

Detailed and Targeted Flora and Vegetation Survey

Vasse Diversion Drain Upgrade



Prepared for Water Corporation
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Executive Summary

- A Detailed and Targeted Flora and Vegetation Survey was undertaken of approximately 6.5 km of the Vasse Diversion Drain between Queen Elizabeth Drive and the Busselton Golf Course, in the City of Busselton.
- The Survey was conducted on the 4, 18, 24 September and 5 October 2019.
- Two targeted species were *Caladenia procera* (T, CR) and *Drakaea elastica* (T, EN).
- The total area surveyed was approximately 42 hectares in size and comprised of approximately 2.38 ha of native vegetation.
- One hundred and four (104) vascular flora taxa were identified within the Survey Area, 22 of these being naturalised non-native or planted species.
- Two species of conservation significance were found.
 - Two populations of *Caladenia procera* were located 1.9 m (1 flower, 15 basal leaves) and 1.2 m (two basal leaves) south of the Survey Area boundary. However, only the single plant that flowered can be considered a certain identification of the taxon.
 - Three plants of *Austrostipa bronwenae* (T, CR), were found within and adjacent to a quadrat installed for the survey. It was located approximately 108 m west of the Survey Area.
- *Drakaea elastica* was not found during this survey.
- The pest plant *Zantedeschia aethiopica* (Arum-lily) was found in the Survey Area.
- One of the five Vegetation Units, Unit A, comprising an area of 1.26 ha shows similar characteristics to the Priority 1 ecological community (PEC) '*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest'. Approximately 0.29 ha of this vegetation unit is classified as in 'good' condition.
- Greater than 97% of the Survey Area is classified as degraded or completely degraded, mainly due to historical drain construction and maintenance activities.
- The Survey Area comprises six vegetation complexes; the Abba Complex, Karrakatta Complex – Central and South Complex, the Quindalup Complex, Yoongarillup Complex, Vasse Complex and the Cokelup Complex. The remnant vegetation within the Survey Area was comparable to three of these complexes: the Quindalup, Vasse and Yoongarillup vegetation complexes in terms of their spatial distribution, species composition and structure.
- The Abba complex has less than 10% of its Statewide pre-European extent remaining. The Cokelup Complex and Karrakatta Complex – Central and South have

less than 30% remaining whilst the Yoongarillup, Vasse and Quindalup complexes exceed the 30% retention target.

- The mapped boundary of a Conservation category wetland occurs within the northern boundary of the Survey Area. This estuary related wetland is associated with the New River.
- The Survey Area is intersected by two recognised ecological axis lines. One associated with the New River and Vasse River Estuary, occurs at the northern boundary of the Survey Area and the other associated with the Vasse River, occurs at the southern boundary of the Area. Vegetation within Survey Area occurring in proximity to these axis lines has been assigned the PV ratings of “1a, 1b and 1c”.
- There is an Environmentally Sensitive Area (ESA) within the northern boundary of the Survey Area. This is associated with Conservation Category New River estuary wetlands. There is also a formally recorded occurrence of *C. procera* approximately 25 m from the Survey Area.

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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 Water Corporation (the Corporation) in August 2019 to undertake a Detailed and Targeted Flora and Vegetation Survey within a proposed Development Area Footprint (DAF) along an approximately 6.5 km section of the Vasse Diversion Drain, from Queen Elizabeth Avenue to the proposed spillway site near the Busselton Golf Course in the City of Busselton (Survey Area) (**Figure 1** and **Figure 2**).

The Corporation proposed works within the DAF include widening the Vasse Diversion Drain, reconstruction of the diversion dam and construction of an overflow structure to manage large storms (1% Annual Exceedance Probability). The Corporation plans to implement this project in the 2020/2021 financial year.

The clearing for this project has potential to impact upon matters of national environmental significance, and was referred to the Department of the Environment and Energy (DotEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in May 2017 (EPBC 2017/7932). In May 2018 a Clearing Permit Application (CPS 8191/1) was submitted to the Department of Water and Environment Regulation.

A number of previous ecological surveys have been undertaken across the project area for fauna, flora and vegetation.

The objectives of this scope of works are to:

- refine the mapping of significant ecological communities (particularly the known PEC),
- more accurately quantify the vegetation condition of significant ecological communities,
- confirm the presence, absence and habitat potential for Threatened orchids and
- Liaise with DBCA SW Region in regards to proposed survey methodology prior to the survey.

The flora and vegetation survey was undertaken over four visits during the period 4 September to 5 October 2019. The methodology aligned with State and Commonwealth requirements for the bioregion and species and communities present, and was consistent with State guidelines and Technical Guides (including Environmental Protection Authority (EPA) Technical Guidance (2016)) and Commonwealth survey guidelines for any relevant threatened species. The project brief was supplied by the Corporation.

The total area surveyed was approximately 42 hectares in size and comprised of approximately 2.38 ha of native vegetation.

This report compiles findings of the survey.

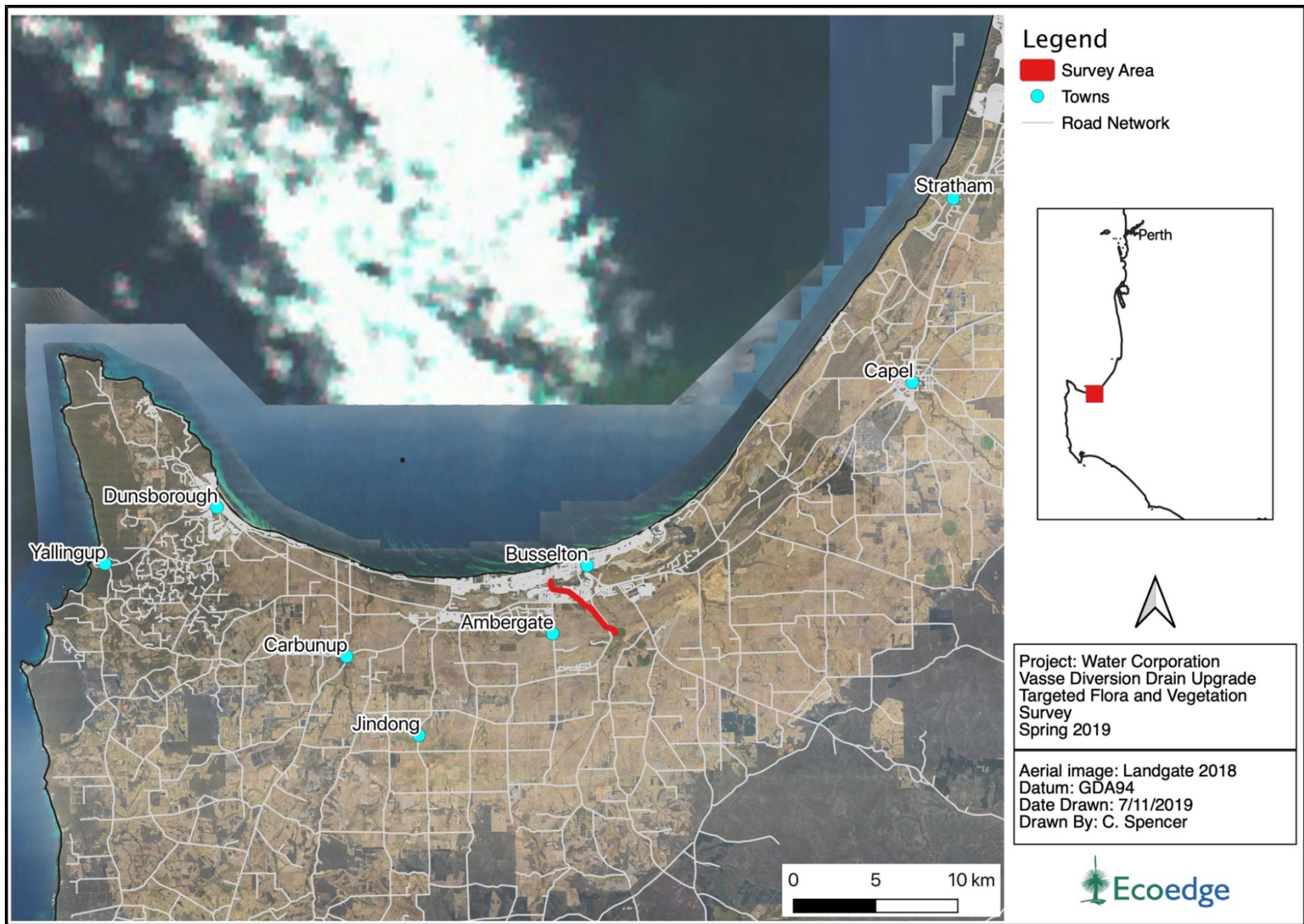


Figure 1. Aerial photograph showing the location of the Survey Area.

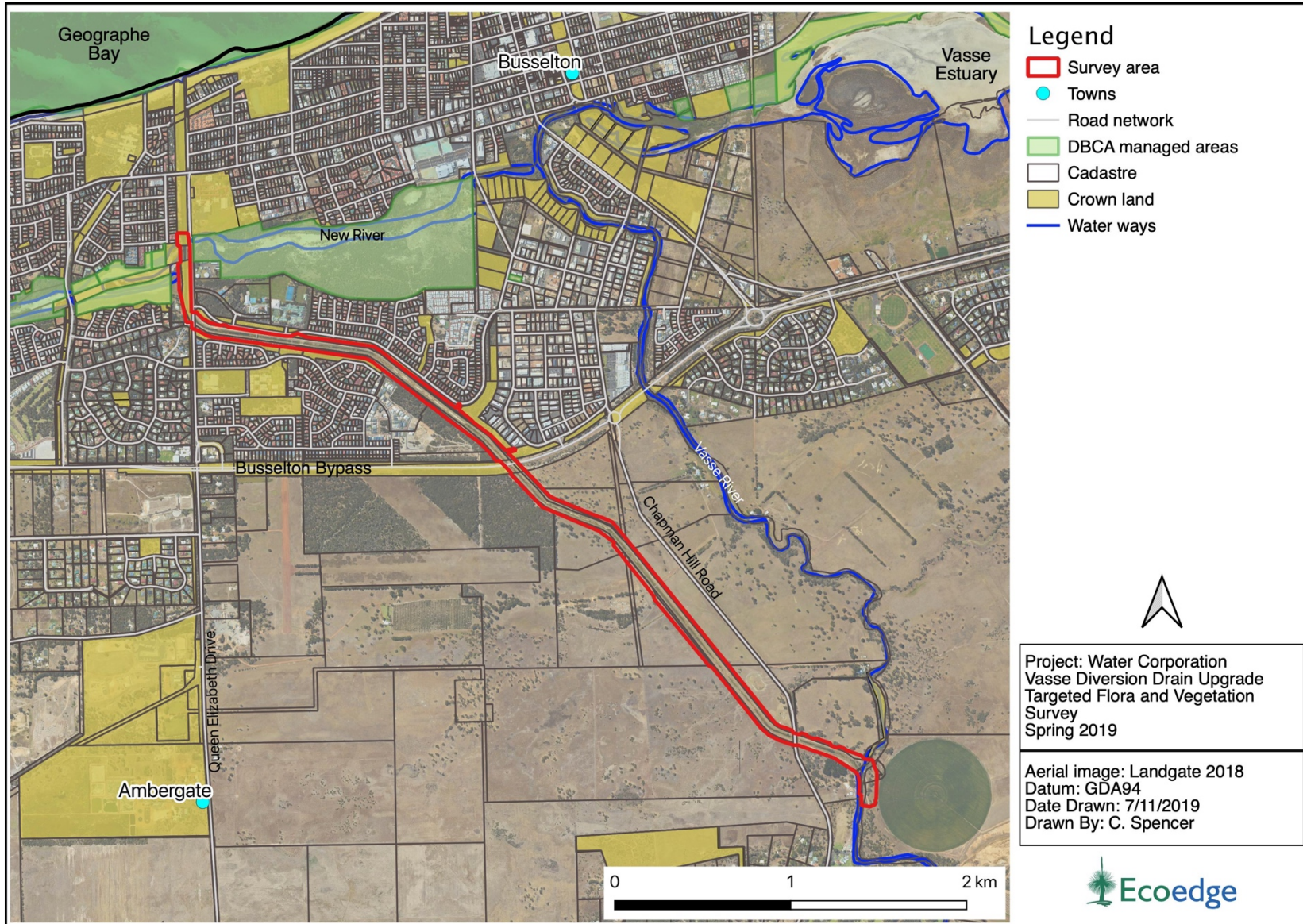


Figure 2. The Survey Area in context of surrounding land uses.

1.1 Scope

The scope of works was to carry out a field survey of the DAF to more clearly define the following:

- Refine the mapping of significant ecological communities (particularly the known PEC).
- More accurately quantify the vegetation condition of significant ecological communities.
- Confirm the presence, absence and habitat potential for Threatened orchids.
- Liaise with DBCA SW Region in regards to proposed survey methodology prior to survey.
- Location and extent (boundaries) and condition of Threatened and Priority Ecological Communities within the DAF. The PEC is known to occur in the study area and this survey will collect data to support and refine this mapping of the PEC.
- Supporting quadrat data collection and Primer/PATN analysis of the Priority 1 listed Priority Ecological Community (PEC) listed as *Eucalyptus rudis* (flooded gum), *Corymbia calophylla*, *Agonis flexuosa* Closed Low Forest (near Busselton).
- Vegetation condition assessment of the PEC.
- Targeted survey for the Carunup King Spider Orchid (*Caladenia procera*) noting that the majority of the DAF is previously cleared and not likely to be supporting habitat.
- Targeted survey for the Hammer Orchid (*Drakaea elastica*); noting the above and that targeted surveys are best undertaken due leaf stage July-August.
- Prepare a technical flora and vegetation survey report, draft and final version.
- Prepare a formal letter/memorandum addressed to Water Corporation providing advice and recommendations based on the field survey and technical report and
- Provide all spatial/mapping data collected during the survey in IBSA compliant format.

Surveys are to be completed during the most appropriate season for detection and identification of the flora likely to occur in the project area. In addition to optimising the timing, surveys must involve adequate sampling effort to support the environmental impact assessment.

Works must be completed in accordance with relevant State and Federal guidelines and legislation relating to flora, vegetation, fauna, MNES, permits and access requirements.

2 Location and Biogeographic Region

The Survey Area is situated within the Swan Coastal Plain (SWA02) sub-region of the Swan Coastal Plain biogeographic region, as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia, 2016). It covers approximately 42 ha and is situated approximately 1.9 kilometres (km) south west of the centre of Busselton within the City of Busselton (**Figure 1**).

It comprises predominantly of non-native vegetation along both sides of the Vasse Diversion drainage reserve between Queen Elizabeth Drive and the Busselton Golf Course. North west of the Busselton Bypass the Survey Area occurs within a suburban context adjacent to generally narrow and linear bush reserves, including the securely fenced Caladenia Reserve managed by the City of Busselton. South east of the Busselton Bypass the Survey Area occurs within a predominantly agricultural context adjacent to predominantly cleared privately managed land holdings (**Figure 2**).

3 Existing Environment

3.1 Geology

The Survey Area is situated on the Swan Coastal Plain, which consists of a series of geomorphological elements which are sub-parallel to the present coastline (McArthur and Bettenay, 1960). Each of these geomorphic elements has distinctive geology, vegetation, topography and soils. The western portion of the Swan Coastal Plain is comprised of a series of three successive coastal dune systems representing the geological history of shoreline movement and aeolian deposition of marine particles. The dominant dune systems in the Swan Coastal Plain, from west to east, are Quindalup Dunes, Spearwood Dunes and Bassendean Dunes. In the Busselton region (i.e. south of the Capel River), the Quindalup Dunes are adjoined in the east to the Ludlow Plains, which in turn are adjoined in the east and south by the Abba Plains. The Abba Plains are bounded in the east by the Blackwood Plateau (Tille and Lantzke, 1990). These soil-landscape systems have been divided into subsystems, and further divided into soil phases (Tille and Lantzke, 1990).

These Systems are intersected by rivers and estuaries such as the Vasse River which have their own characteristic landform systems. Within the Swan Coastal Plain, the Survey Area is situated on soils of four different land form systems (**Figure 3**).

Quindalup System (211Qu): White to cream coloured deep calcareously derived dunes forming along the current coastline.

Spearwood Dune System (211Sp): The Spearwood Dune system is of aeolian origin and is comprised of red/brown, yellow and pale yellow/grey sands. It is characterised by limestone capped peaks and low dunes and swales of shallow pale grey sands over yellow sands (McArthur and Bettenay, 1960).

Vasse System: Poorly drained estuarine flats of the Swan Coastal Plain. Tidal flat soil, saline wet soil and pale deep sand. The associated vegetation is samphire, sedges and paperbark woodland.

Abba System (213Ab): The Abba system is very flat, poorly drained and characterised by wet soils and semi-wet soils, pale deep sands, pale sandy earths and grey deep sandy duplexes (Hanran-Smith, 2002).

Eight soil phases are mapped across the Survey Area. These are described in **Table 1** and mapped in **Figure 3**. The dominant soil phase in the Survey Area is the Spearwood 211SpLDw soil phase.

Table 1. Soil Mapping Units occurring within the Survey Area (Tille and Lantszke, 1990).

System	Soil Phase	Description
211Qu Quindalup	211Qu_Qf2	Relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands.
211Sp Spearwood	211SpLD1	Flats and very low dunes. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
	211SpLDw	Flats with poor subsoil drainage in winter. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
211Va Vasse	211VaWOW	Poorly drained flats around the edge of the Vasse Estuary. Dark calcareous sands and mixed estuarine deposits.
	211VaWOWy	Vasse, Wonnerup and Broadwater Estuaries, low lying depressions which are often underwater in winter and saline in summer.
213Ab Abba	213AbAB1	Flats and low rises with sandy grey brown duplex (Abba) and gradational (Busselton) soils.
	213AbBvw	Small narrow swampy depressions along drainage lines. Alluvial soils.
	213AbCkw	Poorly drained flats with heavy clayey (Cokelup) soils. Some areas saline in summer.

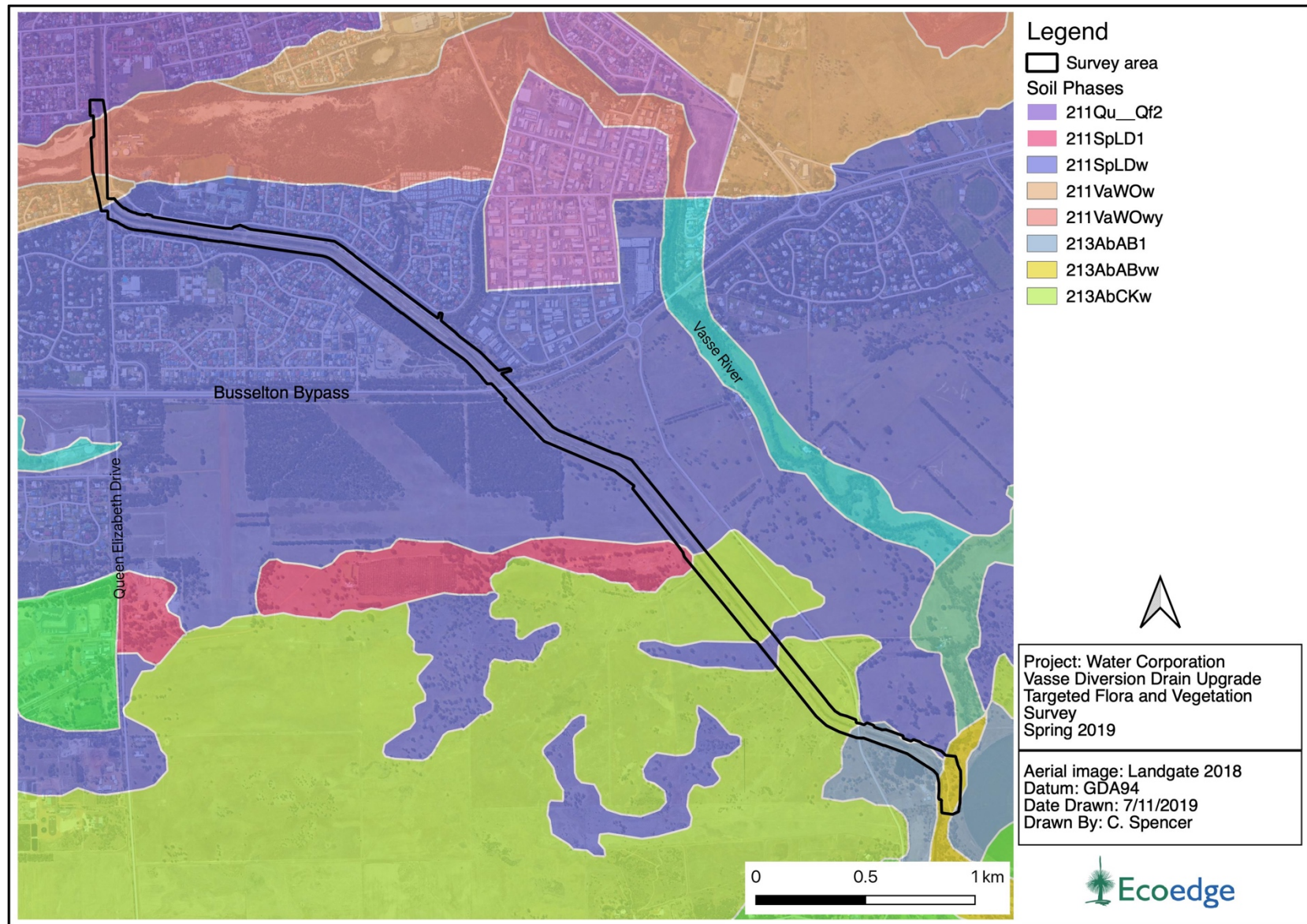


Figure 3. Soil phases mapped within the Survey Area (Tille and Lantszke, 1990).

3.2 Vegetation Description according to pre-European Mapping Datasets

The Survey Area covers approximately 42 ha and contains approximately 2.38 ha of remnant native vegetation classed in ‘degraded’ or better condition.

3.2.1 Vegetation Complexes

In 2016, the Department of Parks and Wildlife (DPaW) revised the mapping datasets for the Darling Scarp and Plateau Regional Forest Agreement (RFA) mapping of Matisse and Havel (1998) and the Swan Coastal Plain mapping of Heddle, *et al.* (1980). The purpose of the revision was to fill data gaps and improve alignment and correlation between the two datasets (Webb, *et al.* 2016)¹.

Six Vegetation Complexes occur within the Survey Area, according to the 1:250,000 mapping of Vegetation Complexes in the Swan Coastal Plain of Western Australia (Heddle, *et al.* 1980) as updated by Webb, *et al.* (2016). These are described in **Table 2** and mapped in **Figure 4**.

Table 2. Vegetation complexes mapped for the Survey Area (Webb, *et al.* 2016).

Vegetation Complex	Description
Abba Complex (30)	A mixture of open forest of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - Banksia species and woodland of <i>Corymbia calophylla</i> (Marri) with minor occurrences of <i>Corymbia haematoxylon</i> (Mountain Marri). Woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - Melaleuca species along creeks and on flood plains.
Karrakatta Complex – Central and South (49)	Predominantly open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri) and woodland of <i>Eucalyptus marginata</i> (Jarrah) - Banksia species. <i>Agonis flexuosa</i> (Peppermint) is co-dominant south of the Capel River.
Quindalup Complex (55)	Coastal dune complex consisting mainly of two alliances - the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of <i>Melaleuca lanceolata</i> (Rottnest Teatree) - <i>Callitris preissii</i> (Rottnest Island Pine), the closed scrub of <i>Acacia rostellifera</i> (Summer-scented Wattle) and the low closed <i>Agonis flexuosa</i> (Peppermint) forest of Geographe Bay.

¹ At the time of preparation of this report, DBCA was transitioning to the use of a revised mapping dataset for both the Swan Coastal Plain and Southern Jarrah Forest that filled data gaps and addressed differences in the Swan Coastal Plain mapping of Heddle, *et al.* (1980) and the Jarrah Forest mapping of Matisse and Havel (1988) (Webb, *et al.* 2016).

Vegetation Complex	Description
Yoongarillup Complex (56)	Woodland to tall woodland of <i>Eucalyptus gomphocephala</i> (Tuart) with <i>Agonis flexuosa</i> in the second storey. Less consistently an open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). South of Bunbury is characterised by <i>Eucalyptus rudis</i> (Flooded Gum)- <i>Melaleuca</i> species open forests.
Vasse Complex (57)	Mixture of the closed scrub of <i>Melaleuca</i> species fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca</i> species and open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). Will include areas dominated by <i>Tecticornia</i> and <i>Sarcocornia</i> species (Samphire) near Mandurah and south of the Capel River.
Cokelup Complex (99)	Closed-scrub/woodland of <i>Melaleuca</i> species over sedges and annually renewed herbs on inundated clay flats. Fringing open forest of <i>Eucalyptus rudis</i> , <i>Corymbia calophylla</i> , <i>Banksia littoralis</i> , <i>E. gomphocephala</i> .

