appendix a

environmental assessment and management strategy

(RPS Group)

ENVIRONMENTAL ASSESSMENT REPORT

Lot 703 Armadale Road, Treeby



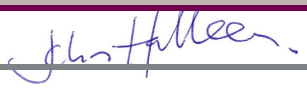
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SUMMARY

The Treeby Local Structure Plan (LSP) is a Joint Venture (JV) development between LWP Group Pty Ltd (LWP) and the Department of Communities which delivers affordable land and housing development(s) and socially and environmentally sustainable community.

The Treeby LSP site is in the suburb of Treeby, approximately two kilometres (km) west of Cockburn Central district centre and 19 km south of Perth Central Business District (CBD). The site is approximately 20 hectares (ha) in area, bordered by Armadale Road to the south, the Calleya residential development to the west and Bush Forever Site No. 390 (Fraser Road Bushland) to the north (Figure A).

This LSP provides an overarching planning framework to guide and facilitate the development of the Treeby site for primarily urban purposes in accordance with both the Metropolitan Region Scheme (MRS) land use zoning and the JV's vision. The structure plan provides an integrated approach focusing on delivering a mix of residential land uses and associated infrastructure, necessary to create a residential community and delivery of affordable housing within the City of Cockburn municipality.

Historically, the site was extensively cleared for sand mining purposes with most of the 20 ha site consisting of open former sand mining areas, or poorly rehabilitated areas and therefore has limited environmental values. The limited existing remnant native vegetation within the LSP site is located on the western and south-western boundaries of the site. These areas were not subject to the historical sand mining although they have been subject to localised impacts from illegal four wheel drive site access and more recently the Armadale Road upgrade works. No bush forever sites are located within the site; however, Bush Forever Site No. 390 is located immediately north. Conservation fencing will be positioned (to the satisfaction of the Department of Biodiversity Conservation and Attractions (DBCA)) along the boundary of the Bush Forever Site No. 390. No paths or access to the bush forever site is promoted.

Remnant vegetation areas within the LSP site and the adjacent Bush Forever Site No. 390 will be managed in accordance with the approved Vegetation Management Plan.

Purpose of this report

This environmental assessment report assesses the existing environment of the site, as shown in Figure A. The purpose of this report is to:

1. Review of the existing environment and address key environmental factors that may be impacted as a result of future development
2. Outline the management measures that will be adopted to mitigate any potentially significant environmental impacts from future development
3. Facilitate the approval of the LSP with the City of Cockburn (CoC) and the Western Australian Planning Commission (WAPC) by providing a land use framework to coordinate residential subdivision and development.

Scope of works

The following key site specific environmental assessment have been undertaken to assist in framing the LSP design and environmental outcomes:

- Site visit
- Targeted search of *Caladenia huegelii* in September 2019 (targeted spring survey)
- Undertaking the Flora and Vegetation Review (RPS 2019a) which reviewed the historical flora and vegetation surveys in the local region including
  - Lot 821 Armadale Road Banjup Environmental Assessment (PGV Environmental 2013)

  - *Caladenia huegelii* monitoring 2016 – Lot 821 Armadale Road, Banjup (PGV Environmental 2017)

- Preparing the Local water management strategy (RPS 2019b)

- Reviewing the land, water and people-themed environmental factors for the site in accordance with the Environmental Protection Authority's (EPA) Environmental Factor Guidelines.

Planning and environmental context

Historically the site (and the local surrounding area) was used for extractive industries (sand quarry). As a result, most of the site comprises of areas cleared as a result of past sand quarrying activities which has either been left as open bare ground or poorly rehabilitated areas.

The site was rezoned to "Urban" under the MRS Amendment No 1289/57 and 'Development' under the CoC's Town Planning Scheme (TPS) No. 3 Amendment No. 117 in 2016.

The site MRS and CoC local scheme zonings are illustrated in Figures B and C.

Post the gazettal of the MRS and the TPS amendments, LWP is advancing this LSP for the Treeby site. The LSP defines the key proposed land uses within the site including:

- Residential dwellings
- Seniors living
- Local roads
- Public Open Space (POS)
- Conservation POS area
- Drainage swale areas
- Childcare facility.

The Treeby LSP is shown in Figure D.

Key environmental factors

Flora and vegetation

RPS has identified the key environmental issue applicable to the Treeby LSP relates to the potential impacts to and management of the existing remnant vegetation. Most of the site has historically been excavated for sand mining purposes.

RPS has undertaken a regional and local assessment of the remnant native vegetation within the site. In summary, there is 0.98 ha of native Banksia Woodland vegetation located along its western and south western boundaries (Figures A and F).

The LSP will retain a minimum of 0.42 ha of the best quality remnant Banksia Woodland. This retained Banksia Woodland vegetation was mapped as being in 'Good' to 'Very Good' condition. This 0.42 ha is currently fenced (conservation type fencing) to prevent illegal access. The 0.42 ha of retained remnant vegetation also protects the historically mapped locations of the Threatened Flora species, *Caladenia huegelii*, which is protected under the State *Biodiversity Conservation Act 2016,* and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Fifteen *Caladenia huegelii* individuals have previously been recorded within the 0.42 ha fenced area of the site between 2012 and 2016. There are no records of *Caladenia huegelii* individuals occurring outside of the 0.42 fenced area, noting PGV Environmental has been undertaking annual *Caladenia huegelii* surveys at this location since 2012.

Additionally, *Caladenia huegelii* individuals have been surveyed within the site by RPS, the DBCA and the WA Orchid Society and Conservation Groups). RPS undertook a targeted survey in September 2019 and confirmed the location of the *Caladenia huegelii* individuals within the 0.42 ha fenced area. No *Caladenia huegelii* individuals were recorded outside of the fenced area within the LSP area.

Figure 1 shows the conservation fence area and the historically mapped locations of the *Caladenia huegelii* individuals. The fenced area also captures the best quality remnant vegetation ('Good' to 'Very Good' condition). The LSP proposes to designate this fenced area as conservation POS.

The potential impact on remnant vegetation is focused on the 0.56 ha of Banksia Woodland (as a maximum level) outside of the fenced area. The potential impacts are a result of accommodating engineering and landscaping design requirements such as entry road, local roads, residential development, POS and civil infrastructure. The existing earth bund where the 0.56 ha of remnant vegetation is located has an approximately 2 m to 3 m topographical height difference from the base of the site, or the former sand quarry. In some areas of the western and south-western bund engineering works will be required particularly around the entry road and areas of residential development. The impact on the 0.56 ha remnant Banksia Woodland will be defined at subdivision once the detailed engineering and landscape designs (undertaken at subdivision) are complete. However, it is likely a portion of the 0.56 ha remnant Banksia Woodland vegetation will be retained in areas of POS which are located north of the conservation POS area as shown in the LSP in Figure D.

Table 1 provides a summary of the estimated extent of remnant vegetation to be cleared or retained within the LSP. Figure 3 shows the location within the LSP area where the native vegetation will be retained and the native vegetation which will be impacted as a result of implementing the LSP.

Table 1: Remnant vegetation to be cleared or retained

Remnant vegetation in POS	Area (ha)
Fenced retained area	0.42
Indicative retained areas – subject to detailed landscape design plans	0.13
Indicative cleared areas – subject to detailed engineering design	0.43

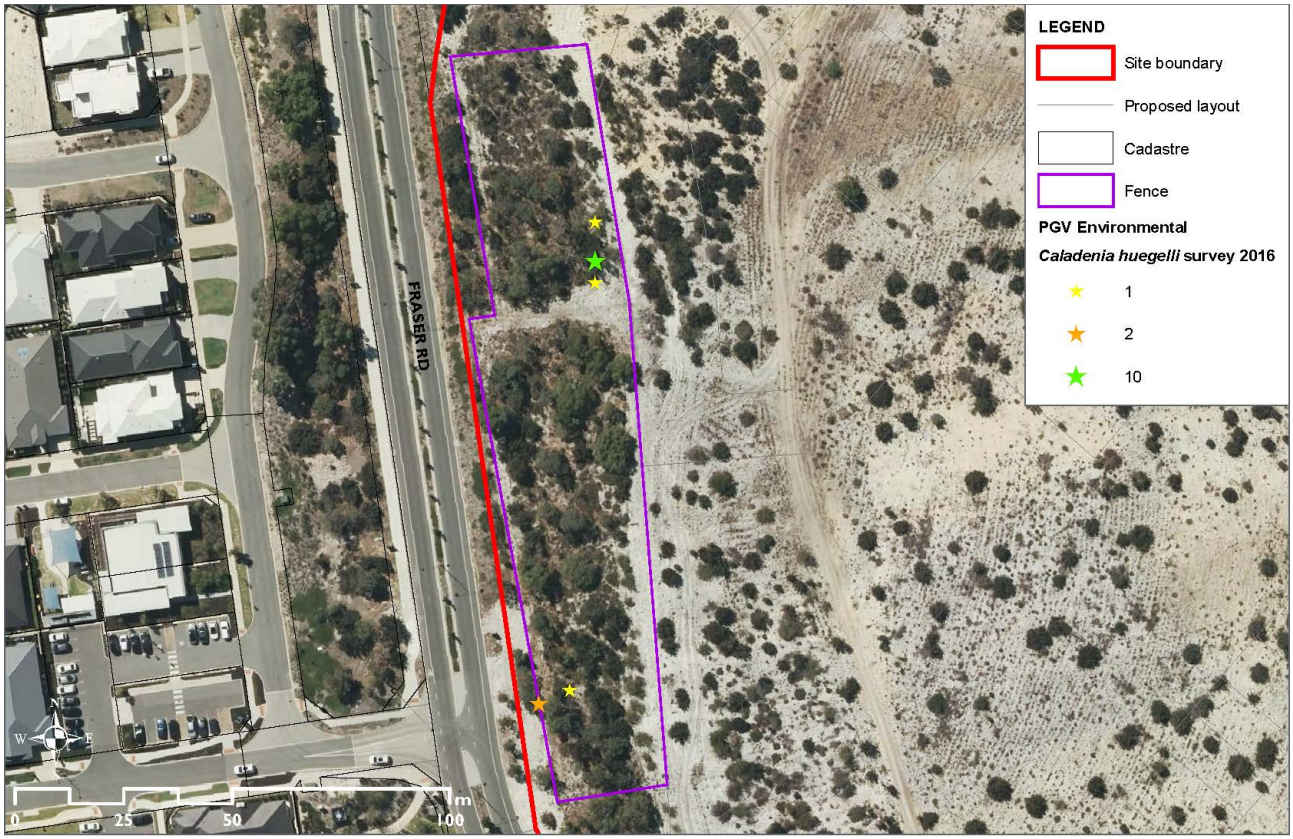


Figure 1: Fenced conservation POS area in the LSP

The proposed management of the remnant vegetation will be through an approved Vegetation Management Plan. The Vegetation Management Plan will be prepared and implemented, at subdivision stage. The Vegetation Management Plan will be applied to the subdivision adjacent to the Bush Forever Site No. 390 and the fenced Conservation POS area. The Vegetation Management Plan will be prepared to the satisfaction of the CoC.

Inland water

The site is currently located within a P3* public drinking water source area (PDWSA). P3* areas are those that were previously P1 or P2 areas and the land has been rezoned within the MRS to 'Urban' (Department of Water and Environmental Regulation (DWER) 2018a).

The P3* zoning is a variation of the P3 to address the increased water quality risks resulting from the approved landuse intensification. Water quality protection note 76 (Department of Water (DoW) 2006) sets out the planning requirements for PDWSAs and water quality protection note 25 (DoW 2016) sets out the land uses that are compatible with public water source priority areas. DWER assigns priority areas within PDWSAs to guide land use decisions. The *Land use compatibility tables for public drinking water source areas*, Water quality protection note no. 25 DoW (2016) identifies that P3 source protection areas are defined and managed to maintain the quality of the drinking water source for as long as possible with the objective of risk management. P3 areas occur within PDWSAs where the land is zoned for urban and commercial or light industrial uses. Within P3 areas, drinking water sources need to co-exist with higher intensity land uses compared to P1 and P2 areas. Key elements in the protection of P3 areas include the need for deep sewerage and implementing best management practices.

The proposed land uses advocated in the Treeby LSP (for example, residential development, childcare site, POS, local roads) are compliant with the *Jandakot land use and water management strategy* (WAPC 1995).

RPS has prepared a Local Water Management Strategy (LWMS) to support the Treeby LSP. This LWMS details the integrated total water cycle water management strategies to be implemented for the Treeby site and includes:

- An assessment of the pre-development environment
- Development of water use sustainability initiatives
- Stormwater management strategy
- Groundwater management strategy
- Plan for implementation of subdivision.

The LWMS is based on the following objectives:

- New developments should achieve a maximum water consumption target of 100 kL/person/year for residential lots
- At the lot scale (residential) less than 40-60 kL of water consumption should be from scheme water
- Retain and treat stormwater runoff from constructed impervious surfaces generated from the first 15 mm rainfall event as close to source as possible
- Designing stormwater management systems to provide serviceability and amenity for roads during minor (20% AEP) rainfall events
- Protection of infrastructure and assets from flooding and inundation, with minimum habitable floor levels being at least 0.3 m above the 1% AEP flood level for the urban drainage system
- Major arterial roads should remain passable in a 1% AEP event
- Provide storage and delineate flow paths for the 1% AEP event
- The CoC also have a requirement that drainage basins will be at least 0.5 m above the maximum groundwater level.

The LWMS stormwater and groundwater management objectives (once approved) will be implemented in future Urban Water Management Plan(s).

Environmental factors and management measures

The following environmental factors were identified in this assessment of the Treeby LSP, including their potential impacts and proposed management commitments are summarised in Table 2.

Table 2: Summary of environmental factors, potential impacts and proposed management measures

Environmental factors	Environmental objective	Applicable legislation and/or guidelines	Potential impacts	Management measures	Timing
Land					
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	• *Environment Protection and Biodiversity Conservation Act 1999* • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Flora and Vegetation (EPA 2016a) • Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)	• Clearing of up to 0.56 ha of Banksia Woodland vegetation (subject to detailed landscape and engineering design) • Introduction and distribution of weed species	Retention of a minimum 0.42 ha of Banksia Woodland vegetation (within the conservation fenced area)	Subdivision design
				Clearly mark out clearing areas to prevent accidental clearing	Prior to construction
				• Conservation fencing will be positioned (to the satisfaction of the DBCA) along the boundary of the Bush Forever Site No. 390. No paths or access to the bush forever site is promoted • Remnant vegetation areas within the LSP site and the adjacent Bush Forever Site No. 390 will be managed in accordance with the approved Vegetation Management Plan	Prior to subdivision approval
				All vehicles to be free of vegetative and soil material	During construction
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	• *Environment Protection and Biodiversity Conservation Act 1999* • Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso* (DEE 2017) • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Terrestrial Fauna (EPA 2016d)	• Clearing of up to 0.56 ha of Banksia Woodland vegetation, including six emergent jarrah trees (subject to detailed landscape and engineering design) • Injury and/or mortality from construction works • Disturbance to fauna behaviour during construction • Impacts to habitat and food sources	• Retention of a minimum 0.42 ha of Banksia Woodland vegetation (within the conservation fenced area) • A hollow assessment of the existing jarrah trees will be undertaken prior to clearing to provide photographic evidence that the trees are not currently in use by black cockatoos	Subdivision design

Environmental factors	Environmental objective	Applicable legislation and/or guidelines	Potential impacts	Management measures	Timing
Terrestrial Environmental Quality – Acid Sulfate Soils	To maintain the quality of land and soils so that environmental values are protected.	• Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016c) • Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015a) • Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER 2015b)	Acidification and release of heavy metals from ASS into groundwater	• Final fill levels and subsequent excavation (e.g. for sewer lines/engineering services and dewatering requirements) will dictate future ASS management requirements. • Appropriate ASS management plan will be prepared at subdivision stage to support the proposed engineering approach (if required).	Prior to subdivision approval
Terrestrial Environmental Quality – potential contamination	To maintain the quality of land and soils so that environmental values are protected.	• *Contaminated Sites Act 2003* • Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016c) • Assessment and Management of Contaminated Sites (DER 2014) • Identification, Reporting and Classification of Contaminated Sites in Western Australia (DER 2017)	Impacts from illegally dumped rubbish and uncontrolled fill materials	All dumped rubbish will be identified and disposed of at an appropriate landfill facility	Prior to construction
Water					
Inland Water	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected	• Environmental Factor Guideline - Inland Waters (EPA 2018) • State Planning Policy (SPP) 2.3: Jandakot Groundwater Protection • Better Urban Water Management (WAPC 2008)	• Altered hydrological regimes. • Contamination of groundwater from construction or polluted stormwater runoff	Preparation of a Local Water Management Strategy	Prior to LSP approval
				Preparation and implementation of Urban Water Management Plan(s) (UWMPs) and detailed engineering plans	Prior to subdivision approval
Social surroundings					
Social Surroundings – Aboriginal heritage and culture	To protect social surroundings from significant harm	• *Aboriginal Heritage Act 1972* • Environmental Factor Guideline Social Surroundings (EPA 2016e)	Impacts to artefacts or other items of Aboriginal cultural significance	Stop construction if any Aboriginal objects are identified or unearthed, and report findings to Department of Planning, Lands and Heritage (DPLH)	During construction

Environmental factors	Environmental objective	Applicable legislation and/or guidelines	Potential impacts	Management measures	Timing
Social Surroundings – Noise	To protect social surroundings from significant harm	• Environmental Factor Guideline Social Surroundings (EPA 2016e) • Environment Protection (Noise) Regulations 1997 • SPP 5.3: Land Use Planning in the Vicinity of Jandakot Airport • SPP 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning	• Aircraft and traffic related noise impacts to future residents • Construction noise and dust impacts to site workers and existing and/or future residents • Dust impacts to retained native vegetation		
Social Surroundings – Bushfire	To protect social surroundings from significant harm	• *Fire and Emergency Services Act 1998* • Environmental Factor Guideline Social Surroundings (EPA 2016e) • SPP 3.7: Planning in Bushfire Prone Areas • Guideline for Planning in Bushfire Prone Areas, Version 1.3 (DPLH and DFES 2017)	• Damage to people, property and infrastructure from fire • Death and/or injury due to fire	Preparation of a Bushfire Management Plan	Prior to subdivision approval
				Update BAL contours to reflect the proposed subdivision outcomes	Prior to subdivision approval

1 INTRODUCTION

1.1 Location

LWP is proposing to develop Lot 703 Armadale Road (the site) in accordance with the proposed Local Structure Plan (LSP). The site is in the City of Cockburn, 19 kilometres (km) south of Perth CBD and 2 km east of the Cockburn Central Activity Centre and Transit Station (Figure A).

Most of the site was historically cleared of native vegetation and excavated as part of its previous use as a sand quarry. Along the site's western and south-western edge there is small area of remnant vegetation where the natural topography was not historically altered by sand mining. More recently remnant vegetation extents on the southern bund located at the periphery of the Treeby site was removed as part of the Armadale Road widening works (Figure A).

1.2 Local structure plan

The LSP has been developed to guide the subdivision and development of approximately 20 hectares (ha) of vacant land within the Treeby District Structure Plan (DSP) area and in accordance with the Metropolitan Region Scheme (MRS) 'Urban' zoning and the City of Cockburn's (CoC) Town Planning Scheme (TPS) 'Development' zoning (Figures B and C).

The purpose of the environmental assessment report is to:

- Review of the existing environment and address key environmental factors that may be impacted as a result of future development.
- Outline the management measures that will be adopted to mitigate any potentially significant environmental impacts from future development.
- Facilitate the approval of the LSP with the CoC and the Western Australian Planning Commission (WAPC) by providing a land use framework to coordinate residential subdivision and development.

1.2.1 Environmental aspects of the LSP design

The site's environmental values are limited to the extents of remnant vegetation along its western and south-western edge. Approximately 19.36 ha (or approximately 97% of the site) has been historically cleared of native vegetation to facilitate sand mining. From an environmental perspective, the key environmental influences of the LSP design are:

- **Flora and vegetation**: Assessing the status of the remnant native revegetation located along the western and south-western boundaries of the site and the presence of Threatened Flora species, *Caladenia huegelii.* Bush Forever Site No. 390 is located immediately north of the site. Conservation fencing will be positioned (to the satisfaction of the Department of Biodiversity Conservation and Attractions (DBCA)) along the boundary of the Bush Forever Site No. 390. No paths or access to the bush forever site is promoted.
- **Terrestrial fauna**: The remnant native vegetation located along the western and south-western boundaries of the site is of potential breeding and foraging value for black cockatoos.
- **Inland waters**: Groundwater and stormwater management / drainage within a P3* requires additional water treatment focus.
- **Social surroundings**: Noise risks due to the proximity to Armadale Road.

The LSP promotes the following environmental outcomes:

- The retention of native (Banksia Woodland) vegetation extents in 'Good' to 'Very Good' condition either within areas of Conservation Public Open Space (POS) or in POS areas.

- Retention of the Threatened Flora species, *Caladenia huegelii* within a defined (0.42 ha) and fenced Conservation POS area.
- The retention of fauna habitat values within Conservation POS and POS areas.
- Best practice stormwater treatment and management practices.
- Installing a noise wall along Armadale Road.

1.3 Planning context for Lot 703

1.3.1 MRS amendment 1289/57

Most of the site was formerly zoned 'Rural – Water Protection' and under the MRS and 'Resource' under the CoC's TPS No. 3. A small portion of the site adjacent to Armadale Road has been reserved for 'Primary Regional Roads' under the MRS. Most of the site was subsequently rezoned to 'Urban' under the MRS in early 2016 (MRS Amendment 1289/57, Lot 821 Armadale Road, Banjup and Surrounds), with the 'Primary Regional Roads' reservation remaining (Figure B).

MRS Amendment 1289/57 was referred to the Environmental Protection Authority (EPA) for assessment under Section 48a of the *Environmental Protection Act 1986* (EP Act). In April 2015, the Chairman of the EPA considered that the likely environmental impacts of the Scheme Amendment were not so significant as to warrant formal environmental assessment and, subsequently, determined that Amendment 1289/57 was assessed as "Scheme Amendment Not Assessed – Advice Given (no appeals)".

However, in its advice on the MRS Amendment 1289/57, the EPA:

- Identified that the key environmental factors requiring management are flora and vegetation and hydrological processes
- Noted that remnant vegetation along the south western and southern boundaries would be retained as well as the area of remnant vegetation on the eastern[1] side of the site, containing the rare orchid *Caladenia hueglii*
- Noted that the (then) Department of Water has approved the District Water Management Strategy and the proposed Amendment is in accordance with the Draft State Planning Policy (SPP) No.2.3 - Jandakot Groundwater Protection
- Expected that this advice would be implemented as part of the local planning scheme and subsequent subdivision and development applications.

Amendment 1289/57 was gazetted on the 20 May 2016.

1.3.2 City of Cockburn TPS No. 3 Amendment No. 117

Amendment 117 to the CoC's TPS No.3 subsequently rezoned the majority of site to 'Development' on 27 June 2017. To accord with the MRS, the small portion of the site adjacent to Armadale Road remained reserved for 'Primary Regional Roads' and 'Water Catchments' under TPS No. 3.

As part of Amendment 117, the following provisions were included (by the WAPC and the EPA) in the scheme text under Part 5 – 'Special Control Areas' of TPS No. 3:

[1] It is anticipated that this is an error in the EPA's advice as the eastern side of the site was cleared for sand mining and *Caladenia hueglii* has only been recorded in the native vegetation on the western side of the site

1. An approved Structure Plan together with all the approved amendments shall be given due regard in the assessment of applications for subdivision, land use and development in accordance with Clause 27(1) of the Deemed Provisions.

2. The Structure Plan is to provide for an appropriate mix of residential and compatible land uses.

3. The Structure Plan is to be provided to the (then) Office of the EPA for consultation and comment as part of the advertising period.

1.4 Land uses

1.4.1 Historical and current land uses

The Treeby site was historically excavated for sand mining purposes.

A review of historical aerial photography shows that most of the site was subject to a late 1994 – early 1995 bushfire, with the regenerating vegetation being primarily cleared for sand mining between 2000 and 2005. The cleared portion of the site appears to have had at some rehabilitation works undertaken in late 2007 – early 2008, which has resulted in most of the site (approximately 95%) being comprised of *Adenanthos cygnorum* scrubland in 'Completely Degraded' condition (Plate 1).



Plate 1: *Adenanthos cygnorum* scrubland in Completely Degraded condition

1.4.2 Surrounding land uses

The site's western boundary lies adjacent to the Ghostgum Avenue reserve. Its northern boundary is bordered by Lot 820 Fraser Road, which is reserved for 'Parks and Recreation' (Figures B and C) and forms part of Bush Forever Site No. 390 (Fraser Road Bushland) (Figure E).Lot 820 is known to contain threatened flora species *Caladenia huegelii*. Bush Forever Site No. 390 is managed by the DBCA. The site's eastern boundary abuts Lot 4 Armadale Road, which is proposed to be developed for urban purposes in accordance with the Treeby DSP.

Armadale Road lies directly to the south of the site. Widening works along Armadale Road (within portion of the site reserved for Primary Regional Roads) are currently being undertaken as part of Main Roads Western Australia's (MRWA) approved road upgrade works.

A regional ecological linkage which connects Bush Forever Site No. 390 to Bush Forever Site No 263 intersects a previously cleared eastern portion of the site. Jandakot Airport is situated approximately 3.5 km to the north-west of the site (Figure E).

2 LAND FACTORS

2.1 Flora and vegetation

2.1.1 Previous flora and vegetation surveys

PGV Environmental undertook reconnaissance flora and vegetation survey in October 2012 within the site, as part of their Environmental Assessment for the site (PGV Environmental 2013). Further since 2012 PGV Environmental has undertaken a survey of the conservation significant flora, *Caladenia huegelii* within the remnant vegetation along the western boundary of the site. The PGV flora and vegetation assessment included:

- Desktop search of the Declared Rare and Threatened Flora database and Threatened Ecological Communities (TEC) database
- Examination of recent aerial photography and contour maps to provisionally identify vegetation types and condition
- Site walk over to ground truth the results of the desktop study
- Advice on the potential for significant species identified in the desktop search to be present within the site.

In addition to the above, in assessing the local flora and vegetation context for the Treeby LSP, the following reports from the surrounding areas were reviewed:

- Flora and Vegetation Assessment Lot 4 Armadale Road, Banjup (ENV Australia 2012)
- Referral of proposed action, Lot 4 Armadale Road Banjup (360 Environmental 2013)
- PGV Environmental - Environmental Assessment Report and Grand Orchid Monitoring Report (2013) findings
- Level 1 Flora and Vegetation Survey, Calleya Site, Banjup (RPS 2014)
- Lot 131 Jandakot Road, Banjup, Flora and Vegetation Survey (360 Environmental 2015)
- Black Cockatoo Habitat Assessment (360 Environmental 2018).

Key conclusions from these reports, as relevant, have been incorporated in this report.

2.1.2 Bush Forever

Bush Forever identifies areas of regional conservation value on the Swan Coastal Plain portion of the Perth Metropolitan Region with an aim to protect a comprehensive representation of the biological diversity on the Swan Coastal Plain (Government of Western Australia 2000). The site is situated immediately adjacent (north) to Bush Forever Site No. 390 – Fraser Road Bushland, Banjup (Figure E).

Previous floristic surveys have inferred two FCTs within this bush forever site are:

- FCT 4 – *Melaleuca preissiana* damplands
- FCT 23a – Central *Banksia attenuata – B. menziesii* woodlands.

2.1.3 Regional context

The regional vegetation complex present (the existing remnant vegetation) on the site is the Bassendean Complex (Central and South), which is described as vegetation ranging from woodland of *Eucalyptus marginata – Casuarina fraseriana – Banksia* spp., to low woodland of *Melaleuca* spp. and sedgelands on the moister sides (Heddle et al. 1980).

The reservation status of this vegetation type within the Swan Coastal Plain, at regional and local levels, is presented in Table 3 and Table 4.

Table 3: Regional conservation status of Bassendean Complex – Central and South

Description	Perth Metropolitan region	Percentage of original area
Original extent	87,416 ha	N/A
Remaining area	22,846 ha	26.1%

(Source: EPA 2015)

Table 4: City of Cockburn status of Bassendean Complex – Central and South

Description	Area	Percentage of original area
Original extent	6,850 ha	N/A
Remaining area	2,217 ha	32%

(Source: Perth Biodiversity Project 2011)

2.1.4 Local assessment

2.1.4.1 Vegetation units and condition

RPS undertook a Flora and vegetation review in July 2019 followed by a Targeted flora survey (*Caladenia huegelii* or grand spider orchid specific) in September 2019. The Treeby LSP reconnaissance flora and vegetation survey report is provided in Appendix A.

RPS consistent with the PGV Environmental and 360 Environmental vegetation surveys in the local area identified and mapped three vegetation units across the site (Figure F). Figure G identifies the mapped vegetation condition.

Table 5 identifies the extent of each vegetation unit and its mapped condition within the site.

Table 5: Vegetation units and condition within the site

Vegetation unit	Description	Condition	Area (ha)
BmBaEmLOW	*Banksia attenuata* / *Banksia menziesii* / *Eucalyptus marginata* (jarrah) Low Open Woodland *Adenanthos cygnorum* (woolly bush) Open shrubland over *Hibbertia hypericoides* / *Lyginia barbata* / *Conostylis aculeata* Closed Low Heath.	Good	0.23
		Good–very good	0.68
BmAfLOW	*Banksia menziesii* / *Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* (woolly bush) Open shrubland over *Eremaea pauciflora* Low Open Heath.	Good	0.07
Post-sand mining	*Adenanthos cygnorum* (woolly bush) Open scrubland over a disturbed understorey of non-local and regenerating native species.	Completely degraded	19.36

2.1.4.1.1 BmBaEmLOW

Banksia attenuata / *Banksia menziesii* / *Eucalyptus marginata* (jarrah) Low Open Woodland *Adenanthos cygnorum* (woolly bush) Open shrubland over *Hibbertia hypericoides* / *Lyginia barbata* / *Conostylis aculeata* Closed Low Heath (Plate 2).

Approximately, 0.91 ha of the BmBaEmLOW vegetation unit primarily in 'Good' to 'Very Good' condition occurs within the site (Table 5; Figures F and G).



Plate 2: BmBaEmLOW vegetation unit

2.1.4.1.2 BmAfLOW

Banksia menziesii / *Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* (woolly bush) Open shrubland over *Eremaea pauciflora* Low Open Heath (Plate 3).

Approximately, 0.07 ha of the BmAfLOW vegetation unit in 'Good' condition occurs within the site (Table 5; Figures F and G).



Plate 3: BmAfLOW vegetation unit

2.1.4.1.3 Post-sand mining

Adenanthos cygnorum (woolly bush) Open scrubland over a disturbed understorey of non-local (exotic weeds) and regenerating native species (Plate 4).

Approximately, 19.36 ha of the post-sand mining vegetation unit in 'Completely Degraded' condition occurs within the site (Table 5; Figures F and G).



Plate 4: Post-sand mining vegetation unit

2.1.4.2 Vegetation assessment

The implementation of the Treeby LSP will result in the following outcomes:

- There is approximately 0.98 ha of remnant Banksia Woodland vegetation which is also mapped at the regional scale as Bassendean Complex (Central and South).
- A minimum of 0.42 ha of the Banksia Woodland will be retained as conservation POS.
- The LSP design may potentially require the clearing of a maximum 0.56 ha of Banksia Woodland vegetation (subject to detailed landscape and engineering design which will be confirmed at subdivision stage). However, it is likely post the detailed engineering and landscape design that a portion of the 0.56 ha will be retained in the areas of POS.

The potential impact on the 0.56 ha is due to accommodating engineering and landscaping requirements such as constructing the entry road, local roads, residential development, POS and civil infrastructure. The existing earth bund where the 0.56 ha is located has, in areas, approximately 2 m to 3 m topographical height difference from the base of the site, or the former sand quarry. In some areas of the western and south-western bund engineering works will be required particularly around the entry road and areas of residential development in the south-west towards Armadale Road. The impact on the 0.56 ha will be defined at subdivision once the detailed engineering and landscape designs are complete. However, it is likely a portion of the 0.56 ha remnant vegetation will be retained in areas of POS which are located north of the currently fenced Conservation POS area as shown in the LSP in Figure D.

An assessment on the potential loss of 0.56 ha of the Bassendean Complex (Central and South) at the local and regional scale has been undertaken in Table 6.

Table 6: Bassendean Complex (Central and South) vegetation units and condition within the site

Description	Perth Metropolitan region	Percentage of original area	Treeby LSP potential impact (worst case)
Regional – Perth Metropolitan region			
Remaining area of Bassendean Complex (Central and South)	22,846 ha	26.1%	0.56 ha or 0.002% at regional scale (or amended retention percentage 26.01%)
Local – within the CoC			
Remaining area of Bassendean Complex (Central and South)	2,217 ha	32%	0.56 ha or 0.025% (or amended retention percentage 31.97%)

In summary, at a worst-case scenario, the potential impact on the remnant Banksia Woodland vegetation is less than 0.02% loss on the Bassendean Complex (Central and South) at a regional and local scale. As outlined above, it is likely post detailed engineering and landscape design a portion of the 0.56 ha of Banksia Woodland will be retained in the areas of formal POS (Figure D).

The best quality remnant Banksia Woodland vegetation (as identified by both RPS and PGV Environmental) which was mapped in 'Good' to 'Very Good' condition is being retained as conservation POS. This 0.42 ha Banksia Woodland is within a fenced area which also protects the conservation significant flora, *Caladenia huegelii* population within the site.

2.1.4.3 Floristic community types

PGV (2013) noted the remnant vegetation within the site is likely to be SCP 23a Central *Banksia attenuata – Banksia menziesii* woodlands. This FCT is a component of the EPBC Act-listed Banksia Woodlands of the Swan Coastal Plain ecological community, however it is not recognised as a TEC or PEC by the State. The community type's reservation status is Well Reserved, and its conservation status is considered Low Risk (Gibson et al. 1994).

2.1.4.4 Banksia Woodland TEC assessment

2.1.4.4.1 Key diagnostic characteristics

The Banksia Woodland consists of Scattered *Eucalyptus marginata, E. todtiana,* over *Banksia attenuata*, *B. menziesii* Low Open Woodland over a mixed Open Low Heath including *Hibbertia hypericoides.*

To be considered representative of the Banksia Woodland TEC the following key diagnostic structural and composition characteristics must be met:

- Low woodland to forest with these features
  - A distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated/co-dominated by one or more Banksia species
  - Emergent trees of medium / tall (>10 m) height of *Eucalyptus* / *Allocasuarina* species may sometimes be present above the Banksia canopy
  - A often highly species-rich understory that consists of
    - A layer of sclerophyllous shrubs of various heights
    - A herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses. The development of a ground layer may vary depending upon the density of the shrub layer and disturbance history

- The canopy is mostly dominated or co-dominated by *B. attenuata* and/or *B. menziesii*. Other Banksia species that dominate in some examples of the ecological community are *B. prionotes* or *B. ilicifolia*
- The patch must include at least one of the following diagnostic species
  - *B. attenuata*
  - *B. menziesii*
  - *B. prionotes*
  - *B. ilicifolia*
- If present, the emergent tree layer often includes *Corymbia calophylla*, *E. marginata*, or less commonly *E. gomphocephala* other trees of a medium height that may be present, and may be codominant with the Banksia species across a patch, include *E. todtiana*, *Nuytsia floribuna*, *A.fraseriana*, *Callitris arenaria*, *C. pyramidalis* and *Xylomelum occidentale* the understorey typically contains a high to very high diversity of shrub and herb species that often vary from patch to patch.

