REPORT

Environmental Assessment Report

Lot 71 Spurr Street, Capel

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Summary

The Capel Three Bears Unit Trust proposes to progress development within Lot 71 Spurr Street, Capel (the site). The site, which totals approximately 8.19 hectares (ha) is proposed to be subdivided into 46 lots and approximately 3.3 ha of Public Open Space (POS) reserve (Figure A).

The site is subject to the Capel Townsite Strategy (Strategy), adopted by the Shire of Capel in July 2008 and endorsed by the Western Australian Planning Commission (WAPC) in October 2009, which provides the long-term (10 – 15 years) strategic planning framework for development within the Capel townsite. The Strategy is complemented by the Shire of Capel Town Planning Scheme (TPS) No. 7, which provides the implementation mechanisms for planning in the Capel townsite.

Specific planning precincts in the Capel townsite were identified in the Strategy as part of the Capel Townsite Structure Plan (Structure Plan). The Structure Plan classified the site as “Residential Area R20”.

Purpose of this Report

The purpose of this Environmental Assessment Report (EAR) is to:

1. Describe the existing environmental attributes of the site in accordance with the Environmental Protection Authority’s (EPA) *Statement of Environmental principles, factors and objectives* (EPA 2016a).
2. Identify any Matters of National Environmental Significance (MNES) within the site that may require referral for assessment under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act).
3. Outline the management measures that will be adopted to mitigate any potentially significant environmental impacts from future development.

Support the submission of a subdivision application to the Shire of Capel and provide a framework for environmental management during construction and development.

Key Environmental Outcomes

The key environmental outcomes achieved in the subdivision design are:

- protection and management of Western Ringtail Possum (WRP) habitat through the EPBC Act referral process
- protection and management of fauna habitats and vegetation within POS reservations and through the development and implementation of a Bushland Management Plan
- undertaking of revegetation and proposed landscaping primarily using peppermint (*Agonis flexuosa*) but also local seed stock of cockatoo food plants, specifically, *Corymbia, Eucalyptus, Banksia, Hakea*, and *Allocasuarina* to improve the availability of WRP and black cockatoo habitat
- implementation of best practice water sensitive urban design and stormwater drainage management
- implementation of management measures to reduce potential fire impacts on future residences.

Management Commitments

Table 1 summarises following key environmental factors and proposes management measures.

Table 1 Summary of Environmental Factors and Proposed Management

Environmental Factor	Environmental Objective	Potential Impacts	Management Response	Timing
Land Factors				
Flora and Vegetation (Section 6.1.1)	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	• Localised modification • Degradation • Loss of species diversity • A significant proportion of vegetation within the site will be retained and conserved within Public Open Space (POS) (approximately 3.3 ha). This includes high quality vegetation (*Melaleuca preissiana* woodland and Marri- *Melaleuca preissiana- M. raphiophylla* low forest) and species identified as conservation significant (*Verticordia attenuata*). • The greatest impacts of clearing will occur in areas of vegetation that are already in a degraded and/or modified/fragmented condition. The significance of the proposed clearing impacts are therefore deemed to be minimal from a conservation perspective.	Remnant vegetation retained within the subdivision will be managed through the development and implementation of a Bushland Management Plan that will outline the management intent for the remnant vegetation, consistent with maintaining conservation values. The Bushland Management Plan will be prepared at subdivision stage to the satisfaction of the Shire of Capel. Other mechanisms for minimising impacts on vegetation will include: • access restrictions using fences and signage to prevent unauthorised access to native vegetation retained within POS reservations • revegetation with local native species where possible.	Bushland Management Plan to be prepared subdivision stage
Terrestrial Environmental Quality (Section 6.1.2)	To maintain the quality of land and soils so that environmental values are protected.	Potential oxidation of excavated or in situ ASS generating acidic conditions, and possibly releasing metals into groundwater and surrounding freshwater environments.	If ground disturbance is required in areas mapped as ASS risk, then ASS investigations will be undertaken in accordance with the Department of Water and Environmental Regulation (DWER) guidelines (DER 2015) and appropriate management protocols will be developed in consultation with the DWER.	ASS investigations to be undertaken at the subdivision stage (if required)
Terrestrial Fauna (Section 6.1.3)	To protect terrestrial fauna so that biological diversity and ecological integrity are protected.	• Loss/modification of habitat through clearing. • Disturbance of local fauna during construction resulting in displacement, injury or death.	• Retention of fauna habitat is the key method for protection of fauna and will include the management of important fauna habitats within POS reservations through the implementation of the Bushland Management Plan. • The impact to Western Ringtail Possum species from habitat clearing will be regulated and managed through the EPBC Act referral process to the Department of Environment and Energy. • A Fauna Management Plan will be formulated for implementation during any approved clearing of the site.	Fauna Management Plan to be prepared at subdivision stage
Water Factors				
Hydrological Processes (Section 6.2)	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	• Changes to the hydrological regime resulting from modified landforms that may alter water flow and levels. • Reduced groundwater or surface water quality caused by discharge of stormwater.	Urban Water Management Plan (UWMP) are required to be completed at subdivision stage to the satisfaction of the Shire of Capel, on advice from the DWER.	UWMP to be prepared at subdivision stage
People Factors				
Social Surroundings (Section **Error! Reference source not found.**)	To protect social surroundings from significant harm.	There are no records of Aboriginal or European heritage artefacts to be located on the site; the potential impacts are likely to be minimal.	Be vigilant during earthworks. If any Aboriginal heritage objects are identified then work will stop immediately and the relevant authorities contacted.	During construction
Human Health (Section 6.3.2)	To protect human health from significant harm.	Wetlands and low-lying areas susceptible to high groundwater levels can support mosquito breeding. Mosquitoes are known to cause nuisance and serious health risks to people.	Management of mosquito populations will be addressed through the careful design and management of the drainage treatment systems. Health risks associated with mosquitoes at the site will be further assessed at subdivision stage and a Mosquito Management Plan will be prepared (if required).	Mosquito management to be addressed through detailed drainage design
Bushfire (Section 6.3.3)	To reduce the risk of bushfire to people, property and infrastructure.	Increased risk to people, property and infrastructure from bushfires.	A Bushfire Management Plan which includes a Bushfire Hazard Level assessment has been prepared for the site. The results and recommendations of which have been incorporated in the subdivision design process and will be implemented as part of the constructed development.	Bushfire Management Plan has been prepared (Appendix 3)

1 Introduction

1.1 Background

The Capel Three Bears Unit Trust proposes to progress development within Lot 71 Spurr Street, Capel (the site). The site is approximately 8.19 ha in extent and proposed to be subdivided into 46 lots and approximately 3.3 ha of POS (Figure A).

The site is subject to the Strategy, adopted by the Shire of Capel in July 2008 and endorsed by the WAPC in October 2009, which provides the long-term (10 – 15 years) strategic planning framework for development within the Capel townsite. The Strategy is complemented by the Shire of Capel TPS No. 7, which provides the implementation mechanisms for planning in the Capel townsite.

The Strategy outlines objectives, policies and recommended actions associated with residential, community, environmental, recreation, social, economic and other issues related to development planning.

Specific planning precincts in the Capel townsite were identified in the Strategy as part of the Structure Plan. The Structure Plan classified the site as “Residential Area R20”.

1.1.1 Local Planning Scheme Context

The site was previously zoned “Residential R10/R15” under the Shire of Capel TPS No. 7, which was gazetted in March 1998. Since inception TPS No. 7 has been subject to 60 amendments, which have included changes to zoning classifications.

The site is currently zoned “Residential R20”. Planning residential development within the site will be subject to conditions of its R20 Residential Design Code (R-Code), Shire of Capel Policies, the Strategy and any relevant Local Development Plans or Local Structure Plans.

Setback distance requirements associated with R20 zoning in the Capel townsite are outlined in Table 2 below.

Table 2 R20 Zoning Setback Distances in Capel Townsite

Front Setback (m)	Secondary Street Setback (m)	Side Setback (m)	Rear Setback (m)
6.0	1.5	1.5/1.0	1.5/1.0

1.1.2 Capel Structure Plan Context

The original Capel Structure Plan was prepared in conjunction with the former TPS No. 5, which was gazetted in July 1984. The original Capel Structure Plan included the site in a series of areas proposed for urban development. Many of these of areas, particularly those in the eastern portion of town, were subsequently developed. The majority of development that occurred comprised relatively low density residential lots.

The original Capel Structure Plan was superseded by the current Structure Plan, which was adopted and endorsed as part of the Strategy in July 2008 and October 2009, respectively. The Structure Plan identified the site as a “Residential Area – R20”. The current zoning represents an increase in residential density from R10/R15 to R20.

1.2 Report Purpose

The purpose of this EAR is to:

1. Describe the existing environmental attributes of the site in accordance with the Environmental Protection Authority's (EPA) Statement of Environmental principles, factors and objectives (EPA 2016a).
2. Identify any MNES within the site that may require referral for assessment under the EPBC Act.
3. Outline the management measures that will be adopted to mitigate any potentially significant environmental impacts from future development.

Support the submission of a subdivision application to the Shire of Capel and provide a framework for environmental management during construction and development.

1.3 Land Use

1.3.1 Previous and Existing Land Use

A review of historical aerial photography, from 1996 to 2013, shows that the site comprises remnant native vegetation since 1996. There is no evidence of land use by industry.

Currently the site continues to be characterised by remnant vegetation and is not used for commercial purposes.

1.3.2 Surrounding Land Uses

- The site is generally bordered by developed land.
- North and east of the site are existing residential developments. Beyond these areas land has been cleared and is used for agriculture.
- The Capel River is located approximately 750 metres (m) north-east of the site.
- The broader area south of the site has been cleared for agriculture.
- Along the site's southern boundary is an east to west oriented strip of remnant vegetation. This area is zoned for railway. South of the railway is the Capel Country Club. Established facilities at the country club include a cricket oval and outdoor tennis hardcourts. South of the country club land has been developed for residential use.
- West of the site is the existing light industrial area (LIA). The Capel Waste Transfer Station is located on the south-western boundary of the LIA, approximately 600 m south-west of the site.
- The Capel Waste Water Treatment Plant is located approximately 1.5 kilometres south-west of the site.
- Adjacent to the north-west of the site, between the established LIA and Bussell Highway, is a large area of remnant vegetation. This area has been zoned as "Multiple Use", to be used for drainage, foreshore protection or as an ecological corridor.

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2 Legislative and Policy Framework

2.1 Legislation and Regulation

The development of the site is required to comply with environmental legislation and regulations. A summary of the key State and Commonwealth legislation and regulations is listed in Table 3.