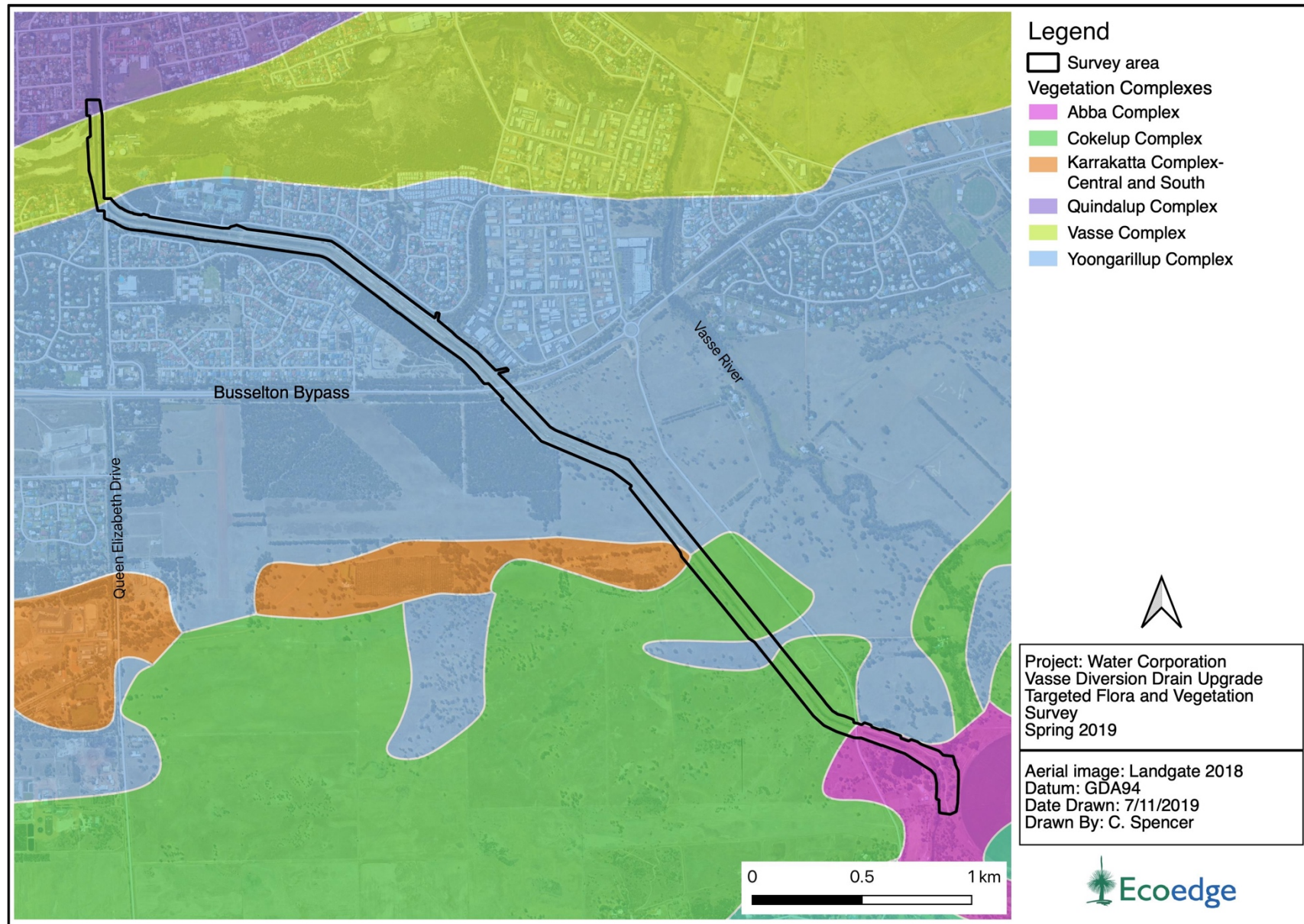


Figure 4. Vegetation Complexes within the Survey Area (Webb, *et al.* 2016).

3.3 Other Surveys

Four other flora and vegetation surveys have been prepared in support of the Vasse Diversion Upgrade Project:

1. GHD 2017a. Water Corporation Vasse Diversion Drain Upgrade: Flora and Fauna Study. Prepared for the Water Corporation.
2. GHD 2017b. Vasse Diversion Drain Fauna and Vegetation Assessment – Additional Survey Area. Prepared for the Water Corporation.
3. GHD 2017c. Vasse Diversion Drain – Caribunup King Spider Orchid Targeted Survey. Prepared for the Water Corporation.
4. Bennett, Dr Eleanor, 2019. Distribution of *Conospermum caeruleum* subsp. Busselton. Prepared for the Water Corporation.

These surveys have been summarised and peer reviewed by Ecoedge for the Corporation in order to identify assess gaps or methodology concerns (Ecoedge, 2019a).

In conclusion all the field surveys and resulting reports were found to be thorough and credible. The two insufficiencies noted, which were both identified by the surveying ecologist / botanist, were the lack of access to all of the survey area in GHD 2017a and the March timing of the survey of additional areas in GHD 2017b.

It was recommended that these areas should be surveyed in spring prior to the commencement of any upgrade works to determine the presence of conservation significant species. No other ‘gaps’ or methodology concerns were noted.

4 Factors of Environmental Significance

4.1 Assessment of Remaining Extent against Pre-European Extent

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).

In its report on the Statewide Vegetation Statistics incorporating the Comprehensive, Adequate and Representative (CAR) Reserve Analysis, the Government of Western Australia 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, 2018). This system is also based on the National retention targets of 30% overall. Only reserves managed by DBCA under the *Conservation and Land Management Act 1984* are considered for inclusion in the “CAR Reserve Analysis”.

Table 3 presents the vegetation statistics as they relate to the percentage remaining of the six vegetation complexes identified within the Survey Area.

The red, orange and yellow shading in the tables indicates the status of the Commonwealth 30% retention target.

Colour indicator	>30%	<30%	<10%
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Table 3. Vegetation complexes mapped within the Survey Area with regard to the Commonwealth retention targets (Government of Western Australia, 2018).

Vegetation Complex	Pre-European (ha)	Current Extent (ha)	% Remaining	% remaining in DBCA reserves
Abba Complex (30)				
Swan Coastal Plain	50,892.78	3,326.20	6.54	0.36
Karrakatta Complex – Central and South (49)				
Swan Coastal Plain	53,080.99	12,465.24	23.48	8.06
Quindalup Complex (55)				
Swan Coastal Plain	54,573.87	32,982.87	60.44	10.98
Yoongarillup Complex (56)				
Swan Coastal Plain	27,977.93	9,946.39	35.55	18.34
Vasse Complex (57)				
Swan Coastal Plain	15,691.63	4,929.02	31.41	14.58
Cokelup Complex (99)				
Swan Coastal Plain	3,010.98	315.75	10.49	4.70

4.2 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia’s DBCA (previously DPaW and 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, 2013).

Under Section 27 of the *Biodiversity Conservation Act 2016* (BC Act) the Western Australian Minister for Environment may list communities that are considered to be under significant threat as a Threatened ecological communities (TEC). These TECs can be listed under one of three conservation categories; critically endangered (CR), endangered (EN), vulnerable (V). The BC Act also provides for listing communities as collapsed ecological communities.

Possible TECs that do not meet survey criteria are added to the DBCA’s PEC lists under Priorities 1, 2 or 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, 2013).

The current listing of Threatened and Priority ecological communities is specified in DBCA (2018a, 2019a). The conservation categories for these Threatened and Priority ecological communities are defined in **Appendix 1**.

Threatened ecological communities can also be listed under the Commonwealth *Environment and Biodiversity Conservation Act 1999* (EPBC Act) (Department of the Environment and Energy (DotEE), 2018a; 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). These are defined in **Appendix 2** (DotEE, 2018b).

Under both the State (BC Act) and Federal Act (EPBC Act) ministerial authorisation is required where significant permanent modification to a TEC will occur.

Noting that if an occurrence of a threatened ecological community is found during a survey conducted under the auspices of the *Environmental Protection Act 1986* (EP Act) it must be mandatorily reported to the Chief Executive Officer of the DBCA under Section 49 of the BC Act.

TECs or PECs occurring within 10 km of the Survey Area generated from an extract from the DBCA databases (DBCA, 2019c) and a Protected Matters Search Tool (PMST) query (DoTEE, 2019a) are listed in **Table 4** and mapped in **Figure 5**. A copy of the PMST data search is provided in **Appendix 3**.

The mapped boundaries of three of these communities occur within the Survey Area. These are the State and Federally listed 'Banksia Woodlands of the Swan Coastal Plain' (TEC, EN) the State and Federally listed Subtropical and Temperate Coastal Saltmarsh (P3, VU) and the *Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest P1 PEC.

Table 4. Threatened and Priority ecological communities occurring within 10 km of the Survey Area (DBCA 2018a; DBCA, 2019a; DBCA 2019c; DotEE, 2018a).

Community Name	Community Description	Status (WA) State	Status (EPBC Act) Federal
	<p>'Claypans of the Swan Coastal Plain' – a federally listed TEC consisting of the following four State-listed communities:</p> <ol style="list-style-type: none"> 1. SWAFCT07: Herb rich saline shrublands in clay pans (TEC) 2. SWA10a: Shrublands on dry clay flats (TEC) 	<ol style="list-style-type: none"> 1. VU 2. EN 	CR
	Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	PEC (P3)	CR
	' <i>Banksia</i> Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed communities	Various	EN
	Subtropical and Temperate Coastal Saltmarsh	PEC (P3)	VU
	SWAFCT2: Southern wet shrublands	TEC (EN)	NA
	<i>Eucalyptus rudis</i> , <i>Corymbia calophylla</i> and <i>Agonis flexuosa</i> Closed Low Forest	PEC (P1)	NA
	Busselton Yate Community	PEC (P1)	NA

Note: This table only includes formally recognised TEC and PECs that are known of and mapped by DBCA and are included in their database.

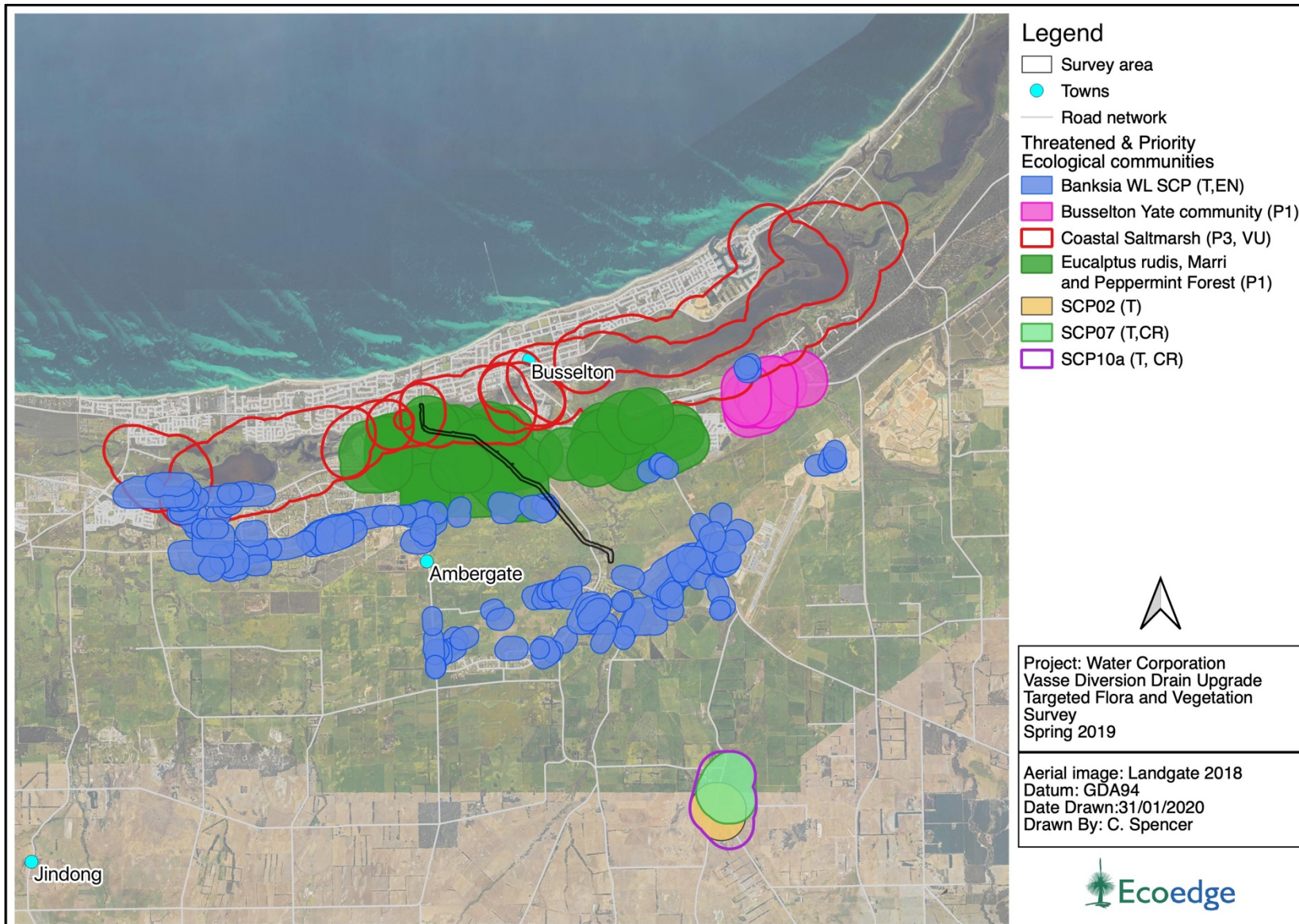


Figure 5. Threatened and priority ecological communities mapped within 10 km of the Survey Area (DBCA, 2019c).

4.3 Threatened and Priority Flora

Species of flora are defined as having a Threatened or Priority conservation status where their extant populations are restricted geographically and or under threat of possible extinction. The DBCA recognises these threats and consequently applies regulations towards population and species protection.

Threatened extant flora species are listed under Section 19 of the BC Act and are ranked according to their level of threat using IUCN Red List categories and criteria of; critically endangered (CR), endangered (EN), vulnerable (VU).

Priority flora are under consideration for future declaration as “Threatened flora”, dependent on more information. Species classified as Priority One to Three (referred to as P1, P2 and P3) are in need of further survey to determine their status, while Priority Four (P4) species are adequately known rare or threatened species that require regular monitoring.

Threatened flora lists are formally reviewed on an annual basis, whilst the priority flora list is subject to a less formal ongoing review. The current listing of Threatened and Priority flora is specified in (DBCA, 2018b). The current list of Threatened and priority flora within the Survey Area is shown in **Figure 6**.

Categories of Threatened and Priority flora as defined by the BC Act are presented in **Appendix 4**, (DBCA, 2019b).

Threatened flora may also be protected under the Commonwealth EPBC Act and be listed in one of six categories; the definitions of these categories are summarised in **Appendix 5** (DotEE, 2018b).

Threatened or Priority flora occurring within 10 km of the Survey Area generated from an extract from the DBCA databases (DBCA, 2019d) and NatureMap search (DBCA, 2019e) are provided in **Appendix 6**. Taxa listed under the EPBC Act (based on results of the Protected Matters Search Tool query (DotEE, 2019a) were also considered in the preparation of the table. Several of the species could potentially occur within the Survey Area, based on an assessment of their preferred habitats.

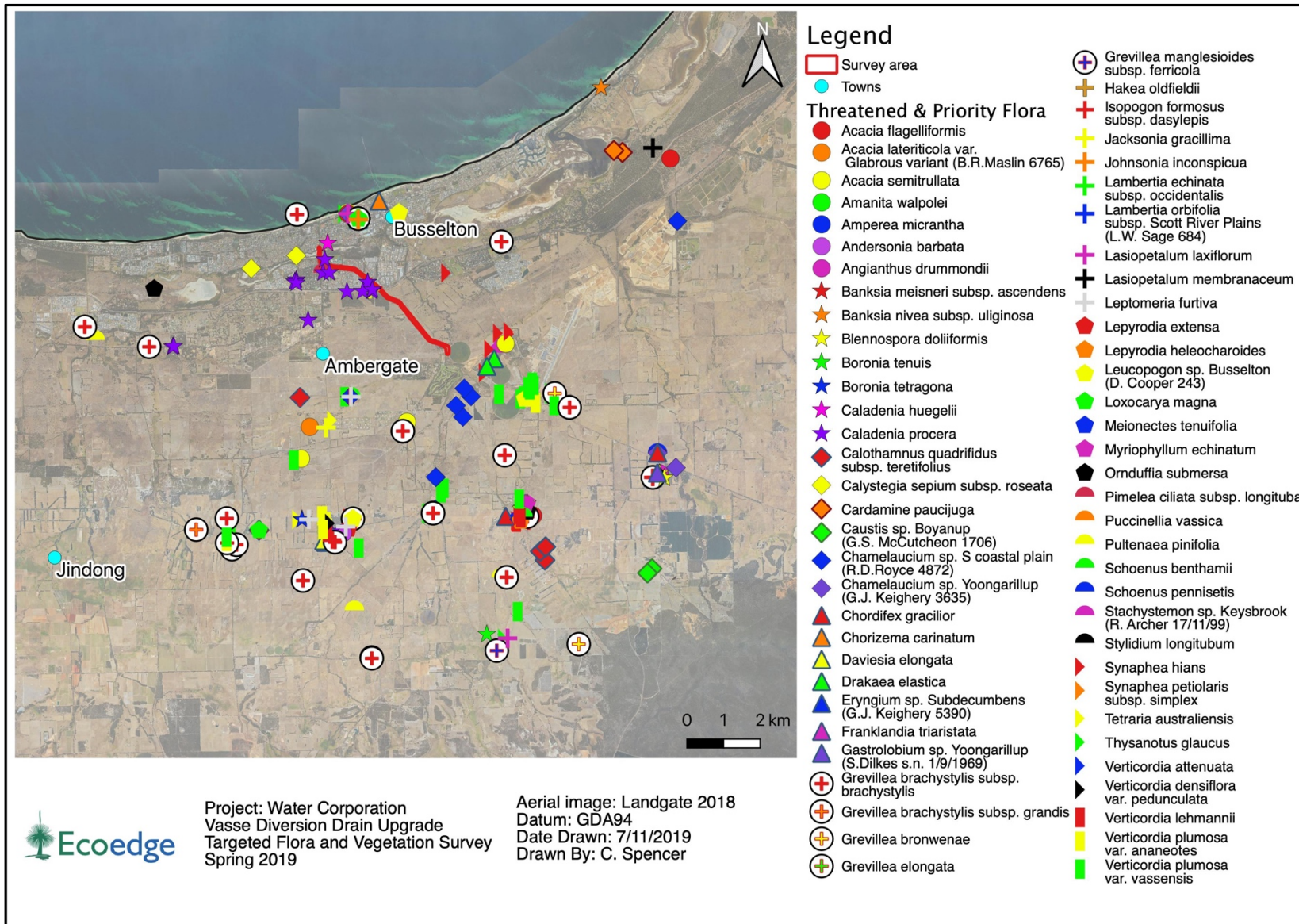


Figure 6. Threatened and priority flora mapped within 10km of the Survey Area (DBCA, 2019d).

4.4 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 lakes, palusplains and damplands. These are described in **Table 5**. 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 6**.

Table 5. Wetland types (adapted from Semeniuk & Semeniuk, 1995).

Management Category	Basin	Flat	Channel	Slope	Highland
Permanently inundated	Lake		River		
Seasonally inundated	Sumpland	Floodplain	Creek		
Intermittent inundation	Playa	Barlkarra	Wadi		
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

Table 6. 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

The mapped boundary of a Conservation category wetland occurs within the northern boundary of the Survey Area. This estuary related wetland is associated with the New River, **Figure 7** and **Figure 8**).

The south east portion of the Survey Area comprises Multiple Use palusplain wetlands which have been predominantly cleared for agriculture **Figure 7** and **Figure 8**).

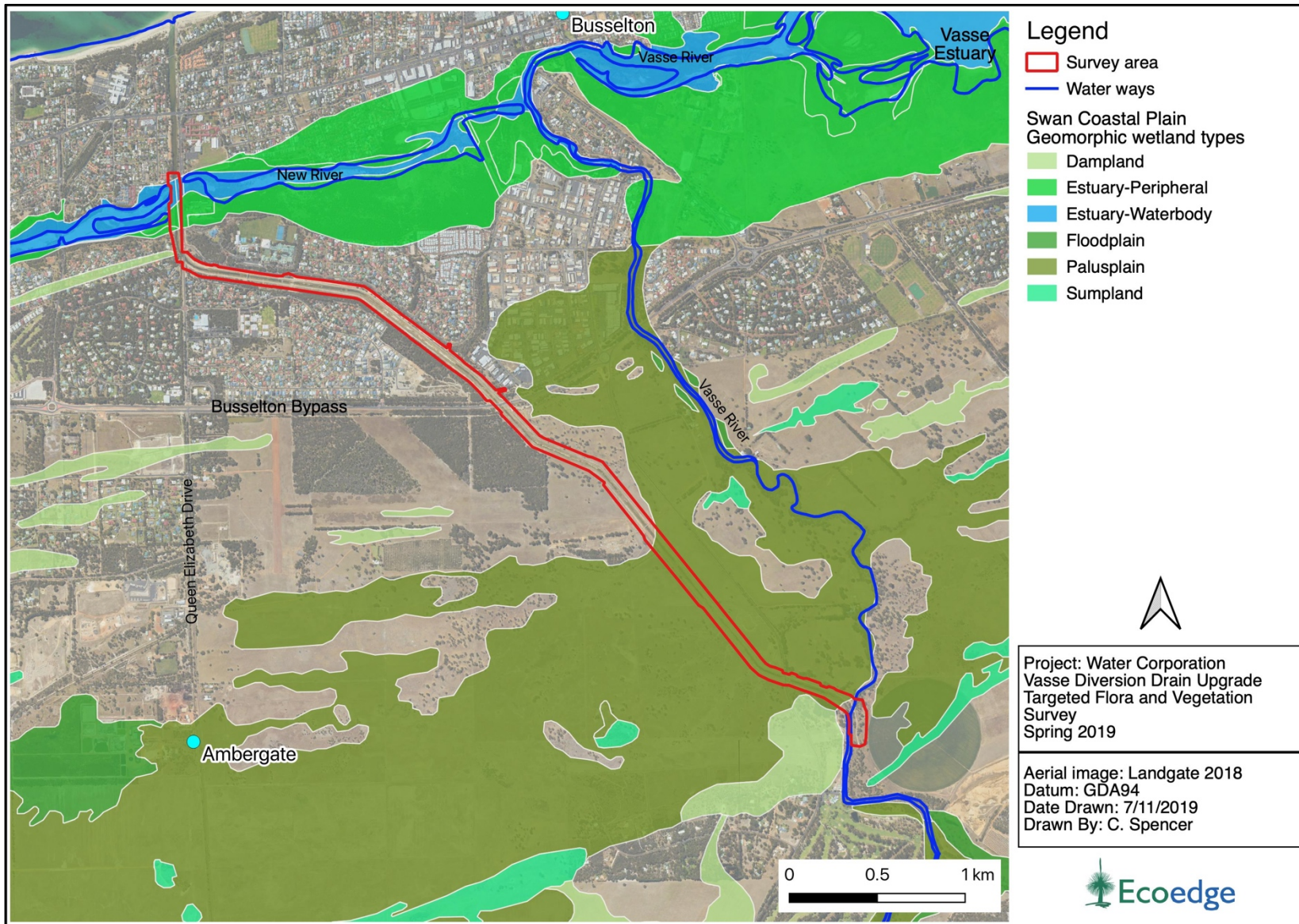


Figure 7. Geomorphic wetlands according to management classifications within the Survey Area (Semenuk & Semenuk, 1995).

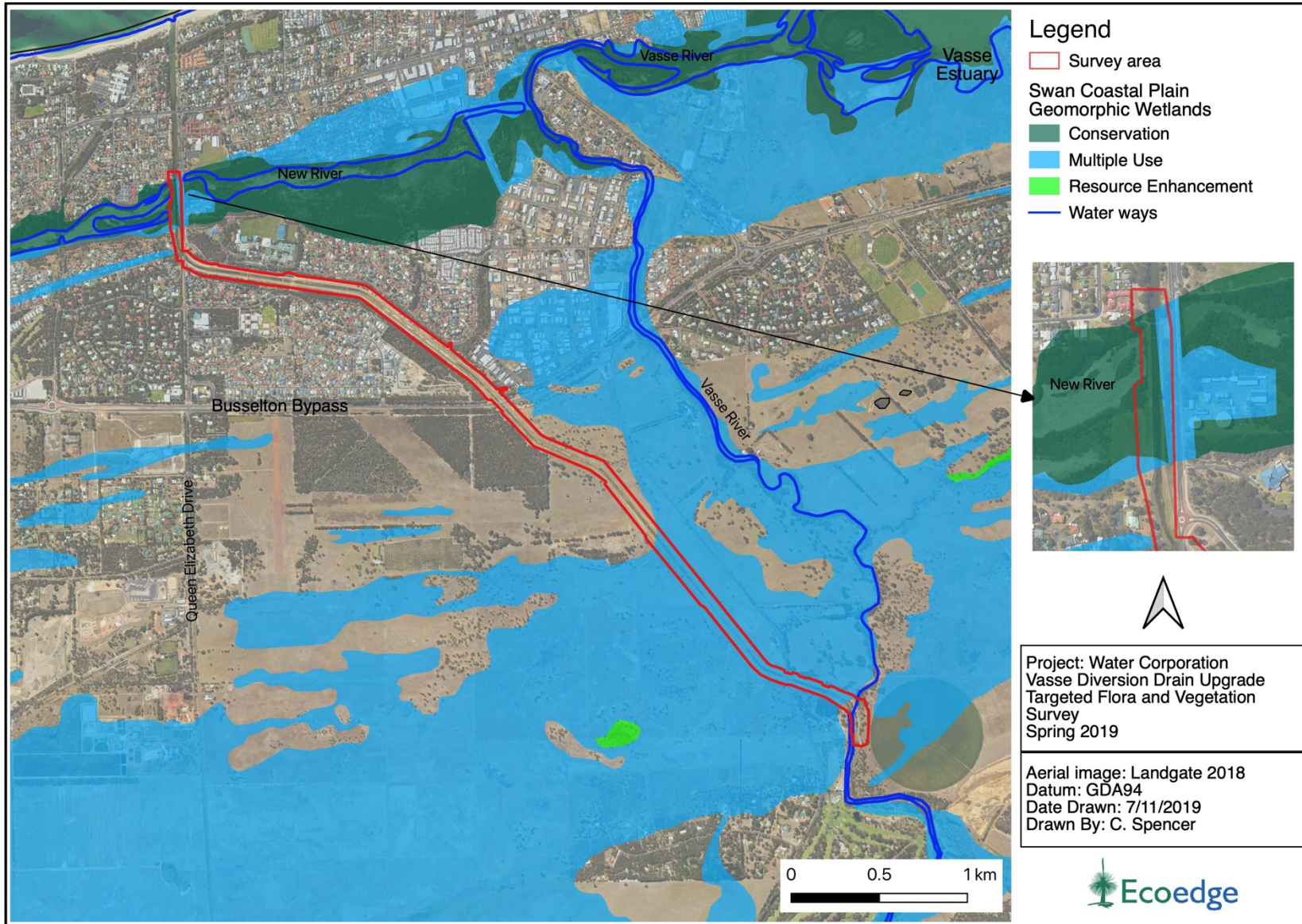


Figure 8. Geomorphic wetlands according to management classifications within the Survey Area (DWER, 2016).