The remnant Banksia Woodland vegetation units within the LSP Treeby site is broadly representative of the Banksia Woodland of the Swan Coastal Plain ecological community, which is listed as a Threatened Ecological Communities (TEC) under the EPBC Act. However, the Banksia Woodland area within the LSP site is a very small patch totalling 0.98 ha in area.

Regarding the Commonwealth Conservation Advice criteria for Banksia Woodland TEC (Threatened Species Scientific Committee, 2016), the small patch (0.98 ha) of Banksia Woodland is considered to be of 'low quality' for the following reason:

- The 0.98 ha patch is small (less than 1 ha) and have a large perimeter / area ratio which exposes the patches to greater edge effect disturbances
- A minimum of 0.42 ha of the Banksia Woodland whose condition is mapped as 'Good' to 'Very Good' will be retained as Conservation POS
- The potential impact is limited to 0.26 ha of Banksia Woodland in 'Good' to 'Very Good' condition and 0.56 ha in 'Good' or better condition. The impact on these areas is maximum 0.56 ha of Banksia Woodland (subject to detailed engineering and landscape design). However, it is anticipated through the detailed engineering / landscape design that a portion of the 0.56 ha Banksia Woodland area will be retained in areas of POS immediately north of the Conservation POS area
- The potential impact areas (i.e. 0.26 ha of Banksia Woodland in 'Good' to 'Very Good' and 0.56 ha in 'Good' or better condition) are below the EPBC Act Banksia Woodland TEC patch size threshold.

2.1.4.4.1.1 EPBC Act context

RPS has assessed the remnant vegetation in accordance with the key Banksia Woodland diagnostic characteristics, the condition, size and specific characteristics and the impact by the proposed action i.e. implementing the LSP (DEE 2017). Consistent with the draft referral guidelines an assessment of the remnant Banksia Woodland vegetation is presented in Table 7.

In summary, the 0.98 ha or small patch of remnant Banksia Woodland vegetation does not, in accordance with the Commonwealth's approved conservation advice (Threatened Species Scientific Committee 2016) for the Banksia Woodland TEC, meet the Commonwealth's minimum patch size requirements due to the size of the remnant vegetation (both retained and potentially impacted) within the site.

Given that the Banksia Woodland vegetation units are floristically similar to the EPBC Act listed Banksia Woodland of the Swan Coastal Plain TEC, with the likely FCT (23a Central *Banksia attenuata – Banksia menziesii* woodlands) forming a component of the EPBC Act listed TEC, it is considered that the banksia woodland vegetation units represent the DBCA-listed Banksia dominated woodlands of the Swan Coastal Plain IBRA region Priority Ecological Community (Priority 3).

Table 7: Key information to characterise the Banksia Woodland TEC within the site

Key diagnostic characteristics	Information	Relevant content to be discussed in the referral	Response and discussion
Location and physical environments	Regional distribution and quality	Quantity/quality of vegetation community in, and in the region around, the site where the proposed action will occur (Section 2.2.2)	There is approximately 0.98 ha of remnant Banksia Woodland vegetation. A minimum of 0.42 ha of the Banksia Woodland is being retained as conservation POS. The LSP design may potentially require the clearing of up to 0.56 ha of Banksia Woodland vegetation (subject to detailed landscape and engineering design). However, it is likely post the detailed engineering and landscape design that a portion of the 0.56 ha will be retained.
Patch condition	Condition thresholds	Minimum applicable patch size: • 'Pristine' condition – no minimum patch size applies. • 'Excellent' condition – 0.5 ha. • 'Very Good' condition – 1 ha. • 'Good' condition – 2 ha.	The remnant Banksia Woodland vegetation potentially impacted includes: • 0.26 ha of Banksia Woodland in 'Good' to 'Very Good' condition • 0.56 ha in 'Good' or better condition The 0.26 ha extent of the Banksia Woodland in 'Good' to 'Very Good' condition is below the Commonwealth's 1 ha 'Very Good' condition minimum patch size. The 0.56 ha Banksia Woodland vegetation in 'Good' or better condition is below the Commonwealth's minimum 2 ha 'Good' condition patch size
Patch size	Patch size in hectares	Is the patch size large enough to meet criteria in Section 2.2.3?	The minimum patch size for consideration of a patch as part of the listed ecological community for EPBC Act referral, assessment and compliance purposes is 0.5 ha in "Excellent" condition or 1 ha in Good' to 'Very Good' condition. Approximately 0.56 ha may potentially be cleared (subject to detailed landscaping and engineering plans). The vegetation condition is assessed as being 'Good' or Good to Very Good'. The area potentially impact is below the EPBC minimum patch size criteria. Noting that it is likely after the detailed engineering and landscape design that a portion of the 0.56 ha Banksia Woodland will be retained in areas of POS
	Surrounding buffer	What is the size and vegetation community of the surrounding buffer? and what is the connectivity to the surrounding vegetation?	Ghost Gum Avenue road and the site and future subdivision area directly abuts the remnant Banksia Woodland area.
Other condition considerations	Presence/absence and spread of *Phytophthora cinnamomi* (dieback)	If present, how much dieback exists and is the proposed action likely to spread dieback further? If not present, can its introduction be prevented?	There is no evidence of dieback within the remnant Banksia Woodland area. The introduction and/or spread of *Phytophthora* dieback can be prevented through the implementation of best practice plant machinery hygiene practices during clearing and construction activities.
	Presence/absence weeds	Does the patch contain weeds? (Appendix D6) Which species are present and how can they be managed?	The Banksia Woodland within the subdivision area was assessed to be in either Good' to 'Very Good' condition or 'Good' condition. Non-aggressive weed species may be present.

Key diagnostic characteristics	Information	Relevant content to be discussed in the referral	Response and discussion
	Any other notable disturbance to the site where relevant (i.e. fragmentation, fire regimes, bare patches, erosion, feral animals)	What disturbance is present which may degrade the quality of the community or species? For any/each form of disturbance, what is the degree of the disturbance? Is there evidence of recruitment of key native plant species following disturbance?	A firebreak has been established along the western borders of the Banksia Woodland area. The firebreak is assessed as being in "Completely Degraded" condition.
	Patch isolation	Is the patch connected to other areas of Banksia Woodland or is it isolated?	The subdivision area is broadly connected to the surrounding extents of Banksia Woodland within Bush Forever Site No. 390.
Sub-community and vegetation unit	Broad scale structural unit (Beard vegetation associations)	Provide the best corresponding Beard vegetation association (s)	The regional vegetation complex present within the subdivision area is the Bassendean Complex (Central and South), which is described as vegetation ranging from woodland of *Eucalyptus marginata – Casuarina fraseriana – Banksia* spp., to low woodland of *Melaleuca* spp. and sedgelands on the moister side (Heddle et al. 1980)*. There is approximately 26.1% of this vegetation complex's original extent remaining with in the Swan Coastal Plain and approximately 32% of the complex's original extent remaining within the City of Cockburn (Perth Biodiversity Project 2013†; Perth Biodiversity Project 2011‡).
	Floristic community types (Gibson et al., 1994; Keighery et al. 2008)	Provide the closest resemblance of floristic community type(s) Conservation advice	The remnant Banksia Woodland area is inferred as being FCT 23a – Central *Banksia attenuata – Banksia menziesii* woodland.
	Western Australian ecological community listing	Is this ecological community listed in Western Australia?	FCT 23a is not listed as a TEC or Priority Ecological Community in Western Australia (Department of Parks and Wildlife 2017)‖.
Surveying	Timing of the surveying	Ideally surveys should be undertaken in spring with two sampling periods to capture early and late flowering species. When was sampling undertaken at the proposed site? Is there any reason why the vegetation community could not be readily identified (e.g. due to recent disturbance such as fire)?	The site has been subject to two independent flora and vegetation surveys including: • PGV Environmental 2013 • RPS 2019a

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

†Perth Biodiversity Project. 2013. 2013 Native Vegetation extent by Vegetation complexes on the Swan Coastal Plain south of Moore River (Local Biodiversity Program, 2013). Accessed 8 December 2014 http://pbp.walga.asn.au/Portals/1/Templates/docs/SCP%202013%20remnant%20veg.pdf

‡Perth Biodiversity Project. 2011. Addendum to Chapter 16 Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region. Accessed 8 December 2014. http://pbp.walga.asn.au/Publications.aspx.

‖Department of Parks and Wildlife. 2017. Threatened Ecological Communities. Accessed 15 May 2018 https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities.

2.1.4.5 Flora survey and assessment – grand spider orchid (*Caladenia huegelii*)

RPS completed a Flora and Vegetation Review for the site in July 2019 (Appendix A). This report included a review of the following:

- Review of the historical mapped locations of the *Caladenia huegelii* (or the grand spider orchid) in the local area based upon DBCA's database, and records from the Orchid Society
- PGV Environmental - Environmental Assessment Report and Grand Orchid Monitoring Report (2013) findings
- Targeted searches for *Caladenia huegelii* undertaken by PGV Environmental between 2012 and 2016
- RPS targeted search for *Caladenia huegelii* undertaken in spring of 2019.

2.1.4.5.1 Species description and habitat requirements

Caladenia huegelii is a tuberous perennial herb belonging to the family Orchidaceae. It grows up to 60 centimetres (cm) tall with a single erect, pale green, hairy leaf and one or two (rarely three) pale greenish-cream flowers 7–10 cm across, with variable suffusions, lines and spots of red–maroon. The large labellum has a pale greenish-cream base and a dark maroon recurved apex.

The species occurs in mixed woodland of *Eucalyptus marginata, Banksia attenuata, B. ilicifolia* and B. *menziesi*i with scattered *Allocasuarina fraseriana* and *Corymbia calophylla* over dense shrubs of *Stirlingia latifolia, Hypocalymma robustum, Hibbertia hypericoides, H. subvaginata, Xanthorrhoea preissii, Adenanthos cuneatus* and *Conostylis* species. Throughout its range the species tends to favour areas of dense undergrowth and occurs on deep grey–white sand associated predominantly with the Bassendean sand dune system (DEC 2009).

The Banjup population is one of the largest populations of the species on the Swan Coastal Plain – Population 42 Banjup, which occurs on private property, road reserve and within Bush Forever Site No 390, and contains hundreds of plants occupying an area greater than 20 hectares (DEC 2009).

Targeted searches of the site and local surrounding areas for the conservation significant flora, *Caladenia huegelii,* have been undertaken by DBCA, PGV Environmental in 2012, 2015 and 2016, Western Australian Native Orchid Study and Conservation Groups in 2012 and RPS in 2014 and in September 2019.

Figure 2 shows the locations of the identified *Caladenia huegelii* individuals and indicative locations from the (then) Department of Parks and Wildlife database search (1985 - 2011), Orchid Society and Conservation Groups (2012) and PGV Environmental local *Caladenia huegelii* surveys (2012 and 2016). No other flora species of conservation significance have been recorded within the site.

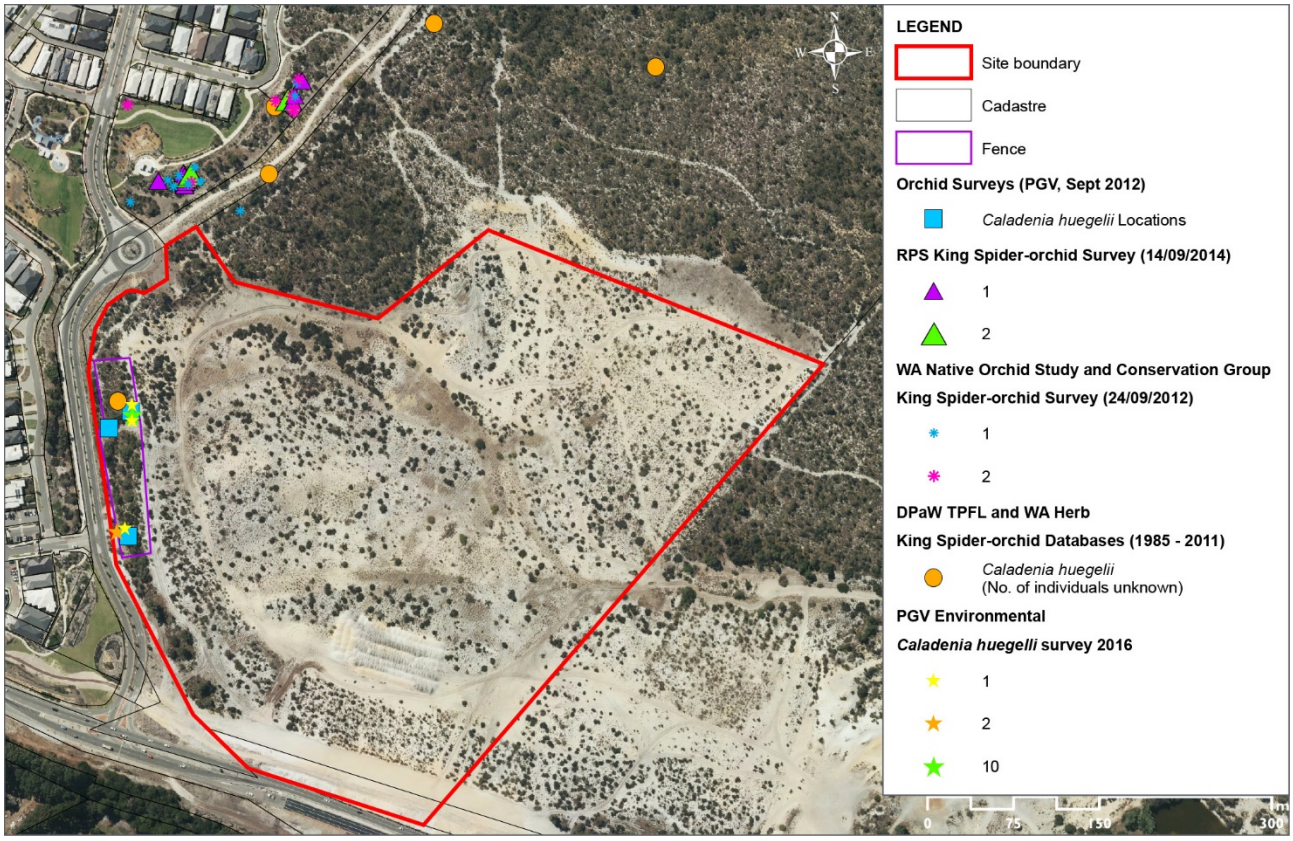


Figure 2: Historical searches for the *Caladenia huegelii*

The flora assessment within the site by RPS and PGV Environmental for *Caladenia huegelii* was focused on the species' preferred and potential habitat on site (i.e. approximately 0.98 ha of remnant Banksia Woodland), noting the remainder of the site was subject to historical sand mining.

Fifteen *Caladenia huegelii* individuals were recorded by PGV Environmental within the site between 2012 and 2016 within a discrete portion of remnant Banksia Woodland vegetation located in the fenced area on the western bund at the permitter of the site. The entire recorded population of the *Caladenia huegelii* individuals are located within this 0.42 ha of remnant vegetation which is mapped as being in 'Good' to 'Very Good' condition. Acknowledging both the *Caladenia huegelii* population and the quality of the vegetation, conservation fencing has been installed around the 0.42 ha area. Based on the historical survey data and in discussing the *Caladenia huegelii* population with PGV Environmental (who continue to monitor the Treeby LSP population each spring to determine the Grand Spider Orchid monitoring period) no individual *Caladenia huegelii* has been recorded outside of the 0.42 ha fenced area.

2.1.4.5.1.1 *Caladenia huegelii* target search

RPS undertook a *Caladenia huegelii* survey on the 16th September 2019 in accordance with current guidance on surveying Australia's threatened orchids listed under the EPBC Act (CoA 2013).

The search involved a systematic grid-based search along transects spaced approximately 5 m apart within all the remnant vegetation on site deemed potential habitat in 'Good' or better condition (according to the Keighery (1994) condition scale). The traverses were recorded as tracks on a hand-held GPS and are shown in Figure H. Potential habitat included areas of Banksia Woodland with an intact native understorey, as well as areas of previously cleared Banksia Woodland that had been rehabilitated, and where natural regeneration of the original understorey species was evident.

For all *Caladenia huegelii* individuals identified within the search area the following information was recorded:

- Number of individuals

- Number of flowers per individual
- Location (on a hand-held GPS – GDA94 UTM zone 50)
- Photographs of the individual or population.

Caladenia huegelii was observed to be in full flower at the time of the search. A total of three *Caladenia huegelii* individuals were recorded within the search area for the current survey (Figure H):

- One within the fenced area in the Banksia Woodland along the western boundary of the site
- Two within the bush forever site immediately to the north.

All three records corresponded with those from targeted searches undertaken in previous years.

As shown in Figure 1 and Figure 2, the known locations of the *Caladenia huegelii* species in the Treeby site are found exclusively within the fenced area, which protects the *Caladenia huegelii* individuals and the site's best quality remnant native vegetation.

Plate 8 illustrates the existing 0.42 ha fenced area. This area will be the future conservation POS as shown in the LSP (Figure D). The fenced area has for management purposes been bisected by a fire break / access way.



(Google Maps 2018)

Plate 5: Fire break / access way in the proposed Conservation POS fenced area

2.2 Landform

2.2.1 Topography

The site has been historically used as a sand quarry; therefore, the natural landform and topography has been significantly altered. More recently the natural topography in the south of the site (or the southern bund adjacent to Armadale Road) has been altered as part of the Armadale Road widening works.

Adjacent to Ghostgum Avenue reserve, the natural ground levels within the site remain around 35 m to 36 m Australian Height Datum (AHD). The remaining bulk of the site has been excavated to 30 m AHD forming a broad sand plain (Figure I).

Importantly, to address the interface between the residential development, local roads, areas of POS and the western and southern sand bunds some engineering works in the southern and western bunds areas will be required.

2.2.2 Geology

The site is underlain by S8 sands which are white to pale grey at the surface, becoming yellow at depth. The sands are is fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin (Figure I).

2.3 Terrestrial environmental quality

2.3.1 Potential contamination

A search of the Department of Water and Environmental Regulation's (DWER) Contaminated Sites Database on 18 July 2019 did not record any matches for the site.

RPS completed a due diligence contamination assessment of the site (RPS 2019c). Soil and groundwater samples were taken, and analytical results were screened against the relevant residential guidelines and ecological screening guidelines, in order to determine if pre-existing contamination was present at the site that may present an unacceptable risk to human health or the environment.

No soil or groundwater concentrations were detected which signify an actual risk to human health through the continued use for a residential end use.

2.3.2 Acid sulfate soils

The WAPC Planning Bulletin No. 64 (WAPC 2009) sets out planning guidelines and risk maps for Acid Sulfate Soils (ASS) in the metropolitan area. The site is mapped as having moderate to low risk of ASS occurring within three metres of the surface (Figure J).

There is unlikely to be significant ASS issues associated with the upper soil profile based on the risk mapping by the WAPC.

2.4 Terrestrial fauna

2.4.1 Targeted fauna survey

PGV Environmental in 2013 undertook reconnaissance fauna survey, as part of their Environmental Assessment for the site which included:

- Desktop search of the (then) DEC's NatureMap database and the Commonwealth's Protected Matters Search Tool to identify conservation significant species within the general area
- Reconnaissance site visit to assess the condition and quality of available fauna habitat

- Description of fauna habitats present with the site
- Assessment of significance of the site for conservation significant species in al local and regional context

RPS repeated the fauna habitat assessment, with a focus on black cockatoo habitat assessment, in July 2019.

2.4.1.1 Fauna habitat

PGV Environmental (2013) identified most of the site comprises open areas or poorly rehabilitated areas of *Adenanthos cygnorum* scrubland which is in a highly degraded condition habitat for fauna.

The remnant native vegetation within the site (which makes less than 5% of the total site) is located on the western or south-western boundaries. The remnant vegetation contains 0.98 ha of Banksia Woodland. This small remnant vegetation has areas of good habitat for native fauna, although there are areas which showed signs of disturbance e.g. through four wheel drive access and weeds. Importantly, 0.42 ha of the best quality Banksia Woodland native vegetation on the western bund will be retained as conservation POS.

2.4.1.2 Conservation significant fauna

The vertebrate fauna assemblages within the site are likely to be:

- Similar to that found elsewhere in the Treeby and Banjup localities, particularly in Bush Forever Site No. 390 which is located directly to the north
- Present in Bush Forever Site No. 390 in far greater numbers (PGV Environmental 2013).

Species identified with the potential to occur within the LSP site and that are listed under the *Biodiversity Conservation Act 2016*, EPBC Act or by DBCA database search are identified in Table 8.

Table 8: Conservation significant fauna species with potential to occur within the site

Species	Conservation status (state)	Conservation status (EPBC Act)	Habitat requirements	Site occurrence	Direct impacts	Significance of direct impacts
Carnaby`s Black Cockatoo (*Calyptorhynchus latirostris*)	Schedule 2	Endangered	Carnaby's Black-Cockatoo is endemic to south-west Western Australia occurring from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. Carnaby's Black-Cockatoo foraging habitat includes native shrubland, kwongan heathland and woodland dominated by proteaceous plant species including *Banksia* spp., *Hakea* spp. and *Grevillea* spp. Carnaby's Black-Cockatoo is known to forage in pine plantations, eucalypt woodland, forest that contains foraging species and individual trees and small stands of these species (Department of the Environmental and Energy (DEE) 2019a).	Occasional visitor to the site	Potentially clearing of up to 0.56 ha of native vegetation (subject to detailed landscape and engineering design)	The Banksia Woodland vegetation is potential foraging habitat for Carnaby`s Black-Cockatoo and the six large (>500 mm diameter at breast height) emergent jarrah trees are potential breeding habitat for this species (Figure F). Lot 703 is in the modelled non-breeding range for Carnaby's Black-Cockatoo (Department of the Environment and Energy (DEE) 2017), therefore this impact assessment considers that this landholding contains foraging habitat only. No roosting has been recorded within the site or the surrounding land holdings (DBCA-050; Birdlife Western Australia and DBCA 2018). PGV Environmental (2013) identified that Carnaby's Black-Cockatoo: • May infrequently forage in the Banksia Woodland vegetation within the site, however, would not rely upon it for survival. • Would more frequently been observed in the native vegetation within Bush Forever Site No. 390. Retention of a minimum 0.42 ha of Banksia Woodland vegetation (within the conservation fenced area) in 'Good' to 'Very Good' condition. Given the retention potential habitat for the Carnaby`s Black-Cockatoo by the LSP and the large extent of similar or better condition potential habitat available within the adjacent Bush Forever Site No. 390, it is considered unlikely that the permanent loss of potentially 0.56 ha (subject to detailed landscape and engineering design) of potential foraging habitat would result in a significant impact to this species. Further, 0.56 ha is the potential maximum impact, it is likely after the detailed landscape and engineering design a portion of the 0.56 ha of Banksia Woodland will be retained in areas of POS.

Species	Conservation status (state)	Conservation status (EPBC Act)	Habitat requirements	Site occurrence	Direct impacts	Significance of direct impacts
Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*)	Schedule 2	Vulnerable	The forest red-tailed black cockatoo is endemic to south-west WA in an area bounded by Gingin, Mt Helena, Christmas Tree Well, West Dale (rarely to Brookton), North Bannister (rarely to Wandering), Mt Saddleback, Kojonup, Rocky Gully, upper King River and Green Range (east of Albany). Forest red-tailed black cockatoos generally inhabit the dense jarrah (*E. marginata*), karri (*E. diversicolor*) and marri (*Corymbia calophylla*) forests receiving more than 600 mm average rainfall annually; although this species has also been observed in a range of other forest and woodland types, including blackbutt (*E. patens*), wandoo (*E. wandoo*), tuart (*E. gomphocephala*), Albany blackbutt (*E. staeri*), yate (*E. cornuta*) and flooded gum (*E. rudis*) (DEE 2019b).	Possible visitor to the site	Potentially clearing of up to 0.56 ha of native vegetation, including up to six emergent jarrah trees (subject to detailed landscape and engineering design)	The six emergent jarrah trees (> 500 mm diameter at breast height) within the Banksia Woodland vegetation provide limited potential foraging and breeding habitat for this species (Figure F). Of the six large emergent jarrah trees: • Three are alive with hollows. At the time of RPS' July 2019 site visit for the flora and vegetation review these trees appeared to be in active use by galahs (*Cacatua roseicapilla*). Behavioural conflict between galahs and forest red-tailed black cockatoos at or near nest hollows has previously been reported by Johnstone et al (2013) which indicates that these trees are unlikely to be used by forest red-tailed black cockatoos at this time. • Two are dead with no hollows and one is dead with hollows. The trunk bases of the dead trees have significant structural damage from the 1990's bushfire and are unlikely to provide a variable long-term nesting option. • No roosting has been recorded within the site or the surrounding land holdings (Birdlife Western Australia and DBCA 2018). • Given the following factors it is considered unlikely that the permanent loss of the three alive and three dead emergent jarrah trees would result in a significant impact to this species.
Peregrine falcon (*Falco peregrinus*)	Schedule 7	-	Peregrine falcons are widely distributed throughout Australian habitats inclusive of woodlands, wetlands and open country, although they are generally absent from treeless and waterless deserts and dense forests. Peregrine falcons prefer cliff faces as nest sites (Birds Australia 2019).	May infrequently fly over the site	Potentially clearing of up to 0.56 ha of native vegetation (subject to detailed landscape and engineering design)	It is considered likely that peregrine falcons may be observed overflying the site infrequently. However, given the substantial extent of potential habitat locally available within Bush Forever Site No. 390, the peregrine falcon is considered unlikely to be significantly impacted by the proposed development of the site for residential purposes.

Species	Conservation status (state)	Conservation status (EPBC Act)	Habitat requirements	Site occurrence	Direct impacts	Significance of direct impacts
Rainbow bee-eater (*Merops ornatus*)	-	Marine	The population size of the rainbow bee-eater within Australia is not known, but it is assumed to be quite large. It is known to occur across most of the mainland. It migrates between Australia, Eastern Indonesia and Japan, and has formed a colony on Rottnest Island. The rainbow bee-eater tends to occupy open forests and woodlands, including cleared or semi-cleared areas and farmland, and prefers timbered landscapes. Their nests consist of an enlarged chamber at the end of a long burrow that is excavated by both the female and male bird from flat or sloping ground, cliff faces or mounds of gravel (DEE 2019c).	Possible visitor to the site	Potentially clearing of up to 0.56 ha of native vegetation (subject to detailed landscape and engineering design)	There is potential habitat within the site for rainbow bee-eaters. However, given the substantial extent of potential habitat locally available within Bush Forever Site No. 390, it is considered unlikely that rainbow bee-eaters would be significantly impacted by the proposed development of the site for residential purposes (if present).
White-bellied sea-eagle (*Haliaeetus leuogaster*)	-	Marine	The white-bellied sea eagle is not globally threatened, but has been subject to population decline within Australia and South East Asia. In Australia, it is distributed along the coastline, and is restricted to a narrow band of coastline in south-western Australia. The population residing within Australia is estimated at 500 mating pairs. The white-bellied sea eagle is found in coastal habitats and it tends to occupy dunes, tidal flats, woodlands, forests and grasslands (generally in areas associated with large bodies of water). When not migrating, the home range of the white-bellied sea eagle can be up to 100 km^2, although breeding adult birds are generally sedentary (breeding season runs from June to January). The nests of these birds are large and conspicuous, generally constructed in large trees, cliffs, rocky outcrops, mangroves, caves or on artificial structures (DEE 2019d).	May infrequently fly over the site	Potentially clearing of up to 0.56 ha of native vegetation (subject to detailed landscape and engineering design) on remnant vegetation	It is considered likely that white-bellied sea eagles may be observed overflying the site infrequently. However, given the substantial extent of potential habitat locally available within Bush Forever Site No. 390, the white-bellied sea eagle is considered unlikely to be significantly impacted by the development of the site for residential purposes.

Species	Conservation status (state)	Conservation status (EPBC Act)	Habitat requirements	Site occurrence	Direct impacts	Significance of direct impacts
Southern brown bandicoot	Priority 5	-	Southern brown bandicoots are broadly distributed near the south-west coast from Guilderton, north of Perth, to east of Esperance with a more patchy distribution through the jarrah and karri forests, swan coastal plain and inland regions. Southern brown bandicoots are generally found in scrubby, often swampy, vegetation with dense cover up to 1 m high and on the Swan Coastal Plain are often associated with wetlands (Department of Environment and Conservation 2012).	Likely visitor to the site	Potentially clearing of up to 0.56 ha of native vegetation (subject to detailed landscape and engineering design) on remnant vegetation	The Banksia Woodland vegetation is potential habitat for the southern brown bandicoot. Retention of a minimum 0.42 ha of Banksia Woodland vegetation (within the conservation fenced area) in 'Good' to 'Very Good' condition within the LSP. Given that the majority of potential habitat for the southern brown bandicoot within the site will be retained by the LSP and the large extent of similar or better condition potential habitat available within the adjacent Bush Forever Site No. 390, it is considered unlikely that the permanent loss of potentially 0.56 ha (subject to detailed landscape and engineering design) would result would result in a significant impact to the local southern brown bandicoot population (if present).
Perth lined lerista (*Lerista lineata*)	Priority 3	-	The Perth lined lerista is found in coastal heath and shrubland vegetation over pale sandy soils. The species has a small distribution, occurring in isolated populations, on the southern Swan Coastal Plan, south of the Swan River and mostly near the coast (DEE 2019e).	May occur in Banksia Woodland	Potentially clearing of up to 0.56 ha of native vegetation (subject to detailed landscape and engineering design) on remnant vegetation	The Banksia Woodland vegetation is potential habitat for the Perth lined lerista. A minimum of 0.42 ha of the Banksia Woodland vegetation in 'Good to Very Good' condition will be retained by the LSP. Given that the majority of potential habitat for the Perth lined lerista within the site will be retained by the LSP and the large extent of similar or better condition potential habitat available within the adjacent Bush Forever Site No. 390, it is considered unlikely the permanent loss of potential habitat in would result in a significant impact to this species (if present).

2.4.2 Black cockatoos

2.4.2.1 Potential foraging habitat

The remnant 0.98 ha of Banksia Woodland vegetation is potential foraging habitat for Carnaby`s Black Cockatoo, whilst the three alive jarrah trees provide limited potential foraging habitat for forest red-tailed black cockatoo (Figure F).

A minimum of 0.42 ha of the Banksia Woodland is being retained as Conservation POS. The LSP design may potentially require the clearing of up to 0.56 ha of Banksia Woodland vegetation, including the three alive jarrah trees (subject to detailed landscape and engineering design). However, it is likely post the detailed engineering and landscape design that a portion of the 0.56 ha of Banksia Woodland. Figure D illustrated the LSP design and the location of POS areas along the western bund area.

2.4.2.2 Potential breeding habitat

Of the six large jarrah trees which potential breeding habitat for the forest red-tailed black cockatoo:

- Three jarrah trees are alive with hollows. At the time of RPS' July 2019 site visit for the Flora and Vegetation Review these trees were being actively used by galahs (*Cacatua roseicapilla*). Behavioural conflict between galahs and forest red-tailed black cockatoos at or near nest hollows has previously been reported by Johnstone et al. (2013) which indicates that these trees are unlikely to be used by forest red-tailed black cockatoos at this time.

- Two trees are dead with no hollows the other dead tree has hollows. The trunk bases of the dead trees have significant structural damage from the 1990s bushfire and are unlikely to provide a variable long-term nesting option.

There was no evidence of use of the tree hollows by any black cockatoos identified by RPS during the July 2019 assessment.

2.4.2.3 EPBC Act context

Based on the Commonwealth's revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso* actions resulting in the clearing of more than 1 ha of quality foraging habitat or any known nesting tree; present a high risk of significant impacts occurring to black cockatoo species and should be referred to the Federal environment minister for determination (DEE 2017).

The clearing of the site in accordance with the proposed LSP will result in the loss of up to:

- 0.56 ha of potential Carnaby's Black-Cockatoo foraging habitat

- Six potential forest red-tailed black cockatoo breeding trees (jarrah), of which three are alive and considered to be potential foraging habitat.

Informed by the DEE (2012) referral guidelines, the potential clearing of up to 0.56 ha of remnant Banksia Woodland vegetation and six large jarrah trees, is unlikely to result in a significant impact occurring to either Carnaby's Black Cockatoo or forest red-tailed black cockatoo.

It should be noted that in additional to retaining 0.42 ha of remnant Banksia Woodland vegetation, it is likely post the detailed engineering and landscape design that a portion of the 0.56 ha Banksia Woodland outside of the fenced area.

However, to comply with the DEE and DBCA black cockatoo guidelines and advice a hollow assessment of the six jarrah trees will be undertaken prior to any clearing works to provide photographic evidence that the trees are not currently in use by black cockatoos.

3 WATER FACTOR

3.1 Inland waters

3.1.1 Groundwater

The site is located within the Jandakot groundwater area and the following sub-areas (DWER 2019):

- Superficial Aquifer: Canning Vale sub-area
- Leederville Aquifer: Jandakot confined sub-area
- Yarragadee North Aquifer: Jandakot confined sub-area.

The Superficial Aquifer across the Jandakot Mound has a maximum saturated thickness of approximately 40 m. The formations are highly permeable with horizontal hydraulic conductivities (K) ranging between 10 to 50 m/day, although they may reduce to less than 10 m/day where coffee rock is present (Davidson & Yu 2008). Groundwater recharge results directly from rainfall infiltration (annual recharge rates of up to 24%) and there is some leakage into underlying aquifers (Davidson 1995).

The Leederville Aquifer is of Cretaceous age and consists of interbedded sandstone, siltstone and shales made up by the Mariginiup, Wanneroo, Pinjar and Henley Sandstone Members. It is separated from the overlying Superficial Aquifer by the Kardinya Shale, which acts as a confining layer between the two aquifers (Davidson & Yu 2008). The South Perth Shale underlies the Leederville Aquifer and acts as a confining bed between the Leederville and Yarragadee Aquifers (Davidson 1995).