Table 3 Key State and Commonwealth Legislation and Regulations

State Legislation	
Aboriginal Heritage Act 1972	Environmental Protection (Noise) Regulations 1997
Conservation and Land Management Act 1984	Environment Protection Regulations 1987
Conservation and Land Management Regulations 2002	*Heritage of Western Australia Act 1950*
Contaminated Sites Act 2003	*Land Administration Act 1997*
Environmental Protection Act 1986	*Planning and Development Act 2005*
*Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016**	*Rights in Water and Irrigation Act 1914*
Commonwealth Legislation	
Environment Protection and Biodiversity Conservation Act 1999	Environment Protection and Biodiversity Conservation Regulations 2000

*The Biodiversity Conservation Act 2016 will eventually fully replace the Wildlife Conservation Act 1950 (WC Act) in listing threatened species and regulating the protection of native species, however these provisions cannot be brought into effect until the necessary Biodiversity Conservation Regulations have been endorsed.

2.2 EPA Guidance and State Planning Policy

The development of the site is also subject to compliance with applicable guidelines which have been developed to assist proponents, and the general public, in understanding the minimum requirements for the protection of the environment that the EPA expects to be met during the assessment process.

Table 4 details the key EPA environmental factor guidelines and state planning policies relevant to the site.

Table 4 Applicable EPA Guidance and Technical Reports

EPA Environmental Factor Guidelines
Environmental Factor Guideline: Flora and Vegetation (EPA 2016b)
Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016c)
Environmental Factor Guideline: Terrestrial Fauna (EPA 2016d)
Environmental Factor Guideline: Hydrological Processes (EPA 2016e)
Environmental Factor Guideline: Social Surroundings (EPA 2016f)
State Planning Policy
State Planning Policy (SPP) 3.7: Planning in Bushfire Prone Areas (Department of Planning and WAPC 2015)

3 Land Factors

3.1 Flora and Vegetation

3.1.1 Flora and Vegetation Survey

Ecoedge was engaged by RPS Australia West Pty Ltd (RPS) in August 2016 to undertake a Level 2 Flora and Vegetation Survey of the site.

The L2 Flora and Vegetation report (Ecoedge 2017) is provided in Appendix A, with a summary of the results as follows:

- The field survey was carried out on 9 and 20 September, 4 November and 12 December, 2016. Nine 10 × 10 m floristic quadrats were marked out within the site.
- One hundred and fifty-two vascular flora taxa were identified within the site, of which 30 (20%) were introduced species. Two of the introduced species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are Declared Pest plants (s22) under the *Biosecurity and Agriculture Management Act 2007.*
- One species of Priority Flora, *Verticordia attenuata* (P3), was found in a population comprised of an estimated 10-15 plants of varying ages (Figure B).
- Based on the results of the multivariate analysis, together with information collected from the relevés, five vegetation units were recognised within the site (Figure B)
  - *Banksia attenuata-B. ilicifolia* low woodland
  - *Kunzea glabrescens* tall shrubland
  - *Marri-Melaleuca preissiana-M. rhaphiophylla* low forest
  - *Melaleuca preissiana* low woodland
  - *Eucalyptus globulus* (Tasmanian bluegum).
- The site has a very variable level of vegetation condition, ranging from “Completely Degraded” (mainly tracks) to “Excellent” (much of the *Melaleuca preissiana* low woodland) (Figure 11 of Appendix A).
- The *Banksia attenuata-B. ilicifolia* low woodland vegetation unit as shown in Figure B, is an occurrence of one of the floristic community types FCT21a or FCT21b. The latter FCT (Southern *Banksia attenuate* woodlands) is listed as a Priority ecological community by the Department of Biodiversity, Conservation and Attractions (DBCA). Both FCT21a and FCT21b are included within the EPBC listed Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC), which has the threat category of “Endangered” (Department of the Environment and Energy, 2016), however, none of the three patches of the *Banksia attenuata-B. ilicifolia* low woodland vegetation unit within the site meet the minimum size requirements and condition requirements to be considered as occurrences of the Banksia Woodlands of the Swan Coastal Plain TEC.
- Detailed analyses of potential ecological linkages for the south west (Molloy et al. 2009) shows vegetation within the site as being adjacent to a recognised ecological linkage (Figure 4 of Appendix A). Vegetation within the site must therefore be seen as contributing to the value on this linkage given the fact that many other sections along the axis line of the corridor are cleared.
- A full account of the flora and vegetation survey findings, potential impacts and recommendations can be found in Appendix A.

3.1.2 Phytophthora Dieback

Degradation of native vegetation within the site has been caused predominantly by the impacts of root-rot disease caused by *Phytophthora cinnamomi* ("*Phytophthora* Dieback") and by human-caused impacts (tracks and rubbish-dumping).

Phytophthora Dieback is still active around the fringes of the site, particularly in the *Banksia attenuata-B. ilicifolia* woodland, as evidenced by recently dead or dying *Banksia* trees. The portion of the site now covered by *Kunzea glabrescens* tall shrubland vegetation unit was once *Banksia attenuata-B. ilicifolia* woodland, and is comprised mainly of the dieback-resistant species of the former vegetation unit (Ecoedge 2017).

The Marri-*Melaleuca preissiana-M. rhaphiophylla* low forest and *Melaleuca preissiana* low woodland units have no doubt been exposed to the dieback causing pathogen(s), but because of their low proportion of susceptible species, they show few impacts of the disease (Ecoedge 2017).

3.2 Landforms

3.2.1 Topography

The site is characterised by low-lying flat topography. The majority of the site has an elevation of approximately 15 metres Australian Height Datum (m AHD), with an isolated peak of 18 m AHD located near the south-east corner (Figure A).

3.2.2 Soils and Geology

Located on the Swan Coastal Plain the site comprises the Bassendean Dunes Southern River unit, which is characterised by Aeolian sand deposits (Nicole Siemon and Associated 2010).

There are two soil mapping units or soil phases occurring within the site as mapped by Barnesby and Proulx-Nixon (2000); these are mapped in Figure 2 of Appendix A and described in Table 5.

Table 5 Soil Mapping Units

Soil Mapping Unit	Description
212Bs_B1b	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.
212BsW_SWAMP	Swamp

3.3 Terrestrial Environmental Quality

3.3.1 Acid Sulfate Soils

According to the Department of Water and Environmental Regulation's (DWER) Acid Sulfate Soil (ASS) risk mapping, the site is characterised by soil with a "moderate to low" risk of encountering ASS within three metres of the natural soil surface and a "high to moderate" risk of encountering ASS beyond three metres of the natural soil surface.

3.4 Terrestrial Fauna

3.4.1 Fauna Habitat

Greg Harewood (B.Sc. Zoology) was engaged by RPS to undertake a Fauna Assessment of the site. The assessment has included a desktop study and a series of site surveys carried out in two phases, one in 2013 and another in 2016.

The Fauna Assessment report (Harewood 2017) is provided in Appendix B, with a summary of the results as follows:

- A total of 35 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the site over the course of the two surveys. Evidence of three introduced species using the site was also located.
- Evidence of four listed threatened species was recorded WRP –individuals, scats and dreys, Carnaby's and Baudin's black cockatoo – foraging evidence, Forest Red-tailed black cockatoo – heard calling). Evidence of one Department of Biodiversity, Conservation and Attractions (formerly Department of Parks and Wildlife) priority species using sections of the site was located (southern brown bandicoot – diggings).
- No evidence of any migratory species using the area was observed.
- The locations of various WRP observations such as dreys, scats and individuals identified during the site survey carried out in 2013 and 2016 are shown in Figure B.
- The habitat tree assessment identified a total of 17 trees with a Diameter at Breast Height (DBH) of >50 cms within the site. Sixteen of the trees contained one or more "small" hollows which were assessed by the Author at the time of the survey as being not suitable for black cockatoos to use for nesting purposes. One tree appeared not to contain hollows of any size (Figure B).

A full account of the fauna assessment findings, potential impacts and recommendations can be found in Appendix B.

4 Water Factors

4.1 Hydrological Processes

4.1.1 Groundwater

The site is located within the Busselton-Capel Groundwater Area and within the Busselton-Capel sub-area (Department of Water [DoW] 2009).

Groundwater beneath the site is characterised by an unconfined superficial aquifer that overlies the Leederville and Yarragadee formations at depth (DoW 2009). The superficial aquifer has a saturated thickness of less than 5 metres and is separated from the Leederville aquifer by a consolidated layer of limestone (Cardno 2013). Typically groundwater flow trends towards the coast.

There is a high risk of ASS in both the superficial and Leederville aquifers.

The site is subject to the Swan Coastal Plain wetlands groundwater management zone (Management Zone 6) and restrictions are in place to minimise impacts of groundwater dependant ecosystems (GDEs) caused by groundwater abstraction (DoW 2009). Management practices in effect within Management Zone 6 include reducing runoff and changes to local agricultural and urban activities, as well as restrictions to groundwater abstraction. No GDEs occur within the site. Immediately north of the site vegetation is considered representative of a GDE.

The Capel Townsite District Water Management Strategy (DWMS) outlines water management strategies suitable for management of environmental values within the site and surrounds. All development within the Capel townsite is required to comply with DWMS, where practicable.

4.1.2 Groundwater Quality

Salinity within the superficial aquifer increases towards the coast, ranging from <1000 mg/L to 7000 mg/L. However, no specific groundwater data were available for the site and as such local quality could not be confirmed.

4.1.3 Surface Water

Low lying depressions within the site are prone to the accumulation of surface water during winter months when rainfall fully recharges the superficial aquifer, which can cause waterlogging or inundation at the surface.

4.1.4 Drainage

The low lying flat topography of the site limits surface water drainage. Surface water flows that occur within the site typically trend towards subtle depressions that act as sinks forming ephemeral sumpland and dampland wetlands.

A drain has been constructed along the eastern boundary of the site to provide some localised drainage.

Regionally, the site is located at the top of the catchment and receives few inflows from surrounding upstream areas (Cardno 2013). Broad scale surface water flows throughout the wider region tend to move towards the Capel River, which is located approximately 750 m north-east of the site and provides the largest surface water receptor in the vicinity of the site.

4.2 Inland Water Environmental Quality

4.2.1 Wetlands

Figure B presents the current Swan Coastal Plain geomorphic wetland mapping for the site and identifies two wetlands within the site:

- UFI 683 – Resource Enhancement Sumpland
- UFI 682 – Multiple Use Dampland.

Located in the north-west portion of the site, UFI 683 comprises a sumpland; a natural basin that becomes inundated during the wetter months when the low the permeability of underlying clayey soils and limited topographic relief restrict drainage.

UFI 682, which is located in the southern portion of the site comprises a dampland. Unlike sumplands, damplands rarely become inundated. This wetland is characterised by a large, shallow basin that becomes waterlogged during winter.

Table 6 identifies the management objectives for the above two categories of geomorphic wetland.

Table 6 Wetland Management Categories and Objectives

Management Category	General Description	Management Objectives
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands. Ultimate objective is for management, restoration and protection towards improving their conservation value. These wetlands have the potential to be restored to conservation category. This can be achieved by restoring wetland structure, function and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use	Wetlands with few important ecological attributes and functions remaining	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through land care. Should be considered in strategic planning.