4.5 Regional Ecological Linkages

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” (Molloy, *et al.* 2009).

Regional ecological linkages have been mapped by Molloy, *et al.* (2009) across the SW of Western Australia in an area spanning between just north of Mandurah to Walpole in the south east.

Molloy, *et al.* (2009) assessed and assigned “proximity value” (PV) ratings to all patches of remnant native vegetation as a way of indicating the value of their connectivity with regional ecological linkages. This was based on their distance from nearest mapped regional ecological linkage axis line (**Table 7**).

Table 7. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (from Molloy, *et al.* 2009).

1a: with an edge touching or <100m from a linkage
1b: with an edge touching or <100m from a natural area selected in 1a
1c: with an edge touching or <100m from a natural area selected in 1b
2a: with an edge touching or <500m from a linkage
2b: with an edge touching or <500m from a natural area selected in 2a
2c: with an edge touching or <500m from a natural area selected in 2b
3a: with an edge touching or <1000m from a linkage
3b: with an edge touching or <1000m from a natural area selected in 3a
3c: with an edge touching or <1000m from a natural area selected in 3b

The Survey Area is intersected by two recognised ecological axis lines mapped by Molloy *et al.* 2009. One associated with the New River and Vasse River Estuary occurs at the northern boundary of the Survey Area and the other associated with the Vasse River occurs at the southern boundary of the Area (**Figure 9**).

Vegetation within Survey Area occurring in proximity to these axis lines has been assigned the PV ratings of “1a, 1b and 1c” (**Figure 9**).

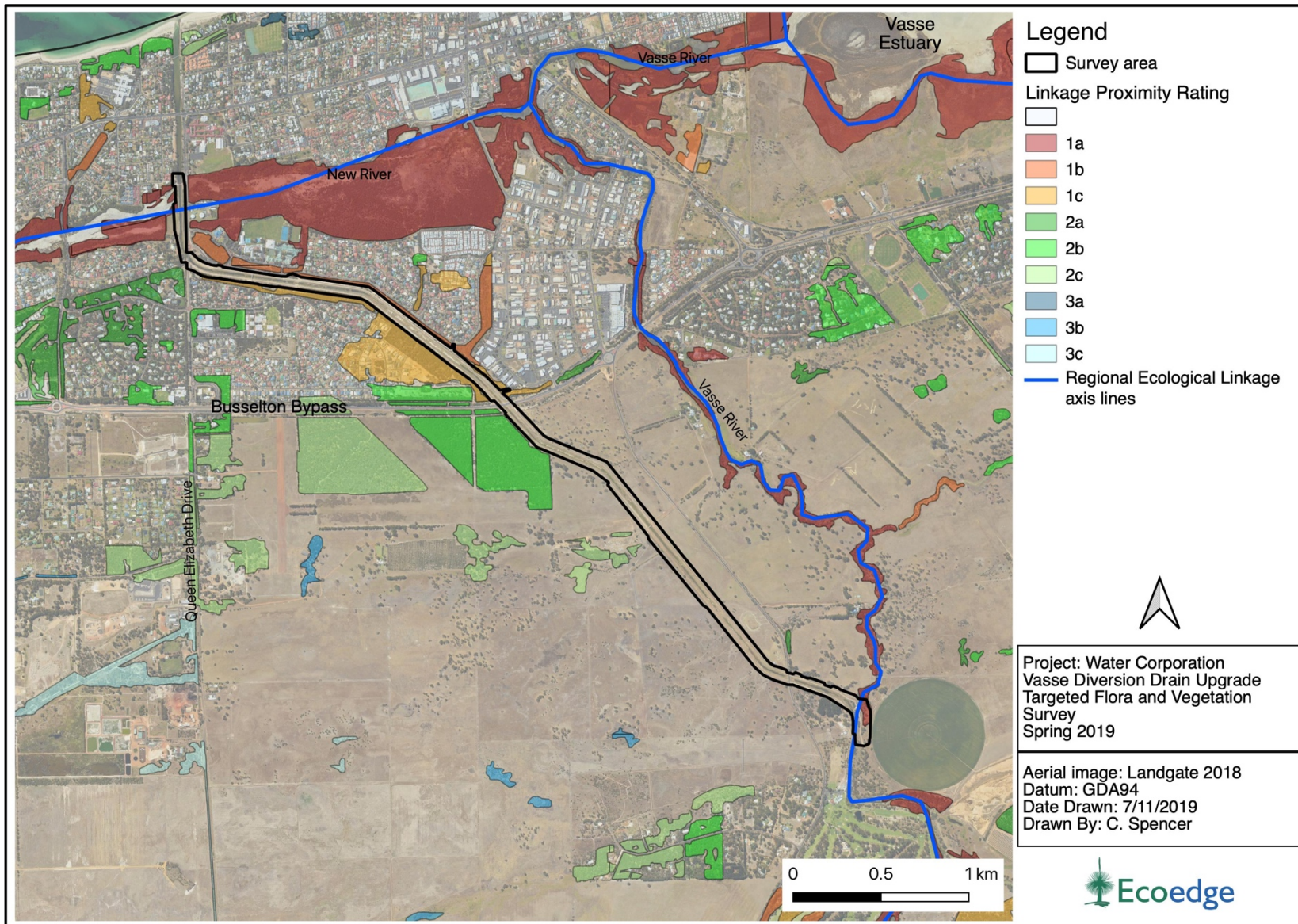


Figure 9. The Survey Area in relation to regional ecological linkages (Molloy, *et al.* 2009).

4.6 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and are selected for their environmental values at state or national levels (Government of Western Australia, 2005). They include:

- Defined wetlands and riparian vegetation within 50 m;
- Areas covered by Threatened Ecological Communities;
- Area of vegetation within 50 m of Threatened flora;
- Bush Forever sites; and
- Declared World Heritage property sites.

The most recent Department of Water and Environment Regulation (DWER) mapping dataset (DER, 2016) shows an ESA within the northern boundary of the Survey Area. This is associated with Conservation Category New River wetlands. Two smaller ESAs occur within proximity to the Survey Area; one located in the NW is approximately 61 m from the Survey Area boundary and is associated with an occurrence of *Caladenia procera*. The other is located approximately 140 m from the SW boundary. The reason for this ESA could not be determined during the desktop assessment but it may be attributed to the presence of threatened flora.

It is noted that at the time of reporting not all the mapped occurrences of threatened flora in proximity to the Survey Area have been formally observed as ESAs (**Figure 10**).

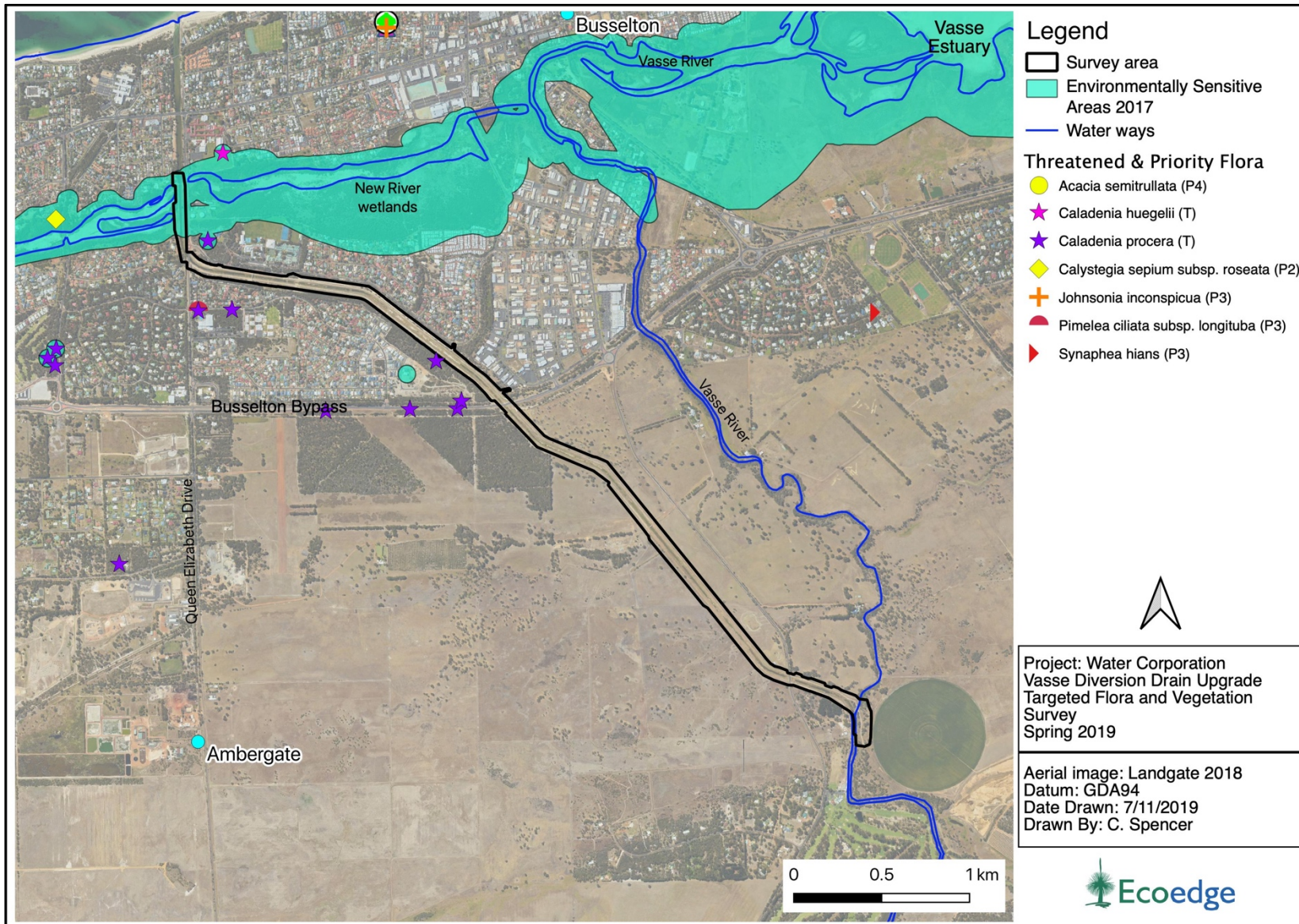


Figure 10. The Survey Area in relation to Environmentally Sensitive Areas (DWER, 2016).

5 Survey Method

5.1 Desktop Assessment

Prior to the field survey, a “desktop assessment” was carried out by downloading a NatureMap report listing all flora (including Threatened flora) occurring within 10 km of the Survey Area (DBCA 2019e) and obtaining a download from the Threatened and Priority Flora Database for a 10 km radius of the Survey Area (DBCA, 2019d). A Protected Matters Search report was also generated to provide information regarding Matters of National Environmental Significance (MNES) known or potentially occurring within 10 km of the Survey Area (DotEE, 2019a) (**Appendix 3**). This data was used to establish the list of Threatened and Priority flora to target during the survey, as well as providing a list of what other plant taxa might be encountered during the survey.

5.2 Field Survey

The survey was carried out by Russell Smith (SL flora permit SL012551) and Colin Spencer (SL flora permit FB62000169) according to the requirements of EPA (2016) on 4, 18 and 24 September and 5 October 2019, with a follow-up visit on 18 December 2019 to obtain more photos of vegetation units. The DBCA were consulted in respect of the Survey Area vegetation and flora prior to the Survey.

A targeted search for *C. procera* and *D. elastica* was carried out in all potential habitat areas on the 4 September 2019². A further visit to look for *C. procera* was made on 18 September. When *C. procera* or potential *C. procera* plants were identified, flagging or a marking stake was placed in close proximity with care taken not to harm the plant in any way.

Three 10 m x 10 m floristic quadrats were also installed and assessed per EPA (2016) on 4 September in vegetation just outside the survey area, in what appeared to be the Priority one ecological community “*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest”. The quadrats were installed from 5 m to 90 m outside of the Survey Area³ to enable them to be placed in less disturbed vegetation (**Figure 11.**)

Experience has shown that when carrying out multivariate analysis (MVA) on floristic data, the lower the proportion of introduced species the more successful the analysis when comparing with other (i.e. non-Survey Area) quadrats. In order to ensure that the quadrats used in this study were sited in vegetation of ‘best condition’ it was decided to place them in similar vegetation adjacent to and contiguous with the Survey Area vegetation.

The quadrats were rechecked for later-flowering species on 5 October 2019. Floristic quadrats were required to confirm using MVA’s that the vegetation mapped as ‘*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest’_within the Survey Area

² That part of the Development Footprint Area between the south-eastern corner of Lot 301 and its southern-most extent was not surveyed for *C. procera* or *D. elastica* because previous surveys (GHD, 2017a) and viewing of high-quality aerial photography showed that it contained no potential habitat.

³ About half of one of the quadrats (VASS01) was within the Survey Area.

was in fact similar to vegetation on the south side of Busselton Bypass that had previously been identified as this PEC (AECOM, 2017; Mr. A. Webb, *pers. comm.*⁴).

During the survey, flora and vegetation data was collected from more than 120 data collection points in order to characterise the vegetation type and vegetation condition
Appendix 7.

Vegetation condition was assessed against the method of the EPA (2016) and the scale used shown in **Appendix 8.**

Characteristic species of known occurrences of the P1 PEC, described below, were used to determine its distribution within the Survey Area.⁵

Eucalyptus rudis, *Corymbia calophylla*, *Agonis flexuosa* Closed Low Forest (near Busselton) (DBCA 2019a).

A low lying Spearwood Dune plant community associated with shallow sandy soils over Tamala limestone that in places is exposed at the surface. The plant community on these soils supports a unique mixture of wetland and upland flora. Typically low forest dominated by *Eucalyptus rudis*, *Eucalyptus calophylla*, *Agonis flexuosa* over a diverse understorey including *Hibbertia hypericoides*, *Logania vaginalis*, *Conospermum caeruleum*, *Agrostocrinum hirsutum* and *Lomandra micrantha*. Other associated species include *Eucalyptus decipiens*, *Melaleuca raphiophylla*, *Banksia littoralis*, *Hakea varia* and the sedge species *Baumea juncea* and *Gahnia trifida*.

On 24 September Russell Smith met with a surveyor from BSO Development Consultants (BSO) to show the location of previously identified and potential specimens of *C. procera* and to walk the boundary of the identified Priority One *Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest Ecological community. BSO accurately mapped the location of the orchids and the boundary of the PEC with a differential GPS (DGPS) on the 26 of September.

Using the boundary as captured by DGPS overlaid on high quality 2019 aerial photography the version of the PEC mapping as presented in this report was produced.

Plant taxonomy and species conservation status was checked against data from the W.A. herbarium database (MAX download, 26/09/2019, DBCA, 2019f).

Ecoedge liaise with DBCA regional botanists on a regular basis and “Technical Guidance for Environmental Impact Assessment” guidelines were followed for this survey. Section 5.4 of these Guideline states that “Quadrats are used to record floristic presence and characterise vegetation units” as required for this survey. Ecoedge met with A. Webb on the 1 August 2019 and discussed proposed survey methodology for TEC/PEC for this and other projects, occurring in spring 2019.

⁴ A. Webb, regional botanist, DBCA, Bunbury, 6/02/2019.

⁵ A know occurrence of this PEC is situated just west of the survey area on the south side of Busselton Bypass.

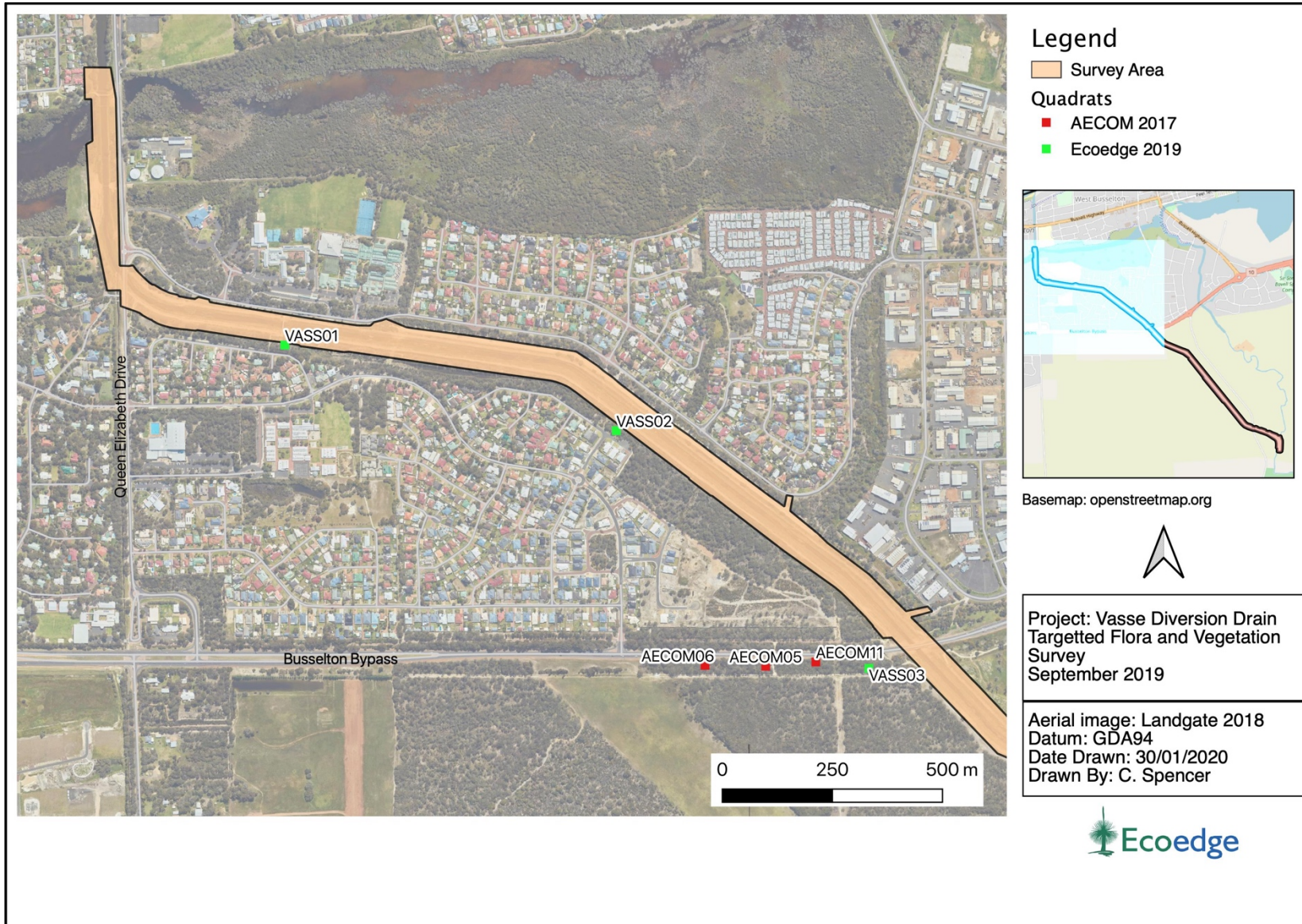


Figure 11. Location of 2019 quadrats and AECOM 2017 quadrats.

5.3 Multivariate Analysis of Floristic Quadrat Data

Quadrat data (species list) from 168 locations, including data from the current survey was used in the MVA, including data from three AECOM (2017) that had been previously classified as PEC and situated close to the Diversion Drain. The floristic quadrat data from adjacent the Survey Area and from three quadrats placed in the “*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest” PEC just east of the Survey Area by AECOM (2017) was subjected to MVA using the software PATN (Belbin, 2003). The results were utilised to determine the relationship of the vegetation units described and mapped within the Survey Area, to the floristic community types derived for the Swan Coastal Plain (SCP) by Gibson, *et al.* (1994) (“the SCP Survey”). A subset of the Gibson, *et al.* 1994 dataset was used in this analysis, comprising 149 quadrats occurring south of Bagieau Road in Myalup, about 45 km north of Bunbury. It was considered that only including quadrats from the Gibson, *et al.* 1994 dataset that were sited within 125 km of the Survey Area would lead to a more accurate assignment of the appropriate FCT.

The MVA used two-way classification (Agglomerative Hierarchical Fusion) of the presence/absence data for each quadrat. The flexible UPGMA classification strategy was used ($\beta = -0.1$), together with the Bray-Curtis site similarity measure. The default settings for number of groups to be produced by the classification (i.e. the “cut-off level”) was accepted in each case. The primary output of the classification were dendrograms and a two-way table of taxa and quadrats.

The data from the Gibson, *et al.*, 1994 survey dataset had been subject to taxonomic updating. Taxonomic updating of the 25-year-old data was required because many taxonomic changes have taken place since the original survey was carried out (e.g. *Dryandra* to *Banksia*, *Eucalyptus calophylla* to *Corymbia calophylla*, etc.). In addition, there is some uncertainty about the identification of such species as *Thysanotus manglesianus* and *T. patersonii*, where many Swan Coastal Plain specimens have intermediate characteristics between the two. In such cases terms such as ‘*Thysanotus manglesianus/patersonii* complex’ were used.

6 Survey Limitations

Potential limitations with regard to the assessment are addressed in **Table 8**.

Table 8. Limitations of the field survey with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	No	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Slight/Moderate	The survey was carried out between early September and early October which is within the prime season for flowering in the south-west of Western Australia. However, the dry winter probably reduced the emergence and growth of herbaceous taxa.
Climatic and seasonal effects	Slight/Moderate	Rainfall for the wet season at Busselton. (1st April – 30 th November) was only 58% of average. Germination and growth of herbaceous taxa was probably negatively affected by lack of rainfall.
Availability of contextual information	Negligible	Comprehensive regional surveys of remnant vegetation, as well as more localised surveys, have been carried out on the southern Swan Coastal Plain.
Completeness of the survey	Negligible	The whole search area was covered on foot. Flowering was good.
Skill and knowledge of the botanists	Negligible	The senior field botanist conducting the survey has had extensive experience in botanical surveys in south west Australia over a period of 25 years.

Survey Results

6.1 Flora

One hundred and four vascular flora taxa were identified within and just outside the Survey Area, 22 of these being naturalised non-native or planted species. The high proportion of non-natives is attributed to the highly disturbed nature of the Survey Area and the fact that there have been amenity plantings on previously cleared areas.

The list of vascular flora recorded during the field survey is included in **Appendix 9**.

6.2 Threatened and Priority Flora

One individual and up to 17 additional individuals of the threatened orchid, *Caladenia procera* (**Figure 12**), which was the subject of the targeted survey, was identified in two locations just south of the Survey Area (**Figure 14**).

Three individuals of another threatened species, *Austrostipa bronwenae*, were found within and adjacent to floristic quadrat VASS03 installed for the present survey. It was located approximately 108 m west of the Survey Area (**Figure 15**).

No other species of conservation significance were found including the targeted species *Drakaea elastica*.

Details of the *C. procera* and *A. bronwenae* plants found during this 2019 survey are presented in **Appendix 10**. Copies of the completed Threatened and Priority Flora Report form, for the confirmed occurrences, are provided in **Appendix 11**.

6.2.1 *Caladenia procera*

During the initial 4 September survey botanists found a number of *Caladenia* leaves in two separate locations (Site 1 and Site 2) of what was suspected to be *C. procera*. On the second visit on 18 September to recheck the locations only one *C. procera* plant had flowered⁶ (**Figure 12**), at Site 1. At this time 15 basal leaves (i.e. 15 plants) at this site were considered likely to also be *C. procera* based on their morphology, proximity to the flowering specimen and 'stiffness' of the leaf. Experience from previous targeted *C. procera* surveys (Ecoedge 2018, 2019b, 2019c) has indicated that the basal portion of *C. procera* leaves are generally stiffer than the commonly co-occurring and similarly-leaved *Caladenia attingens* subsp. *attingens* **Figure 13**. At Site 2 there were also two basal leaves that were also considered likely to be *C. procera*.

However, there is a level of uncertainty regarding identification based purely on leaf morphology especially where the leaves are similar; which is the case with *C. procera* and *C. attingens* as **Table 9** shows. Plant identification is more accurate when in flower.

⁶ The dry winter at Busselton (only 58% of the average wet season rainfall) is probably the reason for the very low proportion of *C. procera* plants that advanced from the basal-leaf only to the flowering stage. Drought years have been previously associated with reduced flowering in rare *Caladenia* taxa (Brundrett, 2016).

Table 9. Plant habit and leaf morphology of *Caladenia attingens* and *Caladenia procera* (Hopper and Brown, 2001).