3.1.1.1 Public drinking water source areas

There are 26 production bores (DWER 2018b) within the Jandakot Underground Water Pollution Control Area (UWPCA) that abstract water from the Superficial and Leederville Aquifers and provide public drinking water as part of the Integrated Water Supply Scheme (Water Corporation 2006). The Jandakot UWPCA was proclaimed in 1975 under the Metropolitan Water Supply Sewerage and Drainage Act 1909 for the purpose of protecting the public drinking water source of the Jandakot Mound (Water Corporation 2006).

The site is in a P3* Public Drinking Water Source Area under the Jandakot proclaimed Underground Water Pollution Control Area (Figure K).

The P3* classification is a variation of the P3 management approach, to address the increased water quality risks and cumulative impact resulting from the approved land use intensification (DWER 2018a). Water quality protection note 76 (Department of Water (DoW) 2006) sets out the planning requirements for PDWSAs and water quality protection note 25 (DoW 2016) sets out the land uses that are compatible with public water source priority areas. DWER assigns priority areas within PDWSAs to guide land use decisions. The *Land use compatibility tables for public drinking water source areas*, Water quality protection note no. 25 DoW (2016) identifies that P3 source protection areas are defined and managed to maintain the quality of the drinking water source for as long as possible with the objective of risk management. P3 areas occur within PDWSAs where the land is zoned for urban and commercial or light industrial uses. Within P3 areas, drinking water sources need to co-exist with higher intensity land uses compared to P1 and P2 areas. Key elements in the protection of P3 areas include the need for deep sewerage and implementing best management practices.

Land use activities of the area are managed under the *Jandakot land use and water management strategy* (WAPC 1995). A number of land uses should be avoided in P3* areas including airports, amusement parks, aquatic centres, caravan parks, cemeteries, hospitals, golf courses, landfill and waste transfer stations, light and heavy industry, service stations, motor vehicle repair, wash, sales and racing centres, and wastewater treatment plants (DWER 2018a). None of the above land uses are proposed within the Treeby LSP.

Additional protection is provided in the immediate vicinity of abstraction points through wellhead protection zones (WPZs). Typically, WPZs are circular, with a radius of 500 m in Priority 1 areas and 300 m in Priority 2 and Priority 3 areas. The nearest bore is located approximately 800 m west of the site.

The P3* classification denotes that the site was previously Priority 2 and has been rezoned under the MRS to be 'Urban'. The appropriateness of urban land uses within the site was resolved by the MRS amendment process through demonstration, by way of sound detailed technical studies, that the groundwater quantity and quality could be adequately protected.

3.1.1.2 Groundwater flow, depth and quality

3.1.1.2.1 Regional groundwater mapping

Regional groundwater mapping from the Perth Groundwater Map (which provides indicative levels only) shows that the historical maximum groundwater levels of the Superficial Aquifer range from 27 m AHD to 28 m AHD across the site (DWER 2019). Groundwater contours indicate that the flow gradient is relatively flat across the site with a regional flow generally in a south-westerly direction towards Thomsons Lake.

3.1.1.2.2 Groundwater levels and quality

From the site-specific groundwater monitoring, minimum groundwater levels were recorded in May 2016, ranging from 24.97 m AHD to 25.58 m AHD. Maximum groundwater levels for the site were recorded in September 2017 ranging from 26.30 m AHD to 26.81 m AHD (hyd2o 2018).

The DWER bores show a historical annual variation of approximately 1 m to 2.5 m between winter peaks and summer lows. Long term hydrographs show a general decline in groundwater levels between 1970 and 2005, after which groundwater levels appear to be stabilising or increasing (DWER 2019). This increase is expected to be due to reduction in groundwater abstraction and/or the change in land use to urban development.

DWER's Perth Groundwater Map identifies the following physiochemical information for groundwater below the site:

The groundwater quality sampling results were compared to the ANZECC (2000) guidelines for lowland rivers in southwest of Australia. The following provides a summary of the results:

- Groundwater was slightly acidic. Mean pH ranged from 5.42 to 6.35, which are above the ANZECC guidelines
- Mean EC ranged from 0.11 mS/cm to 0.22 mS/cm, which are within the ANZECC guideline range of 0.12 mS/cm to 0.3 mS/cm
- Mean TN ranged from 2.25 mg/L to 8.32 mg/L, which are above the ANZECC guideline value of 1.2 mg/L.
- Mean TP ranged from 0.025 mg/L to 0.058 mg/L, which are below the ANZECC guideline value of 0.065 mg/L.
- Mean results for metals were below the 99% trigger level for protection of freshwater species, with results for arsenic, cadmium and mercury below the laboratory limit of reporting for all bores.
- All results for fluoride, *faecal enterococci*, Thermotolerant Coliforms and *E.Coli* were below the laboratory limit of reporting.

3.1.2 Surface water

There are no surface water features within the LSP site. Rainfall infiltration is the dominant hydrological process at the site due to the predominantly sandy soil present. Furthermore, the relatively flat topography indicates that rainfall water would infiltrate and/or evaporate rather than run-off.

The Atwell Drain is located to the south of the site. The Atwell Drain system is approximately 7 km in length, extending from upstream of Harper Road and eventually discharging to Thomson's Lake, a Conservation Category Wetland. In relation to the site, the drain runs through Emma Treeby Reserve, west along Armadale Road to Resource Enhancement Wetland UFI 15297.

3.1.2.1 Water quality treatment and drainage

The District Water Management Strategy for the site, prepared by Hyd2o in 2012, was approved by the (then) DoW prior to Amendment 1289/57 being referred to the EPA for consideration. Further, the Treeby (Banjup) Strategic District Water Management Plan (JDA Consulting Hydrologists 2017), which includes the site, was prepared to support the Treeby District Structure Plan (CLE 2017).

A Local Water Management Strategy (LWMS) has also been prepared for site by RPS to support the proposed LSP (RPS 2019b). The LWMS defines the integrated management of groundwater and surface water that will be implemented at the Treeby site in line with the Better Urban Water Management principles through future Urban Water Management Plans.

Water quality objectives as defined in the LWMS will be met through the stormwater management strategies that will be implemented on site. The development will utilise structural and non-structural controls for water quality treatment including:

- Infiltrating run-off from the 15 mm rainfall event as close to source as possible
- Bio-filtration areas with amended soils with a PRI value of at least 10 to assist in retaining phosphorus
- Stormwater drainage infrastructure maintenance
- Street sweeping during and post-construction
- Erosion and dust control during construction
- Post-development monitoring to ensure that water quality targets are being met.

Rainfall infiltration is the dominant hydrological process at the site. The relatively flat topography and sandy geology of the LSP site means minor rainfall events would infiltrate the sandy soils or evaporate. The key drainage management strategies to be adopted within the site include:

- Protection of infrastructure and assets from flooding, with the minimum habitable floor level being at least 0.3 m above the 1% AEP flood levels for the urban drainage system
- There are no flood ways or flood zones within the development
- The installation of the pit and pipe drainage system will ensure the roads will remain passable up to and including the 20% AEP event
- Lots greater than 300 m^2 will have a soakwell to retain and infiltrate lot-generated run-off
- A biofiltration basin in the main POS area, and a biofiltration roadside swale in the north of the site, will retain and treat run-off generated from the 15 mm rainfall event
- The treatment measures for run-off from the 15 mm rainfall event aim to maintain post-development groundwater quality relative to pre-development and if possible improved.

To comply with the provisions contained in Better Urban Water Management (WAPC 2008), an Urban Water Management Plan(s) (UWMP) are required to be prepared at subdivision stage. The stormwater and groundwater management strategies are outlined in further detail within the LWMS.

4 PEOPLE FACTOR

4.1 Social surroundings

4.1.1 Aboriginal heritage and culture

A search of the Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System undertaken on 18 July 2019 identified that no Registered Heritage sites are located within site.

One Other Heritage Place (ID 4108; Readymix Sandpit 1) partially intersects the site (Figure L). The status of this Other Heritage Place is Stored Data / Not a Site which means it has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972* (i.e. it is not a Registered Site).

4.1.2 Natural and historical heritage

Searches of the Heritage Council's Inherit database and the City of Armadale's Heritage List was undertaken on 18 July 2019 with no matches recorded for the site.

4.1.3 Amenity

4.1.3.1 Aircraft noise

The Jandakot Airport is situated approximately 3.5 km to the north-west of the site and aircraft noise has the potential to be a nuisance for future residents. Figure M presents the Australian Noise Exposure Forecast (ANEF) modelling for the Jandakot Airport Ultimate Capacity, which is calculated on the theoretical maximum movement capacity of the airfield. Figure M identifies that the site lies below the 20 Australian Noise ANEF contour.

SPP 5.3: Land Use Planning in the Vicinity of Jandakot Airport applies to land in the vicinity of Jandakot Airport, which is, or may be in the future affected by aircraft noise associated with the movement of aircraft. Under SPP 5.3 there are no restriction on zoning, development or building type below the 20 ANEF contour, however noise nuisance may still be experienced.

As the site is within the identified frame area of SPP 5.3, a 'notice on title' advising of the potential for noise nuisance from aircraft will be required for the created lots.

4.1.3.2 Traffic noise

Armadale Road lies directly to the south of the site. Widening works within portion of the site reserved for Primary Regional Roads are currently being undertaken as part of MRWA's Armadale Road to North Lake Road Bridge project.

A noise assessment has been undertaken in accordance with SPP 5.4: Road and Rail Transport Noise and Freight Considerations. The noise assessment is included as part of the LSP documentation. The noise assessment has defined the traffic noise source and management measures including, noise wall adjacent to Armadale Road and a portion of Ghostgum Avenue to reduce impacts to the future residences within the LSP site.

4.1.4 Bushfire

The WAPC released SPP 3.7: Planning in Bushfire Prone Areas to reduce the risk of bushfire to people, property and infrastructure. SPP 3.7 defines a bushfire-prone area as an area that has been designated by the Fire and Emergency Services Commissioner under Section 18 of the *Fire and Emergency Services Act 1998* (as amended) as an area that is subject, or likely to be subject, to bushfires.

A Bushfire Management Plan has been prepared to provide the bushfire management framework proposed to be actioned as part of developing the site in accordance with the site. Bushfire Attack Level (BAL) contour mapping within the Bushfire Management Plan will be updated (if required) to reflect the proposed subdivision outcomes. The Bushfire Management Plan is included as part of the LSP documentation.

5 LOCAL STRUCTURE PLAN CONTEXT

The LSP has been prepared to be consistent with the Treeby District Structure Plan (CLE 2017) and outlines the broad land use framework for the Treeby site, including the following elements:

- Residential dwellings and housing diversity
- Seniors living
- Local roads
- POS
- Conservation POS
- Drainage swale areas
- Childcare facility.

The LSP is illustrated in Figure D. Figure 3 shows the LSP's areas of managed POS and conservation POS areas. The 0.42 ha conservation POS area is fenced to protect both the known *Caladenia huegelii* individuals and the better quality remnant vegetation.

Indicative areas which may be impacted due to engineering or civil construction works have been deliberately located outside of the fenced conservation POS area. The indicative cleared and retained areas of remnant vegetation are illustrated in Figure 3. However, to address the interface between the residential development, local roads, areas of POS and the western and southern sand bunds some engineering works in the south-western and western bunds areas will be required.

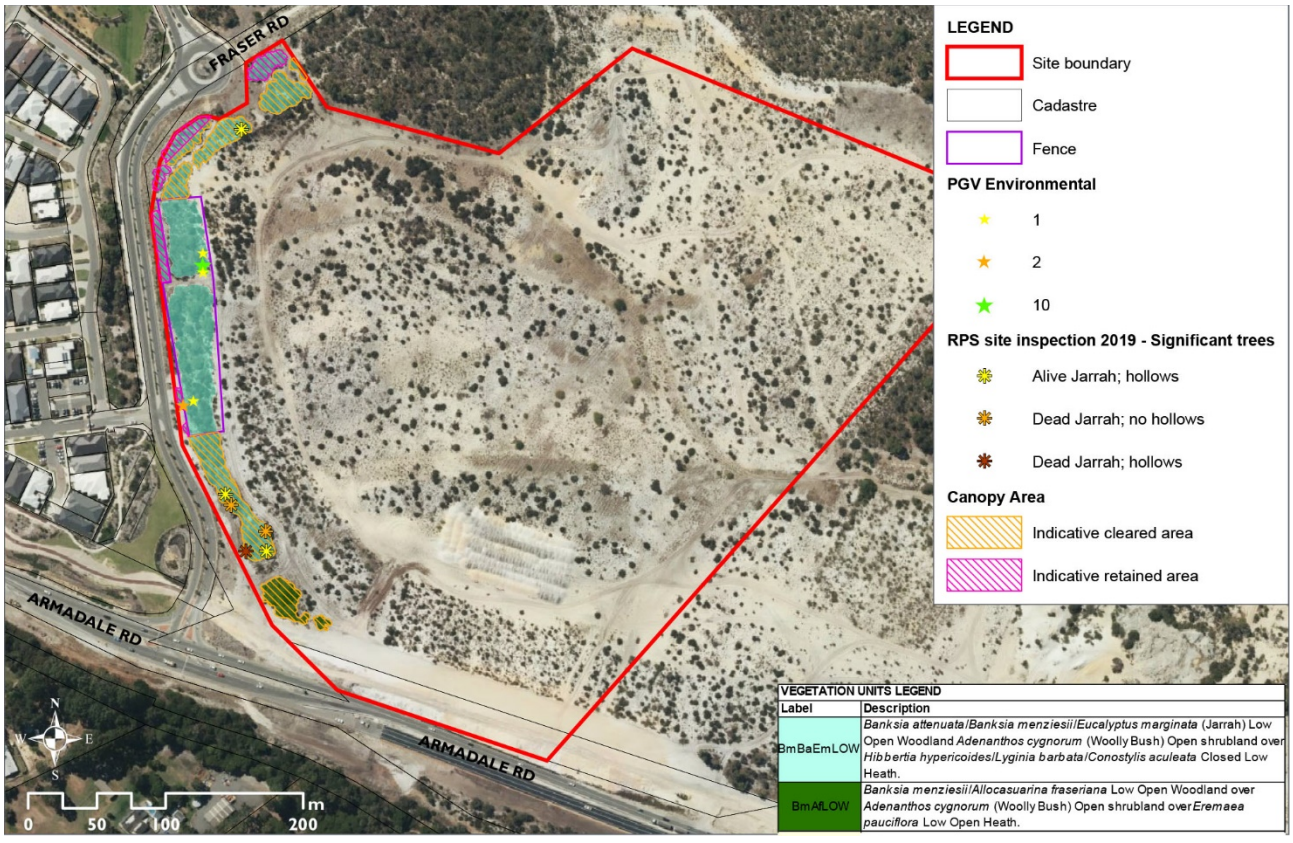


Figure 3: Indicative native vegetation clearing and retention areas within the LSP

6 ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT

6.1 Potential environmental impacts and proposed management measures

To accord with the EPA's 2015 scheme amendment advice and the DPLH's Structure Plan Framework (Department of Planning 2015), the following key environmental factors are considered applicable to the LSP area:

- Flora and vegetation
- Terrestrial environmental quality
- Terrestrial fauna
- Inland waters (including groundwater and drainage management)
- Social surroundings.

Table 9 summarises the potential impacts to the environmental factors from the implementation of the LSP and recommends management measures to mitigate the potential environmental impacts.

Table 9: Summary of the potential environmental impacts and proposed mitigation measures

Flora and vegetation		
EPA objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	
Policy and guidance	• *Environment Protection and Biodiversity Conservation Act 1999* • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Flora and Vegetation (EPA 2016a) • Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)	
Potential impacts	Approximately 19.36 ha of the site has previously been subject to sand mining. The remaining 0.98 ha of Banksia Woodland vegetation located on the western bund is mapped in 'Good' or better condition. Retention of a minimum 0.42 ha of Banksia Woodland vegetation (within the conservation fenced area which includes all the known *Caladenia huegelii* individuals) is proposed to be retained within the LSP. The following minor impacts may be realised as a result of developing the site in accordance with the LSP: • Potentially clearing of up to 0.56 ha of Banksia Woodland vegetation (subject to detailed landscape and engineering design). However, it is likely post the detailed engineering and landscape design that a portion of the 0.56 ha Banksia Woodland will be retained in areas of POS. • Disturbance to native vegetation proposed to be retained through accidental clearing • Introduction and distribution of Declared Pests, other weed species and / or *Phytophthora* dieback	
Mitigation	• Retention of a minimum 0.42 ha of Banksia Woodland vegetation within the conservation fenced area. It is likely after the detailed engineering and landscape design that a portion of the 0.56 ha Banksia Woodland will be retained in areas of POS. • Clearly demarcate the approved clearing area prior to the commencement of construction works to prevent accidental clearing • All vehicles must be free of vegetative and soil material prior to entering the construction area to prevent the introduction of Declared Pests, other weed species and / or *Phytophthora* dieback • Conservation fencing will be positioned (to the satisfaction of DBCA) along the boundary of the Bush Forever Site No. 390. No paths or access to the bush forever site is promoted. • Vegetation Management Plan to be prepared at subdivision stage to the satisfaction of the CoC	
Outcome	Through the retention of a minimum 0.42 ha of Banksia Woodland vegetation (likely to be more native vegetation retained once the detailed design is complete) and implementation of the approved Vegetation Management Plan, the potential impacts to flora and vegetation have been / will be managed to be as low as reasonably practicable.	
Terrestrial environmental quality		
EPA objective	To maintain the quality of land and soils so that environmental values are protected	
Policy and guidance	**Acid sulfate soils**	• Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016c). • Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (Department of Environmental Regulation (DER) 2015a). • Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER 2015b).
	Potential contamination	• *Contaminated Sites Act 2003* • Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016c). • Assessment and Management of Contaminated Sites (DER 2014) • Identification, Reporting and Classification of Contaminated Sites in Western Australia (DER 2017)

Potential impacts	**Acid sulfate soils**	Acidification and release of heavy metals from ASS into groundwater.
	Potential contamination	• No known contaminated sites are located within the site • Due to the presence of dumped rubbish and imported, uncontrolled fill materials there is potential for localised contamination to be present.
Mitigation	**Acid sulfate soils**	• Final fill levels and subsequent excavation (e.g. for sewer lines/engineering services and dewatering requirements) will dictate future ASS management requirements. • Appropriate ASS management plan will be prepared at subdivision stage to support the proposed engineering approach (if required).
	Potential contamination	• All dumped rubbish within the LSP area to be identified and relocated to an appropriate landfill facility prior to commencement of earthworks. • Clean fill certification to be provided for all imported fill materials to prevent the introduction of potential contaminants.
Outcome	• Through the implementation of the approved LWMS and future UWMP(s) the potential impacts to the quality of groundwater under lying the site have been / will be managed to be as low as reasonably practicable. • Given the above and LWP's past performance in implementing appropriate mitigation measures as part of previous land development projects (e.g. Ellenbrook) it is considered that the quality of land and soils will be protected from significant harm so that EPA's terrestrial environmental quality objective is met	
Terrestrial fauna		
EPA objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained	
Policy and guidance	• *Environment Protection and Biodiversity Conservation Act 1999* • Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso* (DEE 2017) • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Terrestrial Fauna (EPA 2016d)	
Potential impacts	The fauna and botanical surveys identified the habitat for native fauna is restricted to 0.98 ha of Banksia Woodland vegetation, of which a minimum of 0.42 ha of Banksia Woodland will be retailed within the conservation fenced area within the LSP as dedicated conservation POS The following minor impacts may be realised as a result of developing the site in accordance with the LSP: • Potentially clearing of up to 0.56 ha of Carnaby's Black Cockatoo foraging habitat including six jarrah trees which are potential foraging and breeding habitat for forest red-tailed black cockatoos (subject to detailed landscape and engineering design). It is likely post the detailed engineering and landscape design that a portion of the 0.56 ha Banksia Woodland will be retained in areas of POS • Injury and/or mortality during clearing activities and construction • Disturbance during construction (clearing activities and noise) may affect the local abundance of fauna populations due to interruption to fauna behaviour • Habitat and food source degradation through increased pollution, waste, spread of weeds and altered hydrology edge effects.	
Mitigation	• Retention of a minimum 0.42 ha of Banksia Woodland fauna habitat • Vegetation Management Plan to be prepared at subdivision stage to the satisfaction of the CoC, and include information on: – interface treatments, including development setbacks to conservation areas – landscape plantings using endemic native species – hard road edges – access control measures for development boundaries abutting Bush Forever Site No. 390 • A hollow assessment of the existing six jarrah trees will be undertaken prior to clearing to provide photographic evidence that the trees are not currently in use by black cockatoos	

Outcome		• Through the retention of a minimum 0.42 ha of Banksia Woodland fauna habitat and implementation of the approved Vegetation Management Plan, the potential impacts to terrestrial fauna will be managed to be as low as reasonably practicable. • Given the above and LWP's past performance in implementing appropriate mitigation measures as part of previous land development projects (e.g. Ellenbrook) it is considered that biological diversity and ecological integrity will be maintained so that EPA's terrestrial fauna objective is met.
Inland waters		
EPA objective		To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected
Policy and guidance		• Environmental Factor Guideline - Inland Waters (EPA 2018) • SPP 2.3: Jandakot Groundwater Protection • Better Urban Water Management (WAPC 2008)
Potential impacts		• Alteration of the existing landscape which in turn alters the surface water flow paths and recharge locations during rainfall. • Contamination of groundwater during construction activities, with potential sources including uncontained spills, refuelling and plant and vehicle fluid leaks. • Pollutants in stormwater runoff from the residential development may impact groundwater values.
Mitigation		• LWMS (RPS 2019b) was prepared to describe the integrated management of groundwater and surface water that will be implemented at the site in line with the Better Urban Water Management principles. • Urban Water Management Plan(s) to be prepared at subdivision stage to the satisfaction of the CoC, on advice from the DWER.
Outcomes		• Through the implementation of the approved LWMS and future UWMP(s) the potential hydrological impacts will be managed through the implementation of the following: – At the lot scale (residential) less than 40-60 kL of water consumption should be from scheme water – Retain and treat stormwater runoff from constructed impervious surfaces generated from the first 15 mm rainfall event as close to source as possible – Designing stormwater management systems to provide serviceability and amenity for roads during minor (20% AEP) rainfall events – Protection of infrastructure and assets from flooding and inundation, with minimum habitable floor levels being at least 0.3 m above the 1% AEP flood level for the urban drainage system – Major arterial roads should remain passable in a 1% AEP event – Provide storage and delineate flow paths for the 1% AEP event – The CoC also have a requirement that drainage basins will be at least 0.5 m above the maximum groundwater level • The objectives of the LWMS and the specific management strategies including engineering drainage requirements and landscape actions within drainage basins will be implemented through future UWMP(s).
Social surroundings		
EPA objective		To protect social surroundings from significant harm
Policy and guidance	Aboriginal heritage and culture	• *Aboriginal Heritage Act 1972* • Environmental Factor Guideline Social Surroundings (EPA 2016e)
	Noise	• *Transfer of Land Act 1893* • Environmental Factor Guideline Social Surroundings (EPA 2016e) • Environment Protection (Noise) Regulations 1997 • SPP 5.3: Land Use Planning in the Vicinity of Jandakot Airport • SPP 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning

	Bushfire	• *Fire and Emergency Services Act 1998* • Environmental Factor Guideline Social Surroundings (EPA 2016e) • SPP 3.7: Planning in Bushfire Prone Areas • Guideline for Planning in Bushfire Prone Areas, Version 1.3 (DPLH and DFES 2017)
Potential impacts	**Aboriginal heritage and culture**	Excavation / construction activities may unearth and/or damage artefacts or other items of Aboriginal cultural significance
	Noise	• Ongoing exposure of future residents to aircraft-related noise from Jandakot Airport • Ongoing exposure of future residents to the traffic-related noise from Armadale Road • Temporary exposure of site workers to the construction-related noise. • Existing and future residences located proximate to or within the site may be temporarily exposed to elevated construction-related noise and dust levels. • Dust may also accumulate on the retained native vegetation within and adjacent to the site, where it settles on leaves and restricts physiological function
	Bushfire	• Damage to people, property and infrastructure from fire • Death and/or injury due to fire
Mitigation	**Aboriginal heritage and culture**	• No Registered Heritage Sites or Other Heritage Places are located within the site • Should any Aboriginal objects be identified or unearthed then construction will be stopped, and the findings will be reported to the DPLH
	Noise	• 'Notice on title' pursuant to s70a of the *Transfer of Land Act 1893* advising of the potential for noise nuisance from aircraft • Noise assessment has been undertaken to determine if noise impacts from Armadale Road on the impact sensitive receptors (i.e. future residences) within the LSP site • A noise wall will be installed along the Armadale Road boundary at subdivision.
	Bushfire	• Bushfire Management Plan will be prepared to provide the bushfire management framework proposed to be actioned as part of developing the site in accordance with the LSP • BAL contour mapping within the Bushfire Management Plan will be updated (if required) to reflect the proposed subdivision outcomes
Outcomes	Through the implementation of the proposed mitigation measures the potential impacts to Aboriginal heritage and culture, noise and bushfire have been / will be managed to be as low as reasonably practicable through engineering design and subdivision approval process.	

7 CONCLUSION

Table 9 provides a summary of the potential impacts, proposed mitigation measures and predicted outcomes for the EPA's environmental factors of specific relevance to the site. The key factors include:

- Flora and vegetation – the management of the potential impact upon 0.56 ha of Banksia Woodland / Bassendean Complex (central and south). However, it is likely post the detailed engineering and landscape design (confirmed at subdivision stage) that a portion of the 0.56 ha Banksia Woodland will be retained in areas of POS north of the Conservation POS boundary. The LSP proposes to retain a minimum 0.42 ha of Banksia Woodland vegetation. The 0.42 Banksia Woodland vegetation Conservation POS area also retains the surveyed *Caladenia huegelii* individuals. RPS proposes to implementation a Vegetation Management Plan, to manage the potential impacts to the remnant Threatened Flora and Banksia Woodland vegetation.
  - The Vegetation management plan to be prepared at subdivision stage to the satisfaction of the CoC, and include information on
    - Interface treatments (fencing), including development setbacks to conservation areas (this includes the Conservation POS and Bush Forever Site No. 390)
    - Protecting the *Caladenia huegelii* individuals within the 0.42 ha fenced Conservation POS area
    - Hard road edges
    - Access control measures for development boundaries abutting the Conservation POS and Bush Forever Site No. 390
- Inland waters – The site is located on a P3* public drinking water source area. Through the implementation of the approved LWMS and future UWMP(s) and detailed engineering plans the potential hydrological impacts will be managed through the implementation of the following
  - At the lot scale (residential) less than 40–60 kL of water consumption should be from scheme water
  - Retain and treat stormwater run-off from constructed impervious surfaces generated from the first 15 mm rainfall event as close to source as possible
  - Designing stormwater management systems to provide serviceability and amenity for roads during minor (20% AEP) rainfall events
  - Protection of infrastructure and assets from flooding and inundation, with minimum habitable floor levels being at least 0.3 m above the 1% AEP flood level for the urban drainage system
  - Major arterial roads should remain passable in a 1% AEP event
  - Provide storage and delineate flow paths for the 1% AEP event
  - The CoC also have a requirement that drainage basins will be at least 0.5 m above the maximum groundwater level
  - The objectives of the LWMS and the specific management strategies including engineering drainage requirements and landscape actions within drainage basins will be implemented through future UWMP(s)
- Terrestrial fauna – The fauna and botanical surveys identified the habitat for native fauna is restricted to 0.98 ha of Banksia Woodland vegetation, of which a minimum of 0.42 ha of Banksia Woodland. This 0.42 ha of Banksia Woodland vegetation will be retailed within the conservation fenced area within the LSP as dedicated conservation POS. The following minor impacts may be realised as a result of developing the site in accordance with the LSP

  - Potentially clearing of up to 0.56 ha of Carnaby's Black-Cockatoo foraging habitat and up to six jarrah trees which provide potential foraging and breeding habitat for forest red-tailed black cockatoos (subject to detailed landscape and engineering design). It is likely after the detailed engineering and landscape design that a portion of the 0.56 ha Banksia Woodland will be retained in areas of POS

  - The LSP will retain of a minimum 0.42 ha of Banksia Woodland fauna habitat

- Terrestrial environmental quality – An ASS management plan will be prepared for DWER approval and then implemented as required depending on the detailed civil infrastructure design

- Social surroundings – Noise (acoustic) assessment has been undertaken. Acoustic sound walls will be installed along Armadale Road. A 'notice on title' pursuant to s70a of the *Transfer of Land Act 1893* advising of the potential for noise nuisance from aircraft.

This report confirms the EPA's consideration of Amendment 1289/57 (i.e. potential environmental impacts from developing the site for urban purposes are unlikely to be significant) through demonstrating that the potential environmental impacts from the implementation of the LSP can be managed through the implementation of standard planning and development controls to be as low as reasonably practicable.

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FIGURES



Figure A

Treeby LSP site location

GDA 1994 MGA Zone 50

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Doc Number: 001
Date: 05.07.19
Scale: Map 1:5,000 Overview 1:500,000 @ A4
Created by: MA
Source: Imagery - Landgate

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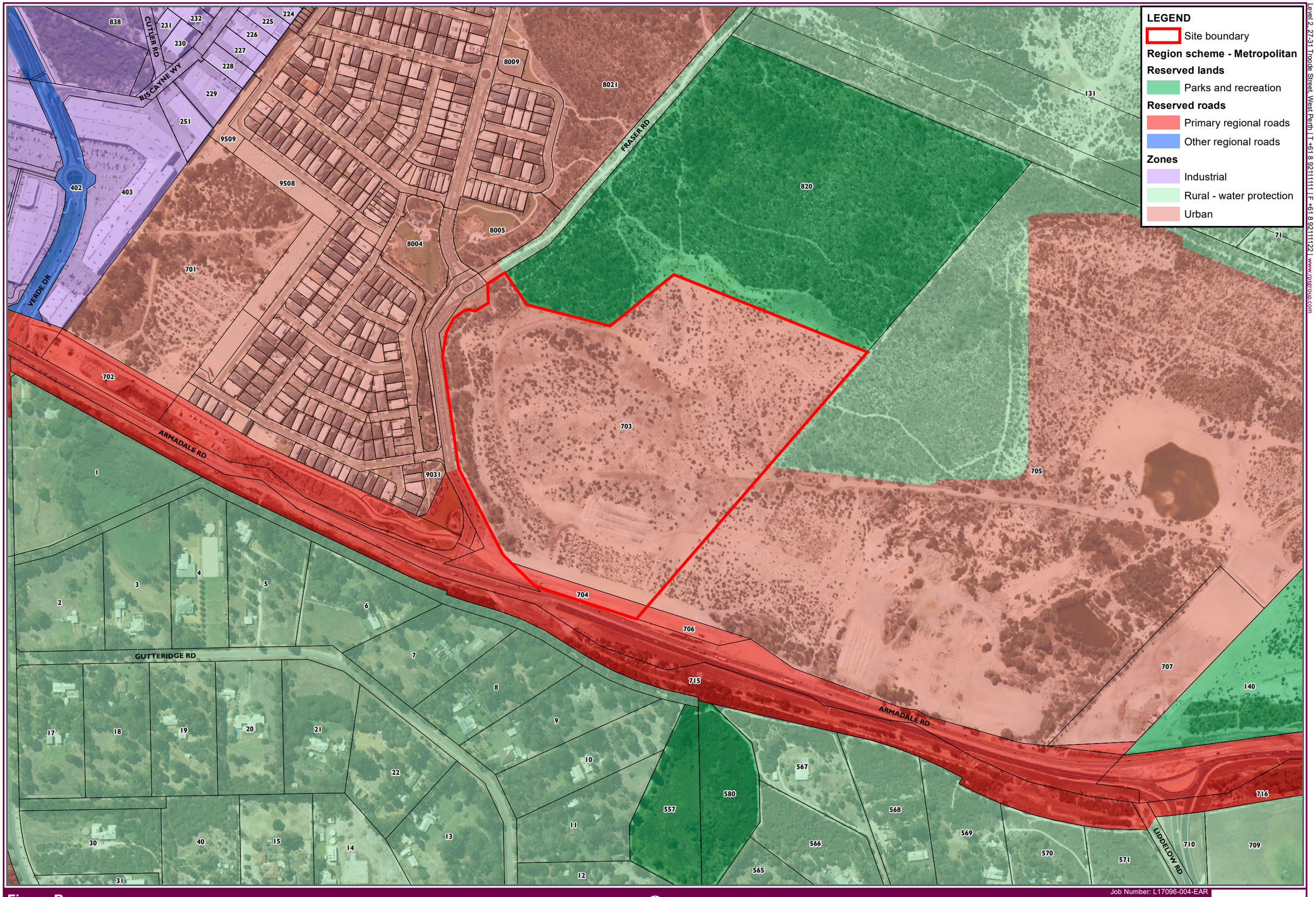


Figure B

Metropolitan region scheme mapping

GDA 1994 MGA Zone 50

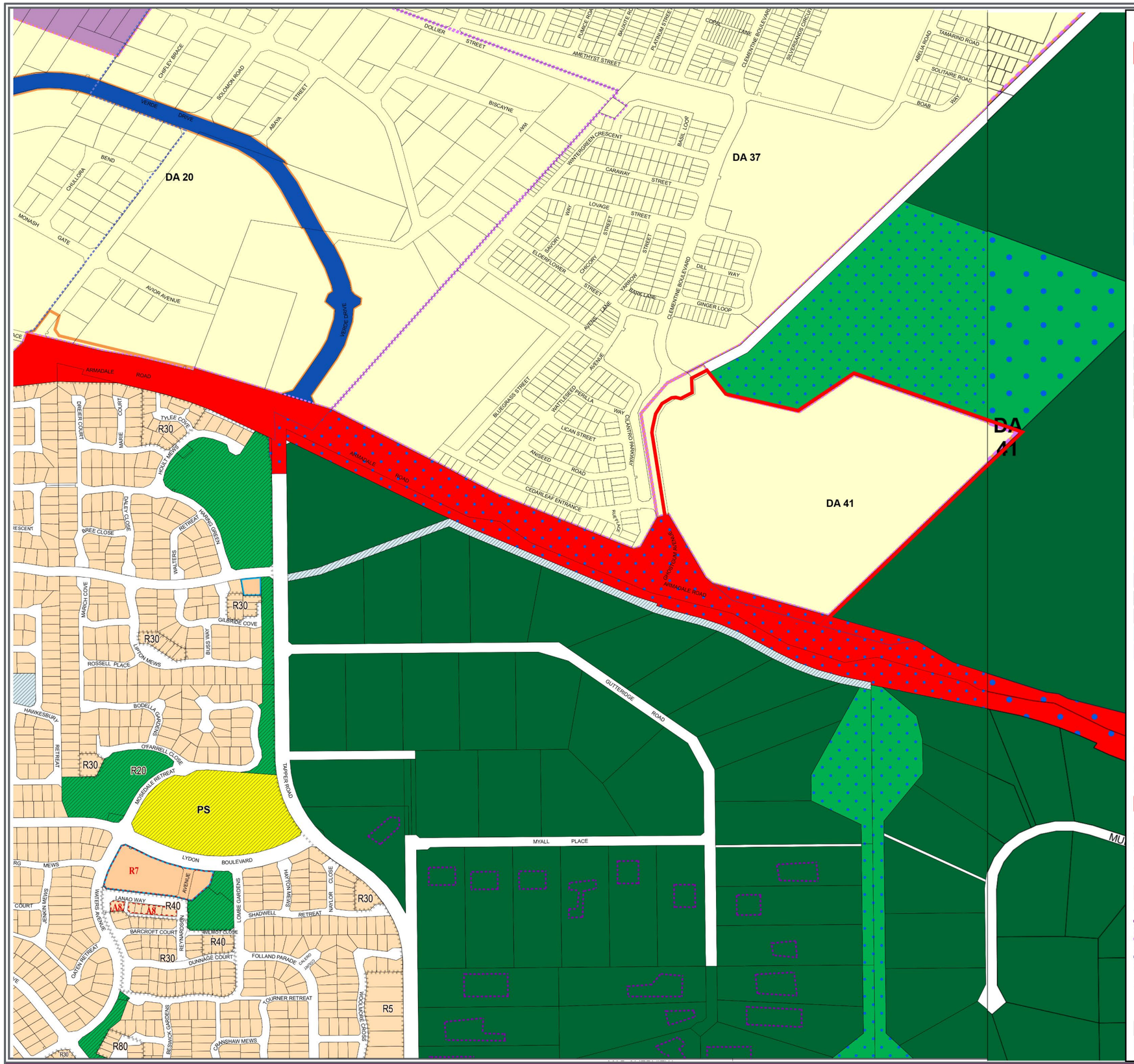
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LEGEND

