural differences in plant community **AmT** were interpreted to have been the result of land management practices employed on Shelamar Station. This includes seasonal prescribed burns in a mosaic pattern and a lack of active grazing.

Generally, there appeared to be only minor disturbance to vegetation in the site. There was also little evidence that native vegetation adjacent to existing horticulture operations had been negatively affected. One impact that was noted was the introduction of scattered \**Cenchrus ciliaris* (buffel grass) in vegetation in the north-west corner of the site. These plants appeared to have spread from a nearby irrigated area that had been historically seeded with buffel grass. Native regrowth in one of these historical buffel grass plots indicated it may not be currently used for cropping.

## Targeted Flora and Vegetation Assessment Shelamar Station



### 6 Conclusions

The site is largely undisturbed and contains native shrubland and open woodland vegetation on red sand plains. Small areas of planted, non-native and cleared vegetation are present in the northern portion of the site.

One threatened species, *S. exastia* (T), was recorded in one location along a vehicular track in the north-western portion of the site. This location was previously identified as potentially supporting *S. exastia* (T) by DWER and DBCA.

One priority species, *S. katatona* (P3), was recorded in the site. A total of 19 individuals of this species were recorded, mostly in the northern half of the site. Individuals of *S. nephrosperma* and unidentified *Seringia* sp. were also recorded within the site. Based on the frequency of records, the unidentified *Seringia* sp. plants are most likely to be individuals of *S. katatona* (P3) or *S. nephrosperma*, rather than *S. exastia* (T).

No other threatened or priority flora species were recorded or are considered likely to occur within the site.

The site supports two native plant communities in 'good' and 'very good' condition, of which neither represent a TEC or PEC.

# Targeted Flora and Vegetation Assessment

## Shelamar Station



## 7 References

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## Targeted Flora and Vegetation Assessment Shelamar Station



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# Figures



*Figure 1: Site Location*

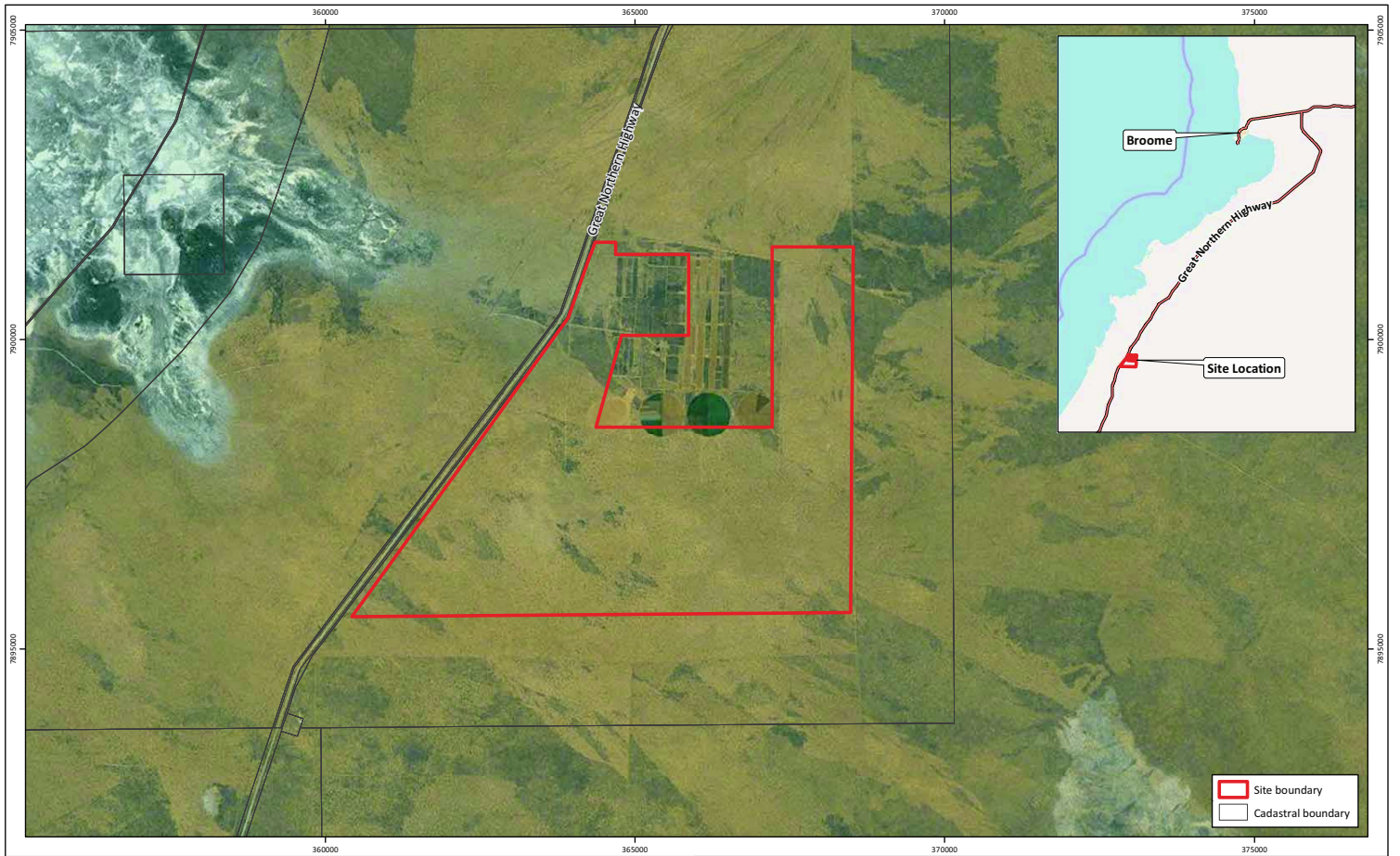
*Figure 2: Transect and Sample Locations*

*Figure 3: Seringia spp. Records*

*Figure 4: Plant Communities*

*Figure 5: Vegetation Condition*





**Figure 1: Site Location**

**Project:** Targeted Flora and Vegetation Assessment  
**Client:** Shelamar Station  
 Shelamar Leasing Company Pty. Ltd.