Species	Leaf morphology
<i>C. attingens</i>	Plants solitary. Leaf erect, linear 5-20 cm long, 1-1.2 cm wide, slightly incurved to flattened in Transverse Section, pale green, the basal third to two thirds often irregularly blotched with red-purple. Scape 12-45 cm tall. Flowers 1, rarely 2, 2-7 cm across, green, white and yellow with dull red markings The labellum bi-coloured, yellowish green at the base, uniformly dark red at the apex. <i>Brown and Brockman 2015, 'New taxa of Caladenia (Orchidaceae from south-west Western Australia. 25: 45-123, Nuytsia: The Journal of the Western Australia Herbarium</i>
<i>C. procera</i>	Plants solitary or in small clumps. Single Leaf erect, linear, pale green 10-30 cm long and 0.6-1 cm wide, basal third usually irregularly blotched with red-purple. Scape 35-70cm tall. Flowers 1-4, 5-9 cm across. The stiffly-held petals and sepals of the flowers are greenish lemon yellow with lines and spots of dull maroon to pink. The labellum is also greenish yellow with pale pink to fawn radiating stripes, ending in a dark maroon recurved tip (Hopper and Brown 2001).



Figure 12. *Caladenia procera* (Carbunup King Orchid) flower and basal leaf.



Figure 13. *Caladenia attingens* subsp. *attingens* (Forest mantis orchid) flower and basal leaf.

The locations of the 16 plants at Site 1 and two plants at Site 2 were recorded using differential GPS on 26 September 2019 and this showed them to be 1.9 m and 1.2 m (respectively) outside of the southern Survey Area boundary.

6.3 Environmental Weeds and Declared Pest Plants

A total of 22 introduced plant species were identified within the Survey Area. One of these, *Zantedeschia aethiopica* (Arum-lily), is listed as a Pest Plant under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Department of Agriculture and Food, 2019). However, there are currently no obligations for management of this species under the Act.

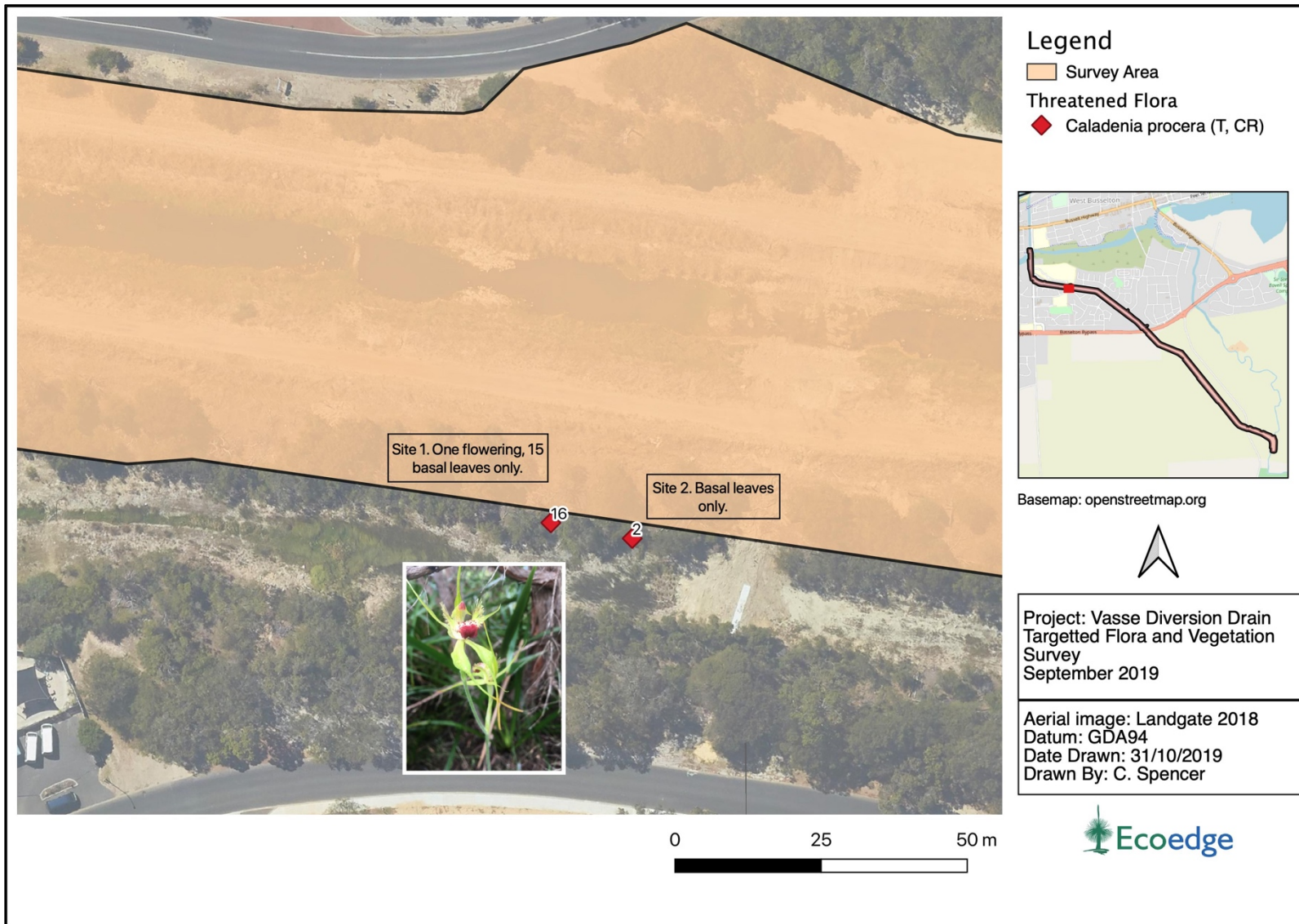


Figure 14. Location of *Caladenia procera* and observed during the field survey.

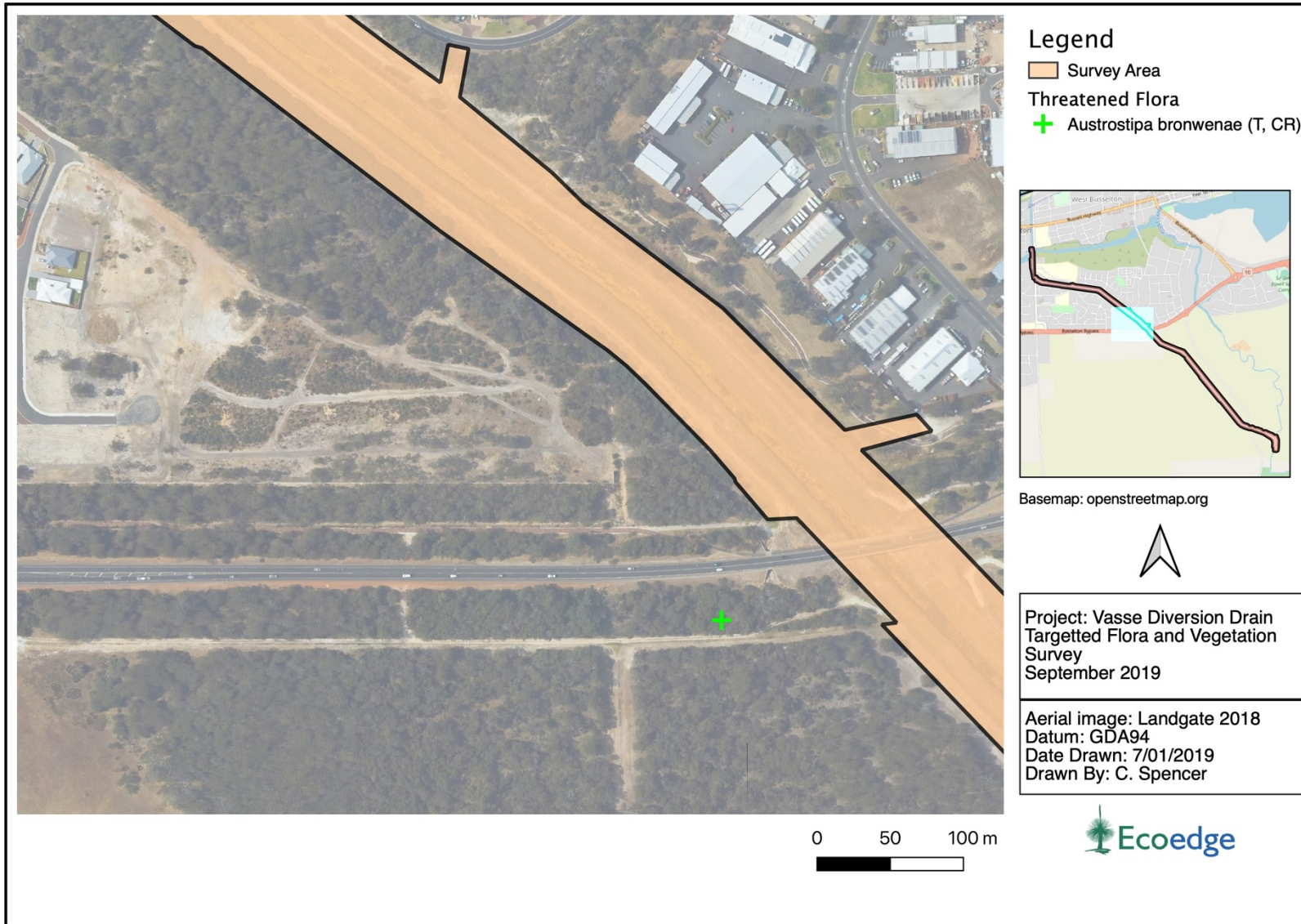


Figure 15. Location of *Austrostipa bronwenae* observed during the field survey.

6.4 Vegetation Units

Five native vegetation units were identified and mapped within the Survey Area. These vegetation units are described in **Table 10** and mapped in **Figure 22** to **Figure 25** at the end of the report. Photographs of the vegetation units are provided in **Appendix 12**. The extent (in hectares) and vegetation condition, of each vegetation unit within the Survey Area is provided in **Table 11**.

Table 10. Description of vegetation units within the Survey Area.

Unit	Description
A	<i>Corymbia calophylla</i> and <i>Agonis flexuosa</i> with occasional <i>Banksia littoralis</i> and <i>Melaleuca raphiophylla</i> mid open forest over <i>Acacia cochlearis</i> , <i>A. saligna</i> , <i>Hibbertia cuneiformis</i> <i>Jacksonia furcellata</i> , <i>Kunzea glabrescens</i> and <i>Spyridium globulosum</i> open shrubland over <i>Adenanthos meisneri</i> , <i>Conospermum caeruleum</i> , <i>Daviesia physodes</i> , <i>Hardenbergia comptoniana</i> , <i>Hibbertia hypericoides</i> , <i>Leucopogon propinquus</i> low shrubland over <i>Lepidosperma squamatum</i> and <i>Tetraria octandra</i> sedgeland and <i>Caesia micrantha</i> , <i>Chamaescilla corymbosa</i> , <i>Conostylis aculeata</i> subsp. <i>gracilis</i> , <i>Opercularia hispidula</i> , <i>Sowerbaea laxiflora</i> , <i>*Sparaxis bulbifera</i> , <i>*Watsonia meriana</i> var. <i>bulbillifera</i> and <i>*Zantedeschia aethiopica</i> mid forbland on dark brown sandy loams. (' <i>Eucalyptus rudis</i> , <i>Corymbia calophylla</i> and <i>Agonis flexuosa</i> Closed Low Forest' PEC). (Degraded-Good)
B	<i>Agonis flexuosa</i> low woodland and scattered <i>Acacia saligna</i> or <i>A. cochlearis</i> tall shrubs over <i>*Ehrharta longifolia</i> , <i>*Watsonia meriana</i> and other introduced herbaceous species (mainly Completely Degraded)
C	<i>Eucalyptus rudis</i> and <i>Corymbia calophylla</i> mid open forest or woodland over <i>Agonis flexuosa</i> open low woodland over scattered <i>Acacia saligna</i> over <i>*Oxalis pes-caprae</i> , <i>*Watsonia meriana</i> and other introduced herbaceous species. (Completely Degraded)
D	<i>Melaleuca cuticularis</i> , <i>M. lanceolata</i> and <i>M. raphiophylla</i> tall open shrubland over <i>Gahnia trifida</i> and <i>Baumea juncea</i> sedgeland (Good-Very Good) (Part of Conservation category wetland)
E	<i>Agonis flexuosa</i> woodland over <i>Acacia littorea</i> , <i>Olearia axillaris</i> and <i>Spyridium globulosum</i> tall open shrubland over <i>Lepidosperma gladiatum</i> sedgeland (Good-Very Good)
F	<i>*Eragrostis curvula</i> , <i>*Cenchrus clandestinus</i> grassland, scattered <i>Acacia saligna</i> shrubs, bare areas and watercourse (Completely Degraded)

Vegetation Unit A comprising, a total area of 1.26 ha (2.99% of total area surveyed), has similar characteristics to the Priority one ecological community ('*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest'). Out of the 1.26 ha, 23% (0.29ha) was classified as having 'good' condition. This vegetation unit is a highly restricted community that occurs on the Spearwood dunes 'Ludlow Wet Flats' and the 'Ludlow wet vales' soil-landscape phases which occur over massive limestone immediately south of Busselton (Webb, *et al.* 2009). Although *E. rudis* may be present in this community as scattered individuals, it is not always present and the small remnants of this community can be quite variable in species composition (AECOM, 2017; A. Webb, *pers. comm.*⁷). *Eucalyptus rudis* was found during this survey, recorded within the point data collection (**Appendix 7**) and included in the list of vascular flora within the Survey Area (**Appendix 9**). Ten out of the 14 (71.43%) known PEC species were found during this survey.

Unit B is comprised of Degraded and Completely Degraded vegetation with no clear links to any other vegetation types, nor has any characteristics similar to the PEC.

⁷ Mr. A. Webb, DBCA, Bunbury, *pers. Comm* 7/2/2019.

Vegetation mapped in this report as unit C was considered by GHD (2017a) to ‘align’ with the ‘*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest’ PEC, however this is considered incorrect. The PEC is restricted to the Spearwood Dune soil-landscape, whereas Vegetation Unit C occurs on alluvial soils of the Abba system. Vegetation Unit C is probably a completely degraded occurrence of a riverine community (‘Riverine Sandy Soil Plant Communities’) as discussed in Webb, *et al.* (2009; pp. 40-41).

Vegetation Unit D is one of the ‘water fringing plant communities’ of the Geographe Coastal Wetland system on the Vasse soil-landscape system described by Webb, *et al.* (2009). It has affinities with the ‘*Melaleuca raphiophylla*-*Gahnia trifida* seasonal wetlands’ floristic community type 17 (FCT) described by Gibson, *et al.* (1994).

Vegetation Unit E occurs on the Quindalup Dunes soil-landscape and is similar to the *Agonis flexuosa* woodland community of the ‘consolidated dunes’ described by Webb, *et al.* (2009; p. 19) and which is an FCT unrecognized by Gibson, *et al.* (1994) because it was not sampled during that survey.

All other vegetation within the Survey Area was completely degraded and did not resemble any other State or Federally listed PEC or TEC.

Table 11. Area of each vegetation unit within the Survey Area.

Vegetation Unit	Cons Status	Condition	Area (ha)	%
A	P1	Good	0.29	
		Degraded	0.97	
Total			1.26	2.99
B	-	Degraded	0.44	
		Completely Degraded	0.26	
Total			0.70	1.66
C	-	Completely Degraded	1.32	
Total			1.32	3.14
D	-	Very Good	0.19	
		Good	0.3	
		Degraded	0.07	
		Completely Degraded	0.01	
Total			0.57	1.35
E	-	Very Good	0.05	
		Good	0.07	
		Degraded	0.02	
Total			0.14	0.33
F	-	Completely Degraded	38.10	
Total			38.10	90.52
Grand Total			42.09	100.00

6.5 Multivariate Analysis of Floristic Quadrats

The main aim of the MVA was to compare the three VASS quadrats with quadrats from within vegetation that has been confirmed as an occurrence of the ‘*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest’ PEC. AECOM (2017) mapped 4.7 ha of the PEC west of the Vasse Diversion Drain adjacent to the Busselton Bypass. The AECOM study involved the installation of 12 floristic quadrats, some of which were located within the PEC. Three of those quadrats were chosen to be used in the MVA reported here. It should be noted that the definition of this PEC is not based on a floristic community type (FCT) from Gibson, *et al.* (1994) but from the description in DBCA (2019a).

The main output of the multivariate analysis was a dendrogram of grouped quadrats based on their degree of similarity in species composition. The three quadrats installed as part of the present study (VASS01, VASS02, VASS03)⁸ clustered with three quadrats installed by AECOM (2017) south of the Busselton Bypass just to the west of the Study Area and one quadrat from a wetland in Manea Park near Bunbury (**Figure 16**). The AECOM quadrats were installed within the ‘*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest’ PEC mapped as such by DPaW⁹.

At a lower level of similarity, with regards to species composition, the VASS quadrats and the AECOM quadrats were grouped with quadrats mainly from the “Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands’ FCT (SWAFCT30b) and the ‘Southern *Eucalyptus gomphocephala*-*Agonis flexuosa* woodlands’ FCT (SWAFCT25).

The results from the MVA show that the three quadrats from the present study were in vegetation that can be characterised as also belonging to the PEC. This is because of their similarity to the AECOM quadrats which were located in an area that has been confirmed as the PEC¹⁰, ‘*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest’. The three VASS quadrats, even though they were placed just outside the Survey Area, were in contiguous vegetation that was of the same species composition as the vegetation mapped as the PEC within the Survey Area¹¹.

The location of the quadrats (and AECOM quadrats) installed for this study, including photographs of quadrats and associated flora species lists are shown in **Appendix 13**.

The complete dendrogram is provided as **Appendix 14**.

⁸ As noted above, the three quadrats were installed just outside the Survey Area to enable them to be placed in areas of “best condition” (EPA, 2016, p. 8), providing a larger species list for the MVA.

⁹ (A. Webb, DBCA, *pers. comm.* 8/01/2020)

¹⁰ (A. Webb, DBCA, *pers. comm.* 6/02/2019)

¹¹ One of the quadrats (VASS01) actually extended into the Survey Area and the boundary of another (VASS02) came within 8 m of the Survey Area.

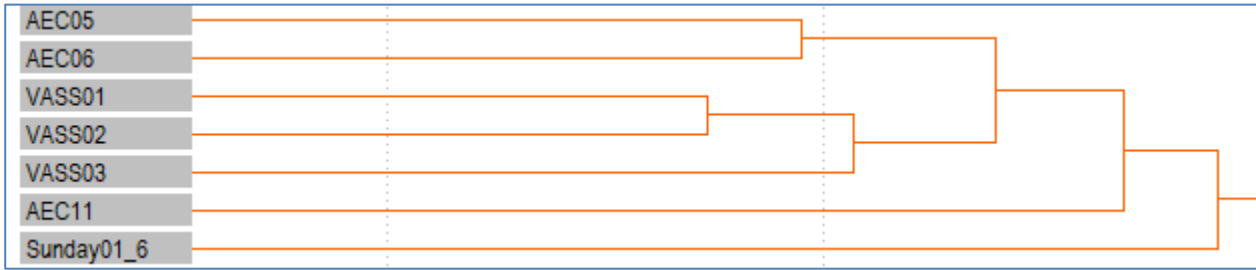


Figure 16 Part of the dendrogram of Survey Area floristic quadrat groups.

6.6 Vegetation Condition

The great majority (94.6%) of vegetation within the Survey Area was Completely Degraded (**Table 12**). This includes the drainage channel itself, plus the levee banks from the Bypass to the southernmost extent of the Survey Area. Only a very small portion of vegetation (2.23%) within the Survey Area was in Good or Very Good condition¹², with most of this being comprised of Vegetation Units A and D. Vegetation condition is shown in photos (**Figures 17 to Figure 20**) mapped (**Figure 22 to Figure 29**) and tabled in **Table 12**.

The main cause of vegetation degradation appears to have past disturbance associated with digging and maintaining the diversion drain, and installation of a swale drain. Viewing old aerial imagery shows that much of the vegetation within the Survey Area between the Busselton Bypass and Queen Elizabeth Drive was cleared sometime between 1954 and 1970.

Aerial images show that most of the Survey Area on the south side of the drain between Busselton Bypass and Queen Elizabeth Drive had regrown by 1985 after the previous clearing, but some of this was cleared again in association with a housing development and the digging of a swale drain around 1996. By 2001 much of this area between the swale drain and the south side of the diversion drain had revegetated. Parts of this were subject to partial clearing in 2013/14.

Small areas of regrowth located in Vegetation Unit A have regenerated sufficiently to be considered in a degraded to good condition. Some bushland in Very Good condition occurs in Vegetation Unit D between the drain and Queen Elizabeth Drive north of the bridge.

Table 12 Vegetation condition within the Survey Area

Condition	Area (ha)	%
Very Good	0.24	0.57
Good	0.66	1.57
Degraded	1.50	3.56
Completely Degraded	39.69	94.30
Total	42.09	100.00

¹² See **Appendix 8** for definitions of the various vegetation condition categories.



Figure 17. Good condition vegetation within Vegetation Unit A.



Figure 18. Degraded condition vegetation within Vegetation Unit A.



Figure 19. Completely Degraded condition vegetation in the foreground adjacent to Vegetation Unit A.



Figure 20. Very Good condition vegetation within Vegetation Unit D.

7 Discussion and Conclusions

7.1 Significance of the Flora

The conservation status of the *Caladenia procera*, *Drakaea elastica* and *Austrostipa bronwenae* is discussed below. As stated above, *D. elastica* was not found within the Survey Area, but it was a targeted species for the survey. *A. bronwenae* was not targeted because it was not previously known from the area, but was subsequently found near the Survey Area during the 2019 spring survey.

7.1.1 *Caladenia procera*

Caladenia procera is declared to be Threatened Flora under the BC Act. It was first listed as Rare flora in April 2002 and ranked as Critically Endangered (CR) in WA under International Union for Conservation of Nature (IUCN 2001) Red List criteria (B1ab(iii)+2ab(iii); C1). It was given this ranking because the extent of occurrence is estimated to be less than 100 km², the area of occupancy less than 10 km², with populations severely fragmented, a continuing decline in area of occupancy, extent and quality of habitat. The C1 criterion was applied because it had a population size of less than 250 mature individuals and an estimated continuing decline of at least 25% in one generation. Criterion C1 may no longer apply as there were about 535 mature plants known in 2010 (DEC, 2011¹³).

A small population of one confirmed *C. procera* and up to 17 additional *C. procera* plants identified less than two metres from the Survey Area, continuous with Vegetation Unit A, represents a minor range extension to the known population of the orchid in the vicinity of the Survey Area. The largest known population of *C. procera*, population 4 (250 plants in 2006), occurs adjacent to the Survey Area in a proposed 'Recreation and Drainage Reserve'. Sub-populations¹⁴ 9A, 9B and 9C along the Busselton Bypass between Queen Elizabeth Drive and the Vasse River Diversion Drain, which totalled 119 plants in a 2018 survey (Ecoedge, 2019b), represents one of the largest 'populations' (or agglomerations of plants) of this critically endangered species.

Based on observations of the adjacent populations of *C. procera*, emergence and flowering were considerably reduced in spring 2019 compared to spring 2018 (Ecoedge, 2019). This may be due to the below average rainfall¹⁵ experienced in Busselton for 2019. This hypothesis is supported by Brundett (2016) who observes that drought years have been previously associated with reduced flowering in rare *Caladenia* taxa. More particularly, rainfall at the start of the growing season at Busselton (May) was only 25 mm in 2019, whereas 107 mm was recorded in May 2018. There was also a dry finish to winter in 2019, with 55 mm being recorded, compared to the 2018 figure with 138 mm for August (115 mm being the long-term average for August).

¹³ These are the most recent population sizes available for *C. procera*.

¹⁴ TPFL numbers refer to the population and sub-populations numbers applied by DBCA.

¹⁵ Rainfall for the wet season at Busselton (1st April – 30th November) was only 58% of the long-term average.

All known habitat that contains wild populations of *C. procera* is considered to be critical to the survival of the species and all populations, including those based on translocation, are important populations (DEC, 2011).

7.1.2 *Drakaea elastica*

Drakaea elastica was declared as Rare Flora (as *D. jeanensis*) under the Western Australian *Wildlife Conservation Act 1950* in July 1988 and is currently ranked as Critically Endangered (CR) under the BC Act, due to the severe fragmentation of populations and the continuing decline in the area, extent and quality of habitat and number of mature individuals. *D. elastica* is listed as Endangered under the EPBC Act.

D. elastica was searched for within the Survey Area, during its optimum survey period (early spring) but no individuals were found. The nearest known population is 1.2 km ESE of the southern tip of the Survey Area, on Bassendean sands in which they are typically known to occur, according to DBCA distribution maps and recovery plan for this species (DEC, 2009). The Survey Area occurred on alkaline Spearwood Soils.

7.1.3 *Austrostipa bronwenae*

Austrostipa bronwenae (**Figure 21**) is listed as Critically Endangered under the BC Act and Endangered under the EPBC Act and is known from populations near Bunbury. The population of three *A. bronwenae* plants identified during the survey were located 108 m west of the DAF boundary, in road reserve vegetation similar to Vegetation Unit A. This population represents an additional range extension for this species. Another recently discovered population of *A. bronwenae*, found during a separate survey (Ecoedge 2019c), is approximately 250 m east of the Survey Area, and occurs in similar habitat to Vegetation Unit D. *Austrostipa bronwenae* is similar to *A. juncifolia* and *A. geoffreyi* in habit, but differs in having shorter lemma lobes and ligules, and occupying different habitat and geographical region (DPaW 2017).