Site boundary

REGION SCHEME RESERVES (MRS)

- Civic and Cultural
- Other Regional Roads
- Parks and Recreation
- R — Parks and Recreation - restricted
- Port Installations
- Primary Regional Roads
- Railways
- State Forests
- Waterways
- Water Catchments

- Public Purposes
- CP — Public Purposes - Car Park
- CG — Public Purposes - Commonwealth Government
- HS — Public Purposes - High School
- H — Public Purposes - Hospital
- P — Public Purposes - Prison
- SU — Public Purposes - Special Uses
- SEC — Public Purposes - State Energy Commission
- TS — Public Purposes - Technical School
- U — Public Purposes - University
- WSD — Public Purposes - Water Authority of WA

LOCAL SCHEME RESERVES

- Lakes and Drainage
- Local Road
- Parks and Recreation
- C — Public Purposes : Civic
- AG — Public Purposes : Dept of Agriculture
- FS — Public Purposes : Fire Station
- GS — Public Purposes : Gas Pipeline
- OP — Public Purposes : Oil Pipeline
- K — Public Purposes : Pre-School
- PS — Public Purposes : Primary School
- WC — Public Purposes : Water Corporation
- WP — Public Purposes : Western Power

LOCAL SCHEME ZONES

- Development
- District Centre
- Industry
- Lakes and Drainage
- Light and Service Industry
- Local Centre
- Mixed Business
- Mixed Use
- Regional Centre
- Residential
- Resource
- Rural
- Rural Living
- Special Use

OTHER CATEGORIES

(see scheme text for additional information)

- Scheme Area Boundary
- Local Government Boundary
- Hope Valley - Wattleup Redevelopment Area
- R20 R Codes
- A1 Additional Uses
- R1 Restricted Uses
- SU1 Special Use Area
- Peel-Harvey Coastal Plain Catchment Area
- Building Envelope
- DA1 Development Area
- Development Contribution Area
- JA Jandakot Airport
- H Heritage Place

- No Zone
- Waterbodies

Figure C

Town planning scheme No. 3 mapping

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Created by: MA
Source: Town Planning Scheme No3 - DPLH, 2019



Figure D

Local structure plan

0 25 50 75 100 m

Job Number: L17096-004 - EAR
Doc Number: 004
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Source: Treeby Structure Plan (LWPTRE RD1 018 RevA) - Roberts Day, 28.11.19

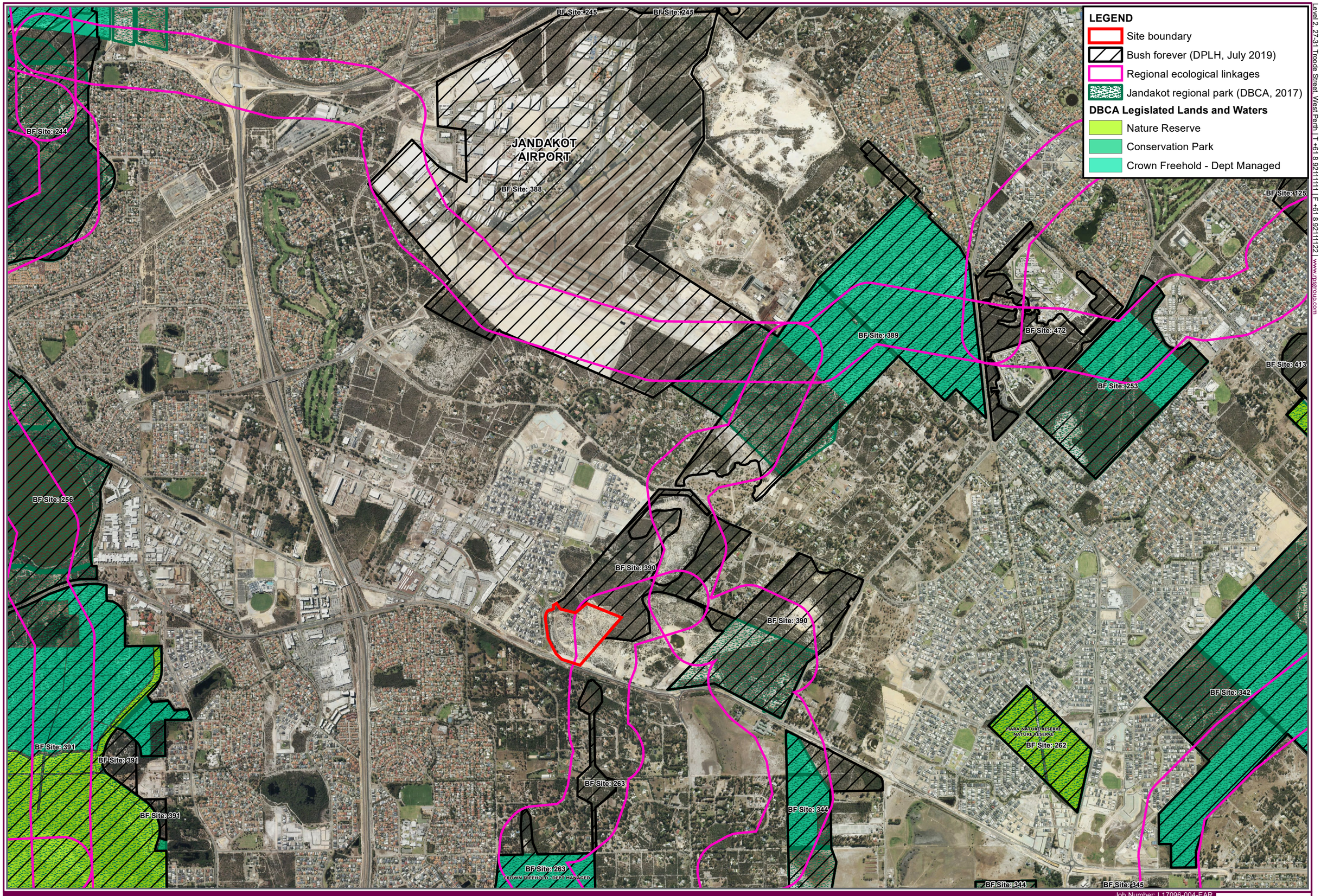


Figure E

Surrounding land uses

GDA 1994 MGA Zone 50

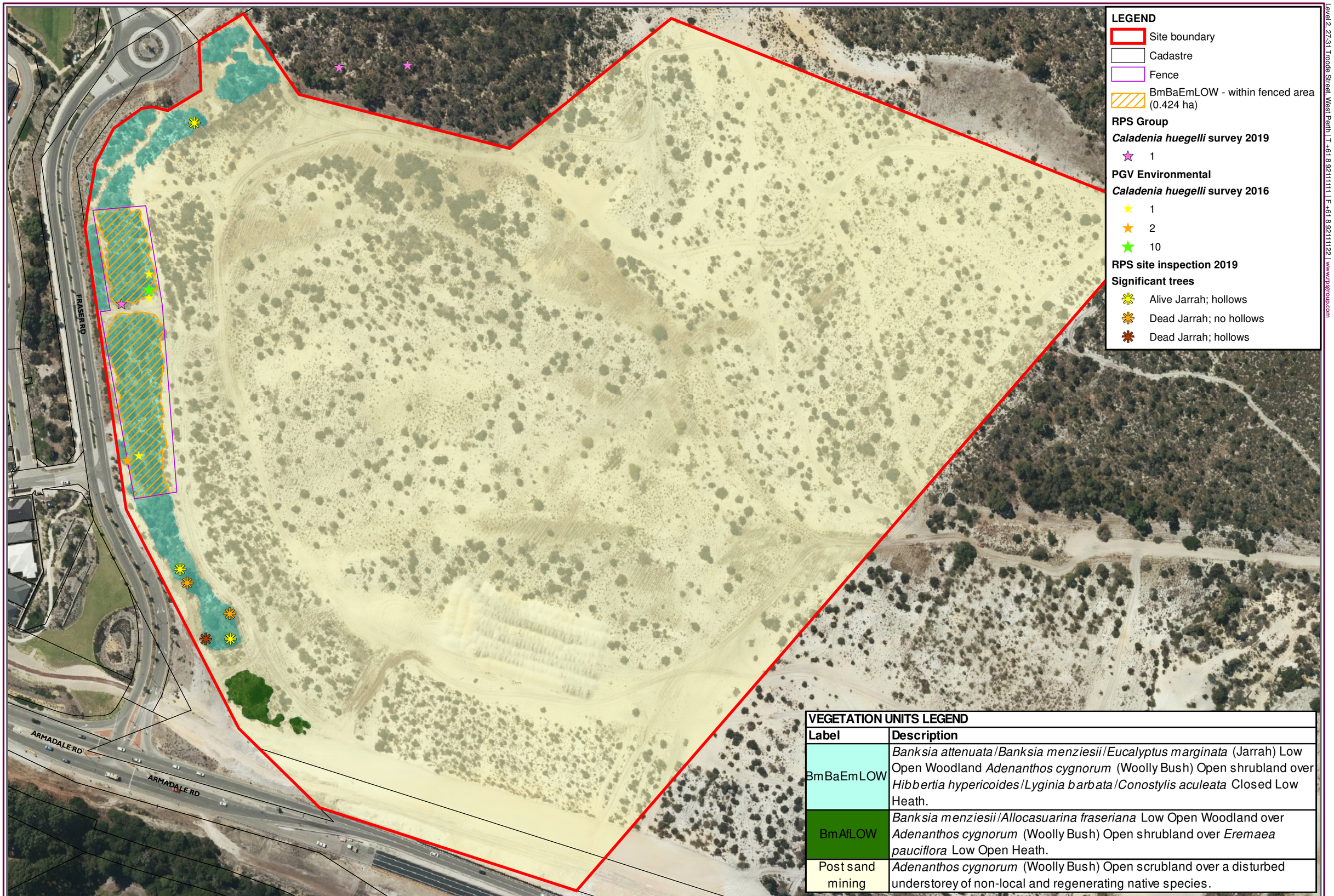
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VEGETATION UNITS LEGEND	
Label	**Description**
BmBaEmLOW	*Banksia attenuata*/*Banksia menziesii*/*Eucalyptus marginata* (Jarrah) Low Open Woodland *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Hibbertia hypericoides*/*Lyginia barbata*/*Conostylis aculeata* Closed Low Heath.
BmAfLOW	*Banksia menziesii*/*Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Eremaea pauciflora* Low Open Heath.
Post sand mining	*Adenanthos cygnorum* (Woolly Bush) Open scrubland over a disturbed understorey of non-local and regenerating native species.

Figure F

Vegetation units, significant flora and trees

GDA 1994 MGA Zone 50

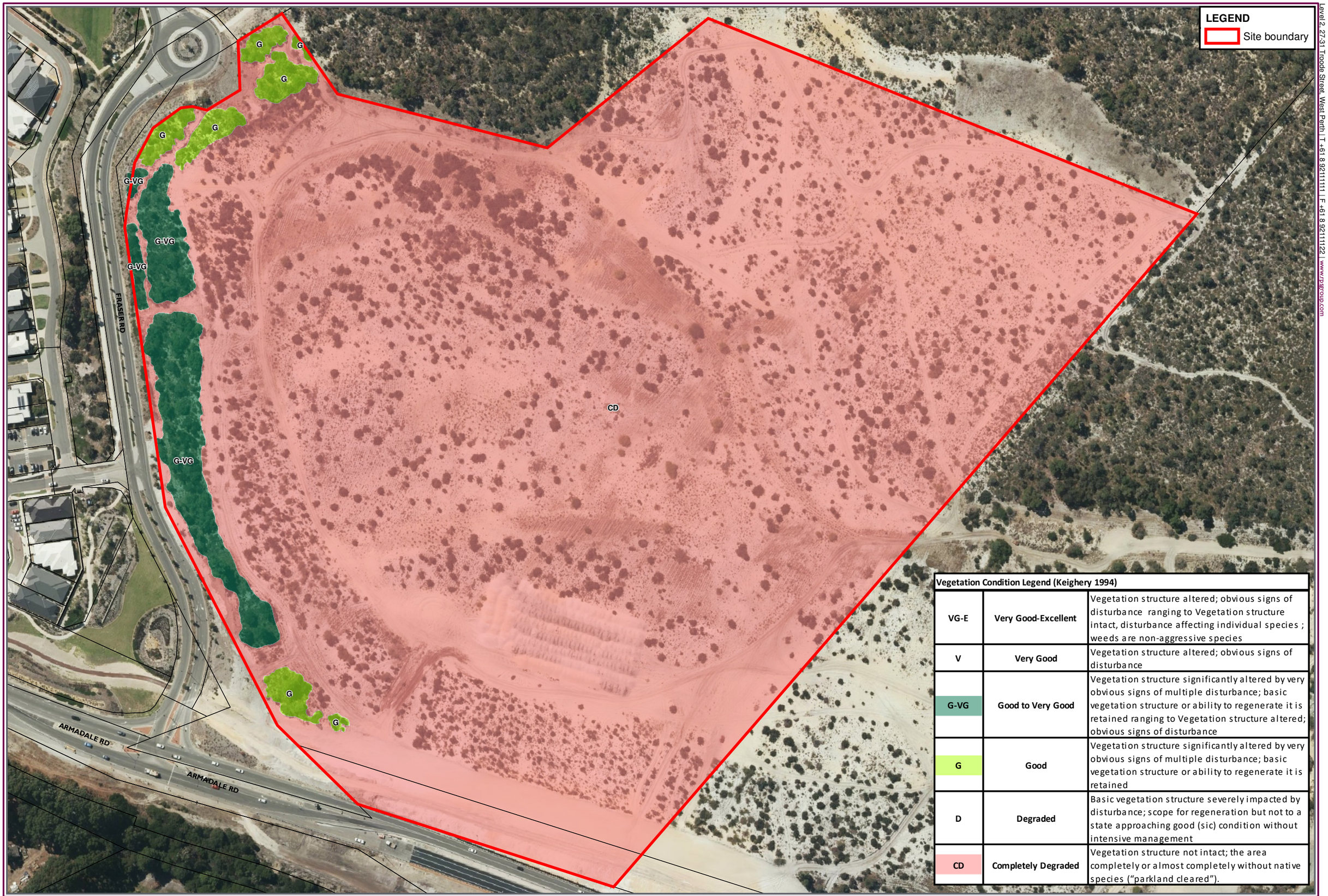
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Vegetation Condition Legend (Keighery 1994)		
VG-E	Very Good-Excellent	Vegetation structure altered; obvious signs of disturbance ranging to Vegetation structure intact, disturbance affecting individual species ; weeds are non-aggressive species
V	Very Good	Vegetation structure altered; obvious signs of disturbance
G-VG	Good to Very Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained ranging to Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ("parkland cleared").

Figure G

Vegetation condition

GDA 1994 MGA Zone 50

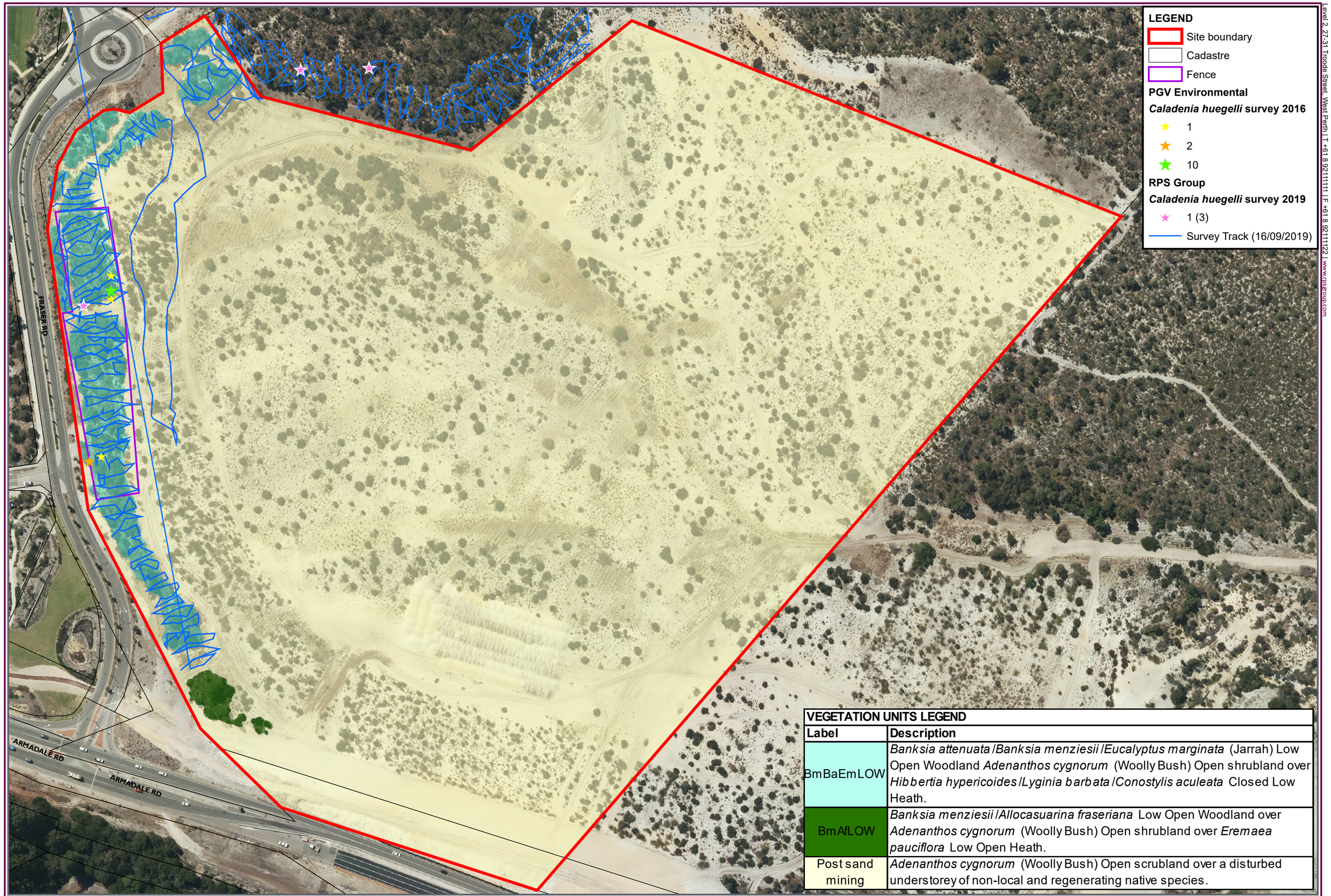
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Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

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Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\EAR figures\L17096-004_EAR_007_FigG_Vegetation Condition_190717.mxd



VEGETATION UNITS LEGEND	
Label	**Description**
BmBaEmLOW	*Banksia attenuata* /*Banksia menziesii* /*Eucalyptus marginata* (Jarrah) Low Open Woodland *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Hibbertia hypericoides* /*Lyginia barbata* /*Conostylis aculeata* Closed Low Heath.
BmAfLOW	*Banksia menziesii* /*Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Eremaea pauciflora* Low Open Heath.
Post sand mining	*Adenanthos cygnorum* (Woolly Bush) Open scrubland over a disturbed understorey of non-local and regenerating native species.

Figure H

2019 Targeted *Caladenia huegelii* search

GDA 1994 MGA Zone 50

0 25 50 100 m

Job Number: L17096-004-EAR
Doc Number: 008
Date: 18.09.19
Scale: 1:2,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\EAR figures\L17096-004_EAR_008_FigH_2019 Targeted Caladenia huegelii search_190918.mxd

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LEGEND

- Contour (mAHD)
- Site boundary
- Cadastre

Geology (DMIRS, 50K Mapsheets)

- Cps - PEATY CLAY - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin
- S10 - SAND - as S8 over sandy clay to clayey sand of the Guildford Formation, of eolian origin
- S8 - SAND - white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals, of eolian origin
- Sp1 - PEATY SAND - grey to black, fine to medium-grained, moderately sorted quartz sand, slightly peaty, of lacustrine origin

CUTLER RD
BISCAYNE WY
ARMADALE RD
GUTTERIDGE RD
S8
S10
Cps
Sp1

Figure 1

Topography and geology

GDA 1994 MGA Zone 50

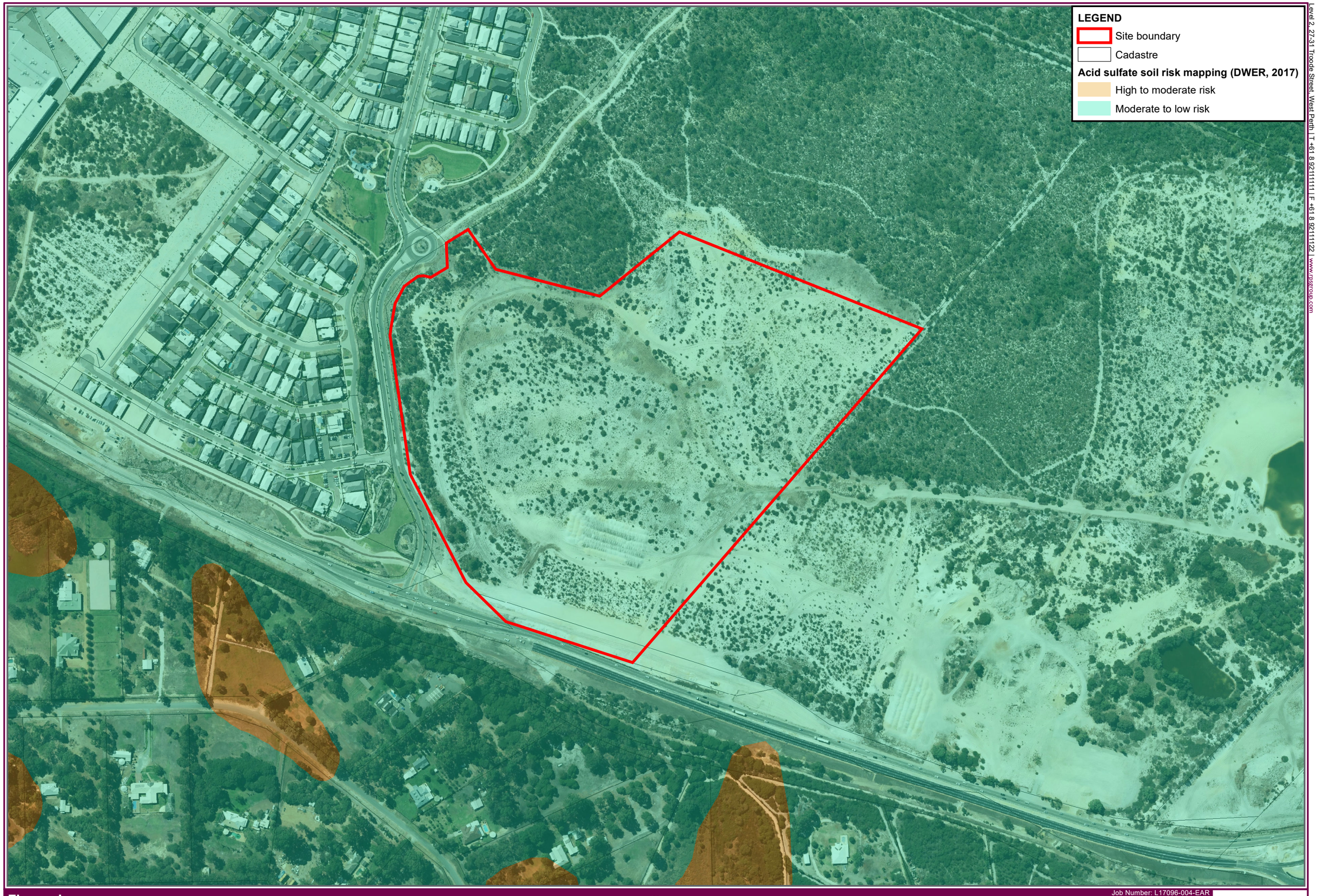
0 50 100 200 m

Job Number: L17096-004-EAR
Doc Number: 009
Date: 19.09.19
Scale: 1:4,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\EAR figures\L17096-004_EAR_009_Fig1_Topo and Geology_190919.mxd

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Figure J

Acid sulfate soils risk mapping

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: L17096-004-EAR
Doc Number: 010
Date: 17.07.19
Scale: 1:4,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\EAR figures\L17096-004_EAR_010_FigJ_ASS Mapping_190919.mxd

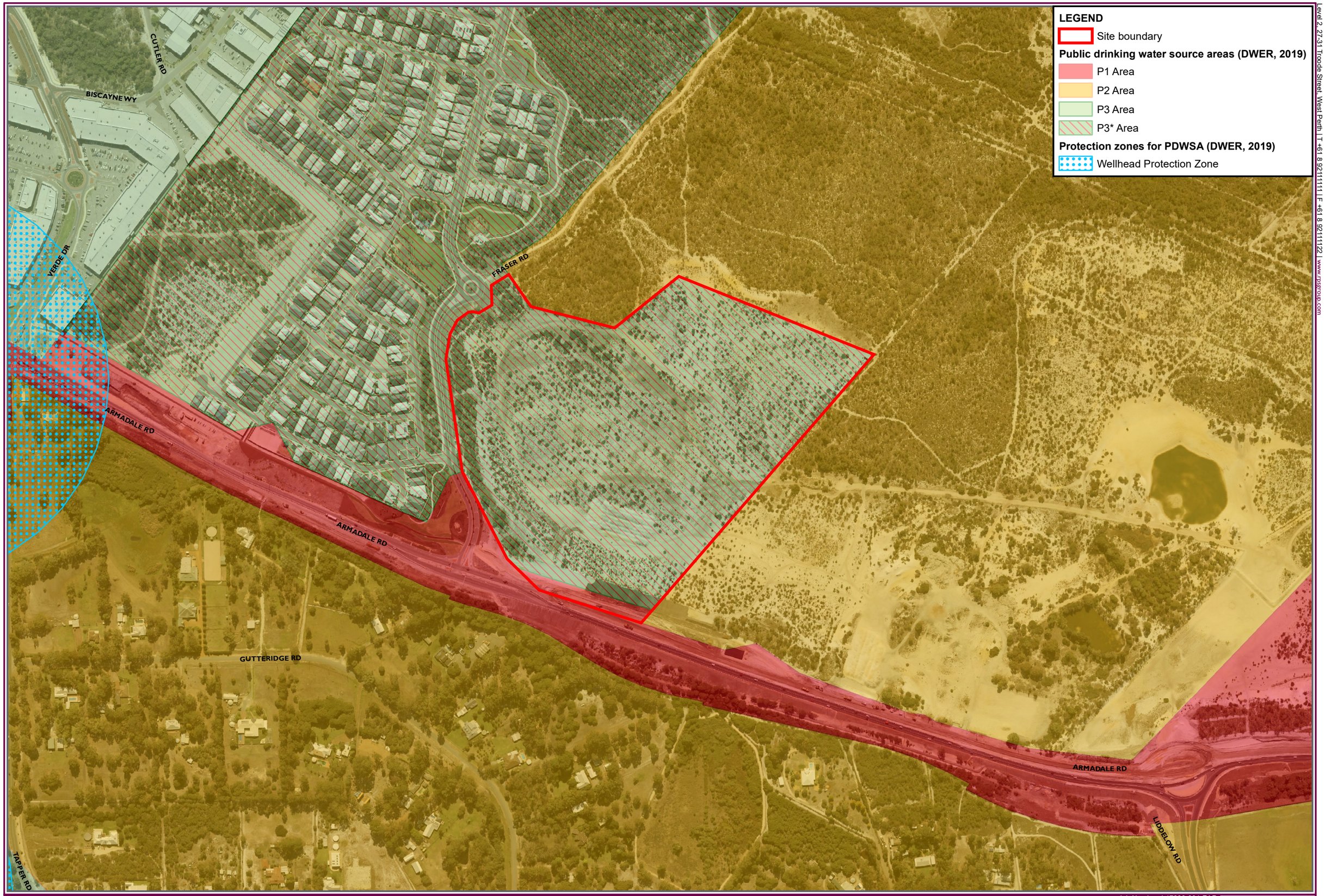


Figure K

Public drinking water source areas

GDA 1994 MGA Zone 50

0 62.5 125 250 m

Job Number: L17096-004-EAR
Doc Number: 011
Date: 19.09.19
Scale: 1:5,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\EAR figures\L17096-004_EAR_011_FigK_Public drinking water source areas_190919.mxd

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Figure L

Aboriginal heritage mapping

GDA 1994 MGA Zone 50

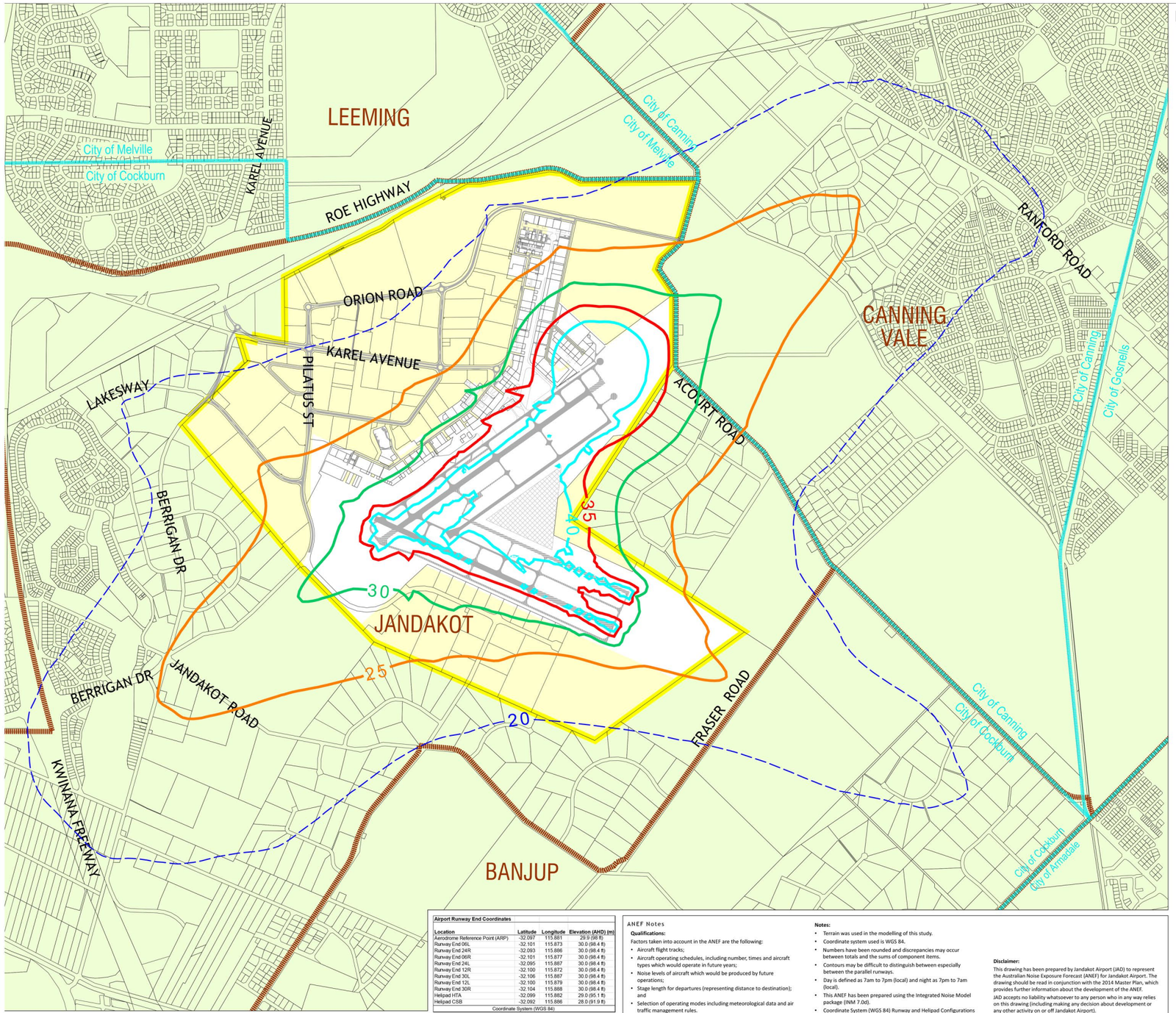
0 75 150 300 m

Job Number: L17096-004-EAR
Doc Number: 012
Date: 19.09.19
Scale: 1:8,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Feb 2019

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\EAR figures\L17096-004_EAR_012_FigL_Aboriginal Heritage mapping_190919.mxd

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Airport Runway End Coordinates			
Location	Latitude	Longitude	Elevation (AHD) (m)
Aerodrome Reference Point (ARP)	-32.097	115.861	29.9 (98 ft)
Runway End 06L	-32.101	115.873	30.0 (98.4 ft)
Runway End 24R	-32.093	115.886	30.0 (98.4 ft)
Runway End 06R	-32.101	115.877	30.0 (98.4 ft)
Runway End 24L	-32.095	115.887	30.0 (98.4 ft)
Runway End 12R	-32.100	115.872	30.0 (98.4 ft)
Runway End 30L	-32.106	115.887	30.0 (98.4 ft)
Runway End 12L	-32.100	115.879	30.0 (98.4 ft)
Runway End 30R	-32.104	115.888	30.0 (98.4 ft)
Helipad HTA	-32.099	115.882	29.0 (95.1 ft)
Helipad CSB	-32.092	115.886	28.0 (91.9 ft)

Coordinate System (WGS 84)

ANEF Notes

Qualifications:

Factors taken into account in the ANEF are the following:

- Aircraft flight tracks;
- Aircraft operating schedules, including number, times and aircraft types which would operate in future years;
- Noise levels of aircraft which would be produced by future operations;
- Stage length for departures (representing distance to destination); and
- Selection of operating modes including meteorological data and air traffic management rules.