(Source: Water and Rivers Commission 2001)

5 People Factors

5.1 Social Surroundings

5.1.1 Aboriginal

A search of the Department of Planning, Lands and Heritage (formerly Department of Aboriginal Affairs) Aboriginal Heritage Inquiry System was undertaken on 30 August 2016 and no matches were recorded for the site.

5.1.2 European

A search of the Heritage Council's inHerit database was undertaken on 30 August 2016 and no matches were recorded for the site.

5.2 Human Health

5.2.1 Contaminated Sites

RPS has undertaken a review of the DWER's online Contaminated Sites Database to determine if the site has any constraints from a contamination perspective. The initial review was undertaken on 30 August 2016. This identified that there were no known or suspected contaminated sites at Lot 71 Spurr Street, Capel.

5.2.2 Mosquitos

Low lying depressions within the site are prone to the accumulation of surface water during winter months when rainfall fully recharges the superficial aquifer, which can cause waterlogging or inundation at the surface. This environment can support mosquito breeding which is known to cause nuisance and serious health risks to people.

5.2.3 Bushfire Risk

A Bushfire Management Plan has been prepared by Ecosystem Solutions Pty Ltd for the site. The Bushfire Management Plan details the fire management methods and requirements that will be implemented, with the aim to reduce the threat to residents and fire fighters in the event of a fire within or near the site. The key findings of are summarised below, with full details provided in the Bushfire Management Plan (Appendix C).

An assessment of the composition of the vegetation and the slope of the land under that vegetation was conducted for a minimum distance of 100 m from the edge of the proposed area of development. Six vegetation plots were identified within the site as described as follows (Map 2 of Appendix C):

- Plot 1, **Class D – Scrub** consists of the majority of the native vegetation remaining within the site and the surrounding area. This vegetation consists of *Kunzea glabrescens* with scattered *Banksia attentuata* and *B. ilicifolia* with **Acacia longifolia, A. pulchella, Calytrix leschenaultii* and *Dasypogon bromeliifolius*.
- Plot 2, **Class A – Forest** is an area of the remnant vegetation to the south-east of the site. This consists of *Melaleuca preissiana* and *M. rhaphiophylla* with scattered *Corymbia calophylla* and an understorey including **Acacia longifolia, Pteridium esculentum* and *Opercularia hispidula*.

- Plot 3, **Class C – Shrubland** is an area within the centre of the site which is. This vegetation includes Pericalymma ellipticum, Hypocalymma angustifolium, Hypolaena exsulca, Kunzea glabrescens, Xanthorrhoea brunonis, Evandra pauciflora and Schoenus efoliatus with scattered Melaleuca preissiana and Corymbia calophylla.
- Plot 4, **Class B – Woodland** within the site and surrounding area. These areas include trees of varying species such as *Agonis flexuosa, Melaleuca preissiana* and *Eucalyptus species*, with an open understorey consisting of introduced grasses.
- Plot 5, **Class G - Grassland** is the grassland within the surrounding properties. These areas consist of introduced grass species with scattered trees and shrubs.
- Plot 6 includes the areas within the site and surrounding landscape which have been excluded from classification under AS 3959-2009 Section 2.2.3.2. These include non-vegetated areas such as proposed or existing buildings and roads, areas of low threat vegetation including nature strips and vegetation currently within the areas of proposed lots as these will be modified and maintained in a low fuel state.
- Plot 7 is an area (0.14 ha) of planted *Eucalyptus globulus* (Tasmanian bluegum) which will be completely removed as part of the development and as such will be excluded from classification as a low fuel zone as it will be maintained as such.

5.2.3.1 Bushfire Hazard and Attack Level Assessment

A Bushfire Hazard Level Assessment has been undertaken by Ecosystem Solutions which considers vegetation type and structure, and the topography of the site. The results are described as follows and presented in Map 4 of Appendix C.

- Class D - Scrub vegetation is an Extreme bushfire hazard
- Class A – Forest vegetation is an Extreme bushfire hazard
- Class C – Shrubland vegetation is a Moderate bushfire hazard
- Class B - Woodland vegetation is a Moderate bushfire hazard.

Any areas that are within 100 m of a Moderate or Extreme bushfire hazard are also considered to be a Moderate hazard to reflect the increase in risk due to proximity. This results in all of the remaining areas of the site being classified as Moderate. Areas of Class G - Grassland, excluded vegetation or non-vegetated areas which are further than 100 m from any Moderate bushfire hazard are considered a Low hazard, however are classified as Moderate due to the proximity to other hazards.

Bushfire Attack Level (BAL) contours for the Class A-Forest, Class B – Woodland, Class C – Shrubland and Class D – Scrub vegetation have been produced, using the slope and proximity of the planned vegetation extent post development (Maps 6-9 of Appendix C).

Based on these assessments, it has been concluded that the development is located in an area that is, or will be on completion, subject to either a moderate bushfire hazard level or BAL-29 or lower and that no structure within the proposed development will be exposed to a radiant heat flux in excess of 29 kW/m^2.

A full account of the fire management methods and requirements that will be implemented within the site is provided in the Bushfire Management Plan (Appendix C).

6 Potential Impacts and Management

This section details potential environmental impacts and proposed management measures associated with the proposed sub-division. Each environmental factor is addressed in the same format, using a series of four sub-headings as follows.

Environmental Objective – States the EPA's objective for the identified environmental factor in accordance with Environmental Assessment Guideline No. 8: Environmental factors and objectives (EPA 2013).

Applicable Guidelines, Standards and Policies – The environmental factor is placed in context of the appropriate policy framework.

Potential Impacts – Describes the identified potential environmental impacts that might arise from the proposed development. This may take the form of impacts of the development on the environment, or constraints the environment might represent to successfully realise the project.

Management Response – Details proposed environmental management responses to address the potential impacts.

6.1 Land Factors

6.1.1 Flora and Vegetation

6.1.1.1 Environmental Objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

6.1.1.2 Applicable Guidelines, Standards and Policies

The relevant policies and standards that have been considered in the environmental assessment process for flora and vegetation on site:

- Environment Protection and Biodiversity Conservation Act 1999
- Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016
- Environmental Factor Guideline: Flora and Vegetation (EPA 2016b).

6.1.1.3 Potential Impacts

No DRF or flora listed as Endangered under the *Wildlife Conservation Act 1950* or the EPBC Act were found within the site, however one species of Priority flora, *Verticordia attenuata* (Priority 3), was found in a population comprised of an estimated 10-15 plants. This population will be retained and conserved within the central POS of the subdivision (Figure B).

Similarly, the two vegetation units which were identified to be in "Excellent" and "Very Good" condition (*Melaleuca preissiana* woodland and *Marri- Melaleuca preissiana- M.* raphiophylla low forest, respectively) will be completely retained within the POS reservations of the site. Clearing impacts as a result of development are therefore deemed to be negligible.

Clearing as a result of development will occur mainly within the *Kunzea glabrescens* tall shrubland. This vegetation will not be removed in its entirety and a significant proportion will be retained within the central POS. The *Kunzea glabrescens* tall shrubland is in "Degraded" condition as a result of the presence of *Phytophthora* dieback (Ecoedge 2017). The clearing impacts are therefore likely to have a minimal to negligible impact on the conservation significance of this vegetation.

The majority of the *Banksia attenuata-B. ilicifolia* low woodland will be impacted by clearing, with a small portion being retained in the central POS reserve. The woodland currently exists in three small patches and does not meet the area and condition thresholds for the EPBC Act listed Banksia Woodlands of the Swan Coastal Plain TEC. Considering the current size and fragmentation within the site, the clearing impacts are deemed to be minimal in terms of its conservation significance within the site.

The entire patch of *Eucalyptus globulus* present on the site (0.14 ha) will be cleared to minimise the bushfire hazard risk. This vegetation is in "Completely Degraded" condition and is not naturally occurring (planted). The removal of this vegetation will have negligible impact on the conservation values of the site.

In light of the above, it is anticipated the proposed subdivision will have minimal impact on conservation significant flora and vegetation within the site.

6.1.1.4 Management Response

Retention of vegetation is the key design objective for the subdivision, with approximately 40% (3.3 ha) of the site set aside as POS. As many remnant trees as practicable will also be retained within road reserves and other areas.

Remnant vegetation retained within the subdivision will be managed through the development and implementation of a Bushland Management Plan that will outline the management intent for the remnant vegetation, consistent with maintaining conservation values. The Bushland Management Plan will be prepared at subdivision stage to the satisfaction of the Shire of Capel.

Other mechanisms for minimising impacts on vegetation will include:

- access restrictions using fences and signage to prevent unauthorised access to native vegetation retained within POS reservations
- revegetation with local native species where possible.

6.1.2 Terrestrial Environmental Quality

6.1.2.1 Environmental Objective

To maintain the quality of land and soils so that environmental values are protected.

6.1.2.2 Applicable Guidelines, Standards and Policies

- Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016c).
- Assessment Levels for Soil, Sediment and Water (Department of Environment and Conservation 2010).
- Acid Sulfate Soils Guideline Series. Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (Department of Environment Regulation [DER] 2015a)
- Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015b).

6.1.2.3 Potential Impacts

ASS soils are stable when left undisturbed, but when they are exposed to air during excavation or dewatering, this can set off a reaction resulting in acidity (sulfuric acid being produced).

The site is within a Class 2 ASS risk category (moderate to low risk of ASS within 3 m of natural soils surface but high to moderate risk beyond 3m of natural soil surface). Potential impacts comprise the potential for oxidation of excavated or in-situ ASS generating acidic conditions, and possibly releasing metals into groundwater and surrounding freshwater environments.

6.1.2.4 Management Response

If ground disturbance is required in areas mapped as ASS risk, then ASS investigations will be undertaken in accordance with the DWER guidelines (DER 2015) and appropriate management protocols will be developed in consultation with the DWER.

6.1.3 Terrestrial Fauna

6.1.3.1 Environmental Objective

To protect terrestrial fauna so that biological diversity and ecological integrity are protected.

6.1.3.2 Applicable Guidelines, Standards and Policies

- Environment Protection and Biodiversity Conservation Act 1999.
- Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016.
- Environmental Factor Guideline: Terrestrial Fauna (EPA 2016d).

6.1.3.3 Potential Impacts

The site contains vegetation types identified as being used as habitat and foraging ground for four listed threatened species, these being; WRP (evidence of individuals, scats and dreys), Carnaby's and Baudin's black cockatoo (foraging evidence) and Forest Red-tailed black cockatoo (heard calling). Evidence of one DBCA (formerly DPaW) priority species; southern brown bandicoot using sections of the site was located (evidence of diggings).Development of the site will result in some of this vegetation being cleared which has the potential to cause detrimental impacts on these species.