Figure 21. *Austrostipa bronwenae*.

7.2 Significance of the Vegetation

7.2.1

Vegetation

Unit

A

Vegetation Unit A comprises approximately 1.26 ha and represents a historical occurrences of the Priority 1 ecological community ‘*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest’ (Webb, *et al.* 2009), which is a highly restricted community that occurs on the Spearwood dunes ‘Ludlow Wet Flats’ and the ‘Ludlow wet vales’ soil-landscape phases which occur over massive limestone immediately south of Busselton.

Unit A’s classification as this PEC is based on primarily on the results of the MVA which show that the vegetation in quadrats just outside and contiguous with the Survey Area is very similar to vegetation determined by AECOM, 2017 to be an occurrence of the PEC. As stated above, (Webb, *et al.* 2009), while *E. rudis* may be present in this community it is not universally present (e.g. AECOM, 2017, Appendix C), and so its absence from Vegetation Unit A does not disqualify this vegetation from being accepted as the PEC. Vegetation A comprises predominantly of regrowth vegetation in a degraded condition (0.97 ha), and a small area of regrowth vegetation in Good condition (0.29 ha).

‘This plant community is key habitat for the critically endangered orchid species *C. procera*’ (Webb, *et al.* 2009, page 25). This community also provides habitat for the recently discovered population of the critically endangered grass *Austrostipa bronwenae*.

7.2.2 Vegetation Unit D

Vegetation Unit D has affinities with the well reserved *Melaleuca raphiophylla* – *Gahnia trifida* SWAFCT 17 and comprises riparian vegetation associated with the New River. It is adjacent to a Conservation Category wetland¹⁶ and most of it is in good or better condition.

This community is similar to the vegetation where a new population of the *Austrostipa bronwenae* (CR) has been found near the Catholic Church, 250 m east of the Survey Area (Ecoedge, 2019c) (**Figure 22**). Further surveys of similar vegetation within broader area may be required to ascertain the conservation significance of this environment to *A. bronwenae*.

There are occurrences of the Federally-listed TEC ‘Subtropical and Temperate Coastal Saltmarsh’ mapped across the Survey Area, in the vicinity of Vegetation Unit D (DPaW, 2019c)(**Figure 5**). However, Vegetation Unit D has few of the species characteristic of the TEC (DSEWPC, 2013, pp. 9-10) and is not considered representative of it.

¹⁶ It isn’t classed as Conservation category wetland because it is flanked by the diversion drain on one side and a road on the other.

Vegetation Unit D is also regarded as riparian vegetation which means that some clearing exemptions under the Environmental Protection (Clearing of Native Vegetation) Regulations (2004) may not apply.

7.2.3 Vegetation Unit E

This unit is an occurrence of a community of Consolidated Quindalup Dunes vegetation which has been extensively cleared for urban settlement around the shore of Geographe Bay (Webb, *et al.* 2009). This vegetation provides important habitat for the Western Ring-tail Possum (Shedley and Williams, 2014).

7.3 Vegetation complexes

The survey area was mapped to comprise six vegetation complexes: the Abba Complex, Karrakatta Complex – Central and South Complex, the Quindalup Complex, Yoongarillup Complex, Vasse Complex and the Cokelup Complex. The Survey Area vegetation was comparable to three of these complexes: the Quindalup, Vasse and Yoongarillup vegetation complexes in terms of their spatial distribution, species composition and structure. The area covered by Abba, Cokelup and Karrakatta Complex – Central and South Complex complexes could not be determined as these areas were assessed to be in a Completely Degraded condition. A breakdown of the Survey Area vegetation complex is presented in **Table 13** below. This breakdown in Survey Area vegetation by complex generally reflects the statistics for the pre-European Extent of the mapped complexes in that poorly represented complexes are poorly represented in the Survey Area and well represented complexes are better represented in the Survey Area.

Table 13. Breakdown of the Survey Vegetation by Webb, *et al.* (2016) Vegetation Complex

Complex	Vegetation Unit	Area of vegetation in the Survey Area (ha)	Pre- European Extent remaining %
Abba	Completely Degraded	0	6.54
Karrakatta Complex – Central and South Complex,	Completely Degraded	0	23.48
Quindalup Complex	Unit E	0.11	60.44
Vasse Complex	Unit D	0.64	31.41
Cokelup Complex	Completely Degraded	0	10.49
Yoongarillup Complex	Unit A and B	15.75	35.55

7.4 Geomorphic Wetlands

A CCW wetland associated with the New River Estuary occurs within the northern portion of the Survey Area in Vegetation Unit D. This wetland occupies approximately 1.22 ha in the Survey of which 0.17 ha is in Good condition with the balance (~1.05 ha) mapped as being in a Completely Degraded condition.

The EPA regards CCW as the “*most valuable wetlands and any activity that may lead to further loss or degradation as inappropriate*” (EPA, 2008). CCW are also recognised as ESAs under the EP Act.

7.5 Regional Ecological Linkages

There are limitations associated with use of the Molloy, *et al.* (2009) Regional Ecological Linkages mapping because the mapping may not be up to date, e.g. due to vegetation clearing, and because the broad scale vegetation mapping doesn't match the finer scale mapping conducted for individual flora and vegetation surveys.

In view of these limitations the Survey Area is intersected by two formally recognised ecological linkage axis lines mapped by Molloy, *et al.* (2009); one associated with the New River and Vasse River Estuary Systems and the other, associated with the Vasse River.

The Survey Area vegetation forming part of the New River and Vasse River Estuary axis line is mapped as having PV ratings of 1a, 1b and 1c.

The 1a PV rated patch of vegetation comprising approximately 0.1 ha is directly connected to vegetation associated with the axis line. Vegetation associated with this patch is mapped as Unit D. This patch of vegetation forms part of a CCW and is part of a larger 1a patch (~6.34 ha) of vegetation within the DBCA managed New River Estuary Wetland Nature Reserve.

The 1b PV rated vegetation comprises 0.26 ha of the Survey Area and is mapped as Vegetation Unit B. This patch occurs on the northern side of the drain and is part of a larger 1b patch (~5.3 ha) of native vegetation in the College Road, road reserve managed by the City of Busselton (City).

The 1c mapped PV rating vegetation comprises approximately 1.31 ha of the Survey Area in three separate patches in larger patches of vegetation with the same 1c PV rating totalling approximately 24 ha. The Survey Area 1c patches are narrow and linear and occur at the boundary of the larger patches. The patches are associated with road reserves and other City managed reserves which extend beyond the Survey Area. These patches of vegetation are mapped as Vegetation Unit A and B in this Survey.

The Survey Area vegetation forming part of the Vasse River Ecological linkage is mapped as having a 1a proximity rating. This patch of 1a vegetation comprises 0.641 ha of the Survey Area and is associated with a larger patch of 1a vegetation (1.3 ha) which extends beyond the Survey Area. This patch of vegetation is mapped as Vegetation Unit E in this Survey.

All of the mapped patches of vegetation within the Survey Area are mapped within highest proximity value linkage bracket (1) due to their proximity and immediate connectivity with the two mapped ecological linkages. The Survey Area patches are located along the boundary or towards the end of mapped patches of vegetation within mapped linkages and are part of larger portions of vegetation with the same PV rating.

There is no statutory basis for the protection of these regional ecological linkages, however the importance of ecological linkages, in general, has been recognised as an environmental

policy consideration in EPA and Planning policy over the last decade (EPA, 2008 and references therein).

7.6 Environmentally Sensitive Areas

An ESA associated within the Conservation Category New River estuary wetlands occurs within Survey Area. This ESA may be impacted as a result of the proposal via vegetation clearing and hydrological changes due to widening of the drain in this locality.

There are two other ESAs mapped (DER, 2016) in proximity to the Survey Area. The closest of these is located approximately 61 m from the Survey Area in bushland and is associated with the presence of the Critically Endangered orchid *C. procera*. This is unlikely to be directly or indirectly affected by the proposal due to the greater than 50m separation distance.

There is a formally recorded occurrence of *C. procera* in closer proximity to the Survey Area (DBCA 2019c) that should be recognised as an ESA. This is approximately 25 m from the Survey Area boundary which means that the standard 50 m ESA buffer would be included within the Survey Area.

ESAs are afforded special protection under the EP Act and exemptions to clearing under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply in these areas.

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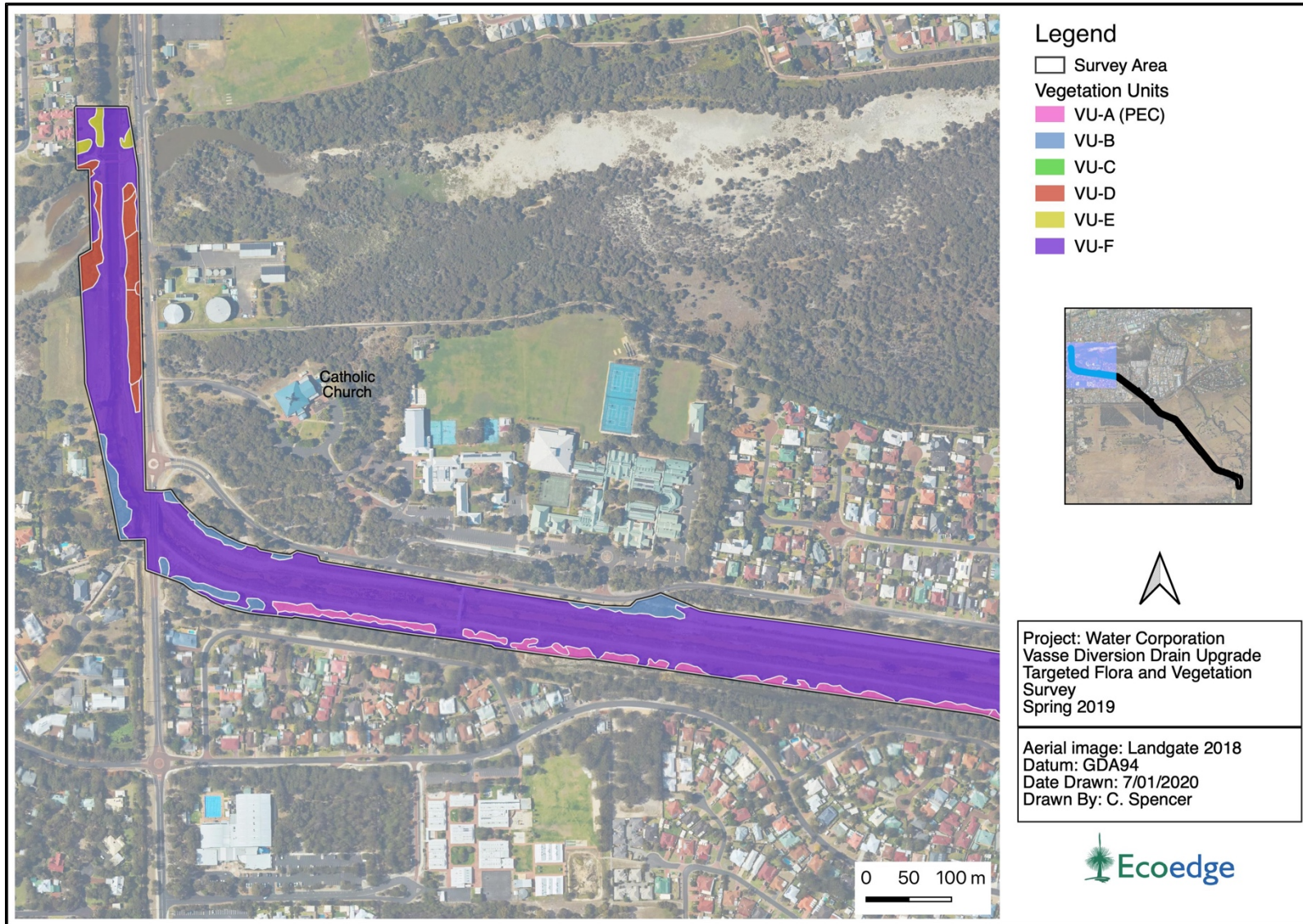


Figure 22. Vegetation Units mapped for the Survey Area.

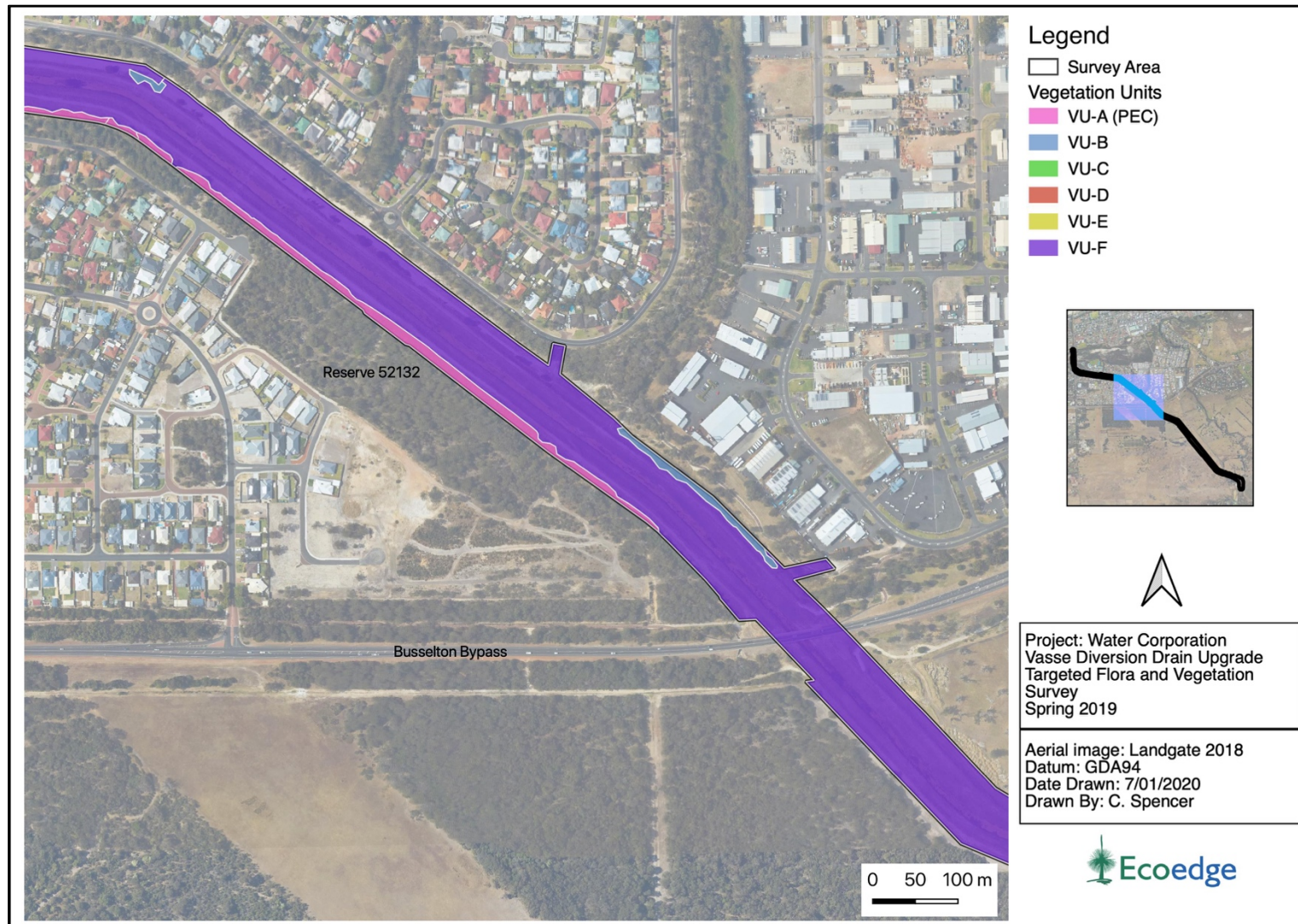


Figure 23. Vegetation Units mapped for the Survey Area.

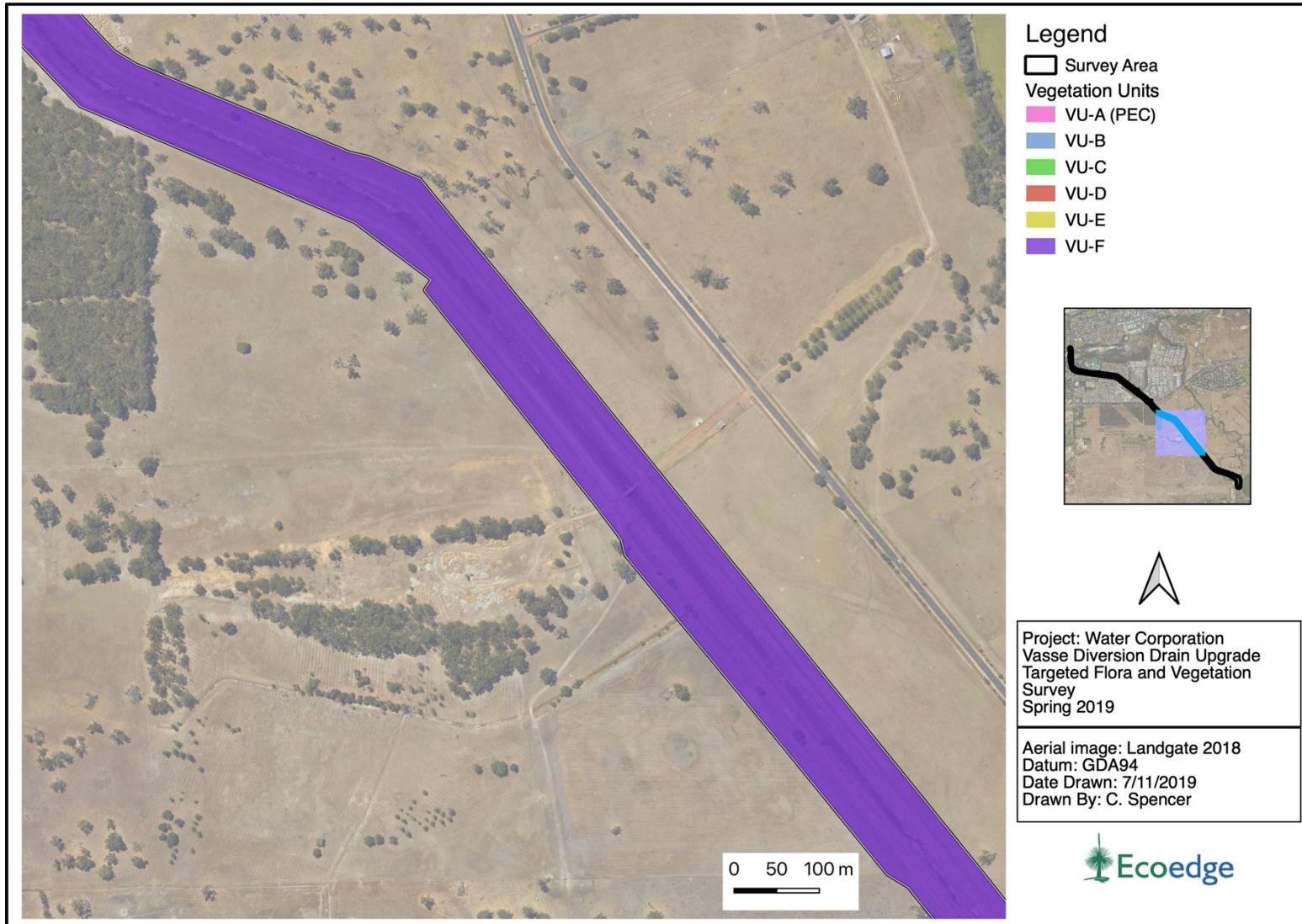


Figure 24. Vegetation Units mapped for the Survey Area.

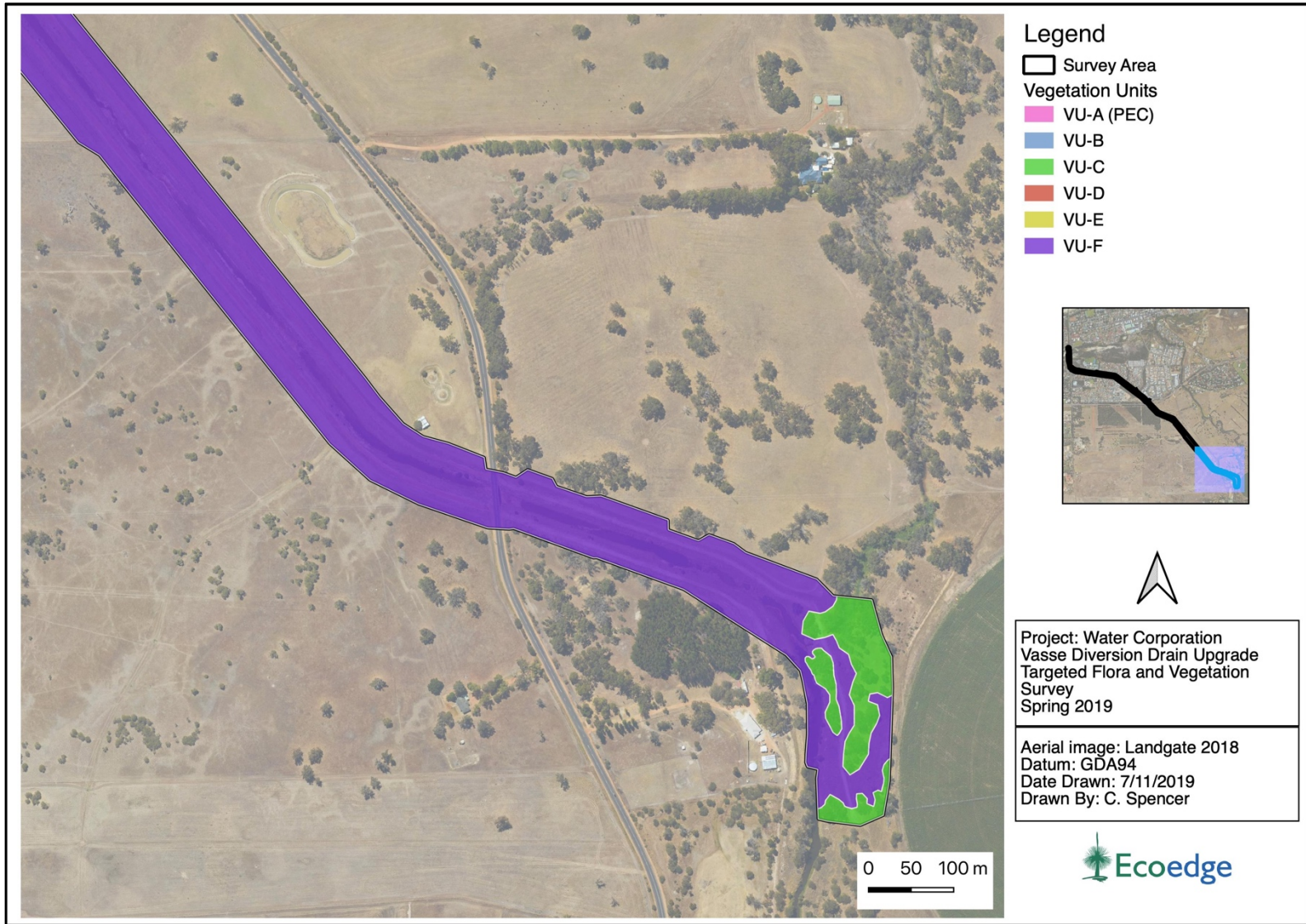


Figure 25. Vegetation Units mapped for the Survey Area.

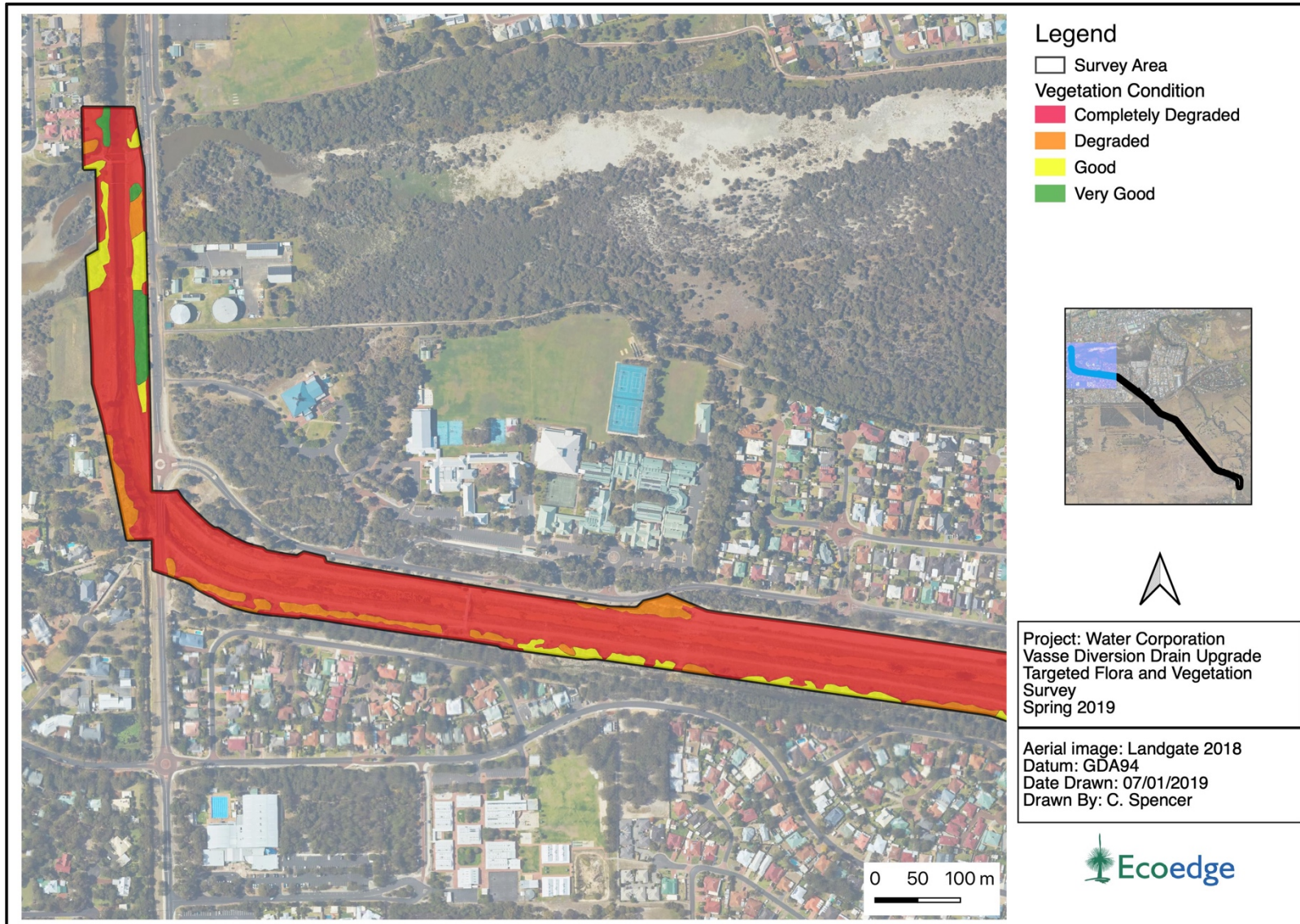


Figure 26. Vegetation condition mapped for the Survey Area.