Notes:

- Terrain was used in the modelling of this study.
- Coordinate system used is WGS 84.
- Numbers have been rounded and discrepancies may occur between totals and the sums of component items.
- Contours may be difficult to distinguish between especially between the parallel runways.
- Day is defined as 7am to 7pm (local) and night as 7pm to 7am (local).
- This ANEF has been prepared using the Integrated Noise Model package (INM 7.0d).
- Coordinate System (WGS 84) Runway and Helipad Configurations

Disclaimer:

This drawing has been prepared by Jandakot Airport (JAD) to represent the Australian Noise Exposure Forecast (ANEF) for Jandakot Airport. The drawing should be read in conjunction with the 2014 Master Plan, which provides further information about the development of the ANEF.

JAD accepts no liability whatsoever to any person who in any way relies on this drawing (including making any decision about development or any other activity on or off Jandakot Airport).



CHART PREPARATION		
PREPARED	29-04-2014	
PREPARED BY	M. BIDDLE	MNG
CHECKED BY	J. GANDY	Airbiz
APPROVED BY	D. COHNEY	Airbiz
BASE MAP TRANSFER BY	M. BIDDLE	MNG
BASE MAP COORDINATE SYSTEM	PCG94	
AMENDMENTS	DRAWING STATUS : Rev E	

NOTE - BASE MAP COORDINATE SYSTEM IS THE PERTH COASTAL GRID 1994 (PCG94) WHICH IS BASED ON THE GEOCENTRIC DATUM OF AUSTRALIA 1994 (GDA94)

LEGEND

- Airport Boundary
- Aviation Operations
- 20 ANEF
- 25 ANEF
- 30 ANEF
- 35 ANEF
- 40 ANEF

The contents and areas of this plan are approximate and subject to survey and are current to the date indicated. All consultants and persons wishing to utilise this data should satisfy themselves of this plans accuracy and currency.

BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES

To be used in conjunction with (AS2021-2000) Table 3.3

Building type	ANEF zone of site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES

1) THE ACTUAL LOCATION OF THE 20 ANEF CONTOUR IS DIFFICULT TO DEFINE ACCURATELY, MAINLY BECAUSE OF VARIATIONS IN AIRCRAFT FLIGHT PATHS. BECAUSE OF THIS, THE PROCEDURE OF (AS2021-2000) CLAUSE 2.3.2 MAY BE FOLLOWED FOR BUILDING SITES OUTSIDE BUT NEAR TO THE 20 ANEF CONTOUR.

2) WITHIN 20 ANEF TO 25 ANEF, SOME PEOPLE MAY FIND THAT THE LAND IS NOT COMPATIBLE WITH RESIDENTIAL OR EDUCATIONAL USES. LAND USE AUTHORITIES MAY CONSIDER THAT THE INCORPORATION OF NOISE CONTROL FEATURES IN THE CONSTRUCTION OF RESIDENCES OR SCHOOLS IS APPROPRIATE (SEE ALSO (AS2021-2000) FIGURE A1 OF APPENDIX A).

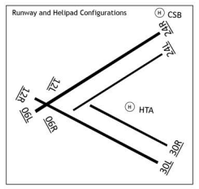
3) THERE WILL BE CASES WHERE A BUILDING OF A PARTICULAR TYPE WILL CONTAIN SPACES USED FOR ACTIVITIES WHICH WOULD GENERALLY BE FOUND IN A DIFFERENT TYPE OF BUILDING (E.G. AN OFFICE IN AN INDUSTRIAL BUILDING). IN THESE CASES THE ABOVE TABLE SHOULD BE USED TO DETERMINE SITE ACCEPTABILITY, BUT INTERNAL DESIGN NOISE LEVELS WITHIN THE SPECIFIC SPACES SHOULD BE DETERMINED BY (AS2021-2000) TABLE 3.3.

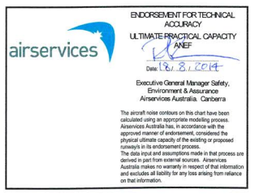
4) THIS STANDARD DOES NOT RECOMMEND DEVELOPMENT IN UNACCEPTABLE AREAS. HOWEVER, WHERE THE RELEVANT PLANNING AUTHORITY DETERMINES THAT ANY DEVELOPMENT MAY BE NECESSARY WITHIN EXISTING BUILT-UP AREAS DESIGNATED AS UNACCEPTABLE, IT IS RECOMMENDED THAT SUCH DEVELOPMENT SHOULD ACHIEVE THE REQUIRED ANR DETERMINED ACCORDING TO (AS2021-2000) CLAUSE 3.2. FOR RESIDENCES, SCHOOLS, ETC., THE EFFECT OF AIRCRAFT NOISE ON OUTDOOR AREAS ASSOCIATED WITH THE BUILDINGS SHOULD BE CONSIDERED.

5) IN NO CASE SHOULD NEW DEVELOPMENT TAKE PLACE IN GREENFIELD SITES DEEMED UNACCEPTABLE BECAUSE SUCH DEVELOPMENT MAY IMPACT AIRPORT OPERATIONS.

SOURCE : AS2021-2000 TABLE 2.1

Runway and Helipad Configurations





Ultimate Capacity Australian Noise Exposure Forecast

Jandakot Ultimate Capacity ANEF Runway Operations

		Arrivals			Departures			Circuits			Touch and Go			All
Runway	Aircraft	Day	Night	Total	Day	Night	Total	Day	Night	Total	Day	Night	Total	Total
06L	BEC58P	8.504	0.895	9.400	8.393	0.895	9.288	0.062	0.451	0.513	0.250	2.229	2.479	21.681
06L	CNA208	6.177	3.345	9.522	6.177	3.345	9.522	0.490	0.224	0.713	0.148	0.168	0.316	20.073
06L	CNA441	1.143	0.447	1.590	1.143	0.447	1.590	0.049	0.014	0.063	0.084	0.039	0.123	3.366
06L	CNA500	1.138	0.345	1.483	1.138	0.345	1.483	0.009	0.002	0.011	0.000	0.000	0.000	2.976
06L	DO228	0.160	0.012	0.172	0.160	0.012	0.172	0.008	0.007	0.015	0.035	0.015	0.050	0.409
06L	CNA172	24.941	0.191	25.132	23.433	0.191	23.624	0.371	1.493	1.864	1.334	7.181	8.515	59.135
06L	CNA182	1.464	0.034	1.498	1.127	0.034	1.161	0.005	0.022	0.027	0.014	0.090	0.103	2.789
06L	CNA206	2.390	0.080	2.470	1.989	0.080	2.070	0.004	0.015	0.019	0.008	0.052	0.060	4.619
06L	GASEPF	12.201	0.397	12.598	11.338	0.397	11.736	0.134	0.590	0.725	0.474	2.828	3.302	28.361
06L	GASEPV	3.842	0.111	3.953	2.881	0.111	2.992	0.014	0.028	0.042	0.043	0.113	0.156	7.143
	TOTAL	**61.960**	**5.857**	**67.817**	**57.780**	**5.857**	**63.638**	**1.146**	**2.847**	**3.993**	**2.390**	**12.714**	**15.105**	**150.553**
06R	BEC58P	0.358	0.000	0.358	0.469	0.000	0.469	2.569	0.000	2.569	10.432	0.000	10.432	13.829
06R	CNA172	2.055	0.000	2.055	3.563	0.000	3.563	15.455	0.000	15.455	55.612	0.000	55.612	76.685
06R	CNA182	0.082	0.000	0.082	0.419	0.000	0.419	0.200	0.000	0.200	0.568	0.000	0.568	1.269
06R	CNA206	0.120	0.000	0.120	0.520	0.000	0.520	0.172	0.000	0.172	0.323	0.000	0.323	1.135
06R	CNA208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
06R	CNA441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
06R	CNA500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
06R	DO228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
06R	GASEPF	0.850	0.000	0.850	1.712	0.000	1.712	5.593	0.000	5.593	19.764	0.000	19.764	27.919
06R	GASEPV	0.211	0.000	0.211	1.172	0.000	1.172	0.601	0.000	0.601	1.780	0.000	1.780	3.765
	TOTAL	**3.676**	**0.000**	**3.676**	**7.856**	**0.000**	**7.856**	**24.590**	**0.000**	**24.590**	**88.480**	**0.000**	**88.480**	**124.602**
12L	BEC58P	0.190	0.000	0.190	0.335	0.000	0.335	0.971	0.000	0.971	3.944	0.000	3.944	5.440
12L	CNA172	1.023	0.000	1.023	3.365	0.000	3.365	5.843	0.000	5.843	21.025	0.000	21.025	31.255
12L	CNA182	0.057	0.000	0.057	0.301	0.000	0.301	0.076	0.000	0.076	0.215	0.000	0.215	0.649
12L	CNA206	0.093	0.000	0.093	0.417	0.000	0.417	0.065	0.000	0.065	0.122	0.000	0.122	0.697
12L	CNA208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12L	CNA441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12L	CNA500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12L	DO228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12L	GASEPF	0.498	0.000	0.498	1.549	0.000	1.549	2.115	0.000	2.115	7.472	0.000	7.472	11.633
12L	GASEPV	0.153	0.000	0.153	0.918	0.000	0.918	0.227	0.000	0.227	0.673	0.000	0.673	1.970
	TOTAL	**2.014**	**0.000**	**2.014**	**6.884**	**0.000**	**6.884**	**9.296**	**0.000**	**9.296**	**33.450**	**0.000**	**33.450**	**51.645**
12R	BEC58P	3.205	0.279	3.483	3.060	0.279	3.339	0.036	0.141	0.177	0.148	0.694	0.842	7.841
12R	CNA172	9.317	0.059	9.377	6.975	0.059	7.034	0.219	0.465	0.684	0.787	2.237	3.023	20.118
12R	CNA182	0.535	0.011	0.545	0.290	0.011	0.301	0.003	0.007	0.010	0.008	0.028	0.036	0.892
12R	CNA206	0.868	0.025	0.893	0.544	0.025	0.569	0.002	0.005	0.007	0.005	0.016	0.021	1.490
12R	CNA208	2.366	1.042	3.408	2.366	1.042	3.408	0.188	0.070	0.257	0.057	0.052	0.109	7.182
12R	CNA441	0.438	0.139	0.577	0.438	0.139	0.577	0.019	0.004	0.023	0.032	0.012	0.044	1.222
12R	CNA500	0.436	0.107	0.543	0.436	0.107	0.543	0.003	0.001	0.004	0.000	0.000	0.000	1.091
12R	DO228	0.061	0.004	0.065	0.061	0.004	0.065	0.003	0.002	0.005	0.013	0.005	0.018	0.153
12R	GASEPF	4.501	0.124	4.624	3.450	0.124	3.573	0.079	0.184	0.263	0.280	0.881	1.161	9.621
12R	GASEPV	1.400	0.035	1.435	0.635	0.035	0.670	0.009	0.009	0.017	0.025	0.035	0.060	2.182
	TOTAL	**23.126**	**1.824**	**24.950**	**18.256**	**1.824**	**20.080**	**0.561**	**0.887**	**1.448**	**1.354**	**3.960**	**5.314**	**51.792**
24L	BEC58P	0.465	0.000	0.465	0.611	0.000	0.611	3.226	0.000	3.226	13.103	0.000	13.103	17.406
24L	CNA172	2.668	0.000	2.668	4.611	0.000	4.611	19.411	0.000	19.411	69.849	0.000	69.849	96.539
24L	CNA182	0.106	0.000	0.106	0.542	0.000	0.542	0.251	0.000	0.251	0.714	0.000	0.714	1.614
24L	CNA206	0.156	0.000	0.156	0.674	0.000	0.674	0.216	0.000	0.216	0.405	0.000	0.405	1.451
24L	CNA208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24L	CNA441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24L	CNA500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24L	DO228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24L	GASEPF	1.103	0.000	1.103	2.216	0.000	2.216	7.025	0.000	7.025	24.824	0.000	24.824	35.168
24L	GASEPV	0.275	0.000	0.275	1.517	0.000	1.517	0.755	0.000	0.755	2.236	0.000	2.236	4.782
	TOTAL	**4.773**	**0.000**	**4.773**	**10.171**	**0.000**	**10.171**	**30.885**	**0.000**	**30.885**	**111.130**	**0.000**	**111.130**	**156.959**
24R	BEC58P	10.962	1.729	12.691	10.816	1.729	12.545	0.165	0.871	1.037	0.671	4.303	4.974	31.247
24R	CNA208	7.965	6.457	14.422	7.965	6.457	14.422	0.631	0.432	1.063	0.191	0.324	0.515	30.422
24R	CNA441	1.474	0.862	2.336	1.474	0.862	2.336	0.063	0.027	0.091	0.109	0.075	0.183	4.947
24R	CNA500	1.467	0.666	2.133	1.467	0.666	2.133	0.012	0.003	0.015	0.000	0.000	0.000	4.281
24R	DO228	0.207	0.023	0.229	0.207	0.023	0.229	0.010	0.014	0.024	0.045	0.028	0.073	0.556
24R	CNA172	32.140	0.369	32.509	30.197	0.369	30.566	0.994	2.882	3.876	3.578	13.863	17.440	84.391
24R	CNA182	1.886	0.066	1.953	1.450	0.066	1.517	0.013	0.043	0.056	0.037	0.173	0.210	3.736
24R	CNA206	3.080	0.155	3.235	2.562	0.155	2.718	0.011	0.029	0.041	0.021	0.100	0.121	6.115
24R	GASEPF	15.724	0.767	16.491	14.612	0.767	15.378	0.360	1.140	1.500	1.271	5.460	6.731	40.100
24R	GASEPV	4.952	0.215	5.167	3.709	0.215	3.924	0.039	0.054	0.092	0.115	0.218	0.333	9.515
	TOTAL	**79.857**	**11.308**	**91.165**	**74.460**	**11.308**	**85.767**	**2.299**	**5.496**	**7.795**	**6.037**	**24.545**	**30.582**	**215.309**
30L	BEC58P	3.180	0.184	3.364	0.854	0.184	1.038	0.036	0.093	0.129	0.146	0.459	0.605	5.136
30L	CNA172	9.246	0.039	9.286	6.616	0.039	6.655	0.217	0.307	0.524	0.781	1.477	2.258	18.723
30L	CNA182	0.531	0.007	0.538	0.255	0.007	0.262	0.003	0.005	0.007	0.008	0.018	0.026	0.834
30L	CNA206	0.861	0.017	0.878	0.486	0.017	0.502	0.002	0.003	0.006	0.005	0.011	0.015	1.401
30L	CNA208	2.348	0.688	3.036	2.348	0.688	3.036	0.186	0.046	0.232	0.056	0.035	0.091	6.395
30L	CNA441	0.435	0.092	0.526	0.435	0.092	0.526	0.019	0.003	0.022	0.032	0.008	0.040	1.115
30L	CNA500	0.433	0.071	0.503	0.433	0.071	0.503	0.003	0.000	0.004	0.000	0.000	0.000	1.011
30L	DO228	0.061	0.002	0.063	0.061	0.002	0.063	0.003	0.001	0.005	0.013	0.003	0.016	0.147
30L	GASEPF	4.467	0.082	4.548	3.386	0.082	3.467	0.079	0.121	0.200	0.278	0.582	0.859	9.075
30L	GASEPV	1.389	0.023	1.412	0.584	0.023	0.607	0.008	0.006	0.014	0.025	0.023	0.048	2.082
	TOTAL	**22.951**	**1.205**	**24.156**	**15.457**	**1.205**	**16.661**	**0.557**	**0.586**	**1.142**	**1.344**	**2.615**	**3.959**	**45.919**
30R	BEC58P	0.188	0.000	0.188	2.515	0.000	2.515	0.964	0.000	0.964	3.914	0.000	3.914	7.581
30R	CNA172	1.015	0.000	1.015	3.646	0.000	3.646	5.799	0.000	5.799	20.865	0.000	20.865	31.324
30R	CNA182	0.057	0.000	0.057	0.332	0.000	0.332	0.075	0.000	0.075	0.213	0.000	0.213	0.677
30R	CNA206	0.092	0.000	0.092	0.468	0.000	0.468	0.065	0.000	0.065	0.121	0.000	0.121	0.746
30R	CNA208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30R	CNA441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30R	CNA500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30R	DO228	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30R	GASEPF	0.494	0.000	0.494	1.575	0.000	1.575	2.099	0.000	2.099	7.415	0.000	7.415	11.583
30R	GASEPV	0.151	0.000	0.151	0.956	0.000	0.956	0.225	0.000	0.225	0.668	0.000	0.668	2.001
	TOTAL	**1.998**	**0.000**	**1.998**	**9.492**	**0.000**	**9.492**	**9.226**	**0.000**	**9.226**	**33.197**	**0.000**	**33.197**	**53.913**
CSB	B206B3	4.425	1.197	5.622	4.425	1.197	5.622	0.000	0.000	0.000	0.000	0.000	0.000	11.244
CSB	B430	2.827	1.705	4.532	2.827	1.705	4.532	0.000	0.000	0.000	0.000	0.000	0.000	9.064
CSB	EC130	2.330	0.136	2.466	2.330	0.136	2.466	0.000	0.000	0.000	0.000	0.000	0.000	4.933
CSB	R22	6.833	0.008	6.841	6.833	0.008	6.841	0.000	0.000	0.000	0.000	0.000	0.000	13.681
CSB	R44	8.326	0.166	8.492	8.326	0.166	8.492	0.000	0.000	0.000	0.000	0.000	0.000	16.984
	TOTAL	**24.741**	**3.212**	**27.953**	**24.741**	**3.212**	**27.953**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**55.905**
HTA	B206B3	3.210	0.043	3.253	3.210	0.043	3.253	0.000	0.000	0.000	0.000	0.000	0.000	6.506
HTA	EC130	3.714	0.050	3.764	3.714	0.050	3.764	0.000	0.000	0.000	0.000	0.000	0.000	7.529
HTA	R22	41.832	0.565	42.396	41.832	0.565	42.396	0.000	0.000	0.000	0.000	0.000	0.000	84.792
HTA	R44	12.871	0.174	13.045	12.871	0.174	13.045	0.000	0.000	0.000	0.000	0.000	0.000	26.089
	TOTAL	**61.626**	**0.832**	**62.458**	**61.626**	**0.832**	**62.458**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**124.916**
	ALL	**286.723**	**24.238**	**310.960**	**286.723**	**24.238**	**310.961**	**78.560**	**9.815**	**88.375**	**277.382**	**43.835**	**321.217**	**1031.514**

Figure M

Aircraft noise (Jandakot Airport) contours

Job Number: L7096.004-EAR
Doc Number: 013
Date: 02.10.19
Scale: NTS @ A3
Created by: RL
Source: Ultimate Capacity Australian Noise Exposure Forecast 29.04.2014

Appendix A

Flora and vegetation review

FLORA AND VEGETATION REVIEW

Lot 703 Armadale Road, Treeby



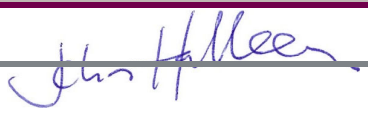
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Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
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Approval for issue

J. Halleen  04 October 2019

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SUMMARY

In June 2019, RPS Australia West Pty Ltd (RPS) was engaged by LWP to undertake a Flora and vegetation review of the vegetation within Lot 703 Armadale Road, Treeby (hereafter referred to as "the site") (Figure A).

This site was visited on 3 October 2012 by PGV Environmental (PGV) and 2 July and 16 September 2019 by RPS. Adjacent landholdings to the west and east of the site underwent Level 1 (now reconnaissance) and Level 2 (now detailed) flora and vegetation surveys on 6 and 7 October 2014 and 12, 15 and 24 October 2012. These surveys' findings can be summarised as follows:

- Of a total of 148 plant taxa from the adjacent landholdings, 21 of which were exotic (weed) species, and six (from the western site) of which were planted (non-local) rehabilitation species were recorded.
- One Threatened Flora species, *Caladenia huegelii*, pursuant to subsection (2) of Section 23F of the Western Australian *Biodiversity Conservation Act 2016,* was recorded within the site by PGV. This species is also listed as Endangered and protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Fifteen individuals were recorded within the site between 2012 and 2019.
- No Priority Flora species as listed by the Department of Biodiversity, Conservation and Attractions (DBCA) have been recorded with the site.
- No flora species of other conservation significance as stated in *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) or as listed in Bush Forever (Government of Western Australia 2000) have been recorded within the site.
- Twenty-one introduced flora taxa (weeds) were recorded for the adjacent landholdings, which is 17% and 10% of the total flora taxa recorded, respectively. The majority of the weed species were from the Poaceae (grass) family. None of the weed species found within the surrounding landholdings are listed as Declared Plants for the state.
- Three vegetation units were mapped for the site: two banksia woodland units and a rehabilitation works unit.
- The banksia woodland units (*BmBaEmLOW* and *BmAfLOW*) was inferred to represent Floristic Community Type SCP23a Central *Banksia attenuata – Banksia menziesii* woodlands, which is considered to be Well Reserved and its conservation status is Low Risk (Gibson et al. 1994).
- None of the vegetation units described and mapped for the site represent Threatened Ecological Communities listed under the EPBC Act or *Biodiversity Conservation Act 2016.* However, the Banksia woodland vegetation units are considered to represent the DBCA-listed Banksia dominated woodlands of the Swan Coastal Plain IBRA region Priority Ecological Community (Priority 3).
- The vegetation condition within the site ranged from "Completely Degraded" in the previously cleared area to "Good" to "Good to Very Good" throughout the Banksia woodland remnants.
- Vegetation within the site belongs to the Bassendean Complex – Central and South (Heddle et al. 1980) which corresponds to the Bassendean 1001: Medium very sparse woodland; jarrah, with low woodland; Banksia and Casuarina (Shepherd et al. 2002). The extent remaining of these vegetation types is below the threshold level of 30% (of their pre-European extent) set by the EPA and is therefore considered conservation significant.
- According to the criteria stated in Bush Forever (Government of Western Australia 2000) the vegetation of the site is considered regionally significant because it satisfies the criterion relating to rarity. The Banksia woodland vegetation within the site in the western edges of the site is habitat for documented records of the Threatened Flora species *Caladenia huegelii*. These records represent a subpopulation of Population 42.

1 INTRODUCTION

1.1 Location

The 20.34 ha Lot 703 Armadale Road, Treeby (hereafter referred to as "the site") is located in the City of Cockburn, approximately 18 kilometres (km) south of Perth and 1.5 km east of the Cockburn Central Activity Centre and Transit Station (Figure A).

1.2 Report objectives

This report presents the findings of a Flora and Vegetation Review of the site. The review was undertaken to meet the intent of *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) and involved the following components:

- A desktop review of significant flora species identified in the Department of Biodiversity, Conservation and Attraction's (DBCA) NatureMap search and the Department of Environment and Energy's (DEE) Protected Matters Search Tool (PMST)
- A site visit to confirm the vegetation and flora present on site against previous vegetation unit and condition mapping undertaken as part of previous surveys of the site
- A targeted search for the Threatened orchid species *Caladenia huegelii* (grand spider orchid) within remnant Banksia woodland in the site and part of Bush Forever Site No. 390 – Fraser Road Bushland, Banjup
- Review of the previous targeted searches for any Threatened Flora (TF) or Priority Flora (PF) species known from the Treeby area (as identified in the NatureMap and PMST results)
- Analysis of the floristic composition of the vegetation for any species of conservation significance. This includes TF and PF species, and any species of other conservation value (EPA 2016)
- Assessment of the condition and conservation significance of the vegetation using criteria for regional and local significance. The Floristic Community Types for the site to be inferred if possible
- Preparation of a report and relevant maps.

1.3 Legislative context

Federal and state legislation pertaining to the conservation of native flora and vegetation include (but are not limited to) the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act); the *Biodiversity Conservation Act 2016* (BC Act); and the *Environmental Protection Act 1986* (EP Act). Section 4A of the EP Act states that the following principles should be adhered to in order to protect the environment of Western Australia:

- Precautionary principle: Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- Principle of intergenerational equity: The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
- Principle of the conservation of biological diversity and ecological integrity: Conservation of biological diversity and ecological integrity should be a fundamental consideration.

1.3.1 Flora of conservation significance

Within Western Australia, TF are listed as such if they are considered to be in danger of extinction, rare or otherwise in need of special protection. These taxa are legally protected under the BC Act. The removal of these taxa or impact to their surroundings is not permitted without prior ministerial approval. The DBCA maintains a list of PF species that may be rare or threatened but for which there are either insufficient survey data to determine accurately their status, or which are rare but not currently considered to be threatened. A PF taxon is assigned to one of five priority categories. TF and PF categories are defined in Appendix A (Table A1.1).

Many taxa listed as TF under the BC Act have additional protection as they are also listed as TF under one of six threat categories (Extinct, Extinct in the wild, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the EPBC Act. TF Taxa are defined as Matters of National Environmental Significance (MNES) under the EPBC Act and penalties apply for any damage to individuals, populations or habitats of these flora. EPBC Act conservation categories are defined in Appendix A (Table A1.2).

In addition to state and Commonwealth protected and listed conservation significant flora, *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) lists species other than TF and PF as of conservation significance where a species has a keystone role, relictual status, anomalous features indicating a potential new discovery, geographical range importance (range extensions, extremes or an outlier population), status as a restricted subspecies, variety, or naturally occurring hybrid, poor reservation, status as a local endemic or a restricted distribution. (This document states that conservation significance includes these criteria but is not limited to them. It may include flora that are poorly represented in the Western Australian Herbarium (WAH) and short-range endemic flora, i.e. those with a known range less than 200 km).

1.3.2 Vegetation of conservation significance

Floristic Community Types (FCTs) are based on a survey of the vegetation of the Swan Coastal Plain (SCP) from Seabird to Dunsborough, completed by Gibson et al. (1994). The purpose of the Gibson et al. (1994) survey was to determine the number and type of vegetation communities present across the southern SCP and to then assess how much of each remained and whether they were protected within reserves. There were 509 bounded 10 m × 10 m floristic sites surveyed. Each FCT defined as a result of Gibson et al. (1994) was given a Reservation Status and a Conservation Status (Appendix A, Tables A1.3 and A1.4).

Most of the SCP Threatened Ecological Communities (TECs) and/or Priority Ecological Communities (PECs) that are protected under state and Commonwealth legislation are defined by their FCT in Gibson et al. (1994).

Under the BC Act and the EP Act TECs, classified by DBCA in one of the TEC categories (Appendix A, Table A1.5) have limited protection. Other ecological communities are classified by DBCA in the category of PEC pending further survey and/or definition.

2 METHODS

2.1 Desktop review

The site was assessed in 2013 by PGV Environmental (PGV), to determine any environmental constraints that occur, or are likely to occur within the site or vicinity and assisted in identifying conservation significant features during the field survey. In 2019, a desktop study of the site was undertaken to identify the conservation significant features present or likely to be present and assess any current environmental constraints.

Constraints included:

- Environmentally Sensitive Areas (ESAs) (Declared by the Minister under section 51B of the EP Act)
- MNES (protected under the EPBC Act)
- Flora taxa and vegetation communities of conservation significance.

A review was undertaken of the flora, vegetation and other environmental data available for the site and surrounds which incorporated the following:

- Regional historical climate, geological, soil and landform data
- Historical flora and vegetation reports
- Regional vegetation mapping and datasets.

In addition, searches of the following state and Commonwealth databases were undertaken for flora and vegetation communities that may occur in the vicinity of the site:

- DBCA's NatureMap search for Threatened and Priority Flora and flora of conservation significance (Appendix B)
- DEE's PMST search for Threatened and Priority Ecological Communities and Threatened Flora species (Appendix C).

The NatureMap and PMST searches were conducted within a 5 km radial area of the central coordinate coordinates S32 07.46 E115 52.45 (GDA94 Zone 50J). From the database search results a table of significant species and their conservation codes was compiled.

2.2 Site validation

Field surveys for the site's surrounding landholdings to the east and west were undertaken by experienced and qualified botanists from ENV Australia on 12, 15 and 24 October 2012 and RPS on 6 and 7 October 2014. In addition, the site was visited by experienced RPS scientists on 2 July 2019 to confirm its floristic attributes.

The Flora and vegetation review aimed to:

- Verify the data from the desktop survey at a local scale.
- Delineate and characterise the flora and vegetation units in the site.
- Identify the potential impacts of the proposed development on local flora and vegetation values particularly flora taxa of conservation significance.

This site validation involved a walkover of the site to confirm PGVs (2013) vegetation unit and condition mapping with existing vegetation onsite and to validate the flora and vegetation attributes from the nearby field surveys.

2.3 Targeted flora search

Targeted flora searches have been undertaken by PGV in 2012, 2015 and 2016 (Appendix D) for conservation significant taxa that were identified in their desktop study (PGV 2013). The searches involved systematics traverses through potential habitat for the target species. Threatened and Priority flora locations (and the number of individuals present) were recorded using a handheld GPS (GDA94 datum).

On 16 September 2019, RPS undertook a targeted search for the Threatened orchid species *Caladenia huegelii* (grand spider orchid) within remnant Banksia woodland in the site, and part of Bush Forever Site No. 390 – Fraser Road Bushland, Banjup. The targeted search focussed on areas of known and potential habitat for the species, with particular focus on locations within the search area where the species had previously been recorded by PGV Environmental in 2012, 2015, 2016, 2017 and 2018 and within the Bush Forever site by the DBCA.

2.3.1 Flora and taxonomy

Vascular flora inventories were previously compiled by RPS and ENV Australia from all flora species recorded and collected within the adjacent landholdings to the west and east of the site (RPS 2014; ENV Australia 2013). Flora specimens were either identified in the field, or collected and identified using the resources (keys, publications and databases) of the Western Australian Herbarium. Nomenclature was aligned with the current names in the DBCA WAH public interface database FloraBase (WAH 1998).

2.3.2 Vegetation mapping

Vegetation description and mapping was conducted using a combination of aerial photo-interpretation, regional vegetation mapping, on-ground confirmation and vegetation structure data (Figure B). Each vegetation unit was defined by the dominant plant species using the vegetation structure classes established under Bush Forever (WAPC, 2000) (Appendix A, Table A1.6).

Vegetation condition mapping was conducted using aerial photo-interpretation and on-site confirmation (Figure C). Vegetation condition was assessed using the Vegetation Condition Scale (Keighery 1994) recommended in Bush Forever (Government of Western Australia 2000) (Appendix A, Table A1.7).

2.3.3 Floristic community types

PGV (2013) assigned an inferred FCT to each mapped vegetation unit in “Good” or better condition within the site. This was determined by comparing the species recorded in the vegetation units on site with the species list per community type in Gibson et al. (1994). The species recorded by Gibson et al. (1994), which occur with frequencies of at least 50% in any one community type, were used for comparison with vegetation units within the site.

2.3.4 Assessment of vegetation conservation significance

The availability of comparable datasets for pre-European vegetation type and extent, and present vegetation type and extent, provides an opportunity to quantify the impacts of land clearing on individual vegetation types in Western Australia (Shepherd et al. 2002), which in turn provides one of several means to assess the conservation significance of vegetation types.

The EPA has articulated several key criteria relating to levels of clearing, for use in assessing vegetation conservation significance. These criteria, based on the COAG Standing Council on Environment and Water *Australia's Native Vegetation Framework* (COAG SCEW 2012), are as follows:

- The threshold level below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-clearing extent of the vegetation type.
- A level of 10% of the original extent is regarded as being a level representing “endangered”.

These criteria provide a tool to assess vegetation conservation significance with the 30% and 10% thresholds guiding decisions on vegetation clearing, reservation and protection.

2.3.4.1 Regional vegetation significance

As part of the state government's Bush Forever strategy (Western Australian Planning Commission (WAPC), 2000) a set of ecological criteria were established for assessing local and regional vegetation conservation significance within bush forever sites, which employed the above-mentioned 30% and 10% thresholds.

The criteria used in Bush Forever (Government of Western Australia 2000) for identifying regionally significant natural areas were:

- Representation of ecological communities
- Diversity
- Rarity
- Maintaining ecological processes or natural systems
- Scientific or evolutionary importance
- General criteria for protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation.

2.3.4.2 Local vegetation significance

The Bush Forever guidelines have been expanded upon in the Local government biodiversity planning guidelines for the Perth Metropolitan Region (Del Marco et al. 2004).

Locally Significant Natural Areas (LSNAs) are Local Natural Areas that meet one or more ecological criteria of significance and have been verified in the field. The fact that a natural area is confirmed as "locally significant" does not necessarily mean that it must and can be protected (Del Marco et al. 2004). LNA refers to all-natural areas, not just bushland, that exist outside of the DBCA Managed Estates, regional parks and Bush Forever sites (Del Marco et al. 2004).

3 EXISTING INFORMATION

3.1 Climate

The site is located on the SCP, which experiences a Mediterranean climate characterised by hot, dry summers and cool, wet winters, with an average maximum summer temperature of 31.6 °C and an average minimum winter temperature of 6.9 °C (Bureau of Meteorology (BoM) 2019).

3.2 Geology and soils

The SCP consists of five major geomorphological elements as defined by McArthur and Bettanay (1960). From west to east these are the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf. These systems lie roughly parallel to the coast and are distinguished by their geology, topography, vegetation and soils.

The site lies within the Bassendean Dune System consisting of gently undulating low vegetated hills of quartz sands with numerous inter-dunal swamps and lakes. This dune system is the oldest and most leached of the three dune systems (Beard 1981). The Bassendean Dune System is described as of "generally low relief, often with broad swales or relatively flat sand sheets between the low dunes. Soils are predominantly deep grey leached quartz sands".

3.3 Interim biogeographical regionalisation of Australia

The Interim biogeographic regionalisation for Australia (IBRA) divides Australia into bioregions based on major biological and geographical/geological attributes (Thackway and Cresswell 1995). The IBRA currently recognises 89 bioregions and 419 biological subregions in Australia. The site lies within the Perth (SWA02) subregion of the SCP bioregion (DEE 2012).

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone and the vegetation is described by Mitchell et al. (2002) as heath and/or tuart woodlands on limestone, banksia and jarrah-banksia woodlands on quaternary marine dunes of various ages and marri on colluvial and alluvials.