Plan Number:  
 EP17-068(02)-F01a  
 Drawn: RAO  
 Date: 07/12/2017  
 Checked: RAO  
 Approved: TAA  
 Date: 08/12/2017

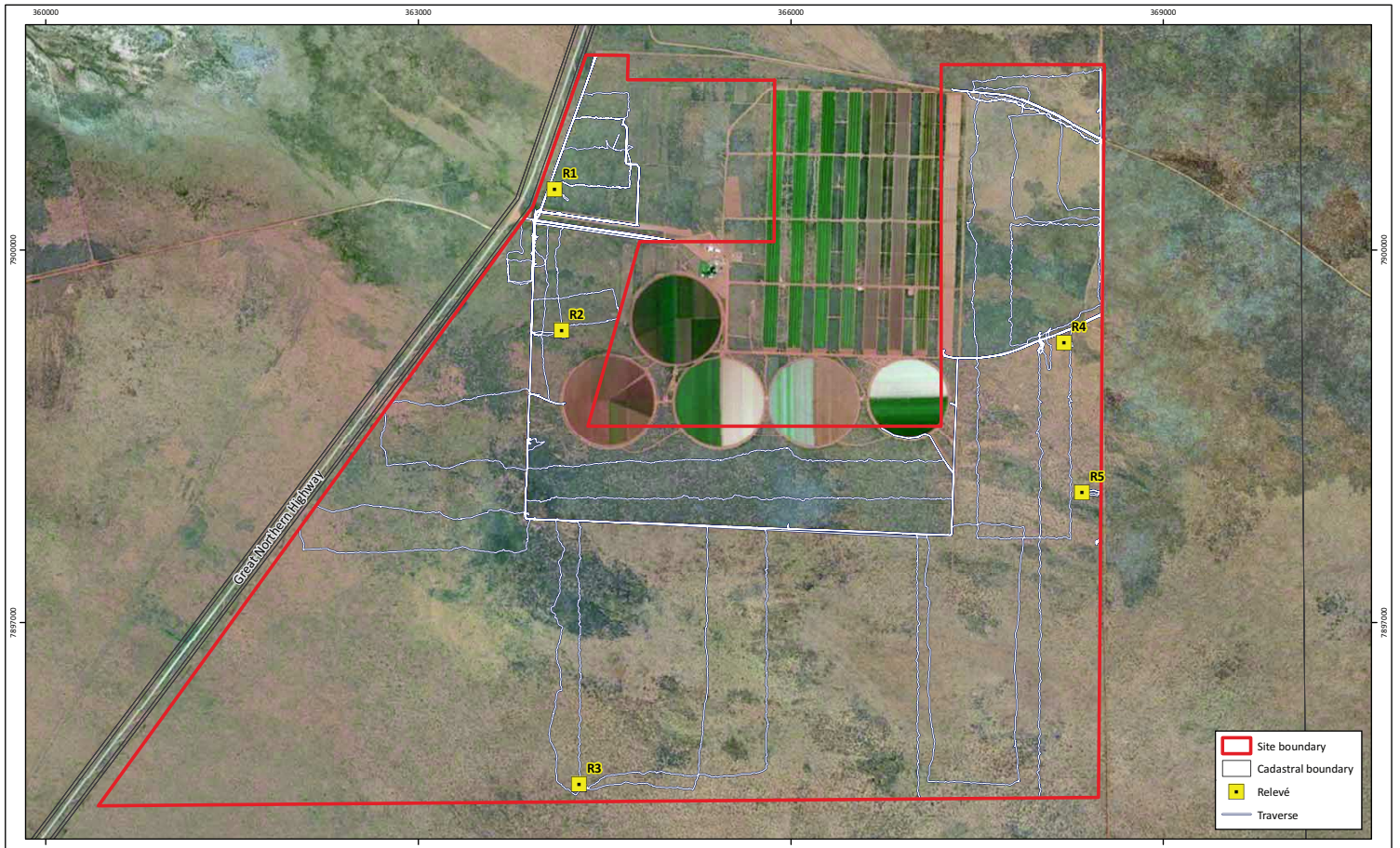


0 1,000 2,000  
 Metres  
 Scale: 1:80,000@A4  
 GDA 1994 MGA Zone 51



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used





**Figure 2: Transect and Sample Locations**

**Project:** Targeted Flora and Vegetation Assessment  
 Shelamar Station  
**Client:** Shelamar Leasing Company Pty. Ltd.

Plan Number:  
 EP17-068(02)-F12a  
 Drawn: RAO  
 Date: 07/12/2017  
 Checked: RAO  
 Approved: TAA  
 Date: 08/12/2017