As discussed in Section Fauna Habitat3.4.1 the habitat tree assessment identified a total of 17 trees with a DBH of > 50 centimetres (cms) within the site. Sixteen of the trees contained one or more "small" hollows. As per Harewood 2017, none of these hollows were deemed to be suitable for black cockatoos to use for nesting purposes (at the time of the survey). As such, it is considered that the black cockatoos may currently use the site for foraging and not breeding purposes. Of the vegetation types which exist onsite, the *Banksia attenuata-B. ilicifolia* low woodland and *Marri- Melaleuca preissiana- M. raphiophylla* low forest would be used for foraging by black cockatoos. The entirety of the *Marri- Melaleuca preissiana- M. raphiophylla* low forest is being retained in the south-east POS and a small portion of the *Banksia attenuata-B. ilicifolia* low woodland in the central POS (Figure B). As such, the minimal loss/modification of small areas of possible foraging habitat is deemed to have a negligible impact on the black cockatoos utilising the site (Harewood 2017).

WRPs have been confirmed to be utilising the site with evidence of individuals, scats and dreys identified across all vegetation types, except the *Melaleuca preissiana* woodland. Most evidence of WRP utilising the site as habitat (individuals and dreys) was found in the south/south-eastern portion of the site in and around the vicinity of the *Marri- Melaleuca preissiana- M. raphiophylla* low forest which will be retained within POS (Figure B). Nevertheless, areas of vegetation confirmed to be supporting WRP habitat / use are proposed to be cleared due to the development footprint. As such there is a potential for localised, modification/loss of small areas of habitat within the site which poses a possibly significant impact to the WRP.

Although there was evidence of the Southern Brown Bandicoot (DBCA priority species) utilising the site, the significance of possible impacts has been deemed negligible (Harewood 2017).

Additionally, as a result of disturbance during construction (noise and clearing activities), there may be an effect on the local abundance of fauna populations, not listed under the EPBC Act, due to interruption to fauna behaviour, including displacement, injury or death.

6.1.3.4 Management Response

Retention of fauna habitat is the key method for protection of fauna and will include the management of important fauna habitats within POS reservations through the implementation of the Bushland Management Plan.

The impact to WRP species from habitat clearing will be regulated and managed through the EPBC Act referral process to the Department of the Environment and Energy.

A Fauna Management Plan will also be formulated for implementation during any approved clearing at the site. The management plan should include, where considered reasonable and practical, the following management practices:

- During clearing operations a suitably experienced "fauna spotter" should be employed to inspect logs, trees and hollows (where possible) and undergrowth before clearing to reduce likelihood of injury to fauna. Trees / large shrubs observed to contain hollows or possum dreys should be felled in a manner that reduces the likelihood that fauna present will be injured. Hollows and dreys in fallen trees should be inspected for fauna prior to removal from the site. If feasible any fauna encountered should be relocated to suitable retained habitat nearby.
- At this stage it is recommended that any WRPs encountered during any clearing operations be moved/directed towards nearby retained vegetation considered as suitable by the fauna spotter. This will however be dependent on the extent of clearing, the number of WRP likely to be encountered and the area and suitability of retained habitat on site and should be re-assess when development plans are further progressed.
- During site works areas requiring clearing should be clearly marked and access to other areas restricted to prevent accidental clearing of areas to be retained.
- Design additional project infrastructure, including access routes, vehicle and plant storage and turn around areas, borrow pits etc. so that previously disturbed areas are used where possible and areas of sensitive vegetation (i.e. wetlands) are avoided.
- Fuel and chemical storage facilities should be bunded and located appropriate distance away from wetlands.
- If the recommended proposed landscaping/plantings are adopted they should primarily utilise peppermint (*Agonis flexuosa*) but also local seed stock of cockatoo food plants, specifically*, Corymbia, Eucalyptus, Banksia, Hakea*, and *Allocasuarina*. The final selection of suitable plants should be carried out after liaison with appropriate experts or local land care groups to ascertain which species are most suitable for the area. Plantings, as far as practical, should aim to ultimately create a continuous link by way of connecting canopies between trees.
- All staff working on site should be made aware that native fauna is protected. Personnel working on the project should not be allowed to bring firearms, other weapons or pets onsite.
- Native fauna injured during clearing or normal site operations should be taken to a designated veterinary clinic or a DPaW nominated wildlife carer. Any holes, pits or trenches required for services should be kept open for only as long as necessary and suitable escape ramps (45° batter) and bridging provided if the site is to be left unattended for extended periods. Significant sized holes, pits or trenches should be inspected for fauna immediately prior to filling.

6.2 Water Factors

6.2.1 Hydrological Processes

6.2.1.1 Environmental Objective

To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

6.2.1.2 Applicable Guidelines, Standards and Policies

- Environmental Factor Guideline: Hydrological Processes (EPA 2016e)
- Better Urban Water Management (WAPC 2008).
- Liveable Neighbourhoods Edition 4 (WAPC 2007).
- Stormwater Management Manual for Western Australia (DoW 2007).

6.2.1.3 Potential Impacts

Apart from a minor drainage line along the site's eastern boundary, there are no surface water courses onsite to be impacted by the development.

A MU wetland is located within the south-eastern portion of the site, the majority of which will be reserved as POS area. MU management category wetlands are defined as; "wetlands with few important ecological attributes and functions remaining" (Water and Rivers Commission 2001).

A RE wetland (priority wetland) is located within the site. This wetland will be retained within the central POS reserve and a 30 m buffer zone around the wetland has been included within the subdivision design to ensure its protection.

Potential impacts to the wetlands include:

- changes the hydrological regime resulting from modified landforms that may alter water flow and levels
- reduced groundwater or surface water quality caused by discharge of stormwater.

6.2.1.4 Management Response

Stormwater and drainage will be managed in accordance with the overarching Capel Townsite District Water Management Strategy (Cardno 2013).

Potential hydrological impacts will be managed through an UWMP which will be required to be completed at subdivision stage to the satisfaction of the Shire of Capel, on advice from the DWER.

6.3 People Factors

6.3.1 Social Surroundings

6.3.1.1 Environmental Objective

To protect social surroundings from significant harm.

6.3.1.2 Applicable Guidelines, Standards and Policies

- Aboriginal Heritage Act 1972.
- Environmental Factor Guideline: Social Surroundings (EPA 2016f).

6.3.1.3 Potential Impacts

The potential impacts of the proposed development on Aboriginal heritage sites are related primarily to direct disturbance of sites including excavation / construction activities unearthing and / or damaging artefacts or other items of cultural Aboriginal significance. Considering that there are no records of aboriginal heritage artefacts to be located on the site, the potential impacts are likely to be minimal.

6.3.1.4 Management Response

To ensure no impacts to Aboriginal heritage occur, the following management measures are recommended:

- Apply for approval to disturb the Aboriginal archaeological site under Section 18 of the *Aboriginal Heritage Act 1972* (if required).
- Be vigilant during earthworks. If any Aboriginal heritage objects are identified then work will stop immediately and the relevant authorities contacted.

6.3.2 Human Health

6.3.2.1 Environmental Objective

To protect human health from significant harm.

6.3.2.2 Applicable Guidelines, Standards and Policies

- Contaminated Sites Act 2003.
- Contaminated Sites Guidelines Series.
- Guidance Statement 40: Guidance Statement for Management of Mosquitoes by Land Developers (EPA 2000).

6.3.2.3 Potential Impacts

There are no known or suspected contaminated sites at Lot 71 Spurr Street, Capel.

Wetlands and low-lying areas susceptible to high groundwater levels can support mosquito breeding. Mosquitoes are known to cause nuisance and serious health risks to people.

6.3.2.4 Management Response

At this stage there is no management response required with regard to the disturbance of contaminated sites.

Management of mosquito populations will be addressed through the careful design and management of the drainage treatment systems. Health risks associated with mosquitoes at the site will be further assessed at subdivision stage and a Mosquito Management Plan will be prepared if required.

6.3.3 Bushfire Risk

6.3.3.1 Environmental Objective

The environmental objective is to reduce the risk of bushfire to people, property and infrastructure.

6.3.3.2 Applicable Guidelines, Standards and Policies

- SPP 3.7: Planning in Bushfire Prone Areas (Department of Planning and WAPC 2015).
- Guidelines for Planning in Bushfire Prone Areas, Version 1.2 (Department of Planning, Lands and Heritage, Department of Fire and Emergency Services and WAPC 2017).
- Australian Standard AS 3959:2009, Construction of Buildings in Bushfire-prone Areas (Standards Australia 2009).

6.3.3.3 Potential Impacts

Development may result in an increased risk to people, property and infrastructure from bushfires.

6.3.3.4 Management Response

A Bushfire Management Plan (Ecosystem Solutions 2017) has been prepared for the site, results and recommendations of which have been incorporated into the subdivision design process and will be implemented as part of the constructed development.

7 Management Commitments and Conclusions

Table 1 provides a summary of the following key environmental factors and proposed management measures:

- flora and vegetation
- acid sulfate soils
- terrestrial fauna
- hydrological processes
- heritage
- human health
- bushfire risk.

The subdivision design recognises the importance of the key environmental and landscape attributes of the site and surrounding areas, and incorporates these in an urban forum that creates an environmental responsive urban development.

The key environmental outcomes achieved are:

- protection and management of WRP habitat through the EPBC Act referral process
- protection and management of fauna habitats and vegetation within POS reservations and through the development and implementation of a Bushland Management Plan
- undertaking of revegetation and proposed landscaping primarily using peppermint (*Agonis flexuosa*) but also local seed stock of cockatoo food plants, specifically*, Corymbia, Eucalyptus, Banksia, Hakea*, and *Allocasuarina* to improve the availability of western ringtail possum and black cockatoo habitat
- implementation of best practice water sensitive urban design and stormwater drainage management
- implementation of management measures to reduce potential noise and fire impacts on future residences.

This EAR concludes that through the implementation of the proposed mitigation and management measures, the subdivision and development of the site meets the EPA's environmental objectives for the assessed environmental factors.