3.4 Beard vegetation mapping

The site is situated in South West Botanical Province and the Darling Botanical District (Beard 1990). This region typically consists of forest country with related woodlands and is divided into four botanic subdistricts. The site is located within the SCP Subregion in the Drummond Botanical Subdistrict, which consists mainly of the following vegetation communities according to Beard (1990):

- Banksia Low Woodland on leached sands and Melaleuca Swamps in poorly drained areas
- Woodland of tuart (*Eucalyptus gomphocephala*); and jarrah (*Eucalyptus marginata*) and marri (C*orymbia calophylla*) on less leached soils.

Vegetation mapping of the Pinjarra region was completed by Beard (1979) at a scale of 1:250,000. Shepherd, Beetson and Hopkins (2002) reassessed Beard's existing mapping dividing some of the broader vegetation units up into smaller units. The site intersects one vegetation associations described by Shepherd, Beetson and Hopkins (2002) as:

- Bassendean 1001: Medium very sparse woodland; jarrah, with low woodland; Banksia and Casuarina (Shepherd et al. 2002).

The current extent of this vegetation association within the Perth (SWA02) subregion is presented in Table 1.

Table 1: Regional representation of Bassendean 1001 Vegetation Association within the Perth (SWA02) subregion

Vegetation association	Pre-European extent (ha)	Present extent (ha) remaining	% of present extent remaining	% of present extent in secure tenure
Bassendean 1001	57,410	12,661	22*	2.80

* Below 30% target for biodiversity conservation (Government of Western Australia 2019)

3.5 Vegetation complexes

According to the 1:250,000 scale vegetation mapping completed by Heddle et al. (1980), the site belongs to the Bassendean Complex – Central and South. This vegetation complex is described below:

> ***Bassendean Complex – Central and South***: Vegetation ranges from woodland of *Eucalyptus marginata – Allocasuarina fraseriana – Banksia* species on the sand dunes to low woodlands of *Melaleuca* species and sedgelands on the low-lying depressions and swamps.

The conservation status of Bassendean Complex – Central and South within the IBRA SCP bioregion between Moore River and Dunsborough is presented in Table 2.

Table 2: Representation of Heddle (1980) Bassendean Complex – central and south on the Swan Coastal Plain

Vegetation complex	Pre-European extent (ha)	2015 extent (ha) remaining	% of 2015 extent remaining	% of 2015 extent secure for conservation in Perth Peel region
Bassendean complex – Central and South	87,416	22,846	26*	1.20

* Below 30% target for biodiversity conservation (EPA 2015)

3.6 Bush Forever

Bush Forever identifies areas of regional conservation value on the SCP portion of the Perth Metropolitan Region (PMR) with an aim to protect a comprehensive representation of the biological diversity on the SCP (Government of Western Australia 2000). The site is situated immediately adjacent to Bush Forever Site No. 390 – Fraser Road Bushland, Banjup. Previous floristic surveys have inferred two FCTs within this bush forever site are:

- FCT 4 – *Melaleuca preissiana* damplands
- FCT 23a – Central *Banksia attenuata – B. menziesii* woodlands.

4 RESULTS

4.1 Desktop review

4.1.1 Threatened and Priority flora database search results

A search of the DBCA's Threatened and Priority Flora and the DEE's Protected Matters was undertaken for known TF and PF records within a 5 km radius of the central coordinates S32 07.46 E115 52.45 (GDA94 Zone 50J). Seventeen conservation significant species were identified including four TF, two Priority 2, five Priority 3 and six Priority 4 species (Table 3).

The only one of these conservation significant taxa for which there were records within the site was *Caladenia huegelii* (PGV 2013).

Table 3: DBCA and DEE significant flora species search results (S32 07.46 E115 52.45)

Species	Conservation code (state)	Conservation code (Commonwealth)
Caladenia huegelii	Threatened	Endangered
Diuris drummondii	Threatened	
Drakaea elastica	Threatened	Endangered
Drakaea micrantha	Threatened	Vulnerable
Poranthera moorokatta	Priority 2	
Thelymitra variegata	Priority 2	
Byblis gigantea	Priority 3	
Cyathochaeta teretifolia	Priority 3	
Jacksonia gracillima	Priority 3	
Phlebocarya pilosissima subsp. *pilosissima*	Priority 3	
Stylidium paludicola	Priority 3	
Dodonaea hakettiana	Priority 4	
Kennedia beckxiana	Priority 4	
Microtis quadrata	Priority 4	
Stylidium longitubum	Priority 4	
Tripterococcus sp. *Brachylobus*	Priority 4	
Verticordia lindleyi subsp. *lindleyi*	Priority 4	

Some flora species have additional protection under the EPBC Act. In Western Australia, this predominantly consists of TF. These are also defined as TF species under the EPBC Act. Penalties apply for any damage to individuals, populations or habitats of species protected.

4.1.2 TEC and PEC database search results

DBCA maintain a database of state listed TECs and PECs and their locations. A search of the NatureMap database was undertaken for known TEC and PEC records within a 5 km radius of the site using the search coordinates S32 07.46 E115 52.45 (GDA94 Zone 50J).

Twelve records of three PECs were identified within the search area (Table 4). The site lies outside of the PEC buffers. The PECs are described in the Flora and Vegetation Survey of Lot 131 Jandakot Road, Banjup (360 Environmental 2015), situated to the north of the site.

The PMST search results identified two TECs potentially occurring in the area and their conservation status (Table 4).

Table 4: Surrounding TECs/PECs

Name	Description	Status (state)	Status (Commonwealth)
PECs			
SCP21c	Low-lying *Banksia attenuata* woodlands or shrublands	Priority 3	Endangered
SCP22	*Banksia ilicifolia* woodlands	Priority 3	Endangered
SCP24	Northern Spearwood shrublands and woodlands	Priority 3	Endangered
TECs			
	Banksia Woodlands of the Swan Coastal Plain ecological community	Priority 3	Endangered
	Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community	Priority 3	Critically Endangered

(DBCA 2019)

The Banksia Woodlands TEC is likely to occur within the area while the Tuart Woodlands TEC may occur within the area. SCP21c and SCP22 are components of the Endangered Banksia Woodlands TEC and SPC24 can be a component of it (DBCA 2019).

4.1.3 Previous surveys

Numerous surveys have been undertaken previously at the site and for surrounding landholdings. PGV's report pertains to the site, while the other three reports surveyed areas north, east and west of the site. A broad overview of the four flora and vegetation assessments is provided in the following sections.

4.1.3.1 Lot 821 Armadale Road Banjup, environmental assessment

A Level 1 (now reconnaissance) Flora and Vegetation Survey was undertaken at the site in 2012 by PGV. It involved a review of vegetation type and condition through aerial photography and conservation significant flora through database searches for Rare and Priority Flora and TECs / PECs. A site walkover was undertaken to ground truth the desktop study results. *Caladenia huegelii* populations were recorded by PGV in 2012 and monitored in 2015 and July to October 2016.

4.1.3.2 Lot 131 Jandakot Road, Banjup, flora and vegetation survey

A Level 2 (now detailed) Flora and Vegetation Survey was undertaken for Lot 131 to the north of the site by 360 Environmental in 2015. It involved a desktop study of relevant literature and databases to identify the significant species and communities, mapping their locations and mapping the vegetation condition and associations present.

4.1.3.3 Flora and vegetation assessment, Lot 4 Armadale Road, Banjup

A Level 2 (now detailed) Flora and Vegetation Survey was undertaken for Lot 4 which is directly west of the site by ENV Australia in 2013. It involved a comprehensive review of flora and vegetation databases and literature, inventorying plant species from field surveys on 24 October 2012, determining the vegetation associations and condition and conducting targeted searches of conservation significant flora on 12 and 15 October 2012 and recording introduced flora.

4.1.3.4 Level 1 flora and vegetation survey, Calleya site, Banjup

A Level 1 (now reconnaissance) Flora and Vegetation Survey was undertaken for Stockland's Calleya residential development which is to the west of the site by RPS in 2014. It involved a desktop review of significant flora species and a site visit on 6 and 7 October 2014 to detail the flora and vegetation on site. Also targeted searches of any TF or PF and an assessment of the condition and significance of vegetation present.

4.2 Previous field surveys

4.2.1 Flora

4.2.1.1 Flora statistics

RPS (2014) and ENV Australia (2013) recorded a total of 148 plant taxa in previous field surveys at locations form Lots 9004, 9002 and 132 to the west of the site and Lot 4 to the east of the site. From both locations, 21 were exotic (weed) species, and 6 from the western site were planted (non-local) rehabilitation species. These species are likely to be reflected in the flora present within the site's remnant vegetation. The list of species recorded from landholdings surrounding the site is presented in Appendix E.

These taxa represent 109 genera from 41 families. The families and genera represented by the greatest number of species are presented in Table 5 and Table 6.

Table 5: Dominant families within the surrounding landholdings

Family	Common name	No. of taxa (Lots 9004, 9002 and 132)	No of taxa (Lot 4)
MYRTACEAE	Myrtles	19	13
FABACEAE	Peas	12	8
PROTEACEAE		8	8
POACEAE	Grasses	7	4
ASTERACEAE	Daisies	7	4
ORCHIDACEAE	Orchids	7	1
HAEMODORACEAE	Bloodroot Family	5	5

Table 6: Dominant genera within the surrounding landholdings

Genus	Common name	No. of taxa (Lots 9004, 9002 and 132)	No of taxa (Lot 4)
Acacia	Wattles	5	3
Hibbertia	Buttercups	4	3
Caladenia	Spider orchids	4	1
Banksia		3	3
Stylidium	Trigger plants	2	3
Eremaea		1	3

4.2.1.2 Flora of conservation significance

One TF species, *Caladenia huegelii*, has previously been recorded within the site. Three populations consisting of 15 individual plants were recorded by PGV between 2012 and 2016. The findings of PGV's (2013) monitoring is provided in Appendix B.

The RPS targeted *Caladenia huegelii* survey was undertaken on 16 September 2019 in accordance with current guidance on surveying Australia's threatened orchids listed under the EPBC Act (CoA 2013).

The search involved a systematic grid-based search along transects spaced approximately 5 m apart within all the remnant vegetation within and adjacent to the Treeby LSP site deemed to have the potential habitat in Good or better condition (according to the Keighery (1994) condition scale) for *Caladenia huegelii* individuals. The survey traverses were recorded as tracks on a hand-held GPS and are shown in Figure D.

Potential habitat included areas of Banksia woodland with an intact native understorey, as well as areas of previously cleared Banksia woodland that had been rehabilitated, and where natural regeneration of the original understorey species was evident. For all *Caladenia huegelii* individuals identified within the search area the following information was recorded:

- Number of individuals
- Number of flowers per individual
- Location (on a hand-held GPS – GDA94 UTM zone 50)
- Photographs of the individual or population.

The locations of thee records from PGV and RPS are presented in Figure E.

No PF species identified by the NatureMap search (Appendix B) were recorded within the site. No other flora species of other conservation significance as stated in EPA (2016) or as listed in Bush Forever (Government of Western Australia 2000) were recorded within the site.

4.2.1.2.1 *Caladenia huegelii* Rchb.f. (TF)

Population 42 of *Caladenia huegelii* is located directly to the north of the site within Lot 820 Fraser Road. Population 42 is formally reserved for conservation through State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region (WAPC 2010) as it located within Bush Forever Site No. 390 – Fraser Road Bushland. Lot 820 is also managed by the DBCA. Sub-populations of Population 42 were discovered on adjacent landholdings (Department of Environment and Conservation (DEC) 2009) and it is likely that the population of *C. huegelii* that occurs within the site is an outlying sub-population of Population 42.

Caladenia huegelii is listed as TF in Western Australia and protected under the BC Act. The species is also listed as Endangered and protected federally under the EPBC Act. *C. huegelii* is a tuberous perennial herb belonging to the family Orchidaceae. It grows up to 60 cm tall with a single erect, pale green, hairy leaf and one or two (rarely three) pale greenish-cream flowers 7–10 cm across, with variable suffusions, lines and spots of red maroon. The large labellum has a pale greenish-cream base and a dark maroon recurved apex. The labellum has distinctively long, fine, sometimes split fringes, extending well above the column (WAH 2019; DEC 2009).



(Source: PGV 2016)

Plate 1: *Caladenia huegelii* individual located in the remnant Banksia woodland within the site

Caladenia huegelii occurs in mixed woodland of *Eucalyptus marginata, Banksia attenuata, B. ilicifolia and B. menziesii* with scattered *Allocasuarina fraseriana and Corymbia calophylla* over dense shrubs of *Stirlingia latifolia, Hypocalymma robustum, Hibbertia hypericoides, H. subvaginata, Xanthorrhoea preissii, Adenanthos cuneatus and Conostylis* species. Throughout its range the species tends to favour areas of dense undergrowth and occurs on deep grey–white sand associated predominantly with the Bassendean sand-dune system (DEC 2009).

Population 42 is one of the largest populations of the species on the SCP, which occurs on private property, road reserve and within Bush Forever Site 390, and contains hundreds of plants occupying an area greater than 20 hectares (DEC 2009). A targeted search during the documented flowering time of the species between mid-September and mid-October (DEC 2009) is required to identify presence of the species within the search area. Fifteen individual plants have previously been recorded within the Banksia woodland vegetation along the western boundary of the site (Figure E; PGV 2016). Due to the location of the orchid populations (i.e. proximate to firebreaks) the Banksia woodland habitat containing the orchids was fenced in 2016. These individuals have been subject to additional monitoring post 2016, with 10 plants (8 of which fully flowered) recorded in 2017 and 9 plants (7 of which fully flowered) recorded in 2018 (Pers. comm. Paul van der Moezel, July 2019). RPS observed one plant in full flower within the fenced Banksia woodland vegetation along the western boundary of the site, and two plants within the Bush Forever site No. 390 located immediately to the north of the site. These plants correspond with those from targeted searches undertaken in previous years and are marked with either white plastic markers or fence droppers. The locations of each of these individuals and a corresponding picture are presented in Table 7.

Table 7: Targeted *Caladenia Huegelii* search results

Photo	Location	GDA94 UTM zone 50H	
		Easting	Northing
	Lot 703 Armadale Rd, Treeby	0394001	6444760
	Bush Forever site 390	0394131	6444901
	Bush Forever site 390	0394172	6444902

4.2.1.3 Introduced flora (weeds)

Twenty-one introduced flora taxa (weeds) were recorded in field surveys from adjacent landholdings (RPS 2014; ENV Australia 2013). This is 17% and 10% of the total flora taxa recorded to the west and east, respectively, and they are likely to reflect the weeds present within the disturbed vegetation on site.

DBCA (2013) prioritises weeds in each region of WA based on invasiveness, ecological impact, potential and current distribution and feasibility of control. The ecological impact of the weeds is ranked as high (H), medium (M), low (L) or unknown (U) and their invasiveness as rapid (R), moderate (M), slow (S) and unknown (U). H category weeds recorded in the surrounding landholdings that should be prioritised for control are presented in Table 8.

Table 8: Weeds of high ecological impact rating (DBCA 2013) recorded within the surrounding landholdings

Weed	Present (Lots 9004, 9002 and 132)	Present (Lot 4)	Ecological impact	Invasiveness
Acacia longifolia	x	x	H	R
Arctotheca calendula	x		H	R
Avena barbata	x		H	R
Bromus diandrus	x		H	R
Fumaria capreolata	x		H	R
Gladiolus caryophyllaceus	x	x	H	R
Hypochaeris glabra	x	x	H	R
Lagurus ovatus	x		H	R
Leptospermum laevigatum	x		H	R
Olea europaea	x		H	R
Pelargonium capitatum	x		H	R

The Agriculture Protection Board under the *Agriculture and Related Resources Protection Act 1976* can "Declare" a plant that must be controlled or eradicated by landholders when it grows on their land. The control requirements of each plant species depends on the declaration status of the plant under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Appendix A, Table A1.8). None of the weed species likely to be found on site are listed as Declared Plants (DPIRD 2018).

4.2.2 Vegetation

4.2.2.1 Vegetation units

The site had been extensively cleared of vegetation with remnant vegetation within the management buffers along the western and southern boundaries of the site. Vegetation units were described and delineated for the site (Figure B; PGV 2013). Descriptions and photographs of the vegetation units for the site follow.

BmBaEmLOW

Banksia attenuata / *Banksia menziesii* / *Eucalyptus marginata* (Jarrah) Low Open Woodland over *Adenanthos cygnorum* (Woolly Bush) Open Tall Shrubland over *Hibbertia hypericoides* / *Lyginia barbata* / *Conostylis aculeata* Closed Low Heath / Herbland (Plate 2). This vegetation unit is the dominant vegetation type within the site.



Plate 2: BmBaEmLOW vegetation unit

BmAfLOW

Banksia menziesii / *Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* Open Tall Shrubland over *Eremaea pauciflora* Low Open Heath (Plate 3).



Plate 3: BmAfLOW vegetation unit

Rehabilitation

Adenanthos cygnorum Open Tall Shrubland over a disturbed understorey of weed species and regenerating native species (Plate 4). This vegetation unit encompasses most of the site.



Plate 4: Rehabilitation works and natural regeneration vegetation unit

4.2.2.2 Floristic community types

PGV (2013) noted that the remnant vegetation within the site is likely to be FCT 23a Central *Banksia attenuata – Banksia menziesii* woodlands. This FCT is a component of the EPBC Act-listed Banksia Woodlands of the Swan Coastal Plain ecological community, however it is not recognised as a TEC or PEC by the State. SCP23a is restricted to the Bassendean System and occurs between Bullsbrook and Woodman Point. Species richness is very high and weed frequency is still relatively low. The community type's reservation status is Well Reserved, and its conservation status is considered Low Risk (Gibson et al. 1994).

A detailed plot-based study and multivariate analysis would be required to further confirm any FCT affiliations.

4.2.2.3 Vegetation condition

The site has undergone extensive clearing in the early 2000's and natural regeneration of native species has been ongoing since 2010, as noted through aerial photography (Government of Western Australia 2019b). The vegetation condition within the site is predominately "Completely Degraded" in the previously cleared area to "Good" and "Good to Very Good" throughout the remnant vegetation along its western border (Figure C).

4.2.2.4 Vegetation conservation significance

The Banksia woodland vegetation units are broadly representative of the Banksia Woodland of the Swan Coastal Plain ecological community, which is listed as a Threatened Ecological Communities (TEC) under the EPBC Act.

However, the 0.68 ha extent of the BmBaEmLOW vegetation unit in Good to Very Good condition is below the Commonwealth's 1 ha Very Good condition minimum patch size, whilst the 0.98 ha combined extent of the Banksia woodland vegetation units is below the Commonwealth's minimum 2 ha Good condition patch size. As the Banksia woodland vegetation units do not meet the Commonwealth's minimum patch sizes, as identified in their approved conservation advice (Threatened Species Scientific Committee 2016), it is considered that the banksia woodland vegetation within the site is not the EPBC Act listed TEC.

Given that the Banksia woodland vegetation units are floristically similar to the EPBC Act listed Banksia Woodland of the Swan Coastal Plain TEC, with the likely FCT (23a Central *Banksia attenuata – Banksia menziesii* woodlands) forming a component of the EPBC Act listed TEC, it is considered that the banksia woodland vegetation units represent the DBCA-listed Banksia dominated woodlands of the Swan Coastal Plain IBRA region Priority Ecological Community (Priority 3).

Given that the BmBaEmLOW vegetation unit also supports *C. huegelii* populations this vegetation unit is considered to be of elevated conservation significance.

4.2.2.5 Regional representation

On a regional scale the site is mapped as Bassendean Complex – Central and South (Heddle 1980), and vegetation association Bassendean 1001 (Shepherd, Beetson and Hopkins 2002).

The Bassendean Complex – Central and South is estimated to have 26% of its pre-European extent remaining with 1.2% of the 2015 extent in secure for conservation (EPA 2015).

Bassendean 1001 Vegetation Association is estimated to have 22% of its pre-European extent remaining with 1.22% of the present extent in secure tenure (Government of Western Australia 2019).

The EPA's criteria for assessing vegetation conservation significance in relation to clearing are:

- The threshold level below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-clearing extent of the vegetation type.
- A level of 10% of the original extent is regarded as being a level representing "endangered".

The extent remaining of both Bassendean Complex – Central and South and Bassendean 1001 is below the threshold level of 30% set by the EPA and is therefore considered conservation significant.

4.2.2.6 Regionally significant vegetation

Within the SCP portion of the PMR, bushland of regional significance is identified by the criteria in Bush Forever (Government of Western Australia 2000) relating to representation of ecological communities; diversity; rarity; maintaining ecological processes or natural systems; scientific or evolutionary importance, as well as general criteria for protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation.

The vegetation within the site is significant because it satisfies one criterion relating to:

- **Rarity**: The Banksia woodland vegetation within the site in the western remnant vegetation is habitat for documented records of the Threatened Flora species *Caladenia huegelii*. These records represent a sub-population of Population 42 is located directly to the north of the site within Lot 820 Fraser Road.

4.2.2.7 Locally significant natural areas

The site is locally significant as it satisfies criteria relating to regional representation, diversity and rarity (Table 9).

Table 9: Criteria for assessing locally significant natural areas (Del Marco et al. 2004) applied to the site

1. Representation		
1a. Regional representation		
(i)	Any natural area with recognised International, National, State or Regional Conservation Value (outside Bush Forever Sites and Department of Conservation and Land Management [CALM] Managed Estate) that is not yet protected and/or managed for conservation (Essential)	NO
(ii)	Natural areas of an ecological community with only 1500 ha or 30% or less (whichever is greater) of their pre-European extent remaining in the South West NRM Region portion of the SCP (Desirable)	YES – There is only 22% remaining of Bassendean 1001 vegetation association and 26% of Bassendean Complex – Central and South remaining
(iii)	Large (greater than 20 ha), viable natural area in good or better condition of an ecological community with over 30% of its pre-European extent remaining within the IBRA Subregion (Desirable)	NO
(iv)	Of an ecological community with only 1500 ha or 15% or less (whichever is the greater) protected for conservation in the Jarrah Forest IBRA Subregion (Desirable – Jarrah Forest Only.)	N/A
(v)	Natural area of an ecological community with only 400 ha or 10% or less (whichever is greater) protected for conservation in the Bush Forever Site (Essential)	NO – 13% of Bassendean Complex – Central and South is proposed for protection under Bush Forever
1b. Local representation		
(i)	Natural area of an ecological community with 10% or less of its pre-European extent remaining within the local government area (Essential)	NO
(ii)	Natural area of an ecological community with 30% or less of its pre-European extent remaining within the local government area (Desirable)	NO
(iii)	Large (greater than 10 ha), viable natural areas in good or better condition of an ecological community with more than 30% of its pre-European extent remaining within the local government area (Desirable)	NO
2. Diversity		
(i)	Natural areas in good or better condition that contain both upland and wetland structural plant communities (Essential)	NO
3. Rarity		
(i)	Natural areas of an ecological community with only 1500 ha or 10% or less (whichever is the greater) of their pre-European extent remaining in the IBRA Subregion (Essential)	NO
(ii)	Natural areas of an ecological community with only 400 ha or 10% or less (whichever is the greater) of their pre- European extent remaining in the Bush Forever Site (Essential)	NO
(iii)	Areas classified by DBCA as containing Threatened Ecological Communities (TECs) (English & Blyth 1997, 1999; DEC TEC GIS database, undated) (Essential)	NO - Banksia woodland vegetation is the DBCA-listed Banksia dominated woodlands of the Swan Coastal Plain IBRA region PEC (Priority 3).
(iv)	Natural areas containing Threatened Flora (TF), Specially Protected Fauna (SPF) or significant habitat for Specially Protected Fauna (Essential)	YES – Contains records of TF species *Caladenia huegelii*
(v)	Natural areas containing Priority or other significant flora or fauna or significant habitat for these fauna (Essential)	NO
4. Maintaining ecological processes or natural systems – connectivity		
(i)	Natural areas acting as stepping stones within a Regional Ecological Linkage (Essential)	NO – Forms part of a linkage but not integral
(ii)	Natural areas acting as stepping stones within a within a local ecological linkage determined by a local government (Essential).	NO – Forms part of a linkage but not integral

5. Protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation		
(i)	Wetlands meeting the criteria for listing as Conservation Category or Resource Enhancement Wetlands plus an appropriate buffer (minimum 50 m) in addition to the wetland dependent vegetation (Essential)	NO
(ii)	Riparian vegetation along rivers, creek lines and other channel wetlands plus an appropriate buffer (minimum 50 m) in addition to the riparian (wetland dependant) vegetation (Essential)	NO
(iii)	Flood plains delineated on the basis of ecological and geomorphic features plus an appropriate buffer (minimum 50 m) in addition to the flood plain area (Essential)	NO
(iv)	Estuarine fringing vegetation plus an appropriate buffer (minimum 50 m) of non-estuarine vegetation (Essential)	NO
(v)	Coastal vegetation on the foredunes and secondary dunes (Essential)	NO

5 LIMITATIONS

As with any biological survey, additional flora species including potential rare, priority or other conservation significant species may be detected in subsequent surveys. For example, ephemeral species such as orchids are not always present in each year/season or at the time a single botanical survey is conducted. This is a common to limitation to all botanical surveys.

Approximately 10% of Western Australian flora species are undescribed, with new species found regularly. The flora identifications for this project were completed in line with the taxonomic resources and expertise available at the time.

The statistics for percentage of vegetation complexes is derived from dated aerial photography circa 1997–1998 with limited ground-truthing. Consequently, the percentages of ecological communities remaining may be an overestimate of the native vegetation remaining at present. This limitation is common to all data analysis utilising regional vegetation complex information. Additionally, the percentage figures stated in Table 2 do not take into account the condition of the remaining vegetation.

Affiliation of TECs or FCTs cannot be confirmed without a plot based multivariate analysis (Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016)).

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FIGURES



Figure A

Site location

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: L17096-004-FV
Doc Number: 001
Date: 05-07.19
Scale: Map 1:5,000 Overview 1:500,000 @ A4
Created by: MA
Source: Imagery - Landgate

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LEGEND

Site boundary

FRASER RD

ARMADALE RD

ARMADALE RD

VEGETATION UNITS LEGEND	
Label	**Description**
BmBaEmLOW	*Banksia attenuata* /*Banksia menziesii* /*Eucalyptus marginata* (Jarrah) Low Open Woodland *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Hibbertia hypericoides* /*Lyginia barbata* /*Conostylis aculeata* Closed Low Heath.
BmAfLOW	*Banksia menziesii* /*Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Eremaea pauciflora* Low Open Heath.
Post sand mining	*Adenanthos cygnorum* (Woolly Bush) Open scrubland over a disturbed understorey of non-local and regenerating native species.

Figure B

Vegetation units

GDA 1994 MGA Zone 50

0 25 50 100 m

Job Number: L17096-004-FV
Doc Number: 002
Date: 02.09.19
Scale: 1:2,000 @ A3
Created by: MA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\Figures Flora and Veg (FV)\L17096-004_FV_002_FigB_Vegetation Units_190902.mxd



Figure C

Vegetation condition

GDA 1994 MGA Zone 50

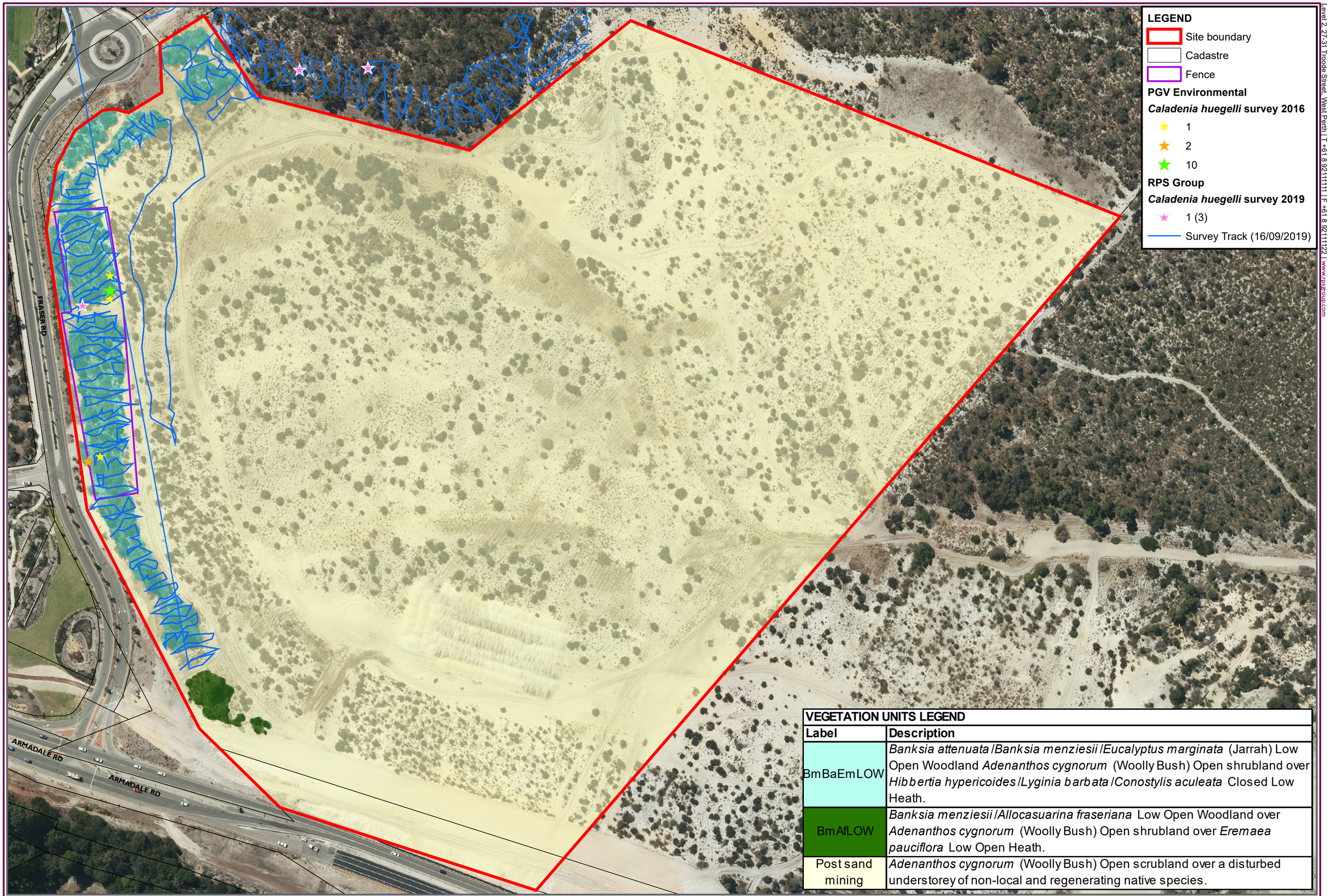
0 25 50 100 m

Job Number: L17096-004-FV
Doc Number: 003
Date: 05.07.19
Scale: 1:2,000 @ A3
Created by: MA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

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Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\Figures Flora and Veg (FV)\L17096-004_FV_003_FigC_Vegetation Condition_190705.mxd



VEGETATION UNITS LEGEND	
Label	**Description**
BmBaEmLOW	*Banksia attenuata* /*Banksia menziesii* /*Eucalyptus marginata* (Jarrah) Low Open Woodland *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Hibbertia hypericoides* /*Lyginia barbata* /*Conostylis aculeata* Closed Low Heath.
BmAfLOW	*Banksia menziesii* /*Allocasuarina fraseriana* Low Open Woodland over *Adenanthos cygnorum* (Woolly Bush) Open shrubland over *Eremaea pauciflora* Low Open Heath.
Post sand mining	*Adenanthos cygnorum* (Woolly Bush) Open scrubland over a disturbed understorey of non-local and regenerating native species.

Figure D

2019 Targeted *Caladenia huegelii* search

GDA 1994 MGA Zone 50

0 25 50 m 100

Job Number: L17096-004-EAR
Doc Number: 004
Date: 18.09.19
Scale: 1:2,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\Figures Flora and Veg (FV)\L17096-004_FV_004_FigD 2019 Targeted Caladenia huegelii search_190918.mxd

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Figure E

***Caladenia huegelli* (spider orchid) locations**

GDA 1994 MGA Zone 50

0 25 50 100 m

Job Number: L17096-004-FV
Doc Number: 005
Date: 11.07.19
Scale: 1:2,000 @ A3
Created by: RA

Source: Cadastre - Landgate, 2019 Orthophoto - Landgate, Aug 2018

Document Path: G:\Jobs\L_Jobs\L17096 - LWP Treeby DD\Figures L17096-004 - LWP Treeby DD\Figures Flora and Veg (FV)\L17096-004_FV_005_FigE Caladenia huegelli (spider orchid) locations_190711.mxd

Appendix A

Definitions

APPENDIX A: DEFINITIONS

Table A1.1: Conservation codes for Western Australian flora (DBCA 2019)

Category	Definition
T	Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). **Threatened flora** is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below. • CR: Critically Endangered – considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". • EN: Endangered – considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines" • VU: Vulnerable – considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".
EX	Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	a. Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. b. Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Table A1.2: EPBC Act conservation categories (IUCN Red List 2014)

Category	Definition
EX	**Extinct** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	**Extinct in the Wild** A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	**Critically Endangered** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	**Endangered** A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	**Vulnerable** A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NT	**Near Threatened** A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	**Least Concern** A taxon is Least Concern when it has been evaluated against the criteria and it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	**Data Deficient** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period has elapsed since the last record of the taxon, threatened status may well be justified.
NE	**Not Evaluated** A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Table A1.3: FCT Reservation Status Categories (Gibson et al. 1994)

Reservation status	Description
Well Reserved	Known from two or more A class National Parks or Nature Reserves
Poorly Reserved	Known from a single A class National Park or Nature Reserve
Unreserved	Not known to occur in any A class National Park or Nature Reserve.

Table A1.4: FCT Conservation Status Categories (Gibson et al. 1994)

Conservation Status	Description
Presumed destroyed	A community that is totally destroyed or so extensively modified that it is unlikely to re-establish ecosystem processes in the foreseeable future.
Critical	A community with most or all of its known occurrences facing severe modification or destruction in the immediate future.
Endangered	A community in danger of severe modification or destruction throughout its range, if causal factors continue operating.
Vulnerable	A community likely to move into the endangered category in the near future if the causal factors continue operating.
Susceptible	A community of concern because there is evidence that it can be modified or destroyed by human activities or would be vulnerable to new threatening process.
Low Risk	A community that does not qualify for one of the above categories

Table A1.5: Threatened Ecological Communities Category of Threat (English and Blyth 1997)

Category	Definition
Presumed Totally Destroyed (PD)	An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies: 1. Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats or; 2. All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria: 1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and **either or both** of the following apply: – Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately five years). – Modification throughout its range is continuing such that in the immediate future (within approximately five years) the community is unlikely to be capable of being substantially rehabilitated. 2. Current distribution is limited, and **one or more** of the following apply (a, b or c): a. Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately five years). b. There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. c. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. 3. The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately five years).