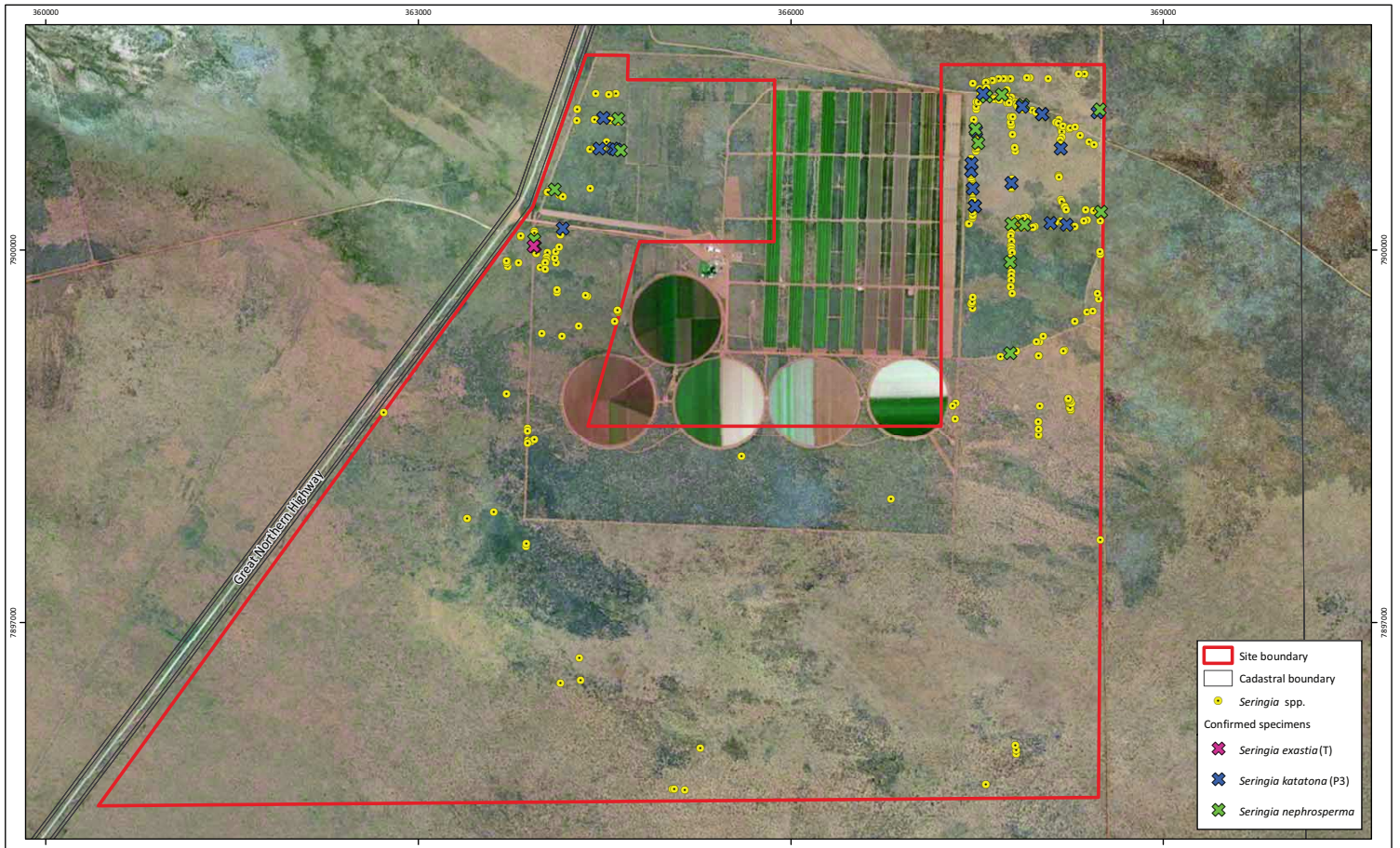


0 500 1,000  
 Metres  
 Scale: 1:40,000@A4  
 GDA 1994 MGA Zone 51



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	Site boundary
	Cadastral boundary
	<i>Seringia</i> spp.
Confirmed specimens	
	<i>Seringia exastia</i> (T)
	<i>Seringia katatona</i> (P3)
	<i>Seringia nephrosperma</i>

Figure 3: *Seringia* spp. Records

**Project:** Targeted Flora and Vegetation Assessment  
 Shelamar Station  
**Client:** Shelamar Leasing Company Pty. Ltd.

Plan Number: EP17-068(02)-F13a  
 Drawn: RAO  
 Date: 07/12/2017  
 Checked: RAO  
 Approved: TAA  
 Date: 08/12/2017



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 Metres  
 Scale: 1:40,000@A4  
 GDA 1994 MGA Zone 51



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used







**Figure 4: Plant Communities**

**Project:** Targeted Flora and Vegetation Assessment  
**Client:** Shelamar Station  
 Shelamar Leasing Company Pty. Ltd.

Plan Number: EP17-068(02)-F14a  
 Drawn: RAO  
 Date: 07/12/2017  
 Checked: RAO  
 Approved: TAA  
 Date: 08/12/2017



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 Metres  
 Scale: 1:40,000@A4  
 GDA 1994 MGA Zone 51



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used





**Figure 5: Vegetation Condition**

**Project:** Targeted Flora and Vegetation Assessment  
 Shelamar Station

**Client:** Shelamar Leasing Company Pty. Ltd.

Plan Number: EP17-068(02)-F15a  
 Drawn: RAO  
 Date: 07/12/2017  
 Checked: RAO  
 Approved: TAA  
 Date: 08/12/2017



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 Metres  
 Scale: 1:40,000@A4  
 GDA 1994 MGA Zone 51



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# Appendix A

Additional Background Information



## Additional Background Information



## Conservation Significant Flora and Vegetation

### Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories as outlined in **Table 1**.

In Western Australia, plant species may be classed 'threatened' under the *Wildlife Conservation Act 1950* (WC Act), enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are gazetted under subsection 2 of section 23F of the WC Act and therefore it is an offence to "take" or damage rare flora without Ministerial approval. Section 23F of the Act defines "to take" as "... to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora to cause or permit the same to be done by any means".

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the WC Act may be added to the DBCA's *Priority Flora List*. Priority flora category definitions are listed in **Table 1**.

*Table 1: Definition of threatened flora species under the WC Act (Smith 2010) and priority flora species on DBCA's Priority Flora List*

Conservation Code	Category
T	Threatened Flora – Extant Taxa Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	Threatened Flora – Presumed Extinct Taxa Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
P1	Priority One – Poorly Known Taxa Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Priority Two – Poorly Known Taxa Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	Priority Three – Poorly Known Taxa Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4	Priority Four – Rare Taxa Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

## Additional Background Information



Note that the WC Act is expected to be repealed some time in 2017 and will be replaced by the *Biodiversity Conservation Act 2016* (BC Act). The BC Act includes updated provisions for the management of threatened flora along with increased penalties and requirements for reporting, management programmes and recovery plans. The BC Act was only recently granted Royal assent on 21 September 2016. Currently, most of the provisions of the BC Act have not come into effect and until they do, the WC Act will continue to guide the management of threatened flora in Western Australia.

### Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Minister of the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable'. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment.

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organizations including tertiary institutions, the Western Australian Museum and DBCA. TECs are assigned to one of the categories outlined in **Table 2** according to their status (in relation to the level of threat). Currently TECs are not afforded direct statutory protection at a state level and their significance is acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009a).

Conservation category	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.



## Additional Background Information



In addition to listing as a TEC, a plant community may be listed as a 'priority ecological community' (PEC). This is an ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined. PECs are categorised as priority category 1, 2 or 3 (these are described in **Table 3**). Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2009a).

*Table 3: Categories of priority ecological communities (DEC 2009a).*

Priority categories	Description
P1	<p>Priority One</p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
P2	<p>Priority Two</p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
P3	<p>Priority Three</p> <p>Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(i) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</p> <p>(ii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4	<p>Priority Four</p> <p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring.</p>
P5	<p>Priority Five</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Note the BC Act, previously introduced in **Section 1**, does include provisions for the management of TECs, as well as, penalties for impacting TECs and requirements for reporting, management programmes and recovery plans. The provisions of the BC Act relating to TECs have not yet come into effect and until they do the management of TECs will continue to be guided by existing environmental approval processes.

## Additional Background Information



### Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS), of which many are also listed under the BAM Act.

### Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; *“a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”*.

Under the BAM Act, all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management). These categories are described further in **Table 4**. The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

*Table 4: Categories of declared pest species under the BAM Act (DAFWA 2016).*

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

## Additional Background Information



## References

### General references

Department of Environment and Conservation (DEC) 2009a, Definitions, Categories and Criteria for Threatened and Priority Ecological Communities, Department of Environment and Conservation, Perth.

Department of Environment and Conservation (DEC) 2009b, Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset, Department of Conservation and Environment, Perth.

English, V. and Blyth, J. 1997, Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province, ANCA National Reserves System Cooperative Program, Project Number N702, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Semeniuk, C. A. 1987, Wetlands of the Darling System - a geomorphic approach to habitat classification, Journal of the Royal Society of Western Australia, 69: 95-112.

Smith, M. G. 2010, Declared Rare and Priority Lists for Western Australia, Department of Environment and Conservation, Como.

