

Report of a Flora and Vegetation survey at the Lower Vasse River.



Prepared for the City of Busselton
December 2017



PO Box 1180 Bunbury WA 6231
enquiries@ecoedge.com.au

Version	Origin	Review	Review date	Ecoedge release approval	Issue date
V1	M. Portman (previously Strang), C. Kemp	R. Smith	02/12/2017		
V2	R. Smith	M. Portman	07/12/2017		
Final Draft	M. Portman	M. Breton (City of Busselton)	19/12/2017	M. Portman	08/12/2017
Final	M. Portman	R. Smith, M. Portman	05/01/2018	M. Portman	05/01/2018

Executive Summary

Ecoedge was engaged by the City of Busselton (the City) in October 2017 to undertake a Flora and Vegetation Survey of remnant vegetation along the foreshore of the Lower Vasse River foreshore near Busselton (the 'Survey Area').

The City intends to prepare a management plan that will assist with the long-term management of the foreshore vegetation and ecosystem. The flora and vegetation survey was required to provide information regarding the current extent, condition and diversity of the foreshore vegetation, as well as detailed mapping of exotic species. The Survey Area covers approximately 34.5 ha and comprises a combination of Crown Land and reserves vested in or managed by the City. The Survey Area sits within wetlands, urban areas and cleared or degraded farmland areas.

The Survey was undertaken on 19 and 31 October 2017 in accordance with the methods of the Environmental Protection Authority (EPA) Technical Guidance (EPA, 2016).

48 vascular plant species were identified within the Survey Area, of which 20 (42%) were naturalised species. Two or three of the 'native' species were a result of plantings of species that probably did not originally occur along the Lower Vasse River. While the number of native species is a fairly accurate reflection of the total number in the Survey Area, there are many other naturalised or non-native species, mostly small annuals, that occurred within the Survey Area, but were not considered to be actual or potential environmental weeds.

Ten weed species that are currently a problem or potentially troublesome to the remnant vegetation along the Lower Vasse River were identified in the Survey Area. Some of them, particularly Arum Lily, would have been introduced to the area more than 150 years ago. Arum lilies (*Zantedeschia aethiopica*) were the most widespread environmental weed, occurring at 17 of the 25 assessment sites, at "Localised" or "Moderate" densities. The next most widespread introduced species was Kikuyu (*Cenchrus clandestinus*) which is a commonly planted lawn or pasture species. Brazilian Pepper tree (*Schinus terebinthifolius*) was recorded (mostly as a localised occurrence) at seven assessment sites, but is more common in the Survey Area than that statistic would imply.

No Threatened flora, Priority flora, species of flora listed under the EPBC Act or other flora of conservation significance were found within the Survey Area.

Five vegetation mapping units were identified in the Survey Area, only three of which have something like their original structure. Two are naturally occurring, one is a mix of naturally occurring and native species, one is parkland cleared and one is devoid of native vegetation altogether. The level of degradation through replacement of native species by introduced species is high in all of the mapped vegetation units. Only two small areas were classified as Good condition, with anything like the original component of native species.

Most of the vegetation was classed as Degraded or Completely Degraded. Only 5.6% of the vegetation was classed as Good, of which part was partially rehabilitated riverine vegetation.

Occurrences of the 'Coastal Salt Marsh' Threatened ecological community, which is listed as 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999* and as a Priority 3 Ecological Community at the State level, are mapped nearby the Survey Area, along with occurrences of the Priority 1 ecological community 'Eucalyptus rudis, Marri and Peppermint Forest near Busselton'. None of the vegetation units mapped for the Survey Area is an occurrence of either the Threatened ecological community or the Priority 1 ecological community.

A regional ecological linkage axis line has been mapped along the entire length of the Survey Area by Molloy *et al.*, (2009), resulting in Survey Area vegetation being assigned proximity rating values of 1a, which is the highest rating. Vegetation in the Survey Area directly forms part of a regional ecological linkage.

An Environmentally Sensitive Area has been designated within the Survey Area, associated with the Ramsar listed Vasse-Wonnerup wetland and Coastal Salt Marsh Threatened ecological community.

Contents

Executive Summary.....	3
Statement of Limitations	8
Reliance on Data	8
Report for Benefit of Client.....	8
1 Introduction	9
1.1 Scope and Objectives	13
1.2 Biogeographic Region and Location.....	15
1.3 Previous Flora Surveys	15
1.4 Geology and Geomorphology	15
1.5 Vegetation Description according to pre-European Mapping Datasets.....	16
1.5.1 Assessment of Remaining Extent against Pre-European Extent	20
1.6 Threatened and Priority Ecological Communities.....	20
1.7 Threatened and Priority Flora	24
1.8 Ecological Linkages	32
1.9 Geomorphic Wetlands	35
1.10 Environmentally Sensitive Areas.....	35
2 Methods.....	38
2.1 Desktop Assessment	38
2.2 Field Survey	38
2.3 Survey Limitations	39
3 Results.....	40
3.1 Flora.....	40
3.2 Pest Plants and Environmental Weeds	40
3.3 Vegetation Units.....	45
3.4 Vegetation Condition	50
4 Discussion and Conclusions	53
5 Suggested Rehabilitation Area and Species List.....	53
6 References	59
Appendix 1. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2017a).	
Appendix 2. Protected Matters Search Tool and NatureMap reports.	