Category	Definition
Endangered (EN)	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (1, 2, or 3): 1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and either or both of the following apply (a or b): a. Geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years). b. Modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated. 2. Current distribution is limited, and one or more of the following apply (a, b or c): a. Geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years). b. There are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes. c. There may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. 3. The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (1, 2 or 3): 1. The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated. 2. The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. 3. The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.
Data Deficient (DD)	An ecological community which has not been adequately evaluated with respect to status or where there is currently insufficient information to assign it to a particular category. (An ecological community with poorly known distribution or biology that is suspected to belong to any of the above categories. These ecological communities have a high priority for survey and/or research.)
Lower Risk (LR)	An ecological community that has been adequately surveyed and does not qualify for any of the above categories of threat and appears unlikely to be under threat of significant modification or destruction in the short to medium term future.

Table A1.6: Vegetation Structure Classes (WAPC 2000)

Life form / height class	Canopy cover (percentage)			
	100%–70%	70%–30%	30%–10%	10%–2%
Trees 10–30 m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees < 10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1–2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs <1 m	Closed Low Heath	Open Low Heath	Low Shrubland	Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Table A1.7: Vegetation Condition Scale (Keighery 1994)

Condition		Definition
P	Pristine	No obvious signs of disturbance.
E	Excellent	Vegetation structure intact, disturbance affecting individual species; weeds are non-aggressive species
V	Very Good	Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
C	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ("parkland cleared").

Table A1.8: Control Requirements of Declared Plants

Requirements	Definition
P1 REQUIREMENTS Prohibits movement	The movement of plants or their seeds is prohibited within the state. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P3 REQUIREMENTS Aims to control infestation by reducing area and/or density of infestation	The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants: • within 100 metres inside of the boundaries of the infestation • within 50 metres of roads and high water mark on waterways • within 50 metres of sheds, stock yards and houses. Treatment must be done prior to seed set each year. Of the remaining infested area: • Where plant density is 1–10 per hectare treat 100% of infestation. • Where plant density is 11–100 per hectare treat 50% of infestation. where plant density is 101–1000 per hectare treat 10% of infestation. Properties with less than 2 hectares of infestation must treat the entire infestation. Additional areas may be ordered to be treated.
P4 REQUIREMENTS Aims to prevent infestation spreading beyond existing boundaries of infestation	The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants: • within 100 metres inside of the boundaries of the infested property • within 50 metres of roads and high water mark on waterways • within 50 metres of sheds, stock yards and houses. Treatment must be done prior to seed set each year. Properties with less than 2 hectares of infestation must treat the entire infestation. Additional areas may be ordered to be treated.
Special Considerations	In the case of P4 infestations where they continue across property boundaries, there is no requirement to treat the relevant part of the property boundaries as long as the boundaries of the infestation as a whole are treated. There must be agreement between neighbours in relation to the treatment of these areas.

Appendix B

NatureMap search report

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 10/07/2019

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 52' 45" E,32° 07' 46" S
Buffer 5km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	1012	19385
Other specially protected fauna	1	8
Priority 1	1	4
Priority 2	2	3
Priority 3	9	166
Priority 4	11	252
Protected under international agreement	16	277
Rare or likely to become extinct	12	355
TOTAL	**1064**	**20450**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
2.	1596	*Caladenia huegelii (Grand Spider Orchid)*		T	
3.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
4.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
5.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
6.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
7.	10796	*Diuris drummondii (Tall Donkey Orchid)*		T	
8.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
9.	13635	*Drakaea micrantha*		T	
10.	24146	*Myrmecobius fasciatus (Numbat, Walpurti)*		T	
11.	48237	*Rostratula australis (Australian Painted Snipe)*		T	
12.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Protected under international agreement					
13.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
14.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
15.	24786	*Calidris melanotos (Pectoral Sandpiper)*		IA	
16.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
17.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
18.	25574	*Charadrius dubius (Little Ringed Plover)*		IA	
19.	47954	*Gelochelidon nilotica (Gull-billed Tern)*		IA	
20.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
21.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
22.	24802	*Philomachus pugnax (Ruff, reeve)*		IA	
23.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
24.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
25.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
26.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
27.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
28.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
Other specially protected fauna					
29.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Priority 1					
30.	33994	*Throscodectes xiphos (Stylet Bush Cricket, Stylet Throsco (Jandakot))*		P1	Y
Priority 2					
31.	42022	*Poranthera moorokatta*		P2	
32.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Priority 3					
33.	3178	*Byblis gigantea (Rainbow Plant)*		P3	
34.	16245	*Cyathochaeta teretifolia*		P3	
35.	48935	*Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)*		P3	
36.	20462	*Jacksonia gracillima*		P3	
37.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
38.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
39.	11557	*Phlebocarya pilosissima subsp. pilosissima*		P3	
40.	25800	*Stylidium paludicola*		P3	
41.	48297	*Styphelia filifolia*		P3	
Priority 4					
42.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
43.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
44.	47975	*Ixobrychus dubius (Australian Little Bittern)*		P4	
45.	4035	*Kennedia beckxiana (Cape Arid Kennedia)*		P4	
46.	33742	*Microtis quadrata*		P4	
47.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
48.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
49.	7756	*Stylidium longitubum (Jumping Jacks)*		P4	
50.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
51.	44444	*Tripterococcus sp. Brachylobus (A.S. George 14234)*		P4	
52.	14714	*Verticordia lindleyi subsp. lindleyi*		P4	
Non-conservation taxon					
53.		*?Adenanthos obovatus*			Y
54.		*?Amphipogon turbinatus*			Y
55.		*?Anigozanthos humilis*			
56.		*?Asparagus asparagoides*			Y
57.		*?Astroloma pallidum*			Y
58.		*?Austrostipa compressa*			
59.		*?Boronia ramosa*			Y
60.		*?Briza maxima*			Y
61.		*?Burchardia congesta*			
62.		*?Caesia sp.*			Y
63.		*?Caladenia discoidea*			Y
64.		*?Calandrinia sp.*			Y
65.		*?Calytrix angulata*			Y
66.		*?Calytrix flavescens*			Y
67.		*?Calytrix sp.*			Y
68.		*?Chamaescilla corymbosa*			Y
69.		*?Cirsium vulgare*			Y
70.		*?Conostylis aculeata*			Y
71.		*?Conostylis juncea*			Y
72.		*?Conostylis sp.*			Y
73.		*?Conyza bonariensis*			Y
74.		*?Dampiera linearis*			
75.		*?Dasypogon bromeliifolius*			Y
76.		*?Diuris corymbosa/magnifica*			Y
77.		*?Ehrharta calycina*			Y
78.		*?Epilobium hirtigerum*			Y
79.		*?Epilobium sp.*			
80.		*?Eremaea pauciflora*			Y
81.		*?Euchiton sphaericus*			Y
82.		*?Gonocarpus pithyoides*			Y
83.		*?Haemodorum spicatum*			
84.		*?Hemiandra sp.*			Y
85.		*?Hibbertia subvaginata*			Y
86.		*?Hovea trisperma var. trisperma*			
87.		*?Hypocalymma angustifolia*			Y
88.		*?Isolepis marginata*			Y
89.		*?Kunzea glabrescens*			
90.		*?Lactuca serriola*			
91.		*?Lepidosperma sp.*			Y
92.		*?Lepidosperma squamatum s.l.*			
93.		*?Leptomeria empetriformis*			Y
94.		*?Leucopogon conostephioides*			Y
95.		*?Lomandra caespitosa*			
96.		*?Lomandra sp.*			Y
97.		*?Lomandra suaveolens*			Y
98.		*?Lotus subbiflorus*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
99.		*?Lysimachia arvensis*			
100.		*?Melaleuca thymoides*			Y
101.		*?Monoculus monstrosus*			Y
102.		*?Opercularia vaginata*			Y
103.		*?Pelargonium capitatum*			Y
104.		*?Petrophile linearis*			Y
105.		*?Petrorhagia dubia*			Y
106.		*?Philotheca spicata*			Y
107.		*?Phlebocarya ciliata*			
108.		*?Phlebocarya filifolia*			Y
109.		*?Phlebocarya sp.*			Y
110.		*?Podotheca sp.*			Y
111.		*?Rhodanthe citrina*			Y
112.		*?Romulea rosea*			Y
113.		*?Rytidosperma occidentalis*			
114.		*?Schoenus curvifolius*			Y
115.		*?Scholtzia involucrata*			Y
116.		*?Solanum nigrum*			Y
117.		*?Sowerbaea laxiflora*			
118.		*?Stylidium repens*			Y
119.		*?Stylidium schoenoides*			Y
120.		*?Thysanotus manglesianus/patersonii complex*			Y
121.		*?Urospermum picroides*			Y
122.		*?Wahlenbergia capensis*			Y
123.		*?Wahlenbergia preissii*			Y
124.		*?Wahlenbergia sp.*			Y
125.		*?Xanthorrhoea brunonis*			Y
126.		*?Zantedeschia aethiopica*			Y
127.		*Acacia ?pulchella*			Y
128.	3207	*Acacia alata (Winged Wattle)*			
129.	15466	*Acacia applanata*			
130.	3262	*Acacia cochlearis (Rigid Wattle)*			
131.	3307	*Acacia divergens*			
132.	3374	*Acacia huegelii*			
133.	17861	*Acacia longifolia*	Y		
134.	3502	*Acacia pulchella (Prickly Moses)*			
135.		*Acacia pulchella ?var glaberrima*			Y
136.	15481	*Acacia pulchella var. glaberrima*			
137.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
138.	30032	*Acacia saligna subsp. saligna*			
139.		*Acacia sp.*			
140.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
141.	3581	*Acacia trigonophylla*			
142.	3602	*Acacia willdenowiana (Grass Wattle)*			
143.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
144.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
145.	24262	*Acanthiza inornata (Western Thornbill)*			
146.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
147.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
148.	25536	*Accipiter fasciatus (Brown Goshawk)*			
149.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
150.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
151.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
152.	24831	*Acrocephalus australis subsp. gouldi (Australian Reed Warbler)*			
153.	1775	*Adenanthos cygnorum (Common Woollybush)*			
154.	11837	*Adenanthos cygnorum subsp. cygnorum (Common Woollybush)*			
155.	1791	*Adenanthos obovatus (Basket Flower)*			
156.		*Aira caryophyllea/cupaniana group*			
157.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
158.	187	*Aira praecox (Early Hairgrass)*	Y		
159.		*Aira/Pentameris sp.*			Y
160.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
161.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
162.	200	*Amphipogon turbinatus*			
163.		*Aname mainae*			
164.		*Aname tepperi*			
165.	24310	*Anas castanea (Chestnut Teal)*			
166.	24312	*Anas gracilis (Grey Teal)*			
167.	24313	*Anas platyrhynchos (Mallard)*			
168.		*Anas platyrhynchos subsp. domesticus*			

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169.	24315	*Anas rhynchotis (Australasian Shoveler)*			
170.	24316	*Anas superciliosa (Pacific Black Duck)*			
171.	7833	*Angianthus preissianus*			
172.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
173.		*Anigozanthos ?humilis*			Y
174.	11434	*Anigozanthos humilis subsp. humilis*			
175.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
176.	11261	*Anigozanthos manglesii subsp. manglesii*			
177.		*Anigozanthos sp.*			
178.	44629	*Anilios australis*			
179.		*Anser anser*			
180.	24561	*Anthochaera carunculata (Red Wattlebird)*			
181.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
182.	12724	*Anthotium junciforme*			
183.	3686	*Aotus cordifolia*			
184.	3692	*Aotus procumbens*			
185.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
186.	24285	*Aquila audax (Wedge-tailed Eagle)*			
187.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
188.	38963	*Arcyria affinis*			Y
189.	38964	*Arcyria cinerea*			
190.	38965	*Arcyria denudata*			
191.	38966	*Arcyria ferruginea*			
192.	38967	*Arcyria incarnata*			
193.	38970	*Arcyria obvelata*			
194.	38973	*Arcyria pomiformis*			
195.	38974	*Arcyria stipata*			Y
196.	25558	*Ardea ibis (Cattle Egret)*			
197.	41324	*Ardea modesta (great egret, white egret)*			
198.	24340	*Ardea novaehollandiae (White-faced Heron)*			
199.	24341	*Ardea pacifica (White-necked Heron)*			
200.	207	*Aristida contorta (Bunched Kerosene Grass)*			
201.	1264	*Arnocrinum preissii*			
202.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
203.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
204.		*Artoria flavimana*			
205.		*Artoria linnaei*			
206.		*Artoria taeniifera*			
207.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
208.	20283	*Astartea scoparia (Common Astartea)*			
209.		*Asteraceae sp.*			
210.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
211.	6323	*Astroloma ciliatum (Candle Cranberry)*			
212.	6334	*Astroloma pallidum (Kick Bush)*			
213.	6339	*Astroloma xerophyllum*			
214.	2471	*Atriplex prostrata (Hastate Orache)*	Y		
215.		*Austrostipa ?compressa*			
216.	17234	*Austrostipa compressa*			
217.	17240	*Austrostipa flavescens*			
218.	17245	*Austrostipa mollis*			
219.	17253	*Austrostipa semibarbata*			
220.		*Austrostipa sp.*			
221.	233	*Avena barbata (Bearded Oat)*	Y		
222.	24318	*Aythya australis (Hardhead)*			
223.	17737	*Azolla pinnata*			
224.	42902	*Azolla rubra*			
225.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
226.	38975	*Badhamia capsulifera*			Y
227.	38976	*Badhamia foliicola*			
228.	38977	*Badhamia goniospora*			Y
229.		*Ballarra longipalpus*			
230.		*Banksia ?menziesii*			Y
231.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
232.	32580	*Banksia dallanneyi subsp. dallanneyi var. dallanneyi*			
233.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
234.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			
235.	1834	*Banksia menziesii (Firewood Banksia)*			
236.		*Banksia sp.*			
237.	1852	*Banksia telmatiaea (Swamp Fox Banksia)*			
238.		*Barnardius zonarius*			

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239.	741	*Baumea articulata (Jointed Rush)*			
240.	743	*Baumea juncea (Bare Twigrush)*			
241.	744	*Baumea laxa*			
242.	5382	*Beaufortia elegans (Elegant Beaufortia)*			
243.	7046	*Bellardia trixago (Bellardia)*	Y		
244.	48868	*Bellardia viscosa*	Y		
245.	24319	*Biziura lobata (Musk Duck)*			
246.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
247.	16636	*Boronia crenulata subsp. viminea*			
248.	4417	*Boronia dichotoma*			
249.	4420	*Boronia fastigiata (Bushy Boronia)*			
250.	11381	*Boronia ramosa subsp. anethifolia*			
251.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
252.	6341	*Brachyloma preissii (Globe Heath)*			
253.	7867	*Brachyscome bellidioides*			
254.	7878	*Brachyscome iberidifolia*			
255.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
256.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
257.	2995	*Brassica x napus*	Y		
258.	244	*Briza maxima (Blowfly Grass)*	Y		
259.	245	*Briza minor (Shivery Grass)*	Y		
260.	249	*Bromus diandrus (Great Brome)*	Y		
261.	1383	*Burchardia bairdiae*			
262.	12770	*Burchardia congesta*			
263.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
264.	25716	*Cacatua sanguinea (Little Corella)*			
265.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
266.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
267.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
268.	1276	*Caesia micrantha (Pale Grass Lily)*			
269.	1277	*Caesia occidentalis*			
270.		*Caesia sp.*			
271.		*Caladenia ?arenicola*			Y
272.		*Caladenia ?flava*			
273.		*Caladenia ?longicauda subsp. calcigena*			Y
274.	15330	*Caladenia arenicola*			
275.	1586	*Caladenia discoidea (Dancing Orchid)*			
276.	1592	*Caladenia flava (Cowslip Orchid)*			
277.	15348	*Caladenia flava subsp. flava*			
278.	15502	*Caladenia footeana*			
279.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
280.	15361	*Caladenia longicauda subsp. calcigena*			
281.	1605	*Caladenia marginata (White Fairy Orchid)*			
282.	17589	*Caladenia occidentalis*			
283.	15503	*Caladenia paludosa*			
284.		*Caladenia sp.*			
285.	15398	*Caladenia xantha*			
286.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
287.	2854	*Calandrinia granulifera (Pygmy Purslane)*			
288.	2856	*Calandrinia liniflora (Parakeelya)*			
289.		*Calandrinia sp.*			
290.	19309	*Calectasia narragara*			
291.	24787	*Calidris minuta (Little Stint)*			
292.	36600	*Callitris pyramidalis (Swamp Cypress)*			
293.	38981	*Calomyxa metallica*			
294.	5411	*Calothamnus hirsutus*			
295.	5415	*Calothamnus lateralis*			
296.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower, Pindak)*			
297.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
298.		*Calytrix ?angulata*			Y
299.	5439	*Calytrix angulata (Yellow Starflower)*			
300.		*Calytrix angulata/flavescens*			Y
301.	5458	*Calytrix flavescens (Summer Starflower)*			
302.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
303.		*Calytrix leschenaultii/fraseri*			Y
304.		*Calytrix sp.*			
305.	32338	*Campylopus introflexus*	Y		
306.	49010	*Cardamine occulta*	Y		
307.	7909	*Carduus pycnocephalus (Slender Thistle)*	Y		
308.	2794	*Carpobrotus aequilaterus (Angular Pigface)*	Y		

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309.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
310.	1162	*Cartonema philydroides*			
311.	2957	*Cassytha racemosa (Dodder Laurel)*			
312.	6542	*Centaurium tenuiflorum*	Y		
313.	6214	*Centella asiatica*			
314.	1125	*Centrolepis drummondiana*			
315.	1131	*Centrolepis inconspicua*			
316.	1134	*Centrolepis polygyna (Wiry Centrolepis)*			
317.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
318.	38982	*Ceratiomyxa fruticulosa*			
319.	17685	*Chaetanthus aristatus*			
320.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
321.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
322.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
323.	1280	*Chamaescilla corymbosa (Blue Squill)*			
324.	11299	*Chamaescilla corymbosa var. corymbosa*			
325.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
326.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
327.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
328.	2483	*Chenopodium album (Fat Hen)*	Y		
329.	2490	*Chenopodium glaucum (Glaucous Goosefoot)*	Y		
330.	33939	*Cherax cainii (Marron)*			
331.		*Cherax destructor*			
332.		*Cherax preissii*			
333.		*Cherax quinquecarinatus*			
334.		*Cherax sp.*			
335.		*Chiloscyphus semiteres var. semiteres*			
336.	7925	*Chondrilla juncea (Skeleton Weed)*	Y		
337.	17706	*Chordifex sinuosus*			
338.	8971	*Chorizema cordatum*			
339.	24980	*Christinus marmoratus (Marbled Gecko)*			
340.		*Chroicocephalus novaehollandiae*			
341.	24288	*Circus approximans (Swamp Harrier)*			
342.	24289	*Circus assimilis (Spotted Harrier)*			
343.	7937	*Cirsium vulgare (Spear Thistle, Scotch Thistle)*	Y		
344.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
345.	38983	*Clastoderma debaryanum*			
346.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
347.	24399	*Columba livia (Domestic Pigeon)*	Y		
348.	38986	*Comatricha elegans*			
349.	38988	*Comatricha laxa*			
350.	38990	*Comatricha nigra*			
351.	38991	*Comatricha pulchella*			
352.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
353.	4554	*Comesperma flavum*			
354.	1858	*Conospermum amoenum (Blue Smokebush)*			
355.	6348	*Conostephium pendulum (Pearl Flower)*			
356.	6349	*Conostephium preissii*			
357.		*Conostylis ?juncea*			Y
358.	1418	*Conostylis aculeata (Prickly Conostylis)*			
359.	11826	*Conostylis aculeata subsp. aculeata*			
360.	1423	*Conostylis aurea (Golden Conostylis)*			
361.	1436	*Conostylis juncea*			
362.	1453	*Conostylis serrulata*			
363.	1454	*Conostylis setigera (Bristly Cottonhead)*			
364.	11597	*Conostylis setigera subsp. setigera*			
365.	1455	*Conostylis setosa (White Cottonhead)*			
366.		*Conostylis sp.*			
367.		*Conyza ?bonariensis*			
368.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
369.		*Conyza sp.*			
370.	20074	*Conyza sumatrensis*	Y		
371.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
372.		*Cormocephalus aurantiipes*			
373.		*Cormocephalus rubriceps*			
374.	48259	*Cortaderia selloana subsp. selloana*	Y		
375.	24416	*Corvus bennetti (Little Crow)*			
376.	25592	*Corvus coronoides (Australian Raven)*			
377.	1285	*Corynotheca micrantha (Sand Lily)*			
378.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		

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379.	25701	*Coturnix ypsilophora (Brown Quail)*			
380.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
381.	25595	*Cracticus tibicen (Australian Magpie)*			
382.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
383.	25596	*Cracticus torquatus (Grey Butcherbird)*			
384.		*Crassula ?colorata*			Y
385.	3137	*Crassula colorata (Dense Stonecrop)*			
386.	11709	*Crassula colorata var. acuminata*			
387.	3139	*Crassula exserta*			
388.	38997	*Craterium leucocephalum*			
389.	38998	*Craterium minutum*			
390.	39001	*Cribraria cancellata*			
391.	39002	*Cribraria microcarpa*			
392.	39003	*Cribraria minutissima*			
393.	39006	*Cribraria tenella*			
394.	25399	*Crinia glauerti (Clicking Frog)*			
395.	25400	*Crinia insignifera (Squelching Froglet)*			
396.	13527	*Croninia kingiana*			
397.	30893	*Cryptoblepharus buchananii*			
398.		*Cryptoerithus quobba*			
399.	1627	*Cryptostylis ovata (Slipper Orchid)*			
400.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
401.	25027	*Ctenotus australis*			
402.	25040	*Ctenotus gemmula (Jewelled South-west Ctenotus (Swan Coastal Plain subpop P3), skink)*			
403.	6663	*Cuscuta epithymum (Lesser Dodder, Greater Dodder)*	Y		
404.	40660	*Cycnogeton huegelii*			
405.	24322	*Cygnus atratus (Black Swan)*			
406.	783	*Cyperus congestus (Dense Flat-sedge)*	Y		
407.		*Cyrtophora parnasia*			
408.	10916	*Cyrtostylis huegelii*			
409.	10942	*Cyrtostylis tenuissima*			
410.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
411.	7454	*Dampiera linearis (Common Dampiera)*			
412.	7462	*Dampiera pedunculata*			
413.		*Daphnia carinata*			
414.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
415.	5508	*Darwinia citriodora (Lemon-scented Darwinia)*			
416.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
417.	6218	*Daucus glochidiatus (Australian Carrot)*			
418.	3807	*Daviesia divaricata (Marno)*			
419.	3832	*Daviesia physodes*			
420.	3845	*Daviesia triflora*			
421.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
422.	24999	*Delma grayii*			
423.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
424.	17691	*Desmocladus fasciculatus*			
425.	16595	*Desmocladus flexuosus*			
426.	1259	*Dianella revoluta (Blueberry Lily)*			
427.	11636	*Dianella revoluta var. divaricata*			
428.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
429.	1287	*Dichopogon capillipes*			
430.	32344	*Dicranoloma diaphanoneuron*			
431.	39011	*Diderma asteroides*			
432.	48606	*Diderma rufostriatum*			Y
433.	39017	*Didymium anellus*			
434.	39023	*Didymium perforatum*			Y
435.	39024	*Didymium serpula*			
436.	39025	*Didymium squamulosum*			
437.	32345	*Didymodon australasiae*			
438.	17838	*Dielsia stenostachya*			
439.		*Dingosa serrata*			
440.	19649	*Disa bracteata*	Y		
441.	7961	*Dittrichia graveolens (Stinkwort)*	Y		
442.		*Diuris ?magnifica*			Y
443.		*Diuris corymbosa/magnifica*			
444.	12939	*Diuris magnifica*			
445.		*Drosera ?porrecta*			
446.		*Drosera ?sp. "climbing"*			Y
447.	48751	*Drosera drummondii*			

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448.	3097	*Drosera gigantea (Giant Sundew)*			
449.	3106	*Drosera macrantha (Bridal Rainbow)*			
450.	3109	*Drosera menziesii (Pink Rainbow)*			
451.	48710	*Drosera micrantha*			
452.	3118	*Drosera pallida (Pale Rainbow)*			
453.	29178	*Drosera porrecta*			
454.		*Drosera sp.*			
455.		*Drosera sp. "climbing"*			
456.	3133	*Drosera subhirtella (Sunny Rainbow)*			
457.	3135	*Drosera zonaria (Painted Sundew)*			
458.	33500	*Dysphania ambrosioides (Mexican Tea)*	Y		
459.	2501	*Dysphania glomulifera*			
460.	11105	*Echinochloa crus-galli*	Y		
461.	39029	*Echinostelium minutum*			
462.	6681	*Echium plantagineum (Paterson's Curse)*	Y		
463.	25100	*Egernia napoleonis*			
464.		*Egretta garzetta*			
465.		*Egretta novaehollandiae*			
466.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
467.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
468.		*Ehrharta sp.*			
469.	42241	*Elaeomyxa reticulospora*			Y
470.		*Elanus axillaris*			
471.	25250	*Elapognathus coronatus (Crowned Snake)*			
472.	5187	*Elatine gratioloides (Waterwort)*			
473.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
474.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
475.	1644	*Elythranthera emarginata (Pink Enamel Orchid)*			
476.	39030	*Enerthenema papillatum*			
477.		*Eodelena convexa*			
478.		*Eolophus roseicapillus*			
479.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
480.	24567	*Epthianura albifrons (White-fronted Chat)*			
481.	13949	*Eremaea asterocarpa*			
482.	13950	*Eremaea asterocarpa subsp. asterocarpa*			
483.	5541	*Eremaea pauciflora*			
484.	14104	*Eremaea pauciflora var. pauciflora*			
485.	1646	*Eriochilus dilatatus (White Bunny Orchid)*			
486.	15412	*Eriochilus dilatatus subsp. multiflorus*			
487.	15414	*Eriochilus helonomos*			
488.	15415	*Eriochilus scaber subsp. scaber*			
489.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
490.		*Erythracarus decoris*			
491.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
492.		*Eucalyptus ?camaldulensis x robusta*			Y
493.		*Eucalyptus ?rudis*			Y
494.	48440	*Eucalyptus grandis*	Y		
495.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
496.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
497.	5739	*Eucalyptus patens (Swan River Blackbutt, Dwuda)*			
498.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
499.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
500.	3872	*Euchilopsis linearis (Swamp Pea)*			
501.	15137	*Euchiton sphaericus*			
502.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
503.	3880	*Eutaxia virgata*			
504.	25621	*Falco berigora (Brown Falcon)*			
505.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
506.	25623	*Falco longipennis (Australian Hobby)*			
507.	24041	*Felis catus (Cat)*	Y		
508.	1747	*Ficus carica (Common Fig)*	Y		
509.	18392	*Freesia alba x leichtlinii*	Y		
510.	25727	*Fulica atra (Eurasian Coot)*			
511.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
512.	39033	*Fuligo septica*			
513.		*Fumaria ?capreolata*			Y
514.	2969	*Fumaria capreolata (Whiteflower Fumitory)*	Y		
515.		*Fumaria sp.*			
516.	7323	*Galium murale (Small Goosegrass)*	Y		
517.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			

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518.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
519.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
520.	20247	*Gamochaeta calviceps*	Y		
521.	19195	*Gamochaeta pensylvanica*	Y		
522.	20475	*Gastrolobium capitatum*			
523.	20483	*Gastrolobium linearifolium*			
524.	42314	*Gavicalis virescens (Singing Honeyeater)*			
525.	24959	*Gehyra variegata*			
526.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
527.	25530	*Gerygone fusca (Western Gerygone)*			
528.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
529.	47962	*Glyciphila melanops (Tawny-crowned Honeyeater)*			
530.	12624	*Gnephosis angianthoides*			
531.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
532.	10909	*Gompholobium confertum*			
533.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
534.	6160	*Gonocarpus paniculatus*			
535.	6161	*Gonocarpus pithyoides*			
536.	24443	*Grallina cyanoleuca (Magpie-lark)*			
537.	37500	*Grammatotheca bergiana var. bergiana*	Y		
538.	2032	*Grevillea leucopteris (White Plume Grevillea)*			
539.		*Gymnopilus purpuratus*			
540.		*Haemodorum ?spicatum*			Y
541.	1470	*Haemodorum paniculatum (Mardja)*			
542.	1472	*Haemodorum simplex*			
543.		*Haemodorum sp.*			
544.	1475	*Haemodorum spicatum (Mardja)*			
545.	2128	*Hakea amplexicaulis (Prickly Hakea)*			
546.	2216	*Hakea varia (Variable-leaved Hakea)*			
547.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
548.	24295	*Haliastur sphenurus (Whistling Kite)*			
549.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
550.	25410	*Heleioporus eyrei (Moaning Frog)*			
551.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
552.	6838	*Hemiandra linearis (Speckled Snakebush)*			
553.	6839	*Hemiandra pungens (Snakebush)*			
554.	25119	*Hemiergis quadrilineata*			
555.	1293	*Hensmania turbinata*			
556.		*Hibbertia huegelii complex*			
557.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
558.	45534	*Hibbertia hypericoides subsp. hypericoides*			
559.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
560.		*Hibbertia racemosa/subvaginata*			Y
561.	43280	*Hibbertia sericosepala*			
562.	48381	*Hibbertia striata*			
563.	5173	*Hibbertia subvaginata*			
564.	5176	*Hibbertia vaginata*			
565.	47965	*Hieraaetus morphnoides (Little Eagle)*			
566.	25734	*Himantopus himantopus (Black-winged Stilt)*			
567.	24775	*Himantopus himantopus subsp. leucocephalus (Black-winged Stilt)*			
568.	24491	*Hirundo neoxena (Welcome Swallow)*			
569.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
570.	6222	*Homalosciadium homalocarpum*			
571.	3966	*Hovea pungens (Devil's Pins, Puyenak)*			
572.	3968	*Hovea trisperma (Common Hovea)*			
573.	12859	*Hovea trisperma var. trisperma*			
574.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
575.	38795	*Hygrocybe conica*			
576.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
577.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
578.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
579.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
580.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
581.	1070	*Hypolaena exsulca*			
582.	17841	*Hypolaena pubescens*			
583.	20200	*Isolepis cernua var. setiformis*			
584.	912	*Isolepis cyperoides*			
585.	917	*Isolepis marginata (Coarse Club-rush)*			
586.	921	*Isolepis producta*			
587.		*Isopeda leishmanni*			

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588.	19700	*Isotropis cuneifolia subsp. cuneifolia*			
589.	8092	*Ixiolaena viscosa (Sticky Ixiolaena)*			
590.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
591.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
592.	1178	*Juncus bufonius (Toad Rush)*	Y		
593.	1186	*Juncus microcephalus*	Y		
594.	1188	*Juncus pallidus (Pale Rush)*			
595.	1190	*Juncus planifolius (Broadleaf Rush)*			
596.	4044	*Kennedia prostrata (Scarlet Runner)*			
597.	15498	*Kunzea glabrescens (Spearwood)*			
598.	48837	*Laccocephalum mylittae*			
599.	13562	*Lachenalia aloides*	Y		
600.	20019	*Lachnagrostis filiformis*			
601.	6777	*Lachnostachys albicans*			
602.	8096	*Lactuca serriola (Prickly Lettuce)*	Y		
603.	18585	*Lagenophora huegelii*			
604.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
605.		*Lampona cylindrata*			
606.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
607.	4052	*Latrobea tenella*			
608.		*Latrodectus hasseltii*			
609.	1307	*Laxmannia ramosa (Branching Lily)*			
610.	11911	*Laxmannia ramosa subsp. ramosa*			
611.	11464	*Laxmannia sessiliflora subsp. australis*			
612.		*Laxmannia sp.*			
613.	1309	*Laxmannia squarrosa*			
614.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
615.	44490	*Leontodon rhagadioloides*	Y		
616.	8099	*Leontodon saxatilis (Hairy Hawkbit)*	Y		
617.		*Lepidosperma ?sp. Brixton Street broad inflorescence*			Y
618.		*Lepidosperma ?sp. Darling Scarp*			Y
619.		*Lepidosperma aff. Brixton Street*			Y
620.	925	*Lepidosperma angustatum*			
621.	940	*Lepidosperma pubisquameum*			
622.		*Lepidosperma pubisquameum "flat form"*			
623.	41649	*Lepidosperma rigidulum*			
624.	944	*Lepidosperma scabrum*			
625.		*Lepidosperma sp.*			
626.		*Lepidosperma sp. Brixton Street broad inflorescence*			
627.		*Lepidosperma sp. Brixton Street narrow inflorescence*			
628.		*Lepidosperma sp. Darling Scarp*			
629.		*Lepidosperma sp. inland scabrum*			
630.		*Lepidosperma sp. terete*			Y
631.	945	*Lepidosperma squamatum*			
632.		*Lepidosperma squamatum s.l.*			
633.	1653	*Leporella fimbriata (Hare Orchid)*			
634.	1077	*Leptocarpus canus (Hoary Twine-rush)*			
635.	46375	*Leptocarpus decipiens*			
636.	19833	*Leptocarpus laxus*			
637.	46382	*Leptocarpus roycei*			
638.	46383	*Leptocarpus tephrinus*			
639.	15418	*Leptoceras menziesii*			
640.	2344	*Leptomeria empetriformis*			
641.	2350	*Leptomeria pauciflora (Sparse-flowered Currant Bush)*			
642.	5847	*Leptospermum erubescens (Roadside Teatree)*			
643.	25133	*Lerista elegans*			
644.	6360	*Leucopogon australis (Spiked Beard-heath)*			
645.	6374	*Leucopogon conostephioides*			
646.	6425	*Leucopogon oxycedrus*			
647.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
648.	6434	*Leucopogon polymorphus*			
649.	6436	*Leucopogon propinquus*			
650.	6451	*Leucopogon tenuis*			
651.		*Levenhookia ?pusilla*			Y
652.	7676	*Levenhookia pusilla (Midget Stylewort)*			
653.		*Levenhookia pusilla/stipitata*			
654.	7677	*Levenhookia stipitata (Common Stylewort)*			
655.	25005	*Lialis burtonis*			
656.	39042	*Licea minima*			
657.	39046	*Licea rufocuprea*			Y