### Online references

Department of Agriculture and Food (DAFWA) 2016, *The Western Australian Organism List (WAOL)*, <<https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>>

# Appendix B

Species List



Vascular Flora List

Vegetation and Targeted Flora Assessment - Shelamar Station

<b>Family</b>	<b>Status</b>	<b>Confirmed Name</b>
<b>Aizoaceae</b>		<i>Trianthema pilosum</i>
<b>Amaranthaceae</b>		<i>Gomphrena</i> sp. <i>Ptilotus obovatus</i> <i>Ptilotus polystachyus</i>
<b>Asteraceae</b>		<i>Pterocaulon sphacelatum</i>
<b>Boraginaceae</b>		<i>Halgania solanacea</i> <i>Trichodesma zeylanicum</i>
<b>Brassicaceae</b>		Brassicaceae sp.
<b>Caryophyllaceae</b>		Caryophyllaceae sp. <i>Polycarpaea</i> sp.
<b>Combretaceae</b>		<i>Terminalia</i> sp.
<b>Cucurbitaceae</b>		<i>Cucumis</i> sp.
<b>Cyperaceae</b>		Cyperaceae sp.
<b>Euphorbiaceae</b>		Euphorbiaceae sp.
<b>Fabaceae</b>		<i>Acacia ancistrocarpa</i> <i>Acacia eriopoda</i> <i>Acacia monticola</i> <i>Acacia</i> sp. 1 <i>Acacia</i> sp. 2 <i>Acacia</i> sp. 3 <i>Acacia</i> sp. 4 <i>Acacia tumida</i> <i>Acacia stipuligera</i> <i>Bauhinia cunninghamii</i> <i>Chamaecrista symonii</i> Fabaceae sp. <i>Gompholobium simplicifolium</i> <i>Indigofera monophylla</i> <i>Isotropis atropurpurea</i> <i>Jacksonia aculeata</i> <i>Senna notabilis</i>
<b>Goodeniaceae</b>		<i>Goodenia azurea</i> <i>Goodenia sepalosa</i> <i>Goodenia triodiophila</i> <i>Scaevola parviflora</i> <i>Velleia panduriformis</i>

<b>Gyrostemonaceae</b>		<i>Gyrostemon tepperi</i>
<b>Lauraceae</b>		<i>Cassytha</i> sp.
<b>Loranthaceae</b>		<i>Amyema miquelii</i>
<b>Malvaceae</b>		<i>Corchorus sidoides</i> subsp. <i>sidoides</i> <i>Corchorus</i> sp. <i>Malvaceae</i> sp.
	T	<i>Serinia exastia</i>
	P3	<i>Seringia katatona</i> <i>Seringia</i> sp. (sterile) <i>Sida</i> sp. <i>Sida</i> sp. Pindan
<b>Montiaceae</b>		<i>Calandrinia strophiolata</i>
<b>Myrtaceae</b>		<i>Calytrix carinata</i> <i>Corymbia</i> sp. <i>Corymbia zygophylla</i> <i>Melaleuca argentea</i> <i>Melaleuca nervosa</i>
<b>Phyllanthaceae</b>		<i>Phyllanthus</i> sp.
<b>Poaceae</b>		? <i>Urochloa</i> sp. <i>Aristida ?inaequiglumis</i> <i>Aristida contorta</i> <i>Aristida holathera</i>
	*	<i>Cenchrus ciliaris</i> <i>Chrysopogon fallax</i> <i>Eragrostis ?brownii</i> <i>Eragrostis eriopoda</i> <i>Eriachne</i> sp. <i>Panicum</i> sp. 1 <i>Panicum</i> sp. 2 Poaceae sp. 1 Poaceae sp. 2 Poaceae sp. 3 Poaceae sp. 4 <i>Triodia ?schinzii</i>
<b>Proteaceae</b>		<i>Grevillea refracta</i> subsp. <i>refracta</i> <i>Grevillea wickhamii</i> <i>Hakea parallela</i> <i>Hakea</i> sp. <i>Persoonia falcata</i>
<b>Sapindaceae</b>		<i>Dodonaea hispidula</i>

**Solanaceae**

*Nicotiana* sp.

*Solanum* sp.

**Thymaleaceae**

?Thymaleaceae sp.

*Pimelea ammocharis*


Note: T = threatened, P3 = Priority 3, \* = non-native.

# Appendix C


Sample Data






Site Details			
Locality	EP17-068	Photo No.	80, 87
Date	25/07/2017	Photo direction	SE,NE
Author	RAO/TAA	Geographic datum and zone	GDA94 51
Sampling unit	Relevé	Easting	364098
Sample number	R1	Northing	7900490
Geographic and Habitat Data			
Aspect	flat	Hydrology	dry
Slope	flat	Adjacent Vegetation	same/Acacia thick shrubland
Topographic position	flat	Vegetation Condition	very good
Altitude (m)	22	Time since fire	>5 yrs
Bare ground %	25	Disturbance	low
Soil type/texture	sand	Rock type	-
Soil colour	red	Rock %	0
Microclimate	-	Litter type and %	leaves, twigs, branches, 40%
Vegetation Description			
<p>Tall shrubland <i>Acacia tumida</i> and <i>A. ancistrocarpa</i> over open shrubland <i>Grevillea wickhammii</i> and <i>Terminalia sp.</i> over low shrubland <i>Acacia spp.</i> over herbland <i>Trichodesma zeylanicum</i> over hummock grassland <i>Triodia ?schinzii</i></p>			
			
R1 Species Data			
<i>Acacia eriopoda</i>			
<i>Acacia monticola</i>			
<i>Acacia sp. 1</i>			
<i>Acacia sp. 2</i>			
<i>Acacia sp. 3</i>			
<i>Acacia sp. 4</i>			
<i>Acacia tumida</i>			
<i>Amyema miquelii</i>			
<i>Aristida contorta</i>			

<b>R1 Species Data</b>
<i>Calandrinia strophiolata</i>
<i>Calytrix carinata</i>
<i>Cassytha</i> sp.
<i>Chrysopogon fallax</i>
<i>Corchorus sidoides</i> subsp. <i>sidoides</i>
<i>Cyperaceae</i> sp.
<i>Eragrostis</i> ? <i>brownii</i>
<i>Fabaceae</i> sp.
<i>Goodenia sepalosa</i>
<i>Goodenia triodiophila</i>
<i>Grevillea wickhamii</i>
<i>Hakea parallela</i>
<i>Halgania solanacea</i>
<i>Indigofera monophylla</i>
<i>Malvaceae</i> sp.
<i>Melaleuca nervosa</i>
<i>Panicum</i> sp. 1
<i>Panicum</i> sp. 2
<i>Phyllanthus</i> sp.
<i>Pimelea ammocharis</i>
<i>Poaceae</i> sp. 1
<i>Poaceae</i> sp. 2
<i>Poaceae</i> sp. 3
<i>Polycarpaea</i> sp.
<i>Ptilotus polystachyus</i>
<i>Scaevola parviflora</i>
<i>Sida</i> sp.
<i>Sida</i> sp. <i>Pindan</i>
<i>Solanum</i> sp.
<i>Terminalia</i> sp.
<i>Trianthema pilosum</i>
<i>Trichodesma zeylanicum</i>
<i>Triodia</i> ? <i>schinzii</i>
<i>Unknown</i> sp.