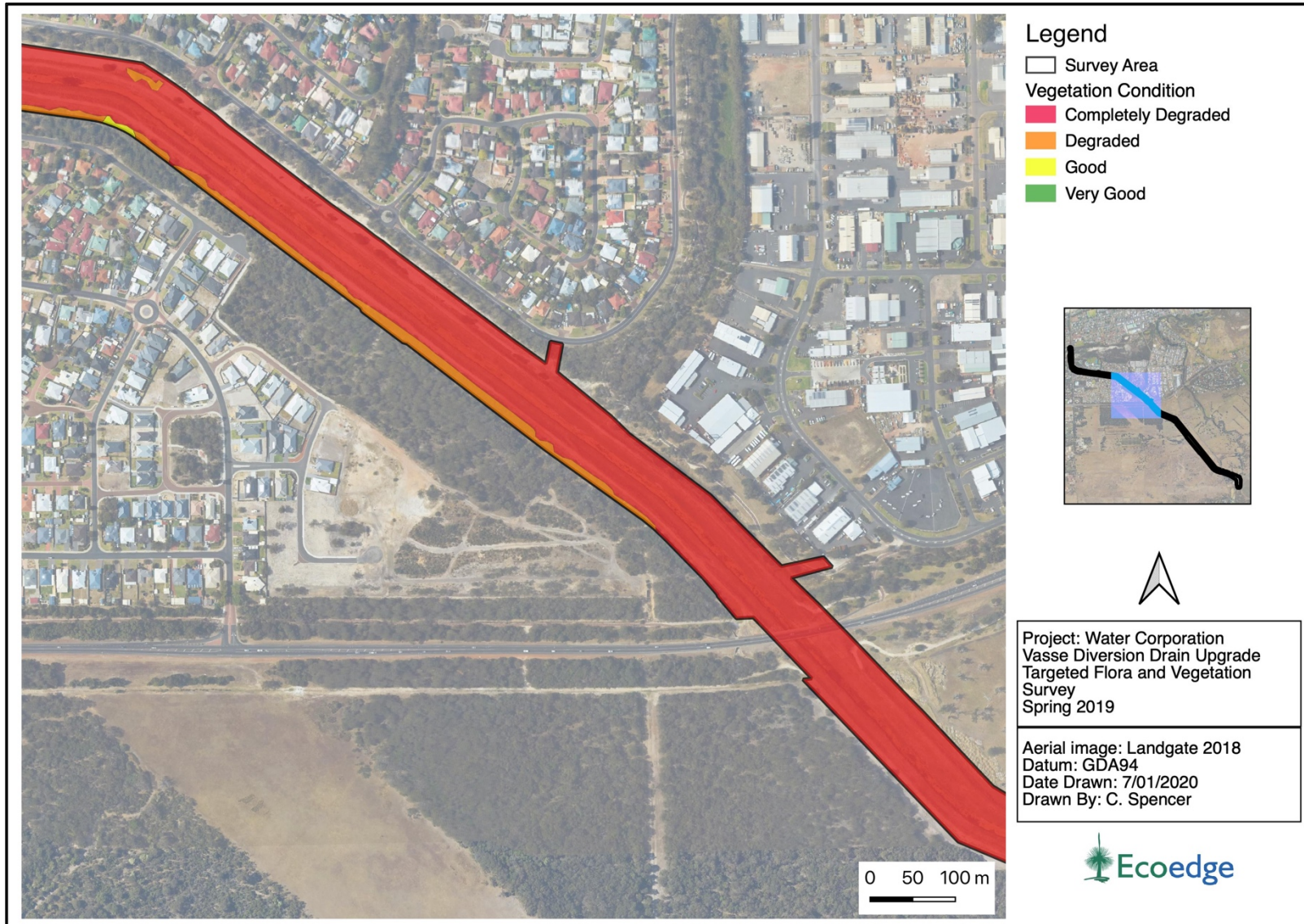


Figure 27. Vegetation condition mapped for the Survey Area.

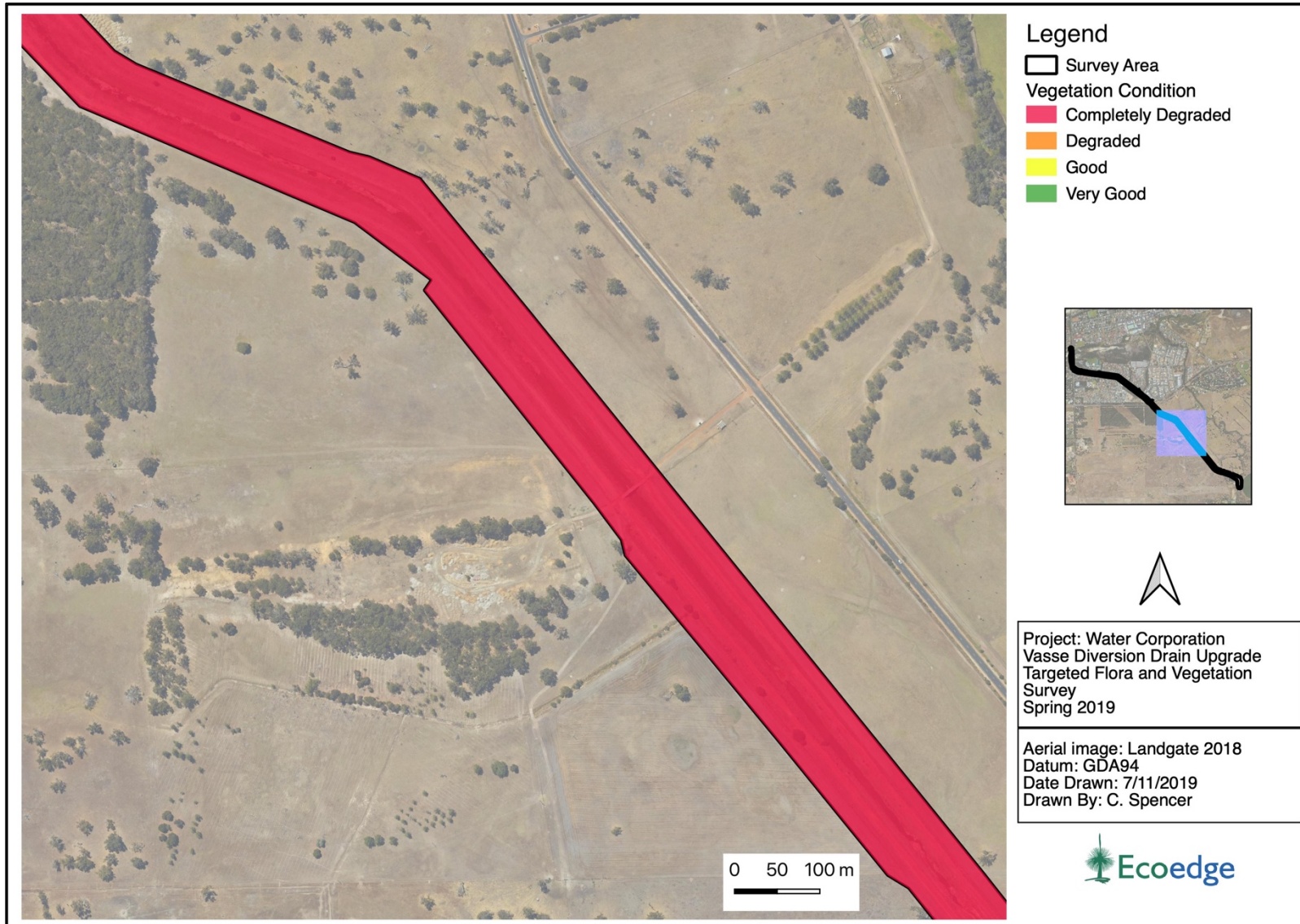


Figure 28. Vegetation condition mapped for the Survey Area.

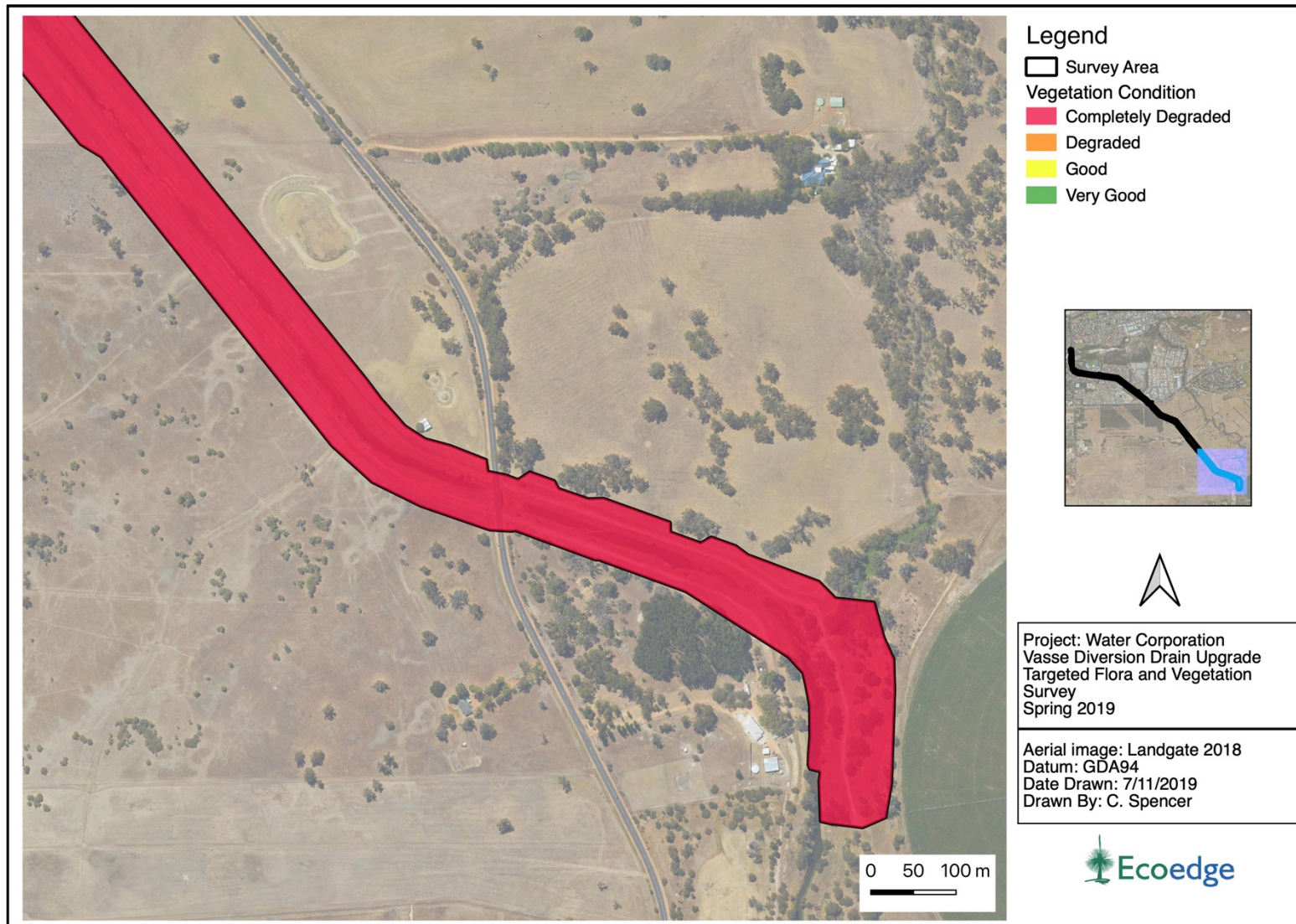


Figure 29. Vegetation condition mapped for the Survey Area.

Appendix 1. Categories of DBCA Threatened and Priority Ecological Communities (DBCA 2018a, 2019b).

Appendix 2. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2018b).

Appendix 3. Protected Matters Search Tool and NatureMap reports (DBCA 2019c).

Appendix 4. Categories of Threatened and Priority List flora (DBCA, 2019b).

Appendix 5. Categories of Threatened Species under the EPBC Act (DotEE, 2018b).

Appendix 6. Table of Threatened and Priority Flora within 10 km of the Survey Area (DBCA 2019d, DBCA 2019e, DotEE 2019a)

Appendix 7. Location of data collection points within the Survey Area

Appendix 8. Vegetation Condition Scale (EPA, 2016).

Appendix 9. List of Vascular Flora found within the Survey Area.

Appendix 10. Threatened and Priority Flora Location and Abundance Tables

Appendix 11. Completed Threatened and Priority Flora Report Forms.

Appendix 12. Photographs and descriptions of Vegetation Units mapped within the Survey Area

Appendix 13. Floristic Quadrat Details and Location Map

Appendix 14. Complete dendrogram produced by the MVA.

Appendix 1. Categories of threatened and priority ecological communities under the BC Act (DBCA, 2018a, 2019b).

Conservation code	Category
	(T) Threatened ecological community pursuant to Sect 27 of the <i>Biodiversity Conservation Act 2016</i> .
T	<p>(T) CR – Critically endangered</p> <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p>
	<p>(T) EN - Endangered</p> <p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p>
	<p>(T) VU - Vulnerable</p> <p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p>
	(P) Priority species – possible threatened communities.
p1	<p>Poorly known communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>

Conservation code	Category
P2	<p>Poorly known communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
P3	<p>Poorly known communities</p> <ul style="list-style-type: none"> a) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: b) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; c) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <ul style="list-style-type: none"> a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Conservation code	Category
P5	<p>Conservation dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Appendix 2. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2018b).

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).

Appendix 3. Protected Matters Search Tool and NatureMap report.



EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/10/19 20:47:20

[Summary](#)

[Details](#)

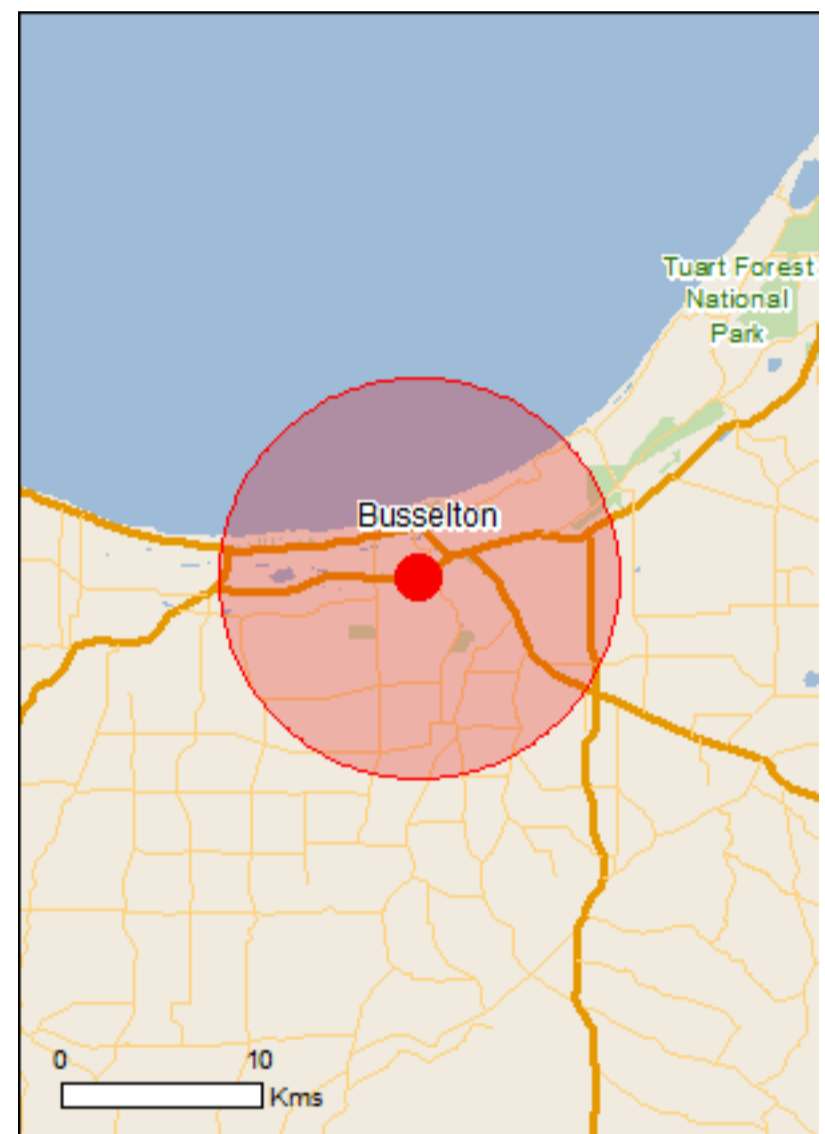
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

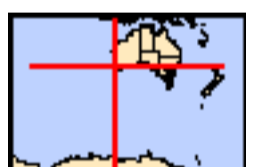
[Acknowledgements](#)



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

[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	66
Listed Migratory Species:	49

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	76
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	14
Regional Forest Agreements:	1
Invasive Species:	24
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	2

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)

[\[Resource Information \]](#)

Name

[Vasse-wonnerup system](#)

Proximity

Within Ramsar site

Commonwealth Marine Area

[\[Resource Information \]](#)

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name

EEZ and Territorial Sea

Marine Regions

[\[Resource Information \]](#)

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name

[South-west](#)

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

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

Name

[Banksia Woodlands of the Swan Coastal Plain ecological community](#)

Status

Endangered

Type of Presence

Community likely to occur within area

[Clay Pans of the Swan Coastal Plain](#)

Critically Endangered

Community likely to occur within area

[Subtropical and Temperate Coastal Saltmarsh](#)

Vulnerable

Community likely to occur within area

[Tuart \(*Eucalyptus gomphocephala*\) Woodlands and Forests of the Swan Coastal Plain ecological community](#)

Critically Endangered

Community likely to occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name

Status

Type of Presence

Birds

[Anous tenuirostris melanops](#)

Australian Lesser Noddy [26000]

Vulnerable

Species or species habitat may occur within area

[Botaurus poiciloptilus](#)

Australasian Bittern [1001]

Endangered

Species or species habitat likely to occur within area

[Calidris canutus](#)

Red Knot, Knot [855]

Endangered

Species or species habitat known to occur within area

[Calidris ferruginea](#)

Curlew Sandpiper [856]

Critically Endangered

Species or species habitat known to occur within area

[Calyptorhynchus banksii naso](#)

Forest Red-tailed Black-Cockatoo, Karrak [67034]

Vulnerable

Species or species

Name	Status	Type of Presence
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	habitat known to occur within area Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species

Name	Status	Type of Presence
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	habitat known to occur within area Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat likely to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia busselliana Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
Caladenia procera Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat known to occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat known to occur within area
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea brachystylis subsp. grandis Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat known to occur within area
Grevillea elongata Ironstone Grevillea [64578]	Vulnerable	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat known to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat known to occur within area

Reptiles

Name	Status	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific		Species or species

Name	Threatened	Type of Presence
Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995] Megaptera novaeangliae		habitat may occur within area
Humpback Whale [38] Natator depressus	Vulnerable	Congregation or aggregation known to occur within area
Flatback Turtle [59257] Orcinus orca	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Killer Whale, Orca [46] Rhincodon typus		Species or species habitat may occur within area
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species

Name	Threatened	Type of Presence
Tringa nebularia Common Greenshank, Greenshank [832]		habitat known to occur within area Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

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

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species

Name	Threatened	Type of Presence
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		habitat known to occur within area Species or species habitat known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species

Name	Threatened	Type of Presence
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		habitat may occur within area Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Whales and other Cetaceans		
		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area

Name	Status	Type of Presence
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Geographe	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Broadwater	WA
Fish Road	WA
NTWA Bushland covenant (0173)	WA
Sabina	WA
Tuart Forest	WA
Unnamed WA25836	WA
Unnamed WA26620	WA
Unnamed WA41568	WA
Unnamed WA41597	WA
Unnamed WA42879	WA
Unnamed WA48837	WA
Unnamed WA49385	WA
Unnamed WA50017	WA
Unnamed WA50270	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species

[[Resource Information](#)]

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

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within

Name	Status	Type of Presence area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands [\[Resource Information \]](#)

Name	State
Vasse-Wonnerup Wetland System	WA

Key Ecological Features (Marine) [\[Resource Information \]](#)

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Commonwealth marine environment within and Western rock lobster	South-west South-west

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-33.6719 115.3447

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix 4. Definitions of Conservation Codes for Threatened and Priority flora (DBCA, 2019b).

Conservation code	Category
(T) Threatened species pursuant to Sect 19 of the BC Act 2016.	
T	<p>(T) CR – Critically endangered</p> <p>Threatened species considered to be <i>“facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”</i>.</p>
	<p>(T) EN - Endangered</p> <p>Threatened species considered to be <i>“facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”</i>.</p>
	<p>(T) VU - Vulnerable</p> <p>Threatened species considered to be <i>“facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”</i>.</p>
(P) Priority species – possible Threatened species.	
P1	<p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>

Conservation code	Category
P3	<p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Appendix 5. Categories of Threatened Species under the EPBC Act (DotEE, 2018b).

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.

Appendix 6 Threatened and Priority Flora within 10 km of the Survey Area (DBCA, 2019d; DBCA, 2019e; DotEE, 2019a.)