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658.	31280	*Lichenomphalia chromacea*			
659.	25661	*Lichmera indistincta (Brown Honeyeater)*			
660.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
661.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
662.	36179	*Liparophyllum violifolium*			
663.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
664.	25388	*Litoria moorei (Motorbike Frog)*			
665.	9289	*Lobelia anceps (Angled Lobelia)*			
666.	7408	*Lobelia tenuior (Slender Lobelia)*			
667.	10957	*Lolium perenne x rigidum*	Y		
668.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
669.		*Lolium sp. (annual)*			
670.		*Lomandra ?caespitosa*			
671.		*Lomandra ?hermaphrodita*			Y
672.		*Lomandra ?nigricans*			Y
673.		*Lomandra ?preissii*			
674.		*Lomandra ?suaveolens*			
675.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
676.		*Lomandra caespitosa/suaveolens*			Y
677.	1228	*Lomandra hermaphrodita*			
678.	14542	*Lomandra micrantha subsp. micrantha*			
679.	1234	*Lomandra nigricans*			
680.	1239	*Lomandra preissii*			
681.	1243	*Lomandra sericea (Silky Mat Rush)*			
682.		*Lomandra sp.*			
683.	1246	*Lomandra suaveolens*			
684.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
685.		*Longepi woodman*			
686.	8564	*Lotus subbiflorus*	Y		
687.	4063	*Lotus uliginosus (Greater Lotus)*	Y		
688.	4065	*Lupinus angustifolius (Narrowleaf Lupin)*	Y		
689.	1198	*Luzula meridionalis (Field Woodrush)*			
690.	39048	*Lycogala epidendrum*			
691.		*Lycosa gilberta*			
692.	1097	*Lyginia barbata*			
693.		*Lyginia barbata/imberbis*			
694.	18049	*Lyginia imberbis*			
695.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
696.	6456	*Lysinema ciliatum (Curry Flower)*			
697.	6458	*Lysinema elegans*			
698.	34736	*Lysinema pentapetalum*			
699.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
700.	2838	*Macarthuria apetala*			
701.	2839	*Macarthuria australis*			
702.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
703.	18119	*Macrozamia fraseri*			
704.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
705.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
706.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
707.	25654	*Malurus splendens (Splendid Fairy-wren)*			
708.		*Maratus pavonis*			
709.		*Marchantia berteroana*			
710.	4079	*Medicago polymorpha (Burr Medic)*	Y		
711.	25758	*Megalurus gramineus (Little Grassbird)*			
712.	34676	*Meionectes brownii (Swamp Raspwort)*			
713.		*Melaleuca ?thymoides*			Y
714.	5881	*Melaleuca brevifolia*			
715.	5900	*Melaleuca cuticularis (Saltwater Paperbark)*			
716.	5921	*Melaleuca incana (Grey Honeymyrtle)*			
717.	13273	*Melaleuca incana subsp. incana*			
718.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
719.	5952	*Melaleuca preissiana (Moonah)*			
720.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
721.	5964	*Melaleuca seriata*			
722.	5978	*Melaleuca teretifolia (Banbar)*			
723.	5980	*Melaleuca thymoides*			
724.	5987	*Melaleuca viminea (Mohan)*			
725.	47997	*Melanodryas cucullata (Hooded Robin)*			
726.	4085	*Melilotus indicus*	Y		
727.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			

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728.	24587	*Melithreptus chloropsis (Western White-naped Honeyeater)*			
729.	24736	*Melopsittacus undulatus (Budgerigar)*			
730.	25184	*Menetia greyii*			
731.	3050	*Menkea australis (Fairy Spectacles)*			
732.	6884	*Mentha spicata (Spearmint)*	Y		
733.	24598	*Merops ornatus (Rainbow Bee-eater)*			
734.	953	*Mesomelaena graciliceps*			
735.	955	*Mesomelaena pseudostygia*			
736.		*Microcarbo melanoleucos*			
737.	485	*Microlaena stipoides (Weeping Grass)*			
738.	8814	*Microtis brownii*			
739.	31713	*Microtis cupularis*			
740.	15419	*Microtis media subsp. media*			
741.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
742.	16693	*Minuartia mediterranea*	Y		
743.		*Missulena granulosa*			
744.		*Mituliodon tarantulinus*			
745.		*Mitzoruga insularis*			
746.	37440	*Monopsis debilis var. depressa*	Y		
747.	4666	*Monotaxis occidentalis*			
748.	19179	*Moraea flaccida (One-leaf Cape Tulip)*	Y		
749.	25191	*Morethia lineoocellata*			
750.	25192	*Morethia obscura*			
751.	24223	*Mus musculus (House Mouse)*	Y		
752.	25420	*Myobatrachus gouldii (Turtle Frog)*			
753.	6199	*Myriophyllum tillaeoides*			
754.		*Myrtaceae sp.*			Y
755.	24738	*Neophema elegans (Elegant Parrot)*			
756.		*Nidula emodensis*			
757.	25252	*Notechis scutatus (Tiger Snake)*			
758.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
759.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
760.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
761.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
762.	14293	*Oenothera indecora subsp. bonariensis*	Y		
763.	20052	*Oenothera jamesii*	Y		
764.	16347	*Oenothera laciniata*	Y		
765.	6140	*Oenothera mollissima*	Y		
766.	39054	*Oligonema schweinitzii*			
767.	18255	*Opercularia vaginata (Dog Weed)*			
768.	36177	*Ornduffia albiflora*			
769.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
770.	4356	*Oxalis pes-caprae (Soursob)*	Y		
771.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
772.	25253	*Parasuta gouldii*			
773.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
774.	25682	*Pardalotus striatus (Striated Pardalote)*			
775.	527	*Paspalum dilatatum*	Y		
776.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
777.	30472	*Patersonia occidentalis var. occidentalis*			
778.		*Pelargonium ?littorale*			Y
779.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
780.	4346	*Pelargonium littorale*			
781.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
782.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
783.	16477	*Pericalymma ellipticum var. ellipticum*			
784.	39057	*Perichaena corticalis*			
785.	39058	*Perichaena depressa*			
786.	2273	*Persoonia saccata (Snottygobble)*			
787.	48060	*Petrochelidon ariel (Fairy Martin)*			
788.	48061	*Petrochelidon nigricans (Tree Martin)*			
789.	48066	*Petroica boodang (Scarlet Robin)*			
790.	24659	*Petroica goodenovii (Red-capped Robin)*			
791.	2299	*Petrophile linearis (Pixie Mops)*			
792.	19825	*Petrorhagia dubia*	Y		
793.		*Peziza sp.*			
794.	25697	*Phalacrocorax carbo (Great Cormorant)*			
795.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
796.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
797.	25699	*Phalacrocorax varius (Pied Cormorant)*			

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798.	24409	*Phaps chalcoptera (Common Bronzewing)*			
799.		*Phellinus gilvus*			
800.		*Phenasteron longiconductor*			
801.	18529	*Philotheca spicata (Pepper and Salt)*			
802.	1478	*Phlebocarya ciliata*			
803.	1479	*Phlebocarya filifolia*			
804.		*Phlebocarya sp.*			
805.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
806.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
807.	16177	*Phyllangium paradoxum*			
808.	4675	*Phyllanthus calycinus (False Boronia)*			
809.	4	*Phylloglossum drummondii (Pigmy Clubmoss)*			
810.	4141	*Phyllota gracilis*			
811.	39061	*Physarum bitectum*			
812.	39062	*Physarum bivalve*			
813.	39063	*Physarum cinereum*			
814.	39064	*Physarum citrinum*			Y
815.	39065	*Physarum compressum*			
816.	39069	*Physarum famintzinii*			Y
817.	39072	*Physarum melleum*			
818.	39074	*Physarum pusillum*			
819.	39076	*Physarum sessile*			
820.	39079	*Physarum viride*			
821.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		
822.		*Phytophthora cinnamomi*			
823.	5243	*Pimelea ferruginea*			
824.	11402	*Pimelea imbricata var. piligera*			
825.	5254	*Pimelea leucantha*			
826.	18117	*Pimelea rosea subsp. rosea*			
827.	12041	*Pimelea suaveolens subsp. suaveolens*			
828.	5268	*Pimelea sulphurea (Yellow Banjine)*			
829.		*Pinkfloydia harveii*			
830.	18353	*Pithocarpa pulchella var. pulchella*			
831.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
832.	25720	*Platycercus icterotis (Western Rosella)*			
833.	24747	*Platycercus spurius (Red-capped Parrot)*			
834.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
835.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
836.	6253	*Platysace filiformis*			
837.	4524	*Platytheca galioides*			
838.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
839.	571	*Poa annua (Winter Grass)*	Y		
840.	578	*Poa porphyroclados*			
841.		*Poaceae sp.*			
842.	25704	*Podiceps cristatus (Great Crested Grebe)*			
843.	8175	*Podolepis gracilis (Slender Podolepis)*			
844.		*Podotheca ?chrysantha*			Y
845.		*Podotheca ?gnaphalioides*			
846.	8182	*Podotheca angustifolia (Sticky Longheads)*			
847.		*Podotheca angustifolia/gnaphalioides*			Y
848.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
849.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
850.		*Podotheca sp.*			
851.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
852.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
853.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
854.	2905	*Polycarpon tetraphyllum (Fourleaf Allseed)*	Y		
855.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
856.	25722	*Polytelis anthopeplus (Regent Parrot)*			
857.	4691	*Poranthera microphylla (Small Poranthera)*			
858.		*Poranthera microphylla/moorokatta*			
859.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
860.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
861.	24769	*Porzana fluminea (Australian Spotted Crake)*			
862.	25732	*Porzana pusilla (Baillon's Crake)*			
863.	24771	*Porzana tabuensis (Spotless Crake)*			
864.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
865.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
866.	1673	*Prasophyllum gibbosum (Humped Leek Orchid)*			
867.	1674	*Prasophyllum giganteum (Bronze Leek Orchid)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
868.	1676	*Prasophyllum hians (Yawning Leek Orchid)*			
869.	1677	*Prasophyllum macrostachyum (Laughing Leek Orchid)*			
870.	10853	*Prasophyllum plumiforme*			
871.	1681	*Prasophyllum regium (King Leek Orchid)*			
872.		*Prionosternum scutatum*			
873.	8189	*Pseudognaphalium luteoalbum (Jersey Cudweed)*			
874.	25511	*Pseudonaja affinis (Dugite)*			
875.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
876.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
877.		*Pterostylis aff. nana*			
878.		*Pterostylis aff. nana ?short sepal*			Y
879.	15426	*Pterostylis aspera*			
880.	17267	*Pterostylis brevisepala*			
881.	48677	*Pterostylis ectypha*			
882.	44723	*Pterostylis glebosa*			
883.		*Pterostylis nana "short sepal"*			
884.	48674	*Pterostylis orbiculata*			
885.	1693	*Pterostylis recurva (Jug Orchid)*			
886.	12217	*Pterostylis sanguinea*			
887.		*Pterostylis sp.*			
888.	18655	*Pterostylis sp. crinkled leaf (G.J. Keighery 13426)*			
889.	2718	*Ptilotus drummondii (Narrowleaf Mulla Mulla)*			
890.	11260	*Ptilotus drummondii var. drummondii (Pussytail)*			
891.	2742	*Ptilotus manglesii (Pom Poms, Mulamula)*			
892.	4177	*Pultenaea ochreata*			
893.	4181	*Pultenaea reticulata*			
894.		*Purpureicephalus spurius*			
895.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
896.	16367	*Pyrorchis nigricans (Red beaks, Elephants ears)*			
897.	8195	*Quinetia urvillei*			
898.	24243	*Rattus fuscipes (Western Bush Rat)*			
899.	24245	*Rattus rattus (Black Rat)*	Y		
900.		*Raveniella cirrata*			
901.		*Raveniella peckorum*			
902.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
903.	6012	*Regelia ciliata*			
904.	6014	*Regelia inops*			
905.	4822	*Rhamnus alaternus (Buckthorn)*	Y		
906.	48096	*Rhipidura albiscapa (Grey Fantail)*			
907.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
908.	13300	*Rhodanthe citrina*			
909.	14485	*Romulea flava var. minor*	Y		
910.	1556	*Romulea rosea (Guildford Grass)*	Y		
911.	14924	*Romulea rosea var. communis*	Y		
912.	10970	*Rostraria cristata*	Y		
913.	44608	*Rosulabryum billarderii*			
914.	2429	*Rumex acetosella (Sorrel)*	Y		
915.	40426	*Rytidosperma occidentale*			
916.	2907	*Sagina procumbens (Spreading Pearlwort)*	Y		
917.	7603	*Scaevola canescens (Grey Scaevola)*			
918.	13182	*Scaevola repens var. repens*			
919.	979	*Schoenus caespititius*			
920.	982	*Schoenus clandestinus*			
921.	984	*Schoenus curvifolius*			
922.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
923.	17614	*Schoenus plumosus*			
924.	1011	*Schoenus rigens*			
925.	1017	*Schoenus subbulbosus*			
926.	16251	*Schoenus subflavus subsp. long leaves (K.L. Wilson 2865)*			
927.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
928.	6	*Selaginella gracillima (Tiny Clubmoss)*			
929.	25878	*Senecio condylus*			
930.		*Senecio diaschides/glomeratus*			Y
931.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
932.	2909	*Silene gallica (French Catchfly)*	Y		
933.	15972	*Silene gallica var. gallica*	Y		
934.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
935.		*Simaetha tenuior*			
936.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
937.	30948	*Smicrornis brevirostris (Weebill)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
938.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
939.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
940.	7037	*Solanum symonii*			
941.	45036	*Solidago chilensis*	Y		
942.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
943.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
944.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
945.	1558	*Sparaxis bulbifera*	Y		
946.	4211	*Sphaerolobium vimineum (Leafless Globe Pea)*			
947.		*Steatoda capensis*			
948.	2918	*Stellaria media (Chickweed)*	Y		
949.	39083	*Stemonitis fusca*			
950.	39088	*Stemonitis virginiensis*			
951.	39090	*Stemonitopsis gracilis*			
952.	24528	*Sterna hybrida subsp. javanica (Whiskered Tern)*			
953.	24329	*Stictonetta naevosa (Freckled Duck)*			
954.	2316	*Stirlingia latifolia (Blueboy)*			
955.	25597	*Strepera versicolor (Grey Currawong)*			
956.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
957.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
958.		*Stylidium ?araeophyllum*			Y
959.	25831	*Stylidium araeophyllum (Stilt Walker)*			
960.		*Stylidium araeophyllum/neurophyllum*			
961.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
962.	7696	*Stylidium calcaratum (Book Triggerplant)*			
963.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
964.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
965.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
966.	7777	*Stylidium preissii (Lizard Triggerplant)*			
967.	7785	*Stylidium repens (Matted Triggerplant)*			
968.	25806	*Stylidium scariosum*			
969.	7798	*Stylidium schoenoides (Cow Kicks)*			
970.		*Stylidium sp.*			
971.	1260	*Stypandra glauca (Blind Grass)*			
972.		*Supunna funerea*			
973.		*Supunna picta*			
974.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
975.	15532	*Synaphea spinulosa subsp. spinulosa*			
976.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
977.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
978.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
979.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
980.	1036	*Tetraria octandra*			
981.	48341	*Tetratheca hirsuta subsp. viminea*			
982.		*Thelymitra benthamiana/crinita/fuscolutea*			Y
983.	1702	*Thelymitra campanulata (Shirt Orchid)*			
984.	11143	*Thelymitra graminea*			
985.	1710	*Thelymitra mucida (Plum Orchid)*			
986.		*Thelymitra sp.*			
987.	1716	*Thelymitra tigrina (Tiger Orchid)*			
988.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
989.		*Thysanotus ?arbuscula*			Y
990.		*Thysanotus ?manglesianus/patersonii complex*			Y
991.		*Thysanotus ?thyrsoideus*			
992.	1318	*Thysanotus arbuscula*			
993.	1338	*Thysanotus manglesianus (Fringed Lily)*			
994.		*Thysanotus manglesianus/patersonii complex*			
995.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
996.	1343	*Thysanotus patersonii*			
997.		*Thysanotus sp.*			
998.	1351	*Thysanotus sparteus*			
999.	1357	*Thysanotus thyrsoideus*			
1000.	1358	*Thysanotus triandrus*			
1001.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
1002.	25519	*Tiliqua rugosa*			
1003.	25204	*Tiliqua rugosa subsp. aspera*			
1004.	25207	*Tiliqua rugosa subsp. rugosa*			
1005.	45838	*Tilletia ehrhartae*			
1006.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1007.	24309	*Todiramphus sanctus subsp. sanctus (Sacred Kingfisher)*			
1008.	6280	*Trachymene pilosa (Native Parsnip)*			
1009.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
1010.	4383	*Tribulus terrestris (Caltrop)*	Y		
1011.	39094	*Trichia affinis*			
1012.	39095	*Trichia botrytis*			
1013.	39096	*Trichia contorta*			
1014.	39097	*Trichia decipiens*			
1015.	39100	*Trichia persimilis*			
1016.	39101	*Trichia varia*			
1017.	39102	*Trichia verrucosa*			
1018.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
1019.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
1020.	1363	*Tricoryne tenella*			
1021.	1038	*Tricostularia neesii*			
1022.		*Trifolium ?campestre*			Y
1023.	17145	*Trifolium angustifolium var. angustifolium*	Y		
1024.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
1025.		*Trifolium campestre/dubium*			
1026.	4295	*Trifolium dubium (Suckling Clover)*	Y		
1027.	14738	*Trifolium resupinatum var. resupinatum*	Y		
1028.	4309	*Trifolium scabrum (Rough Clover)*	Y		
1029.		*Trifolium sp.*			
1030.	4314	*Trifolium suffocatum (Suffocated Clover)*	Y		
1031.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
1032.	39103	*Tubifera ferruginosa*			
1033.	48147	*Turnix varius (Painted Button-quail)*			
1034.	98	*Typha domingensis (Bulrush, Djandjid)*			
1035.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
1036.		*Urodacus novaehollandiae*			
1037.	8254	*Urospermum picroides (False Hawkbit)*	Y		
1038.	8255	*Ursinia anthemoides (Ursinia)*	Y		
1039.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
1040.	25577	*Vanellus miles (Masked Lapwing)*			
1041.	24386	*Vanellus tricolor (Banded Lapwing)*			
1042.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
1043.		*Venator immansueta*			
1044.	15432	*Verticordia densiflora var. densiflora*			
1045.	6077	*Verticordia drummondii (Drummond's Featherflower)*			
1046.	24206	*Vespadelus regulus (Southern Forest Bat)*			
1047.	11474	*Vicia sativa subsp. nigra*	Y		
1048.	4325	*Viminaria juncea (Swishbush, Koweda)*			
1049.	24040	*Vulpes vulpes (Red Fox)*	Y		
1050.		*Vulpia sp.*			
1051.		*Wahlenbergia ?capensis*			Y
1052.		*Wahlenbergia ?preissii*			Y
1053.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
1054.	7389	*Wahlenbergia preissii*			
1055.		*Wahlenbergia sp.*			
1056.	39104	*Willkommlangea reticulata*			
1057.	1251	*Xanthorrhoea brunonis*			
1058.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
1059.		*Xanthorrhoea sp.*			
1060.	6289	*Xanthosia huegelii*			
1061.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
1062.	7113	*Zaluzianskya divaricata (Spreading Night Phlox)*	Y		
1063.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
1064.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

Lot 703, Treeby

Printed by Guest user on 10/7/2019

Query details : Current Names Only=Yes; Core Datasets Only=Yes; Method='By Circle'; Centre=115° 52' 45" E,32° 07' 46" S; Buffer=5km;



Search Results

Selected

- Selected Species

All Results

- Non-conservation taxon
- Other specially protected fauna
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Protected under international agreement
- Rare or likely to become extinct

Reference Layers

Major WA Towns

Major WA Towns

Major WA Towns

Threatened Ecological Communities

- Priority
- Threatened

State Borders

Department of Biodiversity, Conservation and Attractions
WESTERN AUSTRALIAN MUSEUM

NatureMap is a collaborative project of the Department of Biodiversity, Conservation and Attractions, Western Australia, and the Western Australian Museum.

Appendix C

Protected Matters search tool report

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

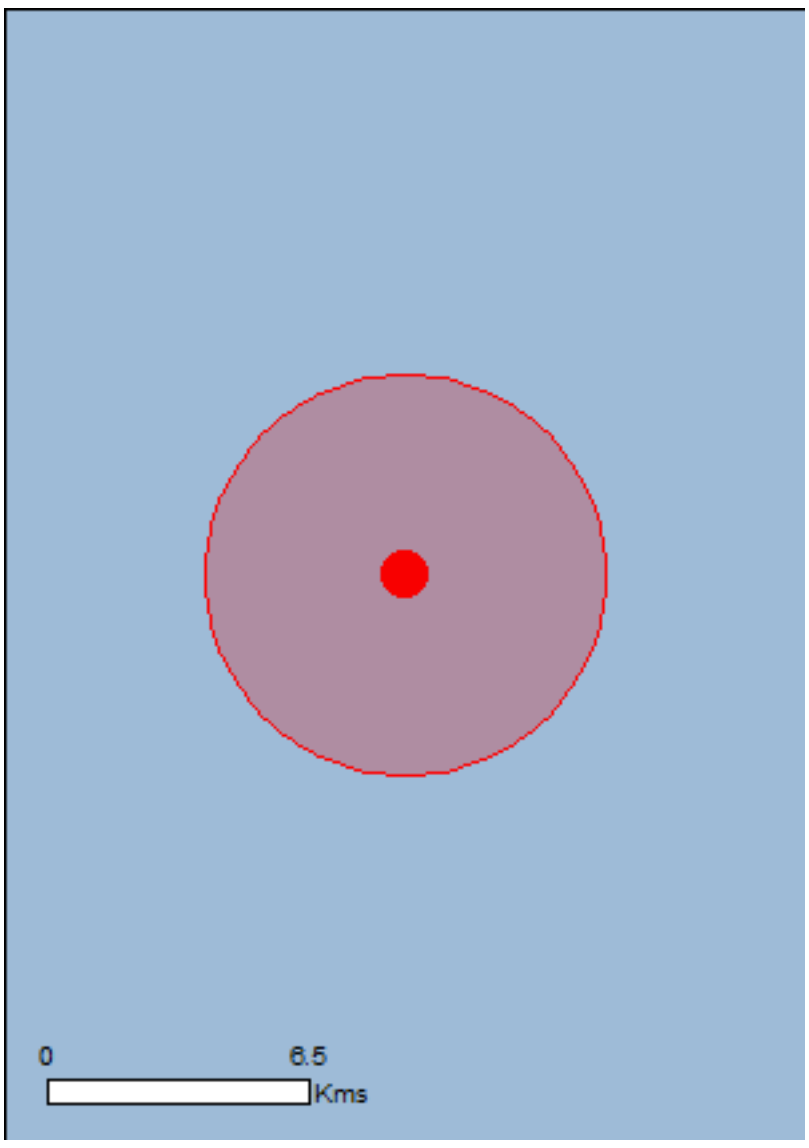
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 10/07/19 11:47:43

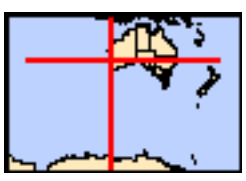
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 5.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	21
Listed Migratory Species:	17

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	26
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	41
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Insects		

Name	Status	Type of Presence
Neopasiphae simplicior		
A native bee [66821]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris micrantha		
Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei		
Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica		
Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha		
Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Lepidosperma rostratum		
Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		
Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum		
Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

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

Name	Threatened	Type of Presence within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Gibbs Road	WA
Piara	WA
Thomsons Lake	WA
Unnamed WA49561	WA

Invasive Species	[Resource Information]

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

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

Name	Status	Type of Presence
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Gibbs Road Swamp System	WA

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-32.12944 115.87917

Acknowledgements

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

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

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

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

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Appendix D

Caladenia huegelii monitoring 2016

3rd April 2017

File Note

***Caladenia huegelii* monitoring 2016 – Lot 821 Armadale Road, Banjup.**

Three populations of the Threatened (Declared Rare) Flora species *Caladenia huegelii* (Grand Spider Orchid) consisting of 11 individual plants were recorded by PGV Environmental on Lot 821 Armadale Road in 2012. Further monitoring of the orchids occurred in 2015 when all but one of the orchids was in flower.

Due to the location of the orchids close to firebreaks in a small area of remnant Banksia woodland and next to a development site it was decided to fence the Banksia woodland in 2016.

The orchids were monitored more intensively in 2016 on 17 July, 18 August, 8 September, 12 September, 22 September and 11 October. In July, leaves were present on 9 of the 11 plants recorded in 2012. The location of the plants with leaves was subsequently recorded by placing a small wooden peg with a unique identifying number approximately 10cm to the west of the leaf.

On 18 August two leaves had been damaged by grazing, presumably rabbits and the remainder were in bud. On 8 September, a further two leaves had been grazed with the flower bud lost. Two of the buds had opened up into flower. On 12 September, all individuals that produced a flower spike were in full flower except one which has a prominent bud. All buds were in full flower on 22 September. On 10 October most flowers were starting to curl up.

Population 3

Orchids 1 (two plants)

Easting: 394005
Northing: 6444667

These two orchids were on the edge of the bush within 30cm of a fire break. The leaves of both plants had been grazed and neither went on to produce a bud or flower.

Photo 1 – Orchid 1 grazed leaf



Orchid 2

Easting: 394012
Northing: 6444670

The orchid is about 5m into the bush from the fire break. The orchid produced a flower in 2016 and was a redder colour than the other *C. huegelii* plants on the site, although not considered to be the more common *C. arenicola* (photo 2). Prior to the fence installation, but before the plant had produced a leaf and flower, a vehicle had driven over the location as evidenced by wheel ruts either side of the orchid. Fortunately the plant tubers were not damaged.



Population 1

Easting: 394018
Northing: 6444769

This is the largest group of orchids consisting in 2012 of 5 plants on the corner next to two firebreaks and two plants close by to the west. In 2016, orchids 4 and 7 did not produce a leaf, however three additional orchids were recorded in the population. All orchids present had single flowers and were healthy (Photo 3-9). A total of 6 orchids flowered in this population in 2016, and two produced leaves but were grazed and did not flower.

Photo 3 – Orchid 5



Photo 4 – Orchid 6



Photo 5 – Orchid 15 (new in 2016, recorded as 6b on 12 Sept)



Photo 6 – Orchid 11 (new in 2016)

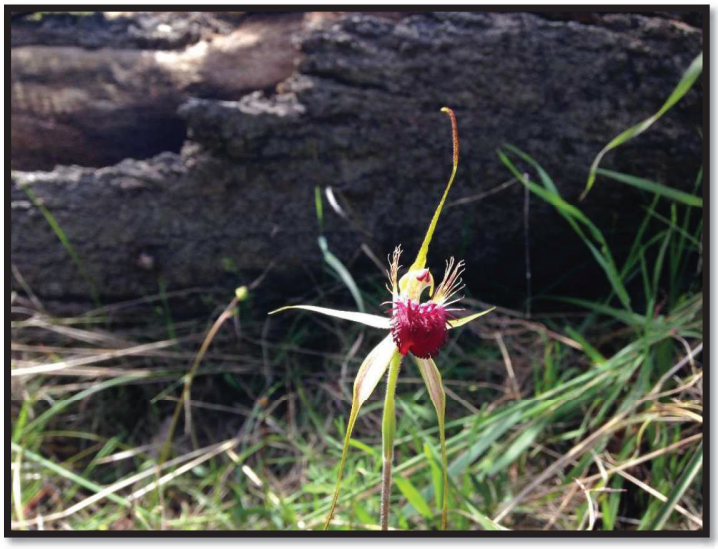


Photo 7 – Orchid 12 (new in 2016)



<u>Population 2</u>

Easting: 394018
Northing: 6444764

This is a single orchid recorded in 2012 near the edge of two firebreaks. It was not recorded in 2015 and was considered to have been damaged by the dumping of some cleared branches from the nearby construction of Fraser Road.

Monitoring in August and early September 2016 again did not record any leaves, buds or flowers in this area despite intensive searching. By surprise a flower was observed in full flower on 22 September and again on 11 October.

Photo 8 – Orchid 13



Population 4 (new)

Easting: 394018
Northing: 6444778

Orchid number 14 was a new orchid not recorded on the site previously. It is located approximately 10m north of Population 1 and about 5m from the north-south firebreak and had a single flower and was healthy.

Appendix E

Lots 9004, 9002 and 132 and Lot 4 flora inventory

APPENDIX E: LOTS 9004, 9002 AND 132 AND LOT 4 FLORA INVENTORY

Family		Species	Lots 9004, 9002 and 132	Lot 4
AIZOACEAE	*	*Carpobrotus edulis*	x	
ANARTHRIACEAE		*Lyginia barbata*	x	
		Lyginia imberbis	x	x
ARALIACEAE		*Trachymene pilosa*	x	
ASPARAGACEAE		*Chamaescilla corymbosa*	x	
		Laxmannia sessiliflora subsp. *australis*	x	
		Laxmannia squarrosa	x	x
		Lomandra hermaphrodita		x
		Lomandra micrantha	x	x
		Lomandra preissii	x	
		Thysanotus triandrus	x	
ASTERACEAE	*	*Arctotheca calendula*		x
		Hyalosperma cotula	x	x
	*	*Hypochaeris glabra*	x	x
		Podotheca gnaphalioides		x
		Siloxerus humifusus	x	x
	*	*Sonchus* sp.		x
	*	*Ursinia anthemoides*	x	x
CAMPANULACEAE	*	*Wahlenbergia capensis*	x	x
CASUARINACEAE		*Allocasuarina fraseriana*	x	x
		Allocasuarina humilis	x	x
		Casuarina sp.		x
COLCHICACEAE		*Burchardia congesta*	x	x
CUPRESSACEAE		*Callitris* sp.		x
CYPERACEAE		*Cyperaceae* sp.		x
		Tricostularia neesii var. *neesii*		x
		Lepidosperma longitudinale		x
		Lepidosperma ?pubisquameum		x
		Lepidosperma squamatum	x	
		Mesomelaena pseudostygia	x	x
		Schoenus curvifolius	x	
DASYPOGONACEAE		*Calectasia narragara*		x
		Dasypogon bromeliifolius	x	x
DILLENIACEAE		*Hibbertia huegelii*		x
		Hibbertia hypericoides	x	x
		Hibbertia pachyrrhiza	x	
		Hibbertia racemosa		x
		Hibbertia subvaginata	x	x
DROSERACEAE		*Platytheca galioides*	x	
ERICACEAE		*Astroloma ciliatum*	x	
		Astroloma xerophyllum		x
		Brachyloma preissii	x	
		Conostephium preissii		x
		Conostephium pendulum	x	x
		Leucopogon sp.		x
EUPHORBIACEAE	*	*Euphorbia peplus*		x
FABACEAE		*Acacia applanata*	x	

Family		Species	Lots 9004, 9002 and 132	Lot 4
		Acacia iteaphylla		x
	*	*Acacia longifolia*	x	x
		Acacia pulchella	x	x
		Acacia saligna		x
		Acacia stenoptera		x
		Bossiaea eriocarpa	x	x
		Daviesia triflora	x	x
		Euchilopsis linearis		x
		Gastrolobium capitatum	x	x
		Gompholobium tomentosum	x	x
		Jacksonia furcellata	x	x
		Viminaria juncea		x
GERANIACEAE	*	*Pelargonium capitatum*		x
GOODENIACEAE		*Dampiera alata*	x	
		Dampiera linearis	x	x
		Lechenaultia floribunda	x	x
		Scaevola ?repens		x
HAEMODORACEAE		*Anigozanthos humilis*		x
		Anigozanthos manglesii	x	x
		Conostylis aculeata		x
		Conostylis aculeata subsp. *aculeata*	x	
		Conostylis juncea	x	x
		Phlebocarya ciliata	x	x
		Phlebocarya filifolia	x	
HALORAGACEAE		*Gonocarpus pithyoides*	x	
HEMEROCALLIDACEAE		*Caesia occidentalis*	x	
		Tricoryne elatior	x	
IRIDACEAE	*	*Gladiolus caryophyllaceus*	x	x
		Patersonia occidentalis	x	x
LAMIACEAE		*Hemiandra pungens*	x	x
LAURACEAE		*Cassytha* sp.		x
LORANTHACEAE		*Nuytsia floribunda*		x
MOLLUGINACEAE		*Macarthuria australis*	x	
MYRTACEAE		*Astartea affinis*		x
		Astartea scoparia	x	
		Beaufortia elegans	x	
MYRTACEAE		*Calothamnus* sp.		x
		Calytrix flavescens	x	x
		Calytrix fraseri	x	
		Eremaea asterocarpa subsp. *asterocarpa*	x	
		Eremaea fimbriata	x	
		Eremaea pauciflora		x
		Eremaea pauciflora var. *pauciflora*	x	
		Eucalyptus marginata	x	x
		Eucalyptus rudis		x
		Eucalyptus sp.1		x
		Eucalyptus sp.2		x
		Eucalyptus todtiana		x
		Hypocalymma angustifolium	x	x
		Hypocalymma robustum		x
		Kunzea glabrescens	x	x

Family		Species	Lots 9004, 9002 and 132	Lot 4
	*	*Leptospermum laevigatum*		x
		Melaleuca preissiana	x	x
		Melaleuca incana		x
		Melaleuca seriata		x
		Melaleuca trichophylla	x	
		Pericalymma ellipticum		x
		Regelia inops		x
		Scholtzia involucrata	x	x
OLEACEAE	*	*Olea europaea*		x
ORCHIDACEAE		*Caladenia discoidea*		x
		Caladenia flava		x
		Caladenia huegelii (T)	x	x
		Caladenia longicauda		x
	*	*Disa bracteata*		x
		Diuris sp.		x
		Pterostylis sp.		x
PAPAVERACEAE	*	*Fumaria capreolata*		x
PHYLLANTHACEAE		*Poranthera microphylla*	x	
POACEAE	*	*Aira caryophyllea*	x	
		Amphipogon turbinatus	x	x
		Austrostipa compressa		x
	*	*Avena barbata*		x
	*	*Briza maxima*	x	x
	*	*Bromus diandrus*		x
	*	*Ehrharta longifolia*	x	x
	*	*Lagurus ovatus*		x
PRIMULACEAE	*	*Lysimachia arvensis*		x
PROTEACEAE		*Adenanthos cygnorum*	x	x
		Banksia attenuata	x	x
		Banksia ilicifolia	x	x
PROTEACEAE		*Banksia menziesii*	x	x
		Persoonia saccata		x
		Petrophile linearis	x	x
		Stirlingia latifolia	x	x
		Synaphea spinulosa		x
		Synaphea spinulosa subsp. *petiolaris*	x	
		Synaphea spinulosa subsp. *spinulosa*	x	
RESTIONACEAE		*Desmocladus fascicularis*		x
		Hypolaena exsulca	x	x
RUBIACEAE		*Opercularia vaginata*	x	
RUTACEAE		*Boronia crenulata* subsp. *crenulata*	x	
		Boronia ramosa subsp. *anethifolia*	x	
		Philotheca spicata	x	x
SANTALACEAE		*Leptomeria empetriformis*		x
STYLIDIACEAE		*Levenhookia stipitata*	x	x
		Stylidium brunonianum	x	x
		Stylidium piliferum	x	x
		Stylidium repens	x	
XANTHORRHOEACEAE		*Xanthorrhoea preissii*	x	x
ZAMIACEAE		*Macrozamia riedlei*		x

* Denotes a weed species

Source (RPS 2014; ENV Environmental 2013)