Site Details			
Locality	EP17-068	Photo No.	142,143
Date	26/07/2017	Photo direction	SE,E
Author	RAO/TAA	Geographic datum and zone	GDA94 51
Sampling unit	Relevé	Easting	364156
Sample number	R2	Northing	7899354
Geographic and Habitat Data			
Aspect	flat	Hydrology	dry
Slope	flat	Adjacent Vegetation	same
Topographic position	flat	Vegetation Condition	very good
Altitude (m)	25	Time since fire	>5 yrs
Bare ground %	30	Disturbance	low
Soil type/texture	sand	Rock type	-
Soil colour	red	Rock %	0
Microclimate	-	Litter type and %	leaves, branches, 15%
Vegetation Description			
<p>Tall shrubland <i>Acacia monticola</i> and <i>A. tumida</i> over hummock grassland <i>Triodia ?schinzii</i> over open herbland <i>Halgania solanacea</i></p>			
			
R2 Species Data			
<i>Acacia ancistrocarpa</i>			
<i>Acacia monticola</i>			
<i>Acacia tumida</i>			
<i>Aristida contorta</i>			
<i>Bauhinia cunninghamii</i>			
<i>Calandrinia strophiolata</i>			
<i>Caryophyllaceae sp.</i>			
<i>Cassytha sp.</i>			
<i>Cenchrus ciliaris</i>			

<b>R2 Species Data</b>
<i>Chamaecrista symonii</i>
<i>Corchorus sidoides subsp. sidoides</i>
<i>Corymbia sp.</i>
<i>Corymbia zygophylla</i>
<i>Cucumis sp.</i>
<i>Eriachne sp.</i>
<i>Euphorbiaceae sp.</i>
<i>Fabaceae sp.</i>
<i>Gomphrena sp.</i>
<i>Goodenia sepalosa</i>
<i>Grevillea wickhamii</i>
<i>Hakea parallela</i>
<i>Hakea sp.</i>
<i>Halgania solanacea</i>
<i>Jacksonia aculeata</i>
<i>Nicotiana sp.</i>
<i>Panicum sp. 1</i>
<i>Phyllanthus sp.</i>
<i>Poaceae sp. 2</i>
<i>Ptilotus obovatus</i>
<i>Ptilotus polystachyus</i>
<i>Scaevola parviflora</i>
<i>Seringia sp. (sterile)</i>
<i>Sida sp. Pindan</i>
<i>Solanum sp.</i>
<i>Trianthema pilosum</i>
<i>Trichodesma zeylanicum</i>
<i>Triodia ?schinzii</i>
? <i>Urochloa sp.</i>

Site Details			
Locality	EP17-068	Photo No.	264-266
Date	26/07/2017	Photo direction	SE
Author	RAO/TAA	Geographic datum and zone	GDA94 51
Sampling unit	Relevé	Easting	364296
Sample number	R1	Northing	7895697
Geographic and Habitat Data			
Aspect	flat	Hydrology	dry
Slope	flat	Adjacent Vegetation	same
Topographic position	very low rise	Vegetation Condition	very good
Altitude (m)	41	Time since fire	~3 yrs
Bare ground %	50	Disturbance	low
Soil type/texture	sand	Rock type	-
Soil colour	red	Rock %	0
Microclimate	-	Litter type and %	leaves, twigs, 5%
Vegetation Description			
<p><b>Open shrubland <i>Bauhinia cunninghamii</i> and <i>Corymbia zygomorpha</i> over tall herbland <i>Ptilotus calostachyus</i> over hummock grassland <i>Triodia schinzii</i></b></p>			
			
R3 Species Data			
<i>Acacia monticola</i>			
<i>Acacia sp. 1</i>			
<i>Acacia sp. 3</i>			
<i>Acacia tumida</i>			
<i>Aristida inaequiglumis</i>			
<i>Bauhinia cunninghamii</i>			
<i>Brassicaceae sp.</i>			
<i>Calandrinia stropholata</i>			
<i>Cassytha sp.</i>			


<b>R3 Species Data</b>
<i>Chrysopogon fallax</i>
<i>Corchorus sp.</i>
<i>Corymbia sp.</i>
<i>Corymbia zygophylla</i>
<i>Cyperaceae sp.</i>
<i>Eragrostis ? brownii</i>
<i>Eriachne sp.</i>
<i>Euphorbiaceae sp.</i>
<i>Gompholobium simplicifolium</i>
<i>Gomphrena sp.</i>
<i>Hakea parallela</i>
<i>Indigofera monophylla</i>
<i>Isotropis atropurpurea</i>
<i>Panicum sp. 1</i>
<i>Poaceae sp. 2</i>
<i>Polycarpaea sp.</i>
<i>Ptilotus obovatus</i>
<i>Ptilotus polystachyus</i>
<i>Scaevola parviflora</i>
<i>Sida sp. Pindan</i>
<i>Solanum sp.</i>
<i>Terminalia sp.</i>
<i>Trianthema pilosum</i>
<i>Trichodesma zeylanicum</i>
<i>Triodia ?schinzii</i>
<i>Velleia panduriformis</i>



Site Details			
Locality	EP17-068	Photo No.	431,432
Date	27/07/2017	Photo direction	SE,E
Author	RAO/TAA	Geographic datum and zone	GDA94 51
Sampling unit	Relevé	Easting	368199
Sample number	R4	Northing	7899252
Geographic and Habitat Data			
Aspect	flat	Hydrology	dry
Slope	flat	Adjacent Vegetation	same
Topographic position	very low rise	Vegetation Condition	very good
Altitude (m)	37	Time since fire	2-3 yrs
Bare ground %	40	Disturbance	low
Soil type/texture	sand	Rock type	-
Soil colour	red	Rock %	0
Microclimate	-	Litter type and %	leaves, sticks, 15%
Vegetation Description			
<p><b>Open shrubland <i>Acacia monticola</i> over low open shrubland <i>Jacksonia aculeata</i> over hummock grassland <i>Triodia ?schinzii</i> over herbland <i>Halgania solanacea</i></b></p>			
			
R4 Species Data			
<i>Acacia ancistrocarpa</i>			
<i>Acacia monticola</i>			
<i>Acacia sp. 1</i>			
<i>Acacia tumida</i>			
<i>Aristida ?inaequiglumis</i>			
<i>Calandrinia strophiolata</i>			
<i>Calytrix carinata</i>			
<i>Cassytha sp.</i>			
<i>Chrysopogon fallax</i>			



<b>R4 Species Data</b>
<i>Corchorus sp.</i>
<i>Corymbia zygophylla</i>
<i>Cyperaceae sp.</i>
<i>Gomphrena sp.</i>
<i>Goodenia sepalosa</i>
<i>Goodenia triodiophila</i>
<i>Gyrostemon tepperi</i>
<i>Halgania solanacea</i>
<i>Indigofera monophylla</i>
<i>Jacksonia aculeata</i>
<i>Nicotiana sp.</i>
<i>Panicum sp. 1</i>
<i>Polycarpaea sp.</i>
<i>Ptilotus polystachyus</i>
<i>Scaevola parviflora</i>
<i>Senna notabilis</i>
<i>Seringia sp. (sterile)</i>
<i>Sida sp.</i>
<i>Sida sp. Pindan</i>
<i>Solanum sp.</i>
<i>Trianthema pilosum</i>
<i>Trichodesma zeylanicum</i>
<i>Triodia ?schinzii</i>