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Figures

RPS

Job Number: 116003.001
Doc Number: 001
Date: 02.10.17
Scale: 1:2,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate 2016 Subdivision Plan - RPS (113754-1-001D), 08.08.17

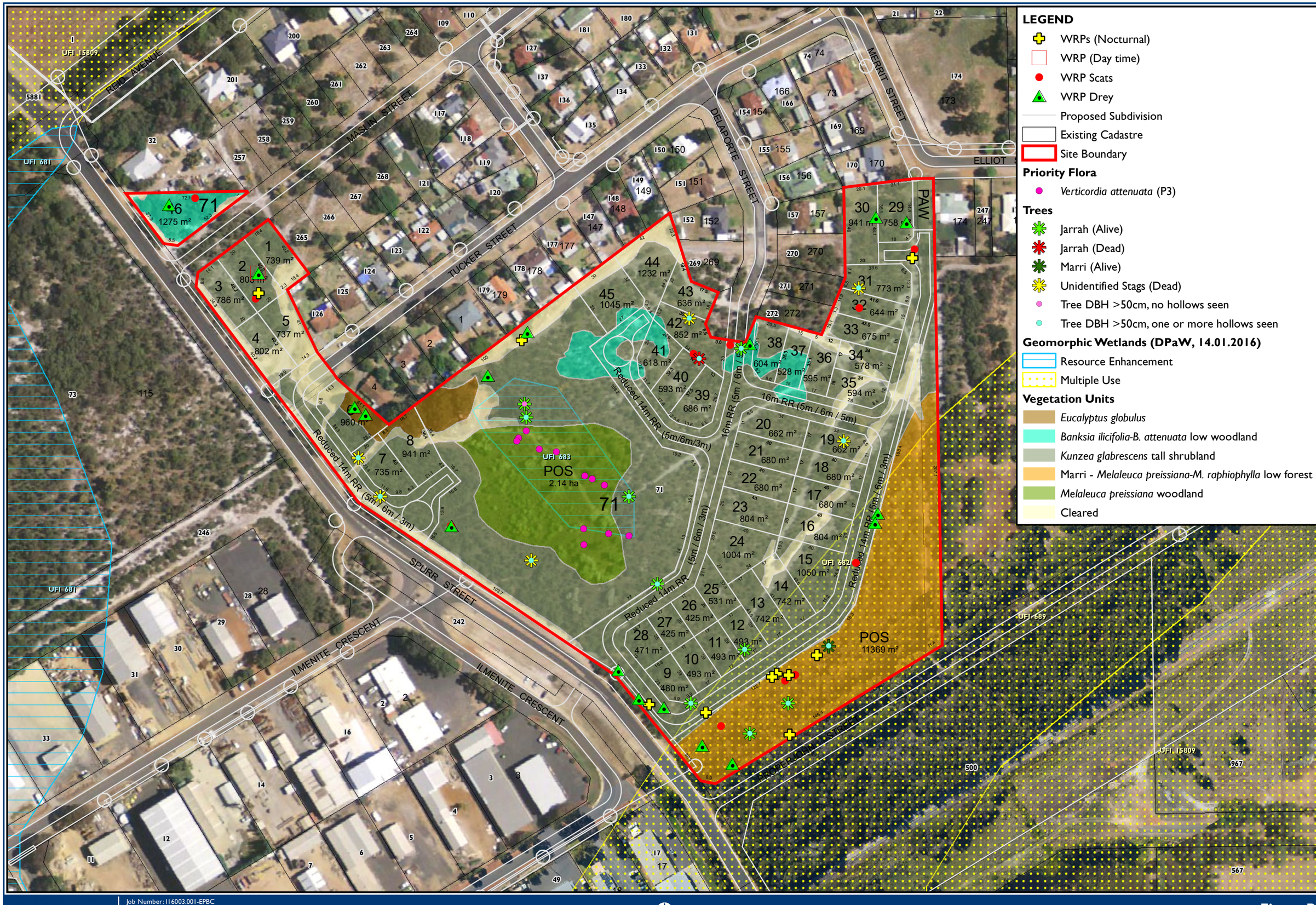
GDA 1994 MGA Zone 50

0 10 20 40 60 80 m

Figure A

Site Layout

Level 2, 27-31 Troode Street, West Perth | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au



LEGEND

- WRPs (Nocturnal)
- WRP (Day time)
- WRP Scats
- WRP Drey
- Proposed Subdivision
- Existing Cadastre
- Site Boundary

Priority Flora

- *Verticordia attenuata* (P3)

Trees

- Jarrah (Alive)
- Jarrah (Dead)
- Marri (Alive)
- Unidentified Stags (Dead)
- Tree DBH >50cm, no hollows seen
- Tree DBH >50cm, one or more hollows seen

Geomorphic Wetlands (DPaW, 14.01.2016)

- Resource Enhancement
- Multiple Use

Vegetation Units

- *Eucalyptus globulus*
- *Banksia ilicifolia-B. attenuata* low woodland
- *Kunzea glabrescens* tall shrubland
- Marri - *Melaleuca preissiana-M. raphiophylla* low forest
- *Melaleuca preissiana* woodland
- Cleared

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RPS

Job Number: 116003.001-EPBC
Doc Number: 002
Date: 13.12.17
Scale: 1:2,000 @ A3
Created by: MA
Source: Cadastre - Landgate, 2017 Orthophoto - Landgate 2017 Subdivision Plan - RPS (113754-1-001D), 08.08.17 Veg Units - Ecoedge, 08.12.17

GDA 1994 MGA Zone 50

0 10 20 40 60 80 m

Figure B

Key Environmental Factors

Appendix A

Level 2 Flora and Vegetation Survey - Lot 71 Spurr Street Capel

Report of a Level 2 Flora and Vegetation Survey at Lot 71 Spurr Street, Capel

Prepared for RPS Australia Asia Pacific
Revised, December 2017

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enquiries@ecoedge.com.au

Version	Origin	Review	Review date	Ecoedge release approval & purpose	Issue date
V1	M. Portman (prev. Strang)	R. Smith	20/12/2016		
V2	R. Smith	M. Portman	20/12/2016		
Final draft	M. Portman	G. Yeatman (RPS)		M. Strang, to G. Yeatman for review	21/12/2016
Final	G. Yeatman	M. Portman, R. Smith	10/02/2017	Final released to G. Yeatman by M. Portman	10/02/2017
Final revised 28/08/17	M. Portman	R. Smith, M. Portman	28/08/2017	Revised Final released to G. Yeatman by M. Portman	28/08/2017
Final revised 08/12/17	M. Portman		08/12/2017	Revised Final released to G. Yeatman by M. Portman	08/12/2017

Executive Summary

Ecoedge was engaged by RPS Australia Asia Pacific (RPS) in August 2016 to undertake a Level 2 Flora and Vegetation Survey of just over 8 ha of remnant vegetation on Lot 71 Spurr Street, in Capel.

Approval to develop part of Lot 71 as a residential subdivision has been received from the Western Australian Planning Commission (WAPC Approval 144786) and it is understood that the proponents are investigating the potential to develop the remainder of the subject site, also for residential subdivision.

The field survey was carried out on 9 and 20 September, 4 November and 12 December, 2016, in accordance with the Environmental Protection Authority and Department of Parks and Wildlife Technical Guide of 2015 (EPA and DPaW, 2015). Nine 10 x 10 m floristic quadrats were marked out within the Project Area.

One hundred and fifty-two vascular flora taxa were identified within the Project Area, of which 30 (20%) were introduced species. Two of the introduced species, **Asparagus asparagoides* and **Zantedeschia aethiopica*, are Declared Pest plants (s22) under the *Biosecurity and Agriculture Management Act 2007.*

One species of Priority Flora, *Verticordia attenuata* (P3), was found in a population comprised of an estimated 10-15 plants of varying ages.

The nine Project Area quadrats were compared to 12 other floristic quadrats from the Southern Swan Coastal Plain Survey (Gibson *et al*., 1994). Based on the results of the multivariate analysis and information collected from the 17 additional relevés, four vegetation units were recognised within the Project Area. Results from the multivariate analysis were used to indicate which floristic community types the Project Area quadrats could be assigned to.

The *Banksia attenuata-B. ilicifolia* low woodland vegetation unit is an occurrence of one of the floristic community types FCT21a or FCT21b. The latter FCT (Southern *Banksia attenuata* woodlands) is listed as a Priority ecological community by DPaW. Both FCT21a and FCT21b are included within the Commonwealth-listed threatened ecological community "*Banksia* Woodlands of the Swan Coastal Plain", which has the threat category of "Endangered" (DotEE, 2016e), however, none of the three patches of the *Banksia attenuata-B. ilicifolia* low woodland vegetation unit within the Project Area meet the minimum size requirements and condition requirements to be considered as occurrences of the "*Banksia* Woodlands of the Swan Coastal Plain" TEC.

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Statement of limitations

Reliance on Data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and for no other party. Ecoedge assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of Ecoedge or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

1 Introduction

Ecoedge was engaged by RPS Australia Asia Pacific (RPS) in August 2016 to undertake a Level 2 Flora and Vegetation Survey of approximately 8.24 ha of remnant vegetation on Lot 71 Spurr Street, Capel (Lot 71).

Approval to develop part of Lot 71 as a residential subdivision has been received from the Western Australian Planning Commission (WAPC Approval 144786) and it is understood that the proponents are investigating the potential to develop the remainder of the subject site, also for residential subdivision.

The flora and vegetation field assessment was undertaken by Russell Smith (Senior Botanist). The survey was undertaken in accordance with the Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) Technical Guide 2015 (EPA and DPaW, 2015).

This report compiles findings of the field survey. Information provided in this report may form part of an environmental impact assessment and may, as part of the approval process, be submitted to regulatory authorities to assist with their determination of the potential impact of the proposed development on flora and vegetation values.

1.1 Scope and Objectives

The primary objective of the Level 2 flora and vegetation survey was to determine whether there are any significant flora and/or vegetation values within the Project Area. The following are standard requirements for a Level 2 flora and vegetation survey under the new EPA/DPaW Technical Guide:

- Review the documented flora and vegetation of significance, based on DPaW records (databases);
- Conduct a review of other literature to summarise the values of flora and vegetation significance in the project area;
- Conduct a field assessment to:
    - identify the vascular flora species present;
    - determine the presence or absence of Declared Rare Flora (DRF), Priority or Significant Species;
    - assess conservation significance of vegetation and flora;
    - define and spatially map vegetation condition;
    - define and spatially map vegetation communities (achieved through the installation of a minimum of three 10 x 10 m floristic quadrats per vegetation unit and unmarked floristic relevés as required);
    - define and map threatened and priority ecological communities;

    - determine whether the Project Area are wholly or partly with an Environmentally Sensitive Area (ESA); and
- Prepare a report summarising findings
- Submit track logs showing the route(s) taken during the flora and vegetation field survey
- Submit shapefiles of all field survey data

1.2 Previous Flora Surveys within the Local Area

An out-of-season (winter) survey of the Project Area was undertaken by Eco Logic Environmental Services Pty Ltd in 2013. Flora and vegetation surveys of vegetation in the local vicinity have been carried out in the past by Ecoedge and others. Flora surveys, assessments and reviews have also been undertaken in nearby areas, although not all are publicly available and therefore could not be referenced. The most relevant and/or significant of those available that were referred to during the preparation of this report are listed below:

- Ecoedge (2015) Report of a Level 2 Flora and Vegetation Survey at the Capel Dry Plant. Unpublished report for Iluka Resources Limited.
- Ecoedge (2015) Report of a Level 1 Flora and Vegetation Survey along Boyanup Capel Road. Unpublished report for Main Roads Western Australia.
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- Mattiske Consulting (2009). Flora and Vegetation Survey of Capel Dry Plant Survey Area. Unpublished report prepared for Iluka Resources Ltd.

1.3 Biogeographic Region, Location and Site Description

The Project Area is situated within Perth Coastal Plain (SWA2) sub-region of the Swan Coastal Plain biogeographic region, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Australian Government, 2009).

It is located on the southwest outskirts of the Capel townsite (**Figure 1**), and covers an area of 7.33 ha. Of this, approximately 6.5 ha is remnant native vegetation, with the remainder being firebreaks and tracks. It is bounded by an unmade road reserve and rail reserve that contains remnant native vegetation to the southeast, Spurr Street to the southwest and residential or rural residential development on the remaining boundaries.