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
<i>Brachyscias verecundus</i>	T (CR)	Nov	Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	Very Low
<i>Caladenia procera</i>	T (CR)	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.	High
<i>Grevillea brachystylis</i> subsp. <i>grandis</i>	T (CR)	Aug-Sep	Shrubs, 0.3–1 m high. Leaves simple, 70–110 mm long, 2–10 mm wide. Flowers red, very irregular. Fruit ovoid, 12–17 mm long. Amongst medium trees, or tall (sclerophyll) shrubland; in sand, or loam.	Low
<i>Lambertia orbifolia</i> subsp. Scott River Plains (L.W. Sage 684)	T (CR)	Oct-Jan	Small tree or shrub, to 5 m high. Fl. red-orange. Yellow-brown sandy clay, grey sand, sandy gravel, laterite.	Low
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	T (CR)	Oct	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. Yellow. Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Low
<i>Verticordia plumosa</i> var. <i>ananeotes</i>	T (CR)	Nov-Dec	Erect, sparsely branched shrub, 0.3-0.5 m high. Fl. pink-purple/white. Sandy loam. Seasonally inundated plains.	Low
<i>Andersonia gracilis</i>	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.	Low
<i>Banksia nivea</i> subsp. <i>uliginosa</i>	T (EN)	July-Sep	Dense, erect, non-lignotuberous shrub, 0.2–1.5 m high. Fl. yellow, brown. Sandy clay, gravel.	Low
<i>Caladenia busselliana</i>	T (EN)	Sept-Oct	Tuberous, perennial, herb, 0.2–0.3 m high. Fl. green, yellow, cream. Sandy loam. Winter-wet swamps	Low
<i>Caladenia huegelii</i>	T (EN)	Sep-Oct	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green, cream, red. Grey or brown sand, clay loam.	Low
<i>Drakaea elastica</i>	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

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
<i>Gastrolobium papilio</i>	T (EN)	Oct-Dec	Tangled, clumped shrub, to 1.5 m high. Fl. cream-red. Sandy clay over ironstone and laterite. Flat plains.	Low
<i>Lambertia echinata</i> subsp. <i>occidentalis</i>	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.	Very Low
<i>Petrophile latericola</i>	T (EN)	Nov	Multi-stemmed shrub, 0.4-1.5 m high. Fl. yellow. Red lateritic clay. Winter-wet flats.	Low
<i>Verticordia densiflora</i> var. <i>pedunculata</i>	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
<i>Verticordia plumosa</i> var. <i>vassensis</i>	T (EN)	Sep-Feb	Shrub, 0.3–1 m high. Fl. pink. White/grey sand. Winter-wet flats.	Moderate
<i>Banksia squarrosa</i> subsp. <i>argillacea</i>	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.	Very Low
<i>Chamelaucium</i> sp. S Coastal Plain (R.D. Royce 4872)	T (VU)	Oct-Dec	Winter-wet areas, loams and ironstone.	Low
<i>Daviesia elongata</i> subsp. <i>elongata</i>	T (VU)	Dec-Feb	Spreading shrub, 0.4–1 m high. Fl. yellow, orange, red. Sandy soils.	Low
<i>Diuris micrantha</i>	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
<i>Drakaea micrantha</i>	T (VU)	Sep-Oct	Tuberous, perennial, herb, 0.15–0.3 m high. Fl. red, yellow. White-grey sand.	Low
<i>Grevillea elongata</i>	T (VU)	Oct	Shrub, 1.5-2 m high. Fl. white-cream. Gravelly clay, sandy clay, sand. Road verges, swamps, creek banks.	Low
<i>Tetraria australiensis</i>	T (VU)	Nov-Dec	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown. Sandy soils associated with heavy soils on the Pinjarra Plain.	Low
<i>Gastrolobium</i> sp. Yoongarillup (S. Dilkes s.n. 1/9/1969)	P1	Aug-Oct	Erect, perennial shrub; 0.5 m high, 1.0 m wide; flowers yellow/orange. Jarrah-Marri forest, white sand, gravel	Low
<i>Puccinellia vassica</i>	P1	Sep-Nov	Caespitose annual or perennial, grass-like or herb, 0.41–0.55 m high. Saline soils. On the outer margins of coastal saltmarshes	Low - Moderate
<i>Stachystemon</i> sp. Keysbrook (R. Archer 17/11/99)	P1		Shrub/herb to 0.2 m high.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
<i>Amperea micrantha</i>	P2	Oct-Nov	Low, spreading, bushy perennial, herb, 0.1–0.3 m high. Fl. brown. Sandy soils.	Moderate
<i>Andersonia barbata</i>	P2	Nov	Erect shrub, ca 0.4 m high. Fl. blue, pink. White sand. Swampy areas.	Low
<i>Calystegia sepium</i> subsp. <i>roseata</i>	P2	Oct-Dec	Vine 5 m high x > 5 m wide. Flowers rose-pink; largely in bud.	Low - Moderate
<i>Cardamine paucijuga</i>	P2	Sep-Oct	Slender erect annual, herb, to 0.4 m high. Fl. white. In moist to dry habitats.	Low
<i>Leptomeria furtiva</i>	P2	Jan, Aug-Oct	Lax, sprawling shrub, 0.2–0.45 m high. Fl. orange, brown. Grey or black peaty sand. Winter-wet flats.	Moderate
<i>Lepyrodia extensa</i>	P2		Herb (sedge-like), ca. 0.3 m high. Sand & sandy peat. Seasonally inundated swamps.	Low
<i>Leucopogon</i> sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. Pericalymma ellipticum wet shrubland, Marri-Jarraah woodland.	Low
<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	P2	Sep-Oct	Tufted shrub, 0.1–0.6 m high. Fl. yellow. Sandy soils. Flats, winter-wet areas.	Low
<i>Acacia lateriticola</i> var. glabrous variant (B.R. Maslin 6765)	P3	Aug-Oct	Shrub, 0.4–0.8 m high. Fl. yellow. Lateritic soils.	Low
<i>Angianthus drummondii</i>	P3	Oct-Dec	Erect annual, herb, to 0.1 m high. Fl. yellow. Grey or brown clay soils, ironstone. Seasonally wet flats.	Very Low
<i>Blennospora doliiformis</i>	P3	Oct-Nov	Erect annual, herb, to 0.15 m high. Fl. yellow. Grey or red clay soils over ironstone. Seasonally-wet flats.	Very Low
<i>Boronia tetragona</i>	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
<i>Caustis</i> sp. Boyanup (G.S. McCutcheon 1706)	P3	Dec-Jan	Rhizomatous, clumped perennial, grass-like or herb (sedge), 0.7–1 m high. White or grey sand.	Low
<i>Chordifex gracilior</i>	P3	Sep-Dec	Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown. Peaty sand. Swamps.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
<i>Chorizema carinatum</i>	P3	Oct-Dec	Erect or spreading shrub, 0.1–0.6 m high. Fl. yellow. Sand, sandy clay.	Low
<i>Eryngium</i> sp. Subdecumbens (G.J. Keighery 5390)	P3	Nov	Erect, open tuberous, herb, 0.1–0.3 m high. Fl. green. Grey to brown loamy to sandy clay, brown cracking clay. Winter-wet flats, swamps, dried claypans, ridges.	Low
<i>Grevillea brachystylis</i> subsp. <i>brachystylis</i>	P3	Aug-Nov	Much-branched, prostrate or decumbent, non-lignotuberous shrub, 0.2–0.5 m high, to 3 m wide. Fl. red. Black sand, sandy clay. Swampy situations.	Low
<i>Grevillea bronwenae</i>	P3	Jun-Dec	Slender, erect shrub, 0.5–1.6 m high. Fl. red. Grey sand over laterite, lateritic loam. Hillslopes.	Low
<i>Grevillea manglesioides</i> subsp. <i>ferricola</i>	P3	Oct	Erect or spreading shrub, 1.5 m high. Fl. red/green/red&green. Red sandy clay over ironstone. Winter wet flats.	Low
<i>Hakea oldfieldii</i>	P3	Aug-Oct	Open, straggling shrub, up to 2.5 m high. Fl. white, cream, yellow. Red clay or sand over laterite. Seasonally wet flats.	Low
<i>Isopogon formosus</i> subsp. <i>dasylepis</i>	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
<i>Jacksonia gracillima</i>	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
<i>Johnsonia inconspicua</i>	P3	Oct-Nov	Rhizomatous, tufted perennial, grass-like or herb, 0.1–0.3 m high, to 0.2 m wide. Fl. green, white, pink. White-grey or black sand. Low dunes, winter-wet flats.	Low
<i>Lasiopetalum laxiflorum</i>	P3	Sep-Oct	Jarraah forest, lateritic soils. 2-3 ft high. Mauve flowers. Brown on underside of leaf.	Low
<i>Lasiopetalum membranaceum</i>	P3	Sep-Dec	Multi-stemmed shrub, 0.2-1 m high. Fl. pink, blue, purple. Sand over limestone.	Moderate
<i>Lepyrodia heleocharoides</i>	P3	Dec	Rhizomatous, slender, tufted perennial, herb (sedge-like), 0.15–0.25 m high. Moist peaty sand. Dry or seasonally inundated heath or woodland, swamps.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
<i>Loxocarya magna</i>	P3	Sep-Nov	Rhizomatous, perennial, herb (sedge-like), 0.5-1.5 m high. Sand, loam, clay, ironstone. Seasonally inundated or damp habitats.	Low
<i>Meionectes tenuifolia</i>	P3		Haloragaceae family, broadly distributed across the Swan Coastal Plain, northern and southern Jarrah forests.	Low
<i>Myriophyllum echinatum</i>	P3	Nov	Erect annual, herb, 0.02-0.03 m high. Fl. red. Clay. Winter-wet flats.	Low
<i>Pimelea ciliata</i> subsp. <i>longituba</i>	P3	Oct-Dec	Erect shrub, 0.3-1 m high. Fl. pink. Grey sand over clay, loam.	Low
<i>Pultenaea pinifolia</i>	P3	Oct-Nov	Erect, slender shrub, 1-3 m high. Fl. yellow, orange. Loam or clay. Floodplains, swampy areas.	Low
<i>Schoenus benthamii</i>	P3	Oct-Nov	Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown. White, grey sand, sandy clay. Winter-wet flats, swamps.	Low
<i>Schoenus pennisetis</i>	P3	Aug-Sep	Tufted annual, grass-like or herb (sedge), 0.05-0.15 m high. Fl. purple-black. Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	Low
<i>Synaphea hians</i>	P3	Jul-Nov	Prostrate or decumbent shrub, 0.15-0.6 m high, to 1 m wide. Fl. Yellow. Sandy soils. Rises.	Moderate
<i>Verticordia attenuata</i>	P3	Dec-May	Shrub, 0.4–1 m high. Fl. pink. White or grey sand. Winter-wet depressions	Low
<i>Acacia flagelliformis</i>	P4	May-Sep	Rush-like, erect or sprawling shrub, 0.3-0.75(-1.6) m high. Fl. yellow. Sandy soils. Winter-wet areas.	Moderate
<i>Acacia semitrullata</i>	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
<i>Banksia meisneri</i> subsp. <i>ascendens</i>	P4	Apr-Sep	Shrub, 0.5-2 m high, leaves ascending, 8-15 mm long. Fl. yellow-orange-brown. White or grey sand. Swampy flats.	Low
<i>Boronia tenuis</i>	P4	Aug-Nov	Procumbent or erect & slender shrub, 0.1–0.5 m high. Fl. blue, pink, white. Laterite, stony soils, granite.	Low
<i>Calothamnus quadrifidus</i> subsp. <i>teretifolius</i> A.S.George & N.Gibson ms	P4	Nov-Dec	Erect, compact, perennial shrub 1.7 m high x 1 m wide. Fl. Red. Seeds held. Fruit exposed.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood
<i>Chamaelucium</i> sp. Yoongarillup (G.J. Keighery 3635)	P4	Jul-Oct	Non-lignotuberous shrub, to 2.5 m high. Fl. cream, yellow. Jarrah-marri forest. Loams, sandy clays. Riverbanks, lower slopes, below laterite breakaways.	Low
<i>Franklandia triaristata</i>	P4	Aug-Oct	Erect, lignotuberous shrub, 0.2-1 m high. Fl. white, cream, yellow, brown, purple. White or grey sand.	Low
<i>Ornduffia submersa</i>	P4	Sep-Oct	Tuberous emergent aquatic perennial dwarf shrub, height to 35 cm; flowers white; leaves floating on surface of water. Clay-based ponds and swamps (semi-aquatic)	Low
<i>Stylidium longitubum</i>	P4	Oct-Dec	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. Pink. Sandy clay, clay. Seasonal wetlands.	Very Low
<i>Thysanotus glaucus</i>	P4	Oct-Mar	Caespitose, glaucose perennial, herb, 0.1–0.2 m high. Fl. purple. White, grey or yellow sand, sandy gravel.	Low
<i>Verticordia lehmannii</i>	P4	Jan/Apr-Aug/Dec	Slender shrub, 0.2–1 m high. Fl. pink. Sandy clay. Winter-wet flats.	Low

Note: The BC Act Conservation Status is shown, EPBC Act status, where relevant, is in brackets.

Appendix 7. Data points and information

SiteType	Author	Comments	Citation	Name	Sym	VegCond	Longitude	Latitude
Data point	Ecoedge	2 x photographs	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2395			345778.803	6273584.462
Data point	Ecoedge	PEC extends into survey area, photo 9.30	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2396			345701.783	6273627.142
Data point	Ecoedge	Photo 9.33	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2397		Degraded	345653.562	6273672.953
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2398		Degraded	345510.967	6273704.040
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2399		Degraded/Good	345485.609	6273706.402
Data point	Ecoedge	Photo 9.59	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2400		Degraded	345452.136	6273717.400
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2401		Good	345392.920	6273720.330
Data point	Ecoedge	Ago fle, Jac fur, Kg, Con sp. Bsn, Con acu, Hib cun, Ade mei, Spy glo, Wat mer, Lyg imb, Aca sal, Pte vit, Lep squ	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2402		Good	345367.995	6273724.251

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2403		Degraded	345316.892	6273729.860
Data point	Ecoedge	Ago fle, Aca sal, Lep gla, weeds	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2404		Degraded	345277.812	6273737.987
Data point	Ecoedge	Ago fle, Aca sal, Lep gla, Con sp. Bsn	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2405		Good	345228.730	6273744.520
Data point	Ecoedge	Ago fle, Spy glo, Lep gla, Ade mei, Lom sua, Tri ela, Photo 10.18	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2406		Very Good	345181.567	6273747.747
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2407		Good	345146.506	6273759.275
Data point	Ecoedge	Condition: Very Good to north	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2408		Degraded	345114.793	6273758.986
Data point	Ecoedge	Marri, Ago fle, Jac fur, Acac sal, Aca coc, Spy glo, Wat mer	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2409		Good	345072.268	6273767.168
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2410		Degraded	345053.072	6273773.068
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2411		Degraded	345006.152	6273783.847

Data point	Ecoedge	Photo 10.38 to south	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2412			345111.446	6273811.173
Data point	Ecoedge	Ago fle, Aca sal, Rha bac	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2413		Degraded	345219.414	6273815.911
Data point	Ecoedge	Line of Ago fle, Aca sal veg	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2414		Degraded	345872.818	6273586.087
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2415		Completely Degraded	346032.689	6273460.767
Data point	Ecoedge	Euc rud rud, Aca coc	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2416		Completely Degraded	344606.456	6273940.863
Data point	Ecoedge	Photo 8.30 g/s Ago fle, Lep gla, Spy glo, Ba (planted), Euc rud (plantted), Kg	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2540		Degraded	345609.965	6273690.333
Data point	Ecoedge	Ago fle, Aca coc, Kg, Spy glo, Jac fur, Aca sal	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2541		Degraded	345568.620	6273694.873
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2542		Completely Degraded	345435.958	6273719.798
Data point	Ecoedge	Photo 9.03, Ago fle, Lep gla, Aca sal	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2543		Good	345260.917	6273738.606

Data point	Ecoedge	Ago fle, Aca sal	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2544		Completely Degraded	345206.239	6273753.249
Data point	Ecoedge	Ago fle, Jac fur, Spy glo, limestone	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2545		Degraded	345164.256	6273751.465
Data point	Ecoedge	Cal pro 1 x fl, basal lvs x 15	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2546			345219.955	6273742.491
Data point	Ecoedge	Cal ?pro - 2 x plants, lvs only	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2547			345205.640	6273744.593
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2548		Degraded	345083.028	6273772.892
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2549		Completely Degraded	345032.821	6273786.500
Data point	Ecoedge	Photo 10.32, g/s, PEC, Ago fle, marri, Aca coc, lom mic, jac fur, Con sp Bsn, Kg, Cal fla, Hib hyp, Ani man, Cha cor, lep cal, Xan bru, Cal lat, Spy glo, Tri ela, Pte vit, Har com, Agr sca, Ade mei	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2550		Very Good	344915.481	6273781.487
Data point	Ecoedge	Ago fle, Wat mer, Spy glo, Aca coc, Con sp Bsn, Aca sal	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2551		Degraded	344907.502	6273793.230

Data point	Ecoedge	Photo 10.46, Ago fle, Kg, Hak pro, Dav phy, Jac fur, Aca sal	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2552		Degraded	344852.130	6273798.767
Data point	Ecoedge	PEC, Marri, Xan bru, Spy glo, Har com, Ago fle, per lon	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2553		Degraded	344781.772	6273796.521
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	2554		Completely Degraded	344771.884	6273811.329
Data point	Ecoedge	Mel cut, Bau jun, Gah tri, Cen asi; north of here Degraded	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	3187		Very Good	344610.140	6274119.725
Data point	Ecoedge	Mel vim, Bau jun, bullrush, kikuyu, couch	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	3188		Degraded	344614.650	6274184.358
Data point	Ecoedge	Ago fle, Wat mer, Aca sal, Spy glo	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	3189			344601.125	6274229.286
Data point	Ecoedge	Ago fle, Lep gla, Rha bac, Lag ova	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	3190		Good	344602.045	6274361.404
Data point	Ecoedge	North of here Very Good, south of here Good	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	3191			344616.738	6274084.345
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	786	Civil	Good	345478.691	6273703.967

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	787	Civil	Good	345469.501	6273704.479
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	788	Civil	Good	345443.742	6273709.056
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	789	Civil	Good	345426.521	6273712.552
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	790	Flag, Blue		345420.833	6273714.785
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	791	Flag, Green	Very good	345405.118	6273711.649
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	792	Flag, Green	Very good	345394.942	6273715.483
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	793	Civil	Good	345389.712	6273711.958
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	794	Civil	Good	345372.987	6273714.124
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	795	Flag, Green	Very good	345371.497	6273714.435

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	796	Flag, Green	Very good	345357.642	6273716.433
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	797	Flag, Green	Very good	345341.018	6273723.37
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	798	Flag, Red	Degraded	345338.926	6273726.776
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	799	Flag, Red	Degraded	345278.603	6273734.783
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	800	Flag, Red	Degraded	345263.104	6273735.537
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	801	Flag, Red	Degraded	345233.418	6273741.603
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	802	Civil	Good	345222.099	6273735.869
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	803	Flag, Blue		345219.503	6273741.601
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	804	Flag, Green	Very good	345213.074	6273737.723

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	805	Flag, Blue		345204.606	6273739.808
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	806	Civil	Good	345190.471	6273747.566
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	807	Civil	Good	345172.234	6273745.607
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	808	Civil	Good	345150.199	6273748.681
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	809	Flag, Red	Degraded	345121.411	6273756.871
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	810	Civil	Good	345098.685	6273757.062
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	811	Flag, Red	Degraded	345081.446	6273756.337
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	812	Flag, Red	Degraded	345059.549	6273762.416
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	813	Flag, Red	Degraded	345057.802	6273761.282

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	814	Flag, Red	Degraded	345042.94	6273768.358
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	815	Flag, Red	Degraded	345029.755	6273775.136
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	816	Pin, Red	Completely degraded	345001.041	6273784.536
Data point	Ecoedge	A flexuosa 2-10%, K glabrescens, S globulosum, A saligna 2-10%, Ad meisneri, D divaricata, O hispidula 2-10%, Introduced grasses, watsonia >70%	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	817	Flag, Red	Degraded	344962.31	6273782.143
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	818	Flag, Red	Degraded	344936.566	6273791.042
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	819	Civil	Good	344927.467	6273791.667

Data point	Ecoedge	A flexuosa 2-10%, K glabrescens, S globulosum, A saligna 2-10%, A cochlearis, Ad meisneri, D divaricata, O hispidula 2-10%, Introduced grasses, watsonia, C caeruleum sp. Busselton >70%	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	820	Flag, Blue		344920.486	6273793.106
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	821	Flag, Red	Degraded	344900.429	6273794.557
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	822	Flag, Red	Degraded	344889.654	6273795.489
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	823	Civil	Good	344875.581	6273799.482
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	824	Pin, Red	Completely degraded	344878.342	6273806.621
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	825	Civil	Good	344859.997	6273799.778
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	826	Flag, Red	Degraded	344857.933	6273795.645

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	827	Flag, Red	Degraded	344849.805	6273799.288
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	828	Flag, Red	Degraded	344846.762	6273803.785
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	829	Flag, Red	Degraded	344831.501	6273801.427
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	830	Flag, Red	Degraded	344812.219	6273806.331
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	831	Flag, Red	Degraded	344794.291	6273807.816
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	832	Flag, Red	Degraded	344786.22	6273807.908
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	833	Pin, Red	Completely degraded	344777.129	6273819.624
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	834	Pin, Red	Completely degraded	344771.873	6273811.999
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	835	Pin, Red	Completely degraded	344766.079	6273808.8

Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	836	Flag, Red	Degraded	344753.922	6273814.925
Data point	Ecoedge	A flexuosa, A saligna 2-10%; E longifolia, Freesia, O pes-caprae, watsonia, occasional C caeruleum sp. Busselton	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	837	Flag, Blue		344749.872	6273813.418
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	838	Flag, Red	Degraded	344738.35	6273820.214
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	839	Pin, Red	Completely degraded	344720.368	6273836.564
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	840	Flag, Red	Degraded	344692.268	6273836.332
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	841	Flag, Red	Degraded	344690.525	6273846.949
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	842	Flag, Red	Degraded	344656.083	6273837.521
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	843	Flag, Red	Degraded	344672.059	6273852.86
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	844	Pin, Red	Completely degraded	344829.07	6273854.075

Data point	Ecoedge	Genista linifolia	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	845	Pin, Blue		345660.596	6273662.422
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	846	Civil	Good	345649.035	6273671.663
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	847	Civil	Good	345636.243	6273677.221
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	848	Civil	Good	345622.588	6273684.215
Data point	Ecoedge	C procera? (4)	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	849	Flag, Blue		345580.408	6273694.181
Data point	Ecoedge	C asiaticum, Ghania trifida, Ag scabrum, Caesia micrantha in understorey. C procera 1?	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	850	Flag, Blue		345577.049	6273695.679
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	851	Civil	Good	345565.909	6273696.169
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	852	Flag, Red	Degraded	345506.81	6273708.743
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	853	Flag, Blue		345449.419	6273707.483

Data point	Ecoedge	C procera?(1)	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	854	Flag, Blue		345361.215	6273724.812
Data point	Ecoedge	C procera? (10)	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	855	Flag, Blue		345222.972	6273739.547
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	856	Flag, Blue		345208.191	6273741.632
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	857	Flag, Blue		345193.388	6273745.056
Data point	Ecoedge	C attingens?	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	858	Flag, Blue		345128.172	6273763.303
Data point	Ecoedge	C attingens? (3)	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	859	Flag, Blue		345124.713	6273753.15
Data point	Ecoedge	A flexuosa/A saligna/J furcellata, K glabrescens/ C caeruleaum sp. Busselton, C aculeata, G tomentosum. C procera?, C attingens?	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	860	Flag, Blue		345121.295	6273764.075
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	861	Flag, Blue		345088.53	6273765.321

Data point	Ecoedge	C attigens (2)	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	862	Flag, Blue		344861.816	6273802.141
Data point	Ecoedge	Possible vegetation unit boundary	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	863	Flag, Blue		344802.167	6273808.278
Data point	Ecoedge	Transition to CD veg unit. Natural soil level and veg type disturbed by excavation, Ehr longifolia, Rap raphanistrum, Hypochaeris glabra, Oxalis pes-caprae, Actotheca calendula > 70%	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	864	Pin, Red	Completely degraded	345859.927	6273522.874
Data point	Ecoedge	Excavation of drain shows shallow limestone	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	865	Pin, Red	Completely degraded	345907.63	6273486.481
Data point	Ecoedge	Weed control along edge compromises vegetation and potential orchid growth	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	866	Pin, Red	Completely degraded	345946.02	6273463.586
Data point	Ecoedge		Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	867	Pin, Red	Completely degraded	346123.824	6273324.133
Data point	Ecoedge	Drain edge completely degraded, Monoculture of A saligna, some E rudis in adjacent veg.	Reconnaissance and Targeted Flora and Vegetation Survey; Vasse Diversion Drain Upgrade	868	Pin, Red	Completely degraded	346339.666	6273137.705

Appendix 8. Vegetation condition scale (EPA, 2016).