Site Details			
Locality	EP17-068	Photo No.	434
Date	27/07/2017	Photo direction	SE
Author	RAO/TAA	Geographic datum and zone	GDA94 51
Sampling unit	Relevé	Easting	368346
Sample number	R5	Northing	7898047
Geographic and Habitat Data			
Aspect	flat	Hydrology	dry
Slope	flat	Adjacent Vegetation	same
Topographic position	flat	Vegetation Condition	very good
Altitude (m)	44	Time since fire	~ 5 yrs
Bare ground %	40	Disturbance	low
Soil type/texture	sand	Rock type	none
Soil colour	red	Rock %	0
Microclimate	-	Litter type and %	leaves, sticks, branches, 10 %
Vegetation Description			
Open woodland <i>Corymbia</i> spp. over tall open shrubland <i>Bauhinia cunninghamii</i> over open shrubland <i>Acacia monticola</i> over hummock grassland <i>Triodia ?schinzii</i> over open herbland <i>Trianthema pilosum</i>			
			
R5 Species Data			
<i>Acacia monticola</i>			
<i>Acacia</i> sp. 1			
<i>Acacia</i> sp. 3			
<i>Acacia tumida</i>			
<i>Aristida contorta</i>			
<i>Bauhinia cunninghamii</i>			
<i>Calandrinia strophiolata</i>			
<i>Chrysopogon fallax</i>			
<i>Corymbia</i> sp.			

<b>R5 Species Data</b>
<i>Corymbia zygophylla</i>
<i>Cucumis sp.</i>
<i>Eriachne sp.</i>
<i>Fabaceae sp.</i>
<i>Gomphrena sp.</i>
<i>Goodenia sepalosa</i>
<i>Goodenia triodiophila</i>
<i>Halgania solanacea</i>
<i>Indigofera monophylla</i>
<i>Isotropis atropurpurea</i>
<i>Nicotiana sp.</i>
<i>Panicum sp. 1</i>
<i>Persoonia falcata</i>
<i>Ptilotus polystachyus</i>
<i>Scaevola parviflora</i>
<i>Sida sp.</i>
<i>Sida sp. Pindan</i>
<i>Solanum sp.</i>
<i>Trianthema pilosum</i>
<i>Triodia ?schinzii</i>

# Attachment 4

Fauna assessment of Shelamar Station (Bamford Consulting Ecologists 2017)







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## Fauna assessment of Shelamar Station

Mike Bamford

25<sup>th</sup> August 2017

### 1 INTRODUCTION

Roper River Agriculture P/L is proposing to extend the pivot irrigation system on Shelamar station in the Shire of Broome (Figure 1). The addition of 67 pivots of varying size will require clearing of native vegetation, and therefore a clearing permit application to clear 1,901ha is being prepared. In its assessment of such applications, the Department of Water and Environmental Regulation (DWER) requires information on the presence and abundance of fauna species of conservation significance. Therefore, Bamford Consulting Ecologists, through Emerge and Associates, was commissioned to undertake a targeted survey for significant species. The species of greatest interest and concern was the Greater Bilby *Macrotis lagotis*, listed as Vulnerable under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Schedule 1 (Vulnerable) under the state *Biodiversity Conservation Act 2016* (BCA) (replacing the *Wildlife Conservation Act 1950*). Other species of conservation significance likely to be present in the area and that could be affected by clearing are the Spectacled Hare-Wallaby *Lagorchestes conspicillatus*, Brush-tailed Mulgara *Dasycercus blythi* and Woma *Aspidites ramsayi* (all listed as Priority 4 by the state Department of Biodiversity, Conservation and Attractions (DBCA)). These species are considered likely to be present because the project area is within their range and supports a suitable environment of acacia shrublands and spinifex on sand and sandy-loam plains.

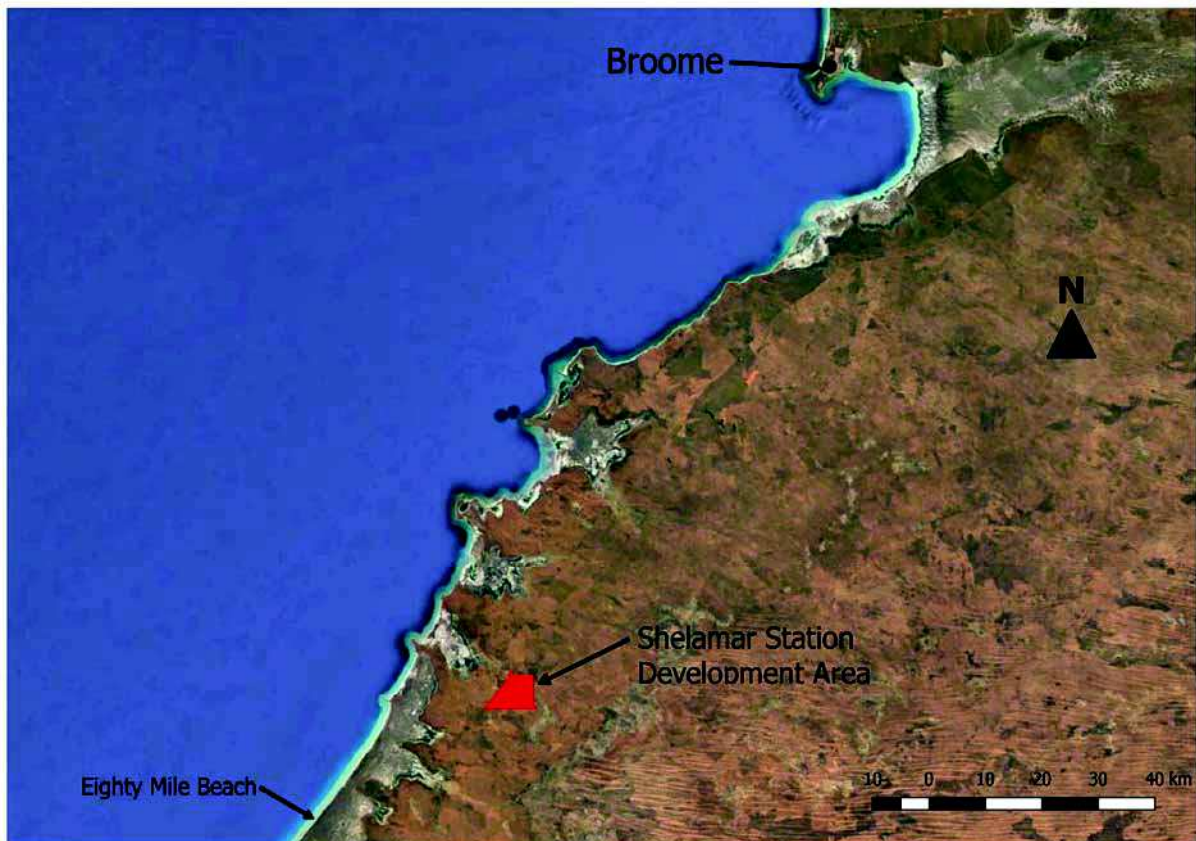


Figure 1. Site location plan.