Elevation on site is fairly consistent, measuring between 14 and 16 m above sea level**.**

Land tenure within the Project Area is freehold, and is zoned Residential under the Shire of Capel Town Planning Scheme No 7.

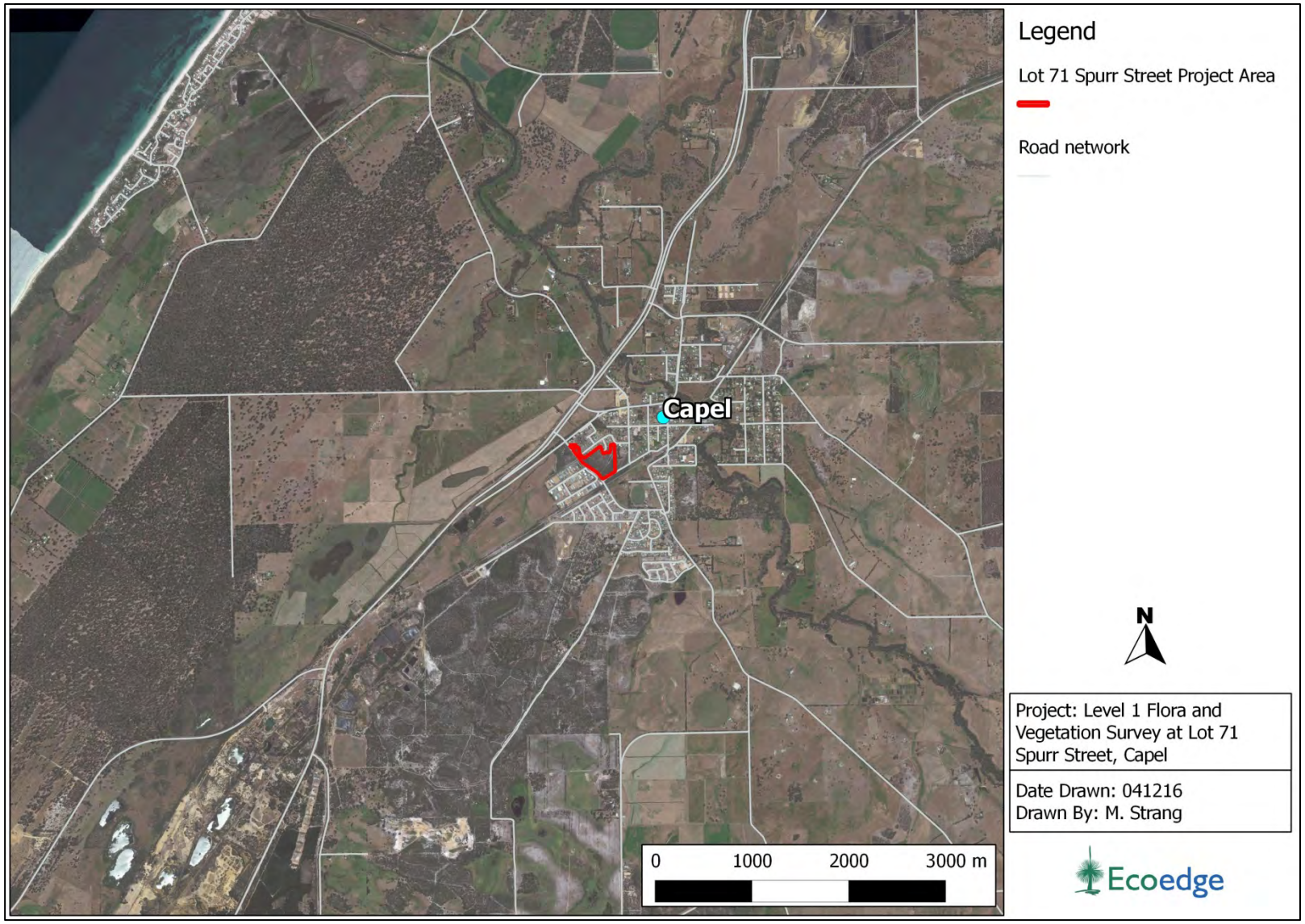

Figure 1. Lot 71 Spurr Street is located southwest of the Capel townsite.

1.4 Geology

Within the Swan Coastal Plain landform, the Project Area is situated on soils of the Bassendean Dune soil landscape system (212) (**Figure 3**). The Bassendean Dunes lie in the centre of the Swan Coastal Plain (between the Spearwood Dunes and the Pinjarra Plain), and are the oldest of the three aeolian dune systems. They are generally of low relief, often with broad swales or relatively flat sand sheets between the low dunes (Government of Western Australia, 2000).

There are two soil mapping units or soil phases occurring within the Project Area as mapped by Barnesby and Proulx-Nixon (2000); these are mapped in **Figure 2** and described in **Table 1.**

Table 1. Description of Soil Mapping Units occurring within the Survey Area (Barnesby and Proulx-Nixon, 2000).

Soil Mapping Unit	Description
212Bs_B1b	Very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons.
212BsW_SWAMP	Swamp

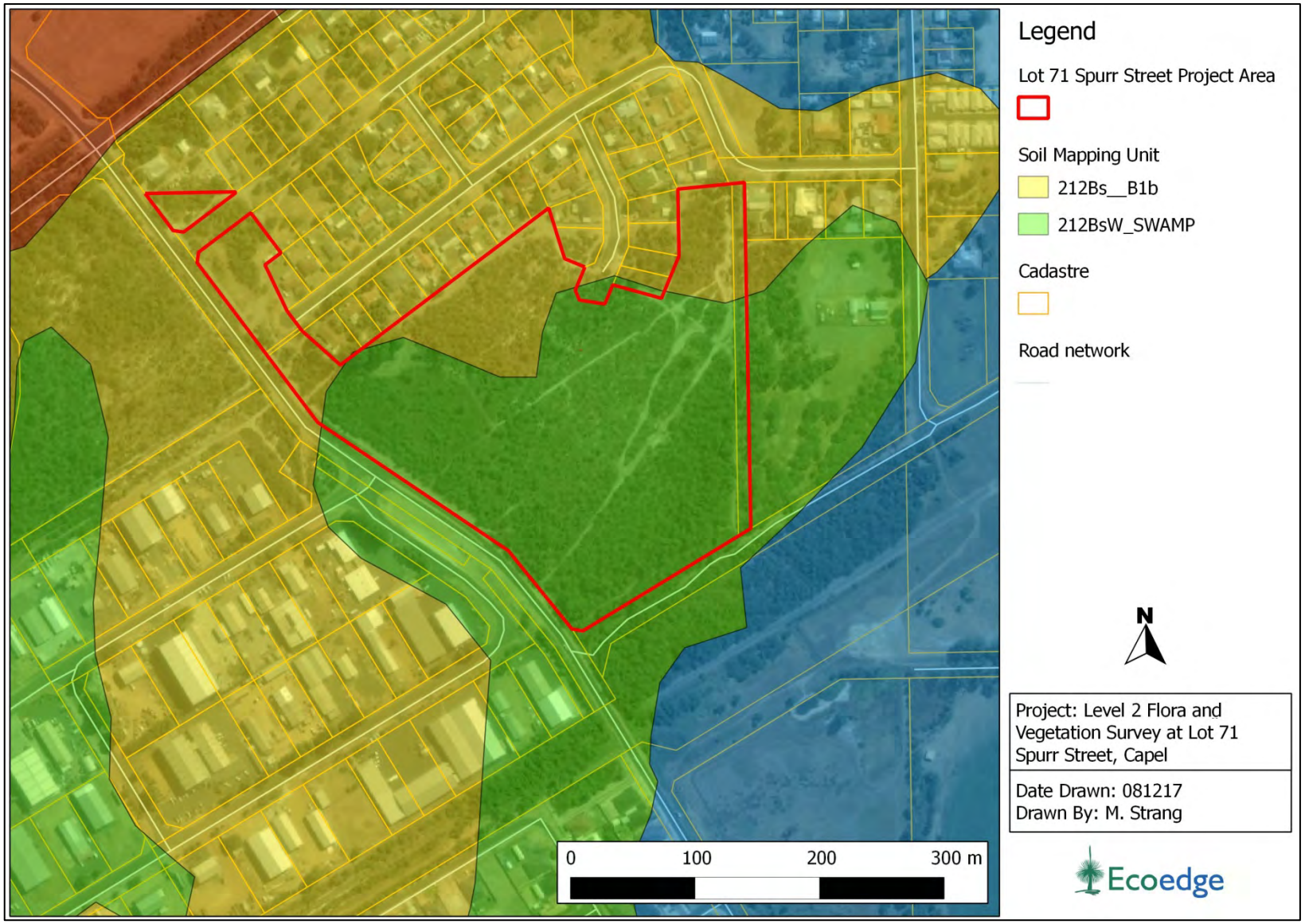

Figure 2. Soil mapping units occurring within the Project Area.

1.5 Vegetation

Variation in vegetation generally reflects the variations in soil and moisture conditions of a landscape.

A systematic survey of native vegetation in Western Australia was undertaken by J. S. Beard (along with others) during the 1970s, which described vegetation systems in the south-west of Western Australia at a scale of 1:250,000. Beard's vegetation maps attempted to depict the vegetation as it might have been prior to European settlement in terms of type and extent (Beeston *et al.*, 2001). The Beard Vegetation Association dataset, also referred to as the pre-European native vegetation extent dataset, was digitised by Shepherd *et al.* (2002).

Beard vegetation associations have been described to a minimum standard of Level 3 'Broad Floristic Formation' for the National Vegetation Inventory System (NVIS) (state-wide to regional scale). Two Beard vegetation associations mapped as occurring within the Project Area, viz. Association code 1000, which is described as 'Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (Melaleuca Spp.)'.

More recently, Heddle *et al*. (1980) mapped the vegetation of part of the Drummond Botanical Sub-district at a very broad scale, describing a series of vegetation complexes that are related groups of vegetation associations found on particular landform-soil units. A total of 38 vegetation complexes were mapped on the Swan Coastal Plain. Remnant vegetation within the Project Area was mapped as the Southern River Complex, which is described as 'open woodland of *Corymbia calophylla* - *Eucalyptus marginata* - Banksia species with fringing woodland of *Eucalyptus rudis* - *Melaleuca rhaphiophylla* along creek beds.'

Vegetation of the Southern River Complex is characterised by being in transition between the Pinjarra Plain and the Bassendean Dunes. This complex supports vegetation communities associated with the Bassendean Dunes but also those associated with pockets of alluvial and colluvial soils characteristic of the Pinjarra Plain.

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30%, or more, of the pre-clearing extent of each ecological community was necessary if Australia's biological diversity was to be protected (Environment Australia, 2001). This level of recognition is in keeping with the targets set in the EPA's Position Statement on the 'Environmental protection of native vegetation in Western Australia: clearing of native vegetation, with particular reference to the agricultural area' (EPA, 2000). With regard to conservation status, the EPA has set a target of 15% of pre-European extent for each ecological community to be protected in a comprehensive, adequate and representative reserve system (EPA, 2006).