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

Appendix 9. List of vascular flora found within the Survey Area at the Vasse Diversion Drain

	FAMILY_NAME	SPECIES_NAME	NATURALISED	CONSV_CODE	PEC species
1	Iridaceae	<i>Ferraria crispa</i>			
2	Iridaceae	<i>Freesia alba</i> × <i>leichtlinii</i>			
3	Anarthriaceae	<i>Lyginia imberbis</i>			
4	Apiaceae	<i>Centella asiatica</i>			
5	Apiaceae	<i>Foeniculum vulgare</i>	*		
6	Apiaceae	<i>Xanthosia candida</i>			
7	Araceae	<i>Zantedeschia aethiopica</i>	*		
8	Asparagaceae	<i>Lomandra micrantha</i>			Yes
9	Asparagaceae	<i>Lomandra suaveolens</i>			
10	Asparagaceae	<i>Sowerbaea laxiflora</i>			
11	Asparagaceae	<i>Thysanotus patersonii</i>			
12	Asteraceae	<i>Arctotheca calendula</i>	*		
13	Asteraceae	<i>Conyza sumatrensis</i>	*		
14	Asteraceae	<i>Gazania linearis</i>			
15	Asteraceae	<i>Hypochaeris glabra</i>	*		
16	Asteraceae	<i>Olearia axilaris</i>			
17	Asteraceae	<i>Symphotrichum squamatum</i>	*		
18	Brassicaceae	<i>Heliophila pusilla</i>	*		
19	Brassicaceae	<i>Rhaphanus rapanistrum</i>	*		
20	Caryophyllaceae	<i>Corrigiola litoralis</i>	*		
21	Caryophyllaceae	<i>Petrorhagia dubia</i>			
22	Chenopodiaceae	<i>Rhagodia baccata</i>			
23	Cupressaceae	<i>Callitris preissii</i>			
24	Cyperaceae	<i>Baumea arthrophylla</i>			
25	Cyperaceae	<i>Baumea juncea</i>			Yes
26	Cyperaceae	<i>Cyathochaeta avenacea</i>			
27	Cyperaceae	<i>Gahnia trifida</i>			Yes
28	Cyperaceae	<i>Lepidosperma calcicola</i>			
29	Cyperaceae	<i>Lepidosperma carphoides</i>			
30	Cyperaceae	<i>Lepidosperma gladiatum</i>			
31	Cyperaceae	<i>Lepidosperma longitudinale</i>			
32	Cyperaceae	<i>Lepidosperma pubisquameum</i>			
33	Cyperaceae	<i>Lepidosperma squamatum</i>			
34	Cyperaceae	<i>Schoenus aff cruentus</i>			
35	Cyperaceae	<i>Schoenus unispiculatus</i>			
36	Dilleniaceae	<i>Hibbertia amplexicaulis</i>			
37	Dilleniaceae	<i>Hibbertia cuneiformis</i>			
38	Dilleniaceae	<i>Hibbertia hypericoides</i>			Yes
39	Dilleniaceae	<i>Hibbertia racemosa</i>			
40	Droseraceae	<i>Drosera glanduligera</i>			
41	Ericaceae	<i>Leucopogon propinquus</i>			
42	Euphorbiaceae	<i>Euphorbia terracina</i>	*		
43	Fabaceae	<i>Acacia cochlearis</i>			
44	Fabaceae	<i>Acacia littorea</i>			
45	Fabaceae	<i>Acacia pulchella</i>			

46	Fabaceae	<i>Acacia saligna</i>			
47	Fabaceae	<i>Acacia stenoptera</i>			
48	Fabaceae	<i>Chamaecytisus palmensis</i>	*		
49	Fabaceae	<i>Daviesia physodes</i>			
50	Fabaceae	<i>Genista linifolia</i>			
51	Fabaceae	<i>Gompholobium tomentosum</i>			
52	Fabaceae	<i>Hardenbergia comptoniana</i>			
53	Fabaceae	<i>Jacksonia furcellata</i>			
54	Fabaceae	<i>Kennedia prostrata</i>			
55	Fabaceae	<i>Vicia sativa</i>	*		
56	Geraniaceae	<i>Erodium botrys</i>	*		
57	Geraniaceae	<i>Pelargonium capitatum</i>	*		
58	Goodeniaceae	<i>Dampiera linearis</i>			
59	Goodeniaceae	<i>Scaevola calliptera</i>			
60	Haemodoraceae	<i>Anigozanthos manglesii</i>			
61	Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
62	Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>gracilis</i>			
63	Haemodoraceae	<i>Haemodorum spicatum</i>			
64	Hemerocallidaceae	<i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i>			
65	Hemerocallidaceae	<i>Caesia micrantha</i>			
66	Hemerocallidaceae	<i>Dianella revoluta</i>			
67	Hemerocallidaceae	<i>Tricoryne elatior</i>			
68	Hypoxidaceae	<i>Pauridia occidentalis</i>			
69	Iridaceae	<i>Gladiolus angustus</i>	*		
70	Iridaceae	<i>Ixia maculata</i>	*		
71	Iridaceae	<i>Patersonia occidentalis</i>			
72	Iridaceae	<i>Romulea rosea</i>	*		
73	Iridaceae	<i>Watsonia meriana</i> var. <i>bulbillifera</i>	*		
74	Myrtaceae	<i>Agonis flexuosa</i>			Yes
75	Myrtaceae	<i>Corymbia calophylla</i>			Yes
76	Myrtaceae	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>			Yes
77	Myrtaceae	<i>Kunzea glabrescens</i>			
78	Myrtaceae	<i>Melaleuca preissiana</i>			
79	Myrtaceae	<i>Melaleuca raphiophylla</i>			Yes
80	Orchidaceae	<i>Caladenia attingens</i>			
81	Orchidaceae	<i>Caladenia latifolia</i>			
82	Orchidaceae	<i>Caladenia procera</i>		T	
83	Orchidaceae	<i>Diuris jonesii</i>			
84	Orchidaceae	<i>Pterostylis vittata</i>			
85	Oxalidaceae	<i>Oxalis pes-caprae</i>	*		
86	Poaceae	<i>Austrostipa bronwenae</i>		T	
87	Poaceae	<i>Austrostipa flavescens</i>			
88	Poaceae	<i>Briza maxima</i>	*		
89	Poaceae	<i>Ehrharta calycina</i>			

90	Poaceae	<i>Ehrharta longiflora</i>	*		
91	Poaceae	<i>Microlaena stipoides</i>			
92	Poaceae	<i>Tetrarrhena laevis</i>			
93	Primulaceae	<i>Samolus junceus</i>			
94	Proteaceae	<i>Adenanthos meisneri</i>			
95	Proteaceae	<i>Banksia littoralis</i>			Yes
96	Proteaceae	<i>Conospermum caeruleum</i>			Yes
97	Restionaceae	<i>Hypolaena pubescens</i>			
98	Rhamnaceae	<i>Spyridium globulosum</i>			
99	Rubiaceae	<i>Opercularia hispidula</i>			
100	Scrophulariaceae	<i>Eremophila glabra</i>			
101	Scrophulariaceae	<i>Verbascum virgatum</i>	*		
102	Stylidiaceae	<i>Stylidium crassifolium</i>			
103	Xanthorrhoeaceae	<i>Chamaescilla corymbosa</i>			
104	Xanthorrhoeaceae	<i>Xanthorrhoea brunonis</i>			

Appendix 9. Threatened and Priority Flora Location and Abundance Tables.

Table 1. Details of *Caladenia procera* and *Austrostipa bronwenae* plants found during the survey.

Site	Taxon Name	Abundance	Date Obs.	Comments	Easting (m)	Northing (m)
1	<i>Caladenia procera</i>	16	18/09/2019	1 plant flowering, 15 basal leaves only	345207.57	6273741.82
2	<i>Caladenia procera</i>	2	18/09/2019	2 x basal leaves only	345221.50	6273739.15
3	<i>Austrostipa bronwenae</i>	3	5/10/2019	Healthy clumps in flower	346330.03	6273038.94



Threatened and Priority Flora Report Form

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au> under Standard Report Forms

TAXON: <u>Caladenia procera</u>		TPFL Pop. No: _____	
OBSERVATION DATE: <u>18/09/2019</u>		CONSERVATION STATUS: <u>TF</u> New population <input type="checkbox"/>	
OBSERVER/S: <u>Russell Smith & Colin Spencer</u>		PHONE: <u>0447809124</u>	
ROLE: <u>Botanists</u>		ORGANISATION: <u>Ecoedge</u>	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place): Busselton
Sussex Loc.5067m, 40 m of Clydebank Ave., 215 E of the footbride over the Vasse Diversion Drain

DBC DISTRICT: _____		LGA: <u>Busselton</u>		Land manager present: <input type="checkbox"/>	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 <input type="checkbox"/>		DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM's <input type="checkbox"/>		GPS <input type="checkbox"/> Differential GPS <input checked="" type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>		Lat / Northing: <u>6273741.82</u>		No. satellites: _____ Map used: _____	
WGS84 <input type="checkbox"/>		Long / Easting: <u>345207.57</u>		Boundary polygon captured: <input type="checkbox"/> Map scale: _____	
Unknown <input type="checkbox"/>		ZONE: <u>50</u>			
LAND TENURE:					
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property <input type="checkbox"/>	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/> SLK/Pole _____ to _____	
				Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>	
				MRWA road reserve <input type="checkbox"/> Other Crown reserve <input checked="" type="checkbox"/>	
				Specify other: _____	

AREA ASSESSMENT: Edge survey Partial survey Full survey Area observed (m²): _____

EFFORT: Time spent surveying (minutes): _____ No. of minutes spent / 100 m²: _____

POP'N COUNT ACCURACY: Actual Extrapolation Estimate Count method: _____
(Refer to field manual for list)

WHAT COUNTED: Plants Clumps Clonal stems

TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:	Totals:	Area of pop (m ²): <u>1</u> <small>Note: Pls record count as numbers (not percentages) for database.</small>
Alive	1			1	
Dead					

QUADRATS PRESENT: No. _____ Size _____ Data attached Total area of quadrats (m²): _____

Summary Quad. Totals: Alive				
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REPRODUCTIVE STATE: Clonal Vegetative Flowerbud Flower
 Immature fruit Fruit Dehisced fruit Percentage in flower: 15%

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

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Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input checked="" type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input checked="" type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input checked="" type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element:				
	(Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia); 2. Open shrubland (Hibbertia sp., Acacia spp.); 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Woodland, Agonis flexuosa, Acacia saligna

2.

3.

4.

ASSOCIATED SPECIES:

Other (non-dominant) spp

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

15 basal leaves of Caladenia sp. were seen nearby, some of which may also have been C. procera. because of the dry winter very few C. procera flowered in the vicinity

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licencing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Russell Smith Role: botanist Signed: Russell Smith Date: 8/01/2020

Please return completed form to **Species And Communities Branch DBCA,**
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

Version 1.3 August 2017

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au> under *Standard Report Forms*

TAXON: <u>Austrostipa bronwenae</u>		TPFL Pop. No: _____	
OBSERVATION DATE: <u>5/10/2019</u>	CONSERVATION STATUS: <u>T</u>	New population <input checked="" type="checkbox"/>	
OBSERVER/S: <u>Colin Spencer & Russell Smith</u>		PHONE: <u>0447809124</u>	
ROLE: <u>Botanists</u>		ORGANISATION: <u>Ecoedge</u>	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Lot 5337, MRWA Road Reserve, south of Busselton Bypass, 120 - 165 m west of the Vasse River Diversion Drain

DBC DISTRICT: _____		LGA: _____	Reserve No: _____
		Land manager present: <input type="checkbox"/>	
DATUM:	COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees <input type="checkbox"/>	DegMinSec <input type="checkbox"/>	UTMs <input checked="" type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	Lat / Northing: <u>6273038.944/6273047.162</u>		GPS <input checked="" type="checkbox"/>
WGS84 <input type="checkbox"/>	Long / Easting: <u>346330.0251/346288.810</u>		Differential GPS <input type="checkbox"/>
Unknown <input type="checkbox"/>	ZONE: <u>50</u>		Map <input type="checkbox"/>
		No. satellites: _____	Map used: _____
		Boundary polygon captured: <input type="checkbox"/>	Map scale: _____
LAND TENURE:			
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input type="checkbox"/>	Rail reserve <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input type="checkbox"/>	MRWA road reserve <input checked="" type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/>	SLK/Pole _____ to _____
		Shire road reserve <input type="checkbox"/>	
		Other Crown reserve <input type="checkbox"/>	
		Specify other: _____	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input checked="" type="checkbox"/> Full survey <input type="checkbox"/> Area observed (m ²): _____			
EFFORT: Time spent surveying (minutes): _____		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/> Count method: _____ (Refer to field manual for list)			
WHAT COUNTED:	Plants <input type="checkbox"/>	Clumps <input checked="" type="checkbox"/>	Clonal stems <input type="checkbox"/>
TOTAL POP'N STRUCTURE:	Mature:	Juveniles:	Seedlings:
Alive	<u>3</u>		
Dead			
			Totals: <u>3</u>
			Area of pop (m ²): _____
Note: Pls record count as numbers (not percentages) for database.			
QUADRATS PRESENT: No. _____ Size _____ Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____			
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE: Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input checked="" type="checkbox"/>			
Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/> Percentage in flower: <u>100%</u>			

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
•	_____	_____	_____
•	_____	_____	_____
•	_____	_____	_____



Threatened and Priority Flora Report Form

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Please return completed form to **Species And Communities Branch** DBCA,
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 **OR** email to: flora.data@dbca.wa.gov.au

RECORDS: Please forward to **Flora Administrative Officer**, Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input checked="" type="checkbox"/>	Brown <input checked="" type="checkbox"/>	Seasonally inundated <input checked="" type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input checked="" type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element:				
	(Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input type="checkbox"/>	Moist <input checked="" type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia); 2. Open shrubland (Hibbertia sp., Acacia spp.); 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Marri, Agonis flexuosa, Melaleuca raphiophylla, Banksia littoralis woodland
2. _____
3. _____
4. _____

ASSOCIATED SPECIES:

Acacia saligna, Hibbertia cuneiformis, Gahnia trifida, Lepidosperma longitudinale

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT:

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licensing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Russell Smith Role: Botanist Signed: _____ Date: 6/10/2019

Please return completed form to **Species And Communities Branch DBCA**, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983 OR email to: flora.data@dbca.wa.gov.au

Appendix 12. Photographs and descriptions of Vegetation Units mapped within the Survey Area.

Vegetation unit A



A

Corymbia calophylla and *Agonis flexuosa* with occasional *Banksia littoralis* and *Melaleuca raphiophylla* mid open forest over *Acacia cochlearis*, *A. saligna*, *Hibbertia cuneiformis* *Jacksonia furcellata*, *Kunzea glabrescens* and *Spyridium globulosum* open shrubland over *Adenanthos meisneri*, *Conospermum caeruleum* subsp. 'Busselton', *Daviesia physodes*, *Hardenbergia comptoniana*, *Hibbertia hypericoides*, *Leucopogon propinquus* low shrubland over *Lepidosperma squamatum* and *Tetraria octandra* sedgeland and *Caesia micrantha*, *Chamaescilla corymbosa*, *Conostylis aculeata* subsp. *gracilis*, *Opercularia hispidula*, *Sowerbaea laxiflora*, **Sparaxis bulbifera*, **Watsonia meriana* var. *bulbillifera* and **Zantedeschia aethiopica* mid forbland on dark brown sandy loams. ('*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest' PEC). (Degraded-Very Good)

Vegetation unit B



B

Agonis flexuosa low woodland and scattered *Acacia saligna* or *A. cochlearis* tall shrubs over **Ehrharta longifolia*, **Watsonia meriana* and other introduced herbaceous species (mainly Completely Degraded)

Vegetation unit C



C

Eucalyptus rudis and *Corymbia calophylla* mid open forest or woodland over *Agonis flexuosa* open low woodland over scattered *Acacia saligna* over **Oxalis pes-caprae*, **Watsonia meriana* and other introduced herbaceous species. (Completely Degraded)

Vegetation unit D



D

Melaleuca cuticularis, *M. lanceolata* and *M. raphiophylla* tall open shrubland over *Gahnia trifida* and *Baumea juncea* sedgeland (Good-Very Good) (Part of Conservation category wetland)

Vegetation unit E



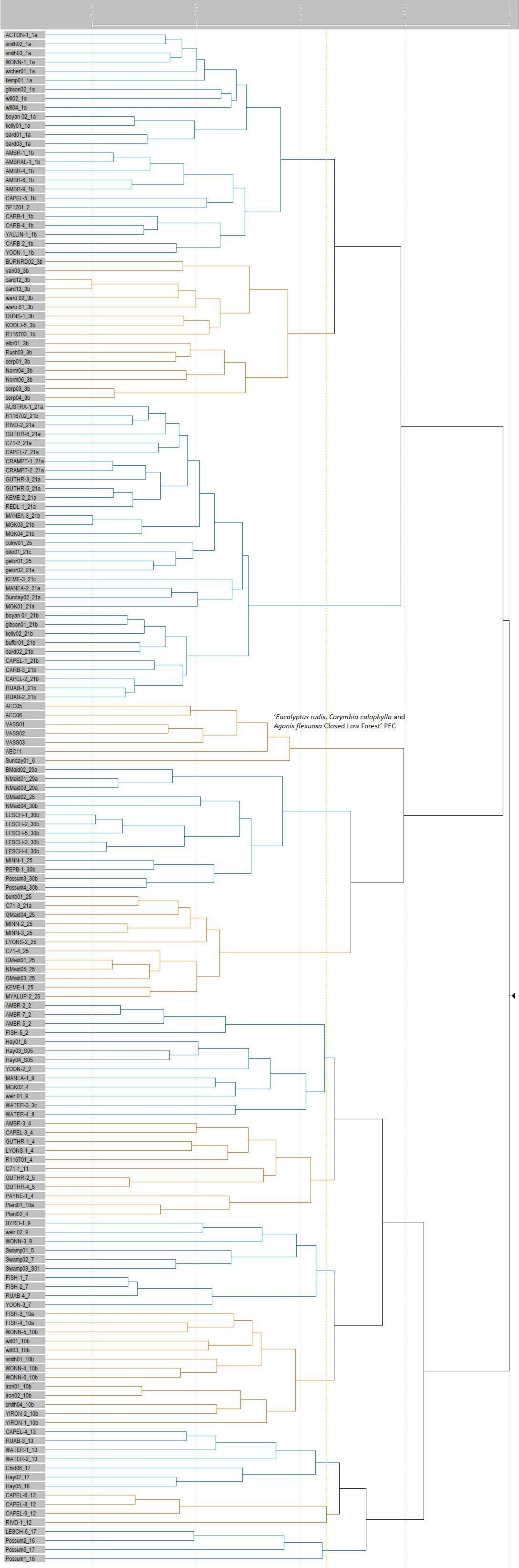
E *Agonis flexuosa* woodland over *Acacia littorea*, *Olearia axillaris* and *Spyridium globulosum*
tall open shrubland over *Lepidosperma gladiatum* sedgeland (Good-Very Good)

Vegetation unit F



F **Eragrostis curvula*, **Cenchrus clandestinus* grassland, scattered *Acacia saligna* shrubs, bare areas and watercourse (Completely Degraded)

Column Fusion Dendrogram



Appendix 13. Floristic Quadrat Details and Location Map



Quadrat VASS01 Dates: 4/09/2019, 5/10/2019

Latitude: 33° 39.881" Longitude: 115° 19.692" Condition: Very Good

Landscape Position: Plain Soil: Grey-brown loamy sand Litter 80%

SPECIES NAME	COVER	SPECIES NAME	COVER
* <i>Briza maxima</i>	5	<i>Cyathochaeta avenacea</i>	1
<i>Agonis flexuosa</i>	4	<i>Dianella revoluta</i>	1
<i>Lepidosperma calcicola</i>	4	* <i>Freesia alba</i> × <i>leichtlinii</i>	1
<i>Spyridium globulosum</i>	3	* <i>Gladiolus angustus</i>	1
<i>Adenanthos meisneri</i>	2	<i>Gompholobium tomentosum</i>	1
<i>Conospermum caeruleum</i> subsp. 'Busselton'	2	<i>Haemodorum spicatum</i>	1
* <i>Ehrharta longiflora</i>	2	<i>Hardenbergia comptoniana</i>	1
<i>Lomandra micrantha</i>	2	<i>Hibbertia hypericoides</i>	1
<i>Lyginia imberbis</i>	2	* <i>Hypochaeris glabra</i>	1
<i>Rhagodia baccata</i>	2	<i>Jacksonia furcellata</i>	1
* <i>Romulea rosea</i>	2	<i>Kunzea glabrescens</i>	1
<i>Tetrarrhena laevis</i>	2	<i>Leucopogon propinquus</i>	1
<i>Xanthorrhoea brunonis</i>	2	<i>Scaevola calliptera</i>	1
<i>Acacia saligna</i>	1	<i>Sowerbaea laxiflora</i>	1
<i>Baumea juncea</i>	1	<i>Thysanotus patersonii</i>	1
<i>Caesia micrantha</i>	1	* <i>Watsonia meriana</i> var. <i>bulbillifera</i>	1
<i>Corymbia calophylla</i>	1	* <i>Zantedeschia aethiopica</i>	1



Quadrat: VASS02 Dates: 4/09/2019, 5/10/2019

Latitude: 33° 39.993" Longitude: 115° 20.177" Condition: Excellent

Landscape Position: Plain Soil: Grey-brown loamy sand Litter 80%

SPECIES NAME	COVER	SPECIES NAME	COVER
<i>Agonis flexuosa</i>	5	<i>Cyathochaeta avenacea</i>	1
<i>Spyridium globulosum</i>	4	* <i>Hypochaeris glabra</i>	1
<i>Conospermum caeruleum</i> subsp. 'Busselton'	4	<i>Thysanotus patersonii</i>	1
<i>Baumea juncea</i>	4	<i>Acacia pulchella</i>	1
* <i>Briza maxima</i>	3	<i>Acacia stenoptera</i>	1
<i>Acacia saligna</i>	3	<i>Conostylis aculeata</i> subsp. <i>gracilis</i>	1
<i>Lepidosperma calcicola</i>	2	<i>Daviesia physodes</i>	1
<i>Lyginia imberbis</i>	2	<i>Diuris jonesii</i>	1
<i>Xanthorrhoea brunonis</i>	2	* <i>Ehrharta calycinus</i>	1
<i>Jacksonia furcellata</i>	2	<i>Hibbertia cuneiformis</i>	1
<i>Kunzea glabrescens</i>	2	<i>Hibbertia racemosa</i>	1
<i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i>	2	<i>Hypolaena pubescens</i>	1
<i>Austrostipa flavescens</i>	2	<i>Lepidosperma pubisquameum</i>	1
<i>Kennedia prostrata</i>	2	<i>Melaleuca preissiana</i>	1
<i>Lomandra suaveolens</i>	2	<i>Microlaena stipoides</i>	1
<i>Patersonia occidentalis</i>	2	* <i>Oxalis pes-caprae</i>	1
<i>Schoenus sp.</i>	2	<i>Pterostylis vittata</i>	1
* <i>Romulea rosea</i>	1	<i>Tricoryne elatior</i>	1
<i>Caesia micrantha</i>	1	<i>Xanthosia candida</i>	1



Quadrat: VASS03 Dates: 4/09/2019, 5/10/2019

Latitude: 33' 40.290" Longitude: 115' 20.543" Condition: Excellent

Landscape Position: Plain Soil: Grey-brown loamy sand Litter 60%

SPECIES NAME	COVER	SPECIES NAME	COVER
<i>Agonis flexuosa</i>	4	<i>Tricoryne elatior</i>	1
<i>Lepidosperma longitudinale</i>	4	<i>Lomandra micrantha</i>	1
<i>Zantedeschia aethiopica</i>	3	<i>Tetrarrhena laevis</i>	1
<i>Chamaescilla corymbosa</i>	3	<i>Corymbia calophylla</i>	1
<i>Baumea juncea</i>	2	<i>Hardenbergia comptoniana</i>	1
<i>Gahnia trifida</i>	2	<i>Sowerbaea laxiflora</i>	1
<i>Acacia saligna</i>	1	<i>Austrostipa bronwenae</i>	1
<i>Xanthorrhoea brunonis</i>	1	<i>Banksia littoralis</i>	1
<i>Agrostocrinum scabrum</i> subsp. <i>scabrum</i>	1	<i>Baumea arthrophylla</i>	1
<i>Austrostipa flavescens</i>	1	<i>Dampiera linearis</i>	1
<i>Romulea rosea</i>	1	<i>Hibbertia amplexicaulis</i>	1
<i>Thysanotus patersonii</i>	1	<i>Hypoxis occidentalis</i>	1
<i>Conostylis aculeata</i> subsp. <i>gracilis</i>	1	<i>Lepidosperma</i> sp. (Vasse 03/11)	1
<i>Hibbertia cuneiformis</i>	1	<i>Melaleuca raphiophylla</i>	1
<i>Hypolaena pubescens</i>	1	<i>Opercularia hispidula</i>	1
<i>Microlaena stipoides</i>	1	<i>Stylidium crassifolium</i>	1
<i>Oxalis pes-caprae</i>	1		

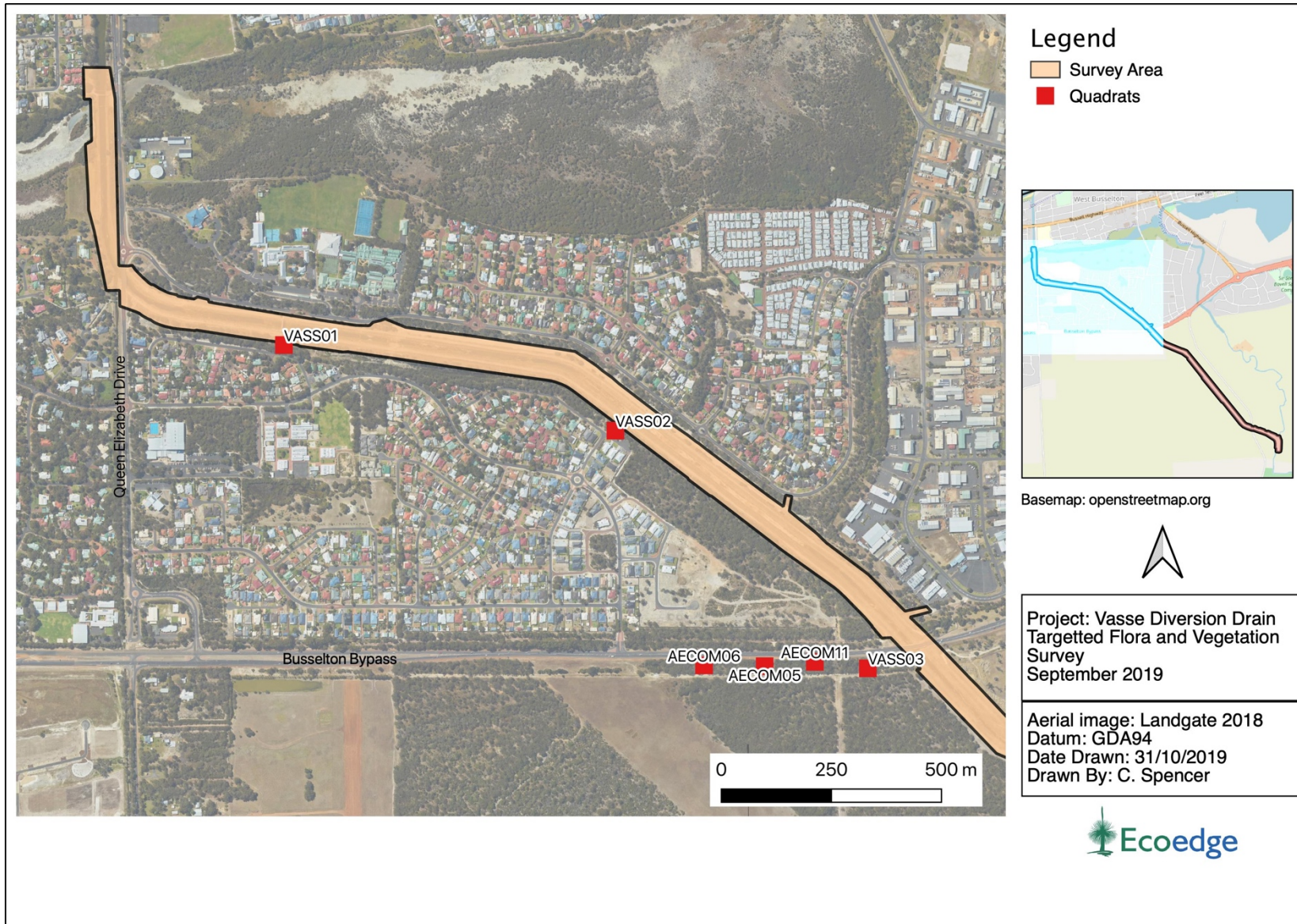


Figure 1. Location of Quadrats within the Survey Area plus AECOM 2017 survey quadrat locations