## 2 METHODS

The project area was visited from 24<sup>th</sup> to 28<sup>th</sup> July 2017 by Mike Bamford (B.Sc. Hons. Ph.D. (Biol.)) in conjunction with Emerge botanists Tom Atkinson and Rachael Omodei. Mandy Bamford (B.Sc. Hons. (Zool.)) had been going to assist with Bilby surveys but had to return to Perth and therefore the Bilby survey team was reduced to one person at very short notice. To offset this loss, the botanists were instructed in the identification of Bilby signs (tracks, burrows, scats and foraging holes), and were provided with written descriptions and photographs of these signs (Appendix 1). The approach to the Bilby survey broadly followed guidance recently released by the DBCA (DBCA 2017) and to which Mike Bamford had contributed.

Bilby signs are distinctive and not likely to be confused with signs left by other species in the Shelamar area. For example, Northern Quoll *Dasyurus hallucatus* and the introduced Rabbit *Oryctolagus cuniculus* have somewhat similar tracks, and the Rabbit does create foraging holes (of similar size but of a quite different shape from those of the Bilby), but neither of these species occurs in the area. Gould's Goanna digs foraging hole similar in size and sometimes shape to those of the Bilby, but these almost always have a characteristic shape and photographs were available for reference.

The Bilby survey approach initially involved slowly driving along all accessible vehicular tracks looking for Bilby signs. Where Bilbies occur in an area, they regularly move along such tracks and their footprints can be readily seen from a slow-moving vehicle. Foraging holes and even occasionally burrows can also be found with this approach. Following this vehicle-based search, transects were walked across the proposed clearing area, with greater searching intensity where Bilby signs had been found during the vehicle-based search. These transects were initially going to be parallel and spaced at 300-400m intervals across the proposed clearing area, but with the departure of Mandy Bamford, diagonal

transects were walked to access the most distant corners of the proposed clearing area, and these were supplemented by transects walked by the botanists. The transect coverage was thus not as complete as had been planned but was considered sufficient to confirm the presence of the Bilby (as proved to be the case; see below). Figure two illustrates the distribution of both vehicle-based and walking transects.



Figure 2. Site plan showing survey effort.

## 2 RESULTS

Locations where evidence of Bilbies and other significant fauna was found are indicated on Figure 3.

There were three areas of recent Bilby activity. In the north-east of the project area there were fresh tracks considered to be less than a week old (Figure 4), as well as some older foraging holes (from before the summer rains) nearby. The tracks were found on the first day of the field trip but there were no new tracks by later in the week and no fresh foraging signs in the area, suggesting it was a single and probably young (based on footprint size) animal passing through. In the west of the project area, adjacent to the airstrip, there were three burrows and abundant foraging holes spread over an area of >1ha (Figure 5). All the activity was since the last heavy rains (about March 2017), but there were no footprints and only one scat was found. This suggests that the airstrip location had not been occupied for several months (perhaps April 2017). The amount of activity suggested a single animal had been resident for only a short period of time and had then moved on (or died). The final area of Bilby activity was along the main vehicular track running through the centre of the project area, and consisted of a short line of footprints, most of which had been obliterated by vehicles. These prints were probably less than a week old and may have been from the same animal that had passed through the north-west of the project area. There were some older foraging holes (from before the summer



rains) nearby. These old foraging signs indicate that another animal had moved through the area over six months before.

The Bilby signs indicate that Bilbies occur in the project area probably as regular transients in small numbers, and occasionally as short-term residents. No large areas of intensive and long-term foraging were found, and there were no old burrows; such evidence would be expected if Bilbies were regular, long-term residents. Staff reports of occasional sightings of Bilbies around existing irrigation areas at night are consistent with this.

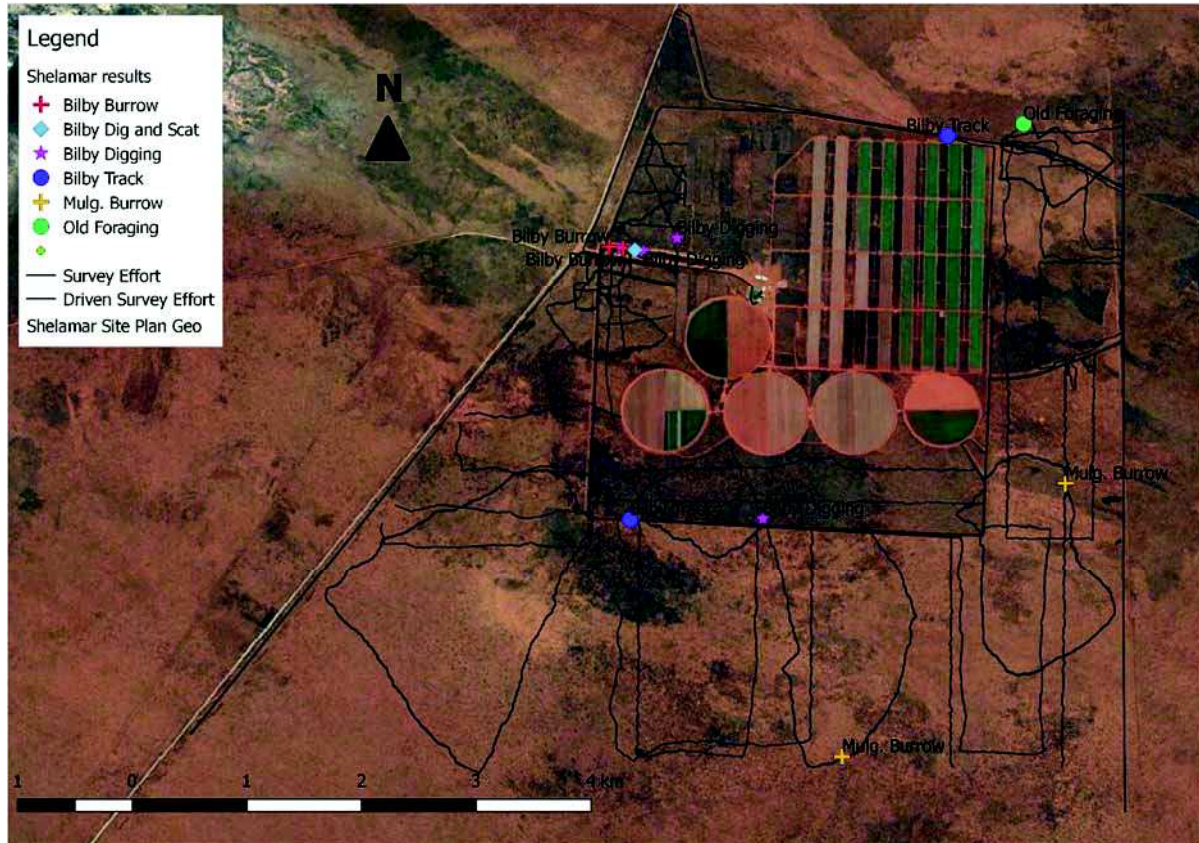


Figure 3. Results of the survey showing locations of evidence of Bilbies and other significant species.