Table 2 lists the percentage remaining of the Southern River Vegetation Complex and the percentage of each vegetation complex in formal and formal plus informal reserves, and

indicates whether this Vegetation Complex meets the Commonwealth's 30% target (Environment Australia, 2001) and the EPA's 15% target (EPA, 2006).

Table 2. Vegetation Complexes present in the Project Area with regard to the EPA and Commonwealth retention targets (DEC, 2007).

Vegetation Complex	% Remaining of pre-European	Is the 30% Target Met?	% in Formal Reserves	% in Formal + All Informal Reserves	Is the 15% Target Met?
Southern River	18.9%	No	1.9%	1.9%	No

In addition to the EPA and Commonwealth targets above, the Government of Western Australia, in its report on the *Statewide Vegetation Statistics incorporating the CAR Reserve Analysis,* provides information on the pre-European and current extent of the ecological communities of Western Australia and reports on the status of the CAR reserve system for WA (Government of Western Australia, 2015). Only reserves managed by DPaW under the *Conservation and Land Management Act 1984* are considered for inclusion in the "CAR Reserve Analysis". For this analysis, the Beard vegetation associations are used, as this is the only mapping dataset that covers the entire state. An assessment of the vegetation associations in the Project Area against the *Statewide Vegetation Statistics* is presented in **Table 3.**

Table 3. Beard Vegetation Associations of the Project Area assessed against the Statewide Vegetation Statistics (Government of Western Australia, 2015).

Beard Vegetation Association	% Remaining of pre-European extent	% of pre-European extent in all DPaW managed land
'Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (Melaleuca Spp.)' (1000)	51.97%	7.72%

1.6 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia's Department of Parks and Wildlife (DPaW, previously the Department of Environment and Conservation (DEC)) as "...naturally occurring biological assemblages that occur in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole, they provide many of the processes which support specific ecosystems and provide ecological services." (DEC, 2010).

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; 'presumed totally destroyed', Critically Endangered (CE), Endangered

(E) or Vulnerable (Vu) (DEC, 2010). Possible threatened ecological communities that do not meet survey criteria are added to DPaW's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC, 2010). The current listing of Threatened and Priority Ecological Communities is specified in DPaW, 2016a and 2016b. Threatened Ecological Communities can also be listed under the EPBC Act (Department of the Environment and Energy (DotEE), 2016a; Department of Environment, Water, Heritage and the Arts (DEWHA, 1999)).

There are three categories of TEC under the EPBC Act: Critically Endangered (CE), Endangered (E) and Vulnerable (V) (DotEE, 2016b). These are defined in **Table 4**.

Table 4. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2016b).

Category	Definition
Critically endangered	If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
Endangered	If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable	If, at that time, an ecological, community is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

A Protected Matters Search Tool query for communities listed under the EPBC Act occurring within a 5 km radius of the Project Area was undertaken (DotEE, 2015c, **Appendix 1**), and the current DPaW TEC and PEC database was consulted (DPaW 2016a, 2016b). An extract from DPaW's TEC and PEC database within a 5 km radius of the Project Area was also generated (DPaW, 2016c). These are presented in **Table 5**.

Table 5. Threatened and Priority Ecological Communities known to occur within 5 km of the Project Area (DPaW 2016c; DotEE, 2016c)

Community Name	Community Description	Status (WA)	Status (EPBC Act)
'Claypans of the Swan Coastal Plain' – a federally listed TEC consisting of the following four State-listed communities: 1. SCP07: Herb rich saline shrublands in clay pans (TEC) 2. SCP08: Herb rich shrublands in clay pans (TEC) 3. SCP09: Dense shrublands on clay flats (TEC) 4. SCP10a: Shrublands on dry clay flats (TEC) 5. Clay pans with shrubs over herbs (PEC)		1. VU 2. VU 3. VU 4. EN 5. P1	CR
'Banksia Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed communities			EN
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	NA	VU
SCP1b	*Eucalyptus (Corymbia) calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	VU	
Busselton Yate community	*Eucalyptus cornuta, Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone	Priority 1	
SCP30b	Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	Priority 3	
SCP21b	Southern *Banksia attenuata* woodlands	Priority 3	

No threatened or priority ecological communities are recorded within or in the immediate vicinity of the Project Area.

1.7 Threatened and Priority Flora

Species of flora and fauna are defined as having Declared Rare (Threatened) or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Environment Regulation recognises these threats of extinction and consequently applies regulations towards population and species protection.

Declared Rare (Threatened) Flora species are gazetted under Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* (WC Act) and therefore it is an offence to 'take' or damage rare flora without Ministerial approval. Section 6 of the WC Act 1950 - 1980 defines 'to take' as "… to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means."

Priority Flora are under consideration for declaration as 'rare flora', but are in need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four).

Under the WC Act, Threatened Flora are ranked according to their level of threat using IUCN Red List categories and criteria of Extinct (EX), Critically Endangered (CE), Endangered (EN) or Vulnerable (VU). **Table 6** presents the categories of Declared Rare and Priority Flora as defined by the WC Act (DPaW 2015).

Table 6. Definitions of Declared Rare and Priority List flora (DPaW, 2015).

Conservation code	Category
T	Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the *Wildlife Conservation Act 1950*. 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 (CR, EN, VU, EX). A species that is listed as Threatened and assessed as 'Critically Endangered' would therefore have its status written as T (CR).
P1	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
P4	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Under the EPBC Act, a species may be listed in one of six categories; the definitions of these categories are summarised in **Table 7** (DotEE, 2016d).

A list of Threatened or Priority flora known to occur within 5 km of the Project Area generated from an extract from DPaW's Declared Rare and Priority Flora database and records from the Western Australian Herbarium (DPaW, 2016d), from a NatureMap search (DPaW, 2016e), and the Protected Matters Search Tool report (DotEE, 2016c) is presented in **Table 8**.

Table 7. Categories of Threatened Species under the EPBC Act (DotEE, 2016d).

Category	Definition
Extinct (Ex)	A native species is eligible to be included in the ***extinct*** category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (ExW)	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Table 8. List of Declared Rare and Priority List flora known to occur within 5 km of the Project Area (DPaW, 2016d, 2016e; DotEE, 2016c).

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Brachyscias verecundus	T (CE)		Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	Low
Caladenia procera	T (CE)	Sep-Oct	Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow. Rich clay loam. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Low
Andersonia gracilis	T (EN)	Sep-Nov	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	None
Banksia nivea subsp. *uliginosa*	T (EN)	Aug-Sep	Dense, erect, non-lignotuberous shrub, 0.2–1.5 m high. Fl. yellow, brown. Sandy clay, gravel.	Low
Caladenia huegelii	T (EN)	Sep-Oct	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green, cream, red. Grey or brown sand, clay loam.	Low
Darwinia whicherensis	T (EN)	Oct-Nov	Erect low shrub to 30 cm, flowers green, outer red. Winter-wet area of shrubland over shallow red clay over ironstone.	Low
Drakaea elastica	T (EN)	Oct-Nov	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red, green, yellow. White or grey sand. Low-lying situations adjoining winter-wet swamps.	Low-Moderate
Gastrolobium papilio	T (EN)	Oct-Dec	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red. Sandy clay over ironstone and laterite. Flat plains.	Low
Lambertia echinata subsp. *occidentalis*	T (EN)	Feb/May-Jun/Oct	Prickly, much-branched, non-lignotuberous shrub, to 3 m high. Fl. yellow. White sandy soils over laterite, orange/brown-red clay over ironstone.	Low
Petrophile latericola	T (EN)	Nov	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow. Red lateritic clay. Winter-wet flats.	Low
Synaphea stenoloba	T (EN)	Aug-Oct	Caespitose shrub, 0.3–0.45 m high. Fl. Yellow. Sandy or sandy clay soils. Winter-wet flats, granite. Shrublands and woodlands on loamy soils.	Low

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Verticordia densiflora var. *pedunculata*	T (EN)	Dec-Jan	Erect to spreading shrub, 0.3-0.6 m high. Fl. pink/pink-white. Grey/yellow sand, sandy loam. Winter-wet low-lying areas.	Low-Moderate
Banksia squarrosa subsp. *argillacea*	T (VU)	Jun-Nov	Erect, open, non-lignotuberous shrub, 1.2–4 m high. Fl. yellow, Jun–Nov. White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats.	Low
Chamelaucium sp. S coastal plain (R.D.Royce 4872)	T (VU)	Oct-Dec		Low
Diuris drummondii	T (VU)	Nov-Jan	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow. Low-lying depressions, swamps.	Low
Diuris micrantha	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.3–0.6 m high. Fl. yellow, brown. Brown loamy clay. Winter-wet swamps, in shallow water.	Low
Drakaea micrantha	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.15–0.3 m high. Fl. red, yellow. White-grey sand.	Low-Moderate
Caladenia busselliana	T	Sep-Oct	Tuberous, perennial, herb, 0.2–0.3 m high. Fl. green, yellow, cream. Sandy loam. Winter-wet swamps	Low
Calectasia cyanea	T	Jun-Oct	Rhizomatous, clump forming, woody perennial, herb, 0.1-0.6 m high, to 0.3 m wide. Fl. blue/purple. White, grey or yellow sand, gravel.	Low
Bolbcschoenus medianus	P1		Rhizomatous, perennial, grass-like or herb (sedge). Fl. red-brown. Mud. In water and on river banks.	Low
Amperea micrantha	P2	Oct-Nov	Low, spreading, bushy perennial, herb, 0.1–0.3 m high. Fl. brown. Sandy soils.	Low-Moderate
Calytrix sp. Tutunup (G.J. Keighery & N. Gibson 2953)	P2	Oct	Slender, spreading shrub, to 3 m high. Fl. white. Yellow-grey clayey loam, red clayey loam, laterite, ironstone. Slopes and flats, winter-wet areas, grazed paddocks.	Low-Moderate
Leucopogon sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. Pericalymma ellipticum wet shrubland, Marri-Jarrah woodland.	Low
Mantia australasica	P2	Oct-Nov		Low