*Figure 4. Recent (c. 1 week) Bilby track in north-east corner of project area.*





Figure 5. Bilby burrow and foraging holes near the airstrip. These signs are thought to be three to four months old.

There were few signs or sightings of other significant fauna.

- Two burrows probably of the Brush-tailed Mulgara were found (Figure 3), but these are considered unconfirmed as there were no supporting tracks or scats. If these burrows were from a mulgara, they suggest a low population density, as where the species is common its burrows are found regularly.
- An adult Woma was found (and photographed; Figure 6) by T. Atkinson and R. Omodei in the west of the project area. This species is likely to be resident in small numbers throughout the project area.
- Rainbow Bee-eaters *Merops ornatus* were seen regularly throughout the project area. Currently listed as Migratory under the BCA but recently delisted from the EPBC Act, this species is abundant and often nests in disturbed areas.
- The Australian Bustard *Ardeotis australis* and Bush Stone-curlew *Burhinus grallarius* were both present and were listed as Priority until recently.
- Tracks of the Brush-tailed Possum *Trichosurus vulpecula* were found on the southern edge of the existing irrigation areas and, while not listed as significant or priority, the species is rarely recorded in the region.
- Nests of a pair of Wedge-tailed Eagles *Aquila audax* and a pair of Brown Falcons *Falco berigora* were found at (51K) 365,555E and 7,896,453N; and 366,720E and 7,896,946N respectively.

Note that there was no evidence of the Spectacled Hare-Wallaby but this species can be very hard to detect. With recent records from other projects in the general area (Bamford Consulting) it should be assumed to be present.



*Figure 6. Woma found in the west of the project area.*

### **3 CONCLUSIONS**

The vegetation and soils of the Shelamar project area within the range of and provide habitat for the Greater Bilby, Brush-tailed Mulgara, Spectacled Hare-Wallaby and Woma. The presence of the Bilby and Woma was confirmed, and probable evidence of the Mulgara was found. The Rainbow Bee-eater was also present, although this species is less at risk from land-clearing than the other species. Other species of note found to be present (but not of listed conservation significance or priority) were the Australian Bustard, Bush Stone-curlew and Brush-tail Possum.

Observations on Bilby signs suggest that it occurs regularly in the project area, but in only small numbers, and is likely to be represented by transient or temporarily resident animals rather than there being long-term resident population.

It is recommended that if a clearing permit is approved, pre-clearing surveys for Bilbies should be undertaken to check for the presence of resident animals at the time of clearing. These pre-clearing surveys should also check for the presence of the Brush-tail Possum in tree hollows, and should check the activity status of nests of the Brown Falcon and Wedge-tailed Eagle.

### **4. REFERENCE**

DBCA (2017). Bilby survey guide.

Appendix 1. Reference photographs (not taken at Shelamar) provided to T. Atkinson and R. Omodei to aid in the recognition of Bilby signs.



Foraging holes of Bilby.



Forging holes of Bilby



Bilby scats.



Line of Bilby footprints in sand



Close-up of set of Bilby prints; hindfeet on left and animal traveling right to left.



Forging hole of Gould's Goanna.

Appendix 2. Annotated species list from Shelamar Station, July 2017.

1. Straw-necked Ibis. Few around irrigated crops.
2. White-necked Heron. One around homestead.
3. Crested Pigeon. Flocks of up to 50 birds on irrigated areas.
4. Diamond Dove. Occasional groups of 2-5 birds seen.
5. Budgerigar. Few flocks of up to 100 birds seen.
6. Red-winged Parrot. Several pairs seen.
7. Wedge-tailed Eagle. Nest in good condition but not active in south (SHWTEN).
8. Whistling Kite. Two seen over house.
9. Black Kite. One along nearby highway and one over pivots.
10. Brown Falcon. Pair seen on pivots and pair at nest in south (SHBFN).
11. Collared Sparrowhawk. One seen in north and one in south.
12. Australian Bustard. Tracks throughout and few seen.
13. Little Button-quail. Single birds and pairs flushed regularly.
14. Bush Stone-curlew. Fresh tracks along entrance road and elsewhere.
15. Pheasant Coucal. Calling in evening around homestead.
16. Blue-winged Kookaburra. Several around homestead.
17. Red-backed Kingfisher. Several seen.
18. Rainbow Bee-eater. Groups of up to five birds seen regularly.
19. Horsfield's Bronze-Cuckoo. Several calling in south.
20. Red-backed Fairy-wren. Parties seen regularly and one coloured males observed.
21. Variegated Fairy-wren. Several parties in areas of dense acacia. Coloured males present.
22. Red-browed Pardalote. Few calling in areas of eucalypts.
23. Yellow-throated Miner. Party near homestead.
24. Singing Honeyeater. Common in shrubland.
25. Brown Honeyeater. Few in shrubland.
26. Varied Sittella. Group of three seen in south and another group seen in east.
27. Grey-crowned Babbler. Three parties seen.
28. Rufous Whistler. Few calling in shrublands. Only uncoloured birds seen.
29. Grey Shrike-thrush. Seen and heard in shrubland south of pivots.
30. Black-faced Cuckoo-shrike. Few seen including a flock of about 10 birds.
31. White-winged Triller. Pairs and small groups seen regularly but males mostly uncoloured.
32. Mistletoebird. Few heard and one coloured male seen.
33. Magpie-lark. Few birds amongst pivots.
34. Pied Butcherbird. Few around homestead.
35. Torresian Crow. Groups of 2-3 birds seen regularly.
36. Black-faced Woodswallow. Groups of up to 10 birds seen regularly.
37. Masked Woodswallow. Flock of about 50 birds high overhead.
38. Zebra Finch. Small parties throughout.
39. Rufous Songlark. Few seen and occasional calls heard.
40. Horsfield's Bushlark. Pairs seen in south-east and north-east.

*Ctenophorus isolepis*. Abundant.

*Ctenophorus nuchalis*. Several seen.



*Pogona minor*. Several seen; large and noticeably yellow.

*Aspidites ramsayi*. Large specimen in good condition seen.

Dingo. Tracks found regularly.

Feral cat. Tracks found regularly.

Brush-tailed Possum. Tracks just south of western pivots.

Agile Wallaby. Tracks and scats abundant.

Mulgara. No clear evidence but likely burrows at SHM01 and SHM02.