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Thelymitra variegata	P2	Jun-Sep	Tuberous, perennial, herb, 0.1–0.35 m high. Fl. orange, red, purple, pink. Sandy clay, sand, laterite.	Low
Adelphacme minima	P3	Nov-Jan	Sandy soils.	Low-Moderate
Angianthus drummondii	P3	Oct-Dec	Erect annual, herb, to 0.1 m high. Fl. yellow. Grey or brown clay soils, ironstone. Seasonally wet flats.	Low-Moderate
Boronia anceps	P3	Sep-Dec or Jan	Perennial, herb, 0.3-0.6 m high, lacking lignotuber, stem flattened and ancipitous when young. Fl. pink/pink-purple. White sand, gravelly laterite. Seasonally swampy heaths.	Low
Boronia tetragona	P3	Oct-Dec	Perennial, herb, 0.3–0.7 m high, leaves sessile, entire, with papillate margins, branches quadrangular, sepals ciliate. Fl. pink, red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	Low
Chamaescilla gibsonii	P3	Sep	Clumped tuberous, herb. Fl. blue. Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Low
Chordifex gracilior	P3	Sep-Dec	Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown. Peaty sand. Swamps.	Low
Isopogon formosus subsp. *dasylepis*	P3	Jun-Dec	Low, bushy or slender, upright, non-lignotuberous shrub, 0.2–2 m high. Fl. pink, purple, red. Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Low
Jacksonia gracillima	P3	Oct-Nov	Decumbent shrub - 20 cm high and 50 cm wide. Flowers standard orange-yellow; eye yellow with red halo; wings/keel red. Seasonally damp shrublands and woodlands, on sandy loams or clay loams.	Low
Lasiopetalum membranaceum	P3	Sep-Dec	Multi-stemmed shrub, 0.2-1 m high. Fl. pink, blue, purple. Sand over limestone.	None
Loxocarya magna	P3	Sep-Nov	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Low

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Meeboldina thysanantha	P3	Dec	Rhizomatous, perennial, herb (rush-like), 0.4-1 m high. Fl. brown. Sand. Swamps.	Low
Pultenaea pinifolia	P3	Oct-Nov	Erect, slender shrub, 1-3 m high. Fl. yellow, orange. Loam or clay. Floodplains, swampy areas.	Low
Stylidium paludicola	P3	Oct-Dec	Reed-like perennial, herb, 0.35-1 m high, leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide. Inflorescence racemose. Fl. pink. Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	Low
Synaphea hians	P3	Jul-Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. Yellow. Sandy soils. Rises.	Low-Moderate
Tetratheca patvifolia	P3	Oct	Small shrub, 0.2-0.3 m high. Fl. pink. Jarrah, woodland, wandoo woodland, gravelly soils.	Low
Verticordia attenuata	P3	Dec-May	Shrub, 0.4–1 m high. Fl. pink. White or grey sand. Winter-wet depressions.	Moderate
Acacia flagelliformis	P4	May-Sep	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow. Sandy soils. Winter-wet areas.	Low-Moderate
Acacia semitrullata	P4	May-Oct	Slender, erect, pungent shrub, (0.1-)0.2-0.7(-1.5) m high. Fl. cream, white. White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Moderate
Aponogeton hexatepalus	P4	Jul-Oct	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green, white. Mud. Freshwater: ponds, rivers, claypans.	Low
Caladenia speciosa	P4	Sep-Oct	Tuberous, perennial, herb, 0.35-0.6 m high. Fl. white, pink. White, grey or black sand.	Low
Eucalyptus rudis subsp. *cratyantha*	P4	Jul-Sep	Tree, 5-20 m high, bark rough, box-type. Fl. white. Loam. Flats, hillsides.	Moderate
Franklandia triaristata	P4	Aug-Oct	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white, cream, yellow , brown, purple. White or grey sand.	Low-Moderate

Species	Cons Status*	Flowering	Habitat	Likelihood of Occurrence
Stylidium striatum	P4	Oct-Nov	Rosetted perennial herb. Inflorescence racemose. Fl. yellow. Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	Low
Thysanotus glaucus	P4	Oct-Mar	Caespitose, glaucose perennial, herb, 0.1–0.2 m high. Fl. purple. White, grey or yellow sand, sandy gravel.	Low

* The WC Act Conservation Status is shown, the EPBC Act status, where relevant, is in brackets.

Some of the species listed in **Table 8** could potentially occur within the Survey Area, based on an assessment of their preferred habitats. All species listed would have either been flowering at the time of survey or could be identified in the field without flowers.

1.8 Regional Ecological Linkages

Information for this section is taken from Molloy *et al*. (2009) and their report on the South West Regional Ecological Linkages (SWREL) Project.

Ecological linkages are defined as:

"*A series of (both contiguous and non-contiguous) patches which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape*."

Regional ecological linkages link protected patches of regional significance by retaining the best (condition) patches available as stepping stones for flora and fauna between regionally significant areas. This increases the long-term viability of all the constituent areas.

The SWREL report is the result of collaboration between the Western Australian Local Government Association's *South West Biodiversity Project* and the then Department of Environment and Conservation's *Swan Bioplan* to provide a tool for the identification of ecological linkages and guidance for the protection of linkages through planning policy documents.

Molloy *et al.* (2009) assessed and assigned 'proximity value ratings' to all patches of remnant native vegetation as a way of indicating their distance from the nearest regional ecological linkage axis line. These values are defined in **Figure 3.** It should be noted however, that the proximity value of a patch of remnant vegetation to an ecological linkage is not intended to replace the need to consider the other biodiversity conservation values of that patch of remnant vegetation.

Molloy *et al.* (2009) identify a regional ecological linkage axis line within 100 m of the Project Area (**Figure 4**). This linkage is associated with the adjacent vegetated unmade road reserve and rail reserve, which is contiguous with the vegetation of the Project Area. Vegetation within the Project Area has subsequently been classified as having a '1a' proximity value rating, which is the highest category. Vegetation within the Project Area forms part of a regional ecological linkage.

While there is no statutory basis for regional ecological linkages identified through the SWREL project, the importance of ecological linkages have been recognised as an environmental policy consideration in EPA and Planning policy over the last decade (EPA, 2009 and references therein). In its statement regarding the SWREL Project, the EPA stated

that even though Ecological Linkages are just one measure of the conservation values of a patch of remnant vegetation it expected that:

> *In preparing plans and proposals for development, consideration will be given to both the site-specific biodiversity conservation values of patches of native vegetation, as well as the landscape function and core linkage significance of a patch in supporting the maintenance of ecological linkage* (EPA, 2009).

Figure 3. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (from Molloy et al., 2009).

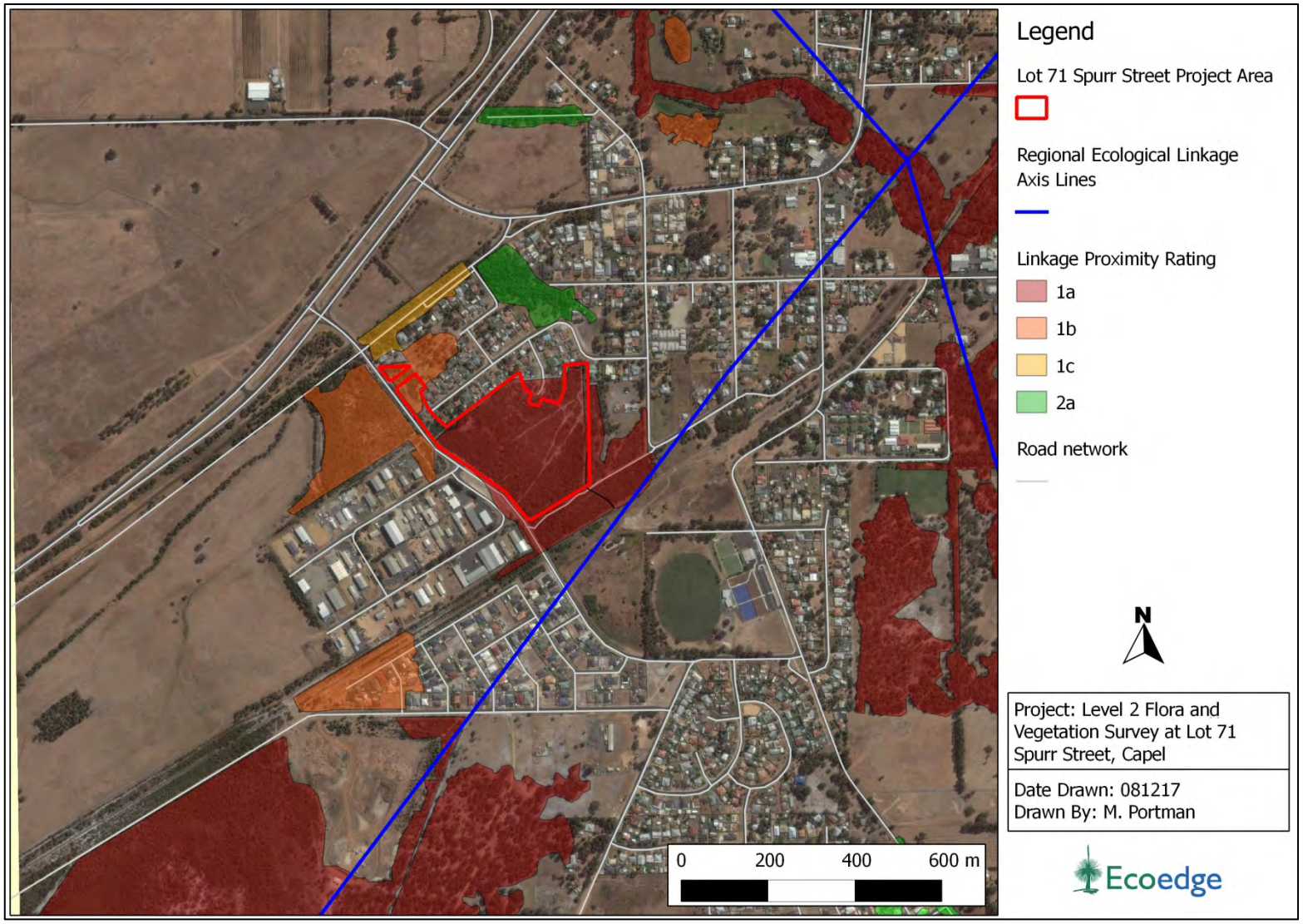

Figure 4. The Project Area in relation to regional ecological linkages (Molloy et al., 2009).

1.9 Geomorphic Wetlands

Wetlands on the Swan Coastal Plain have been classified into types using the geomorphic wetland classification system of Semeniuk & Semeniuk (1995), which is based on the characteristics of landform and water permanence, for example. lake, sumpland and dampland. The Swan Coastal Plain wetlands have also been evaluated and assigned an appropriate management category and corresponding category objective, providing guidance on the nature of the management and protection the wetland should be afforded. These categories are described in **Table 9**.

Table 9. Definitions of and objectives for the different wetland management categories (modified from Essential Environmental Services, 2005).

Management Category	Definition	Category Objective
Conservation	Wetlands with high conservation value for both natural or human use	To preserve wetland (natural) attributes and functions
Resource Enhancement	Wetlands with moderate natural and human use attributes that can be restored or enhanced	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use	Wetlands that score poorly on both natural and human use attributes	To use, develop and manage wetlands in the context of water, town and environmental planning

Two wetlands have been mapped within the Project Area – a small 'Resource Enhancement' sumpland in the west and a 'Multiple Use' dampland along the southern and eastern boundaries (DEC, 2008) (**Figure 5**). A sumpland is defined as a seasonally inundated basin; a dampland is a seasonally waterlogged basin.