Appendix 3. Definitions of Declared Rare and Priority List flora (DBCA, 2017b).	
Appendix 4. Categories of Threatened Species under the EPBC Act (DotEE, 2017c).	
Appendix 5. Vegetation Condition Scale (EPA, 2016).	
Appendix 6. List of Vascular Flora found within the Survey Area.	

Table of Tables

Table 1. Soil Mapping Units occurring within the Survey Area (Tille and Lantszke, 1990).	16
Table 2. Vegetation complexes mapped for the Survey Area (Webb, <i>et al.</i> 2016).	17
Table 3. Vegetation Complexes mapped within the Survey Area with regard to EPA and Commonwealth retention targets (Government of Western Australia, 2017).	20
Table 4. Threatened Ecological Communities occurring near to the Survey Area (Gibson <i>et al.</i> , 1994; DPaW, 2017a; DBCA, 2017a; DotEE, 2017b).	22
Table 5. List of Threatened and Priority flora known to occur within 5 km of the Survey Area (DBCA, 2017c, 2017d; DotEE, 2017b).	25
Table 6. Definitions of and objectives for the different wetland management categories (modified from Essential Environmental Services, 2005).	35
Table 7. Limitations with regard to assessment adequacy and accuracy.	39
Table 8. The occurrences of “environmental significant weeds” at the four density classes.	40
Table 9. Summary of vegetation condition classes within the Survey Area.	50
Table 10. List of taxa for use in the suggested rehabilitation areas.	56

Table of Figures

Figure 1. The location of the Survey Area in relation to the coastline, nearby towns, and road network.	10
Figure 2. The Survey Area in relation to surrounding land uses and reserves.	11
Figure 3. Freehold land within the Survey Area.	12
Figure 4. The desktop assessment area is marked in dark blue, the areas accessed on foot in mint green.	14
Figure 5. Soil mapping units occurring within the Survey Area (Tille and Lantszke, 1990).	18
Figure 6. Known occurrences of TECs and PECs within the Survey Area (map provided by the City)	23
Figure 7. Known locations of Threatened and Priority flora in the vicinity of the Survey Area (DBCA, 2017c).	31
Figure 8. Linkage proximity rating values assigned to patches of remnant vegetation within a landscape (from Molloy <i>et al.</i> , 2009).	33
Figure 9. A regional ecological linkage axis line is mapped along the entire length of the Survey Area (Molloy <i>et al.</i> , 2009).	34
Figure 10. The Survey area contains Conservation and Multiple Use category wetlands.	36

Figure 11. An Environmentally Sensitive Area has been designated over the northern end of the Survey Area.....	37
Figure 12. The Survey Area is divided into two sections at the Busselton Bypass for mapping purposes.....	41
Figure 13. Pest plants and environmental weeds mapped in Section 1 of the Survey Area. .	42
Figure 14. Pest plants and environmental weeds mapped in Section 2 of the Survey Area. .	43
Figure 15. A dense Kikuyu infestation, together with some Arum Lilies on the banks of the Lower Vasse River.	44
Figure 16. Vegetation units mapped during the field survey for Section 1 of the Survey Area.	47
Figure 17. Vegetation units mapped during the field survey for Section 2 of the Survey Area.	48
Figure 18. <i>Eucalyptus rudis</i> – <i>Melaleuca raphiophylla</i> open forest or woodland.	49
Figure 19. <i>Corymbia calophylla</i> – <i>Eucalyptus rudis</i> open forest.....	49
Figure 20. Condition of vegetation within Section 1 of the Survey Area.	51
Figure 21. Condition of vegetation within Section 2 of the Survey Area.	52
Figure 22. The proposed rehabilitation areas in the Survey Area.....	55
Figure 23. Proposed grassland rehabilitation area (Area A).....	57
Figure 24. Proposed <i>Eucalyptus rudis</i> woodland rehabilitation area (Area A).....	57
Figure 25. Foreshore in Area C.....	58
Figure 26. Thick undergrowth of Brazilian Peppertree (<i>S. terebinthifolius</i>) in Area E.....	58

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 the City of Busselton (the City) in October 2017 to undertake a Flora and Vegetation Survey of remnant vegetation along the foreshore of the Lower Vasse River near Busselton (the 'Survey Area') (**Figure 1**). The 34 hectare (ha) Survey Area comprises the foreshore of the Lower Vasse River, south of the Busselton townsite. It begins in the townsite near the corner of Peel Terrace and Queen Street, and meanders southwards to end approximately 4.3 km south southeast of the town. It comprises a combination of Crown Land and reserves vested in or managed by the City (**Figure 2**). Freehold land is shown in **Figure 3**.

The City intends to prepare a management plan that will assist with the long-term management of the foreshore vegetation and river ecosystem. The flora and vegetation survey was required to provide information regarding the current extent, condition and diversity of the foreshore vegetation, as well as detailed mapping of exotic species.

The field survey was carried out on 19 and 31 October 2017 in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016). This report compiles findings of the desktop study and field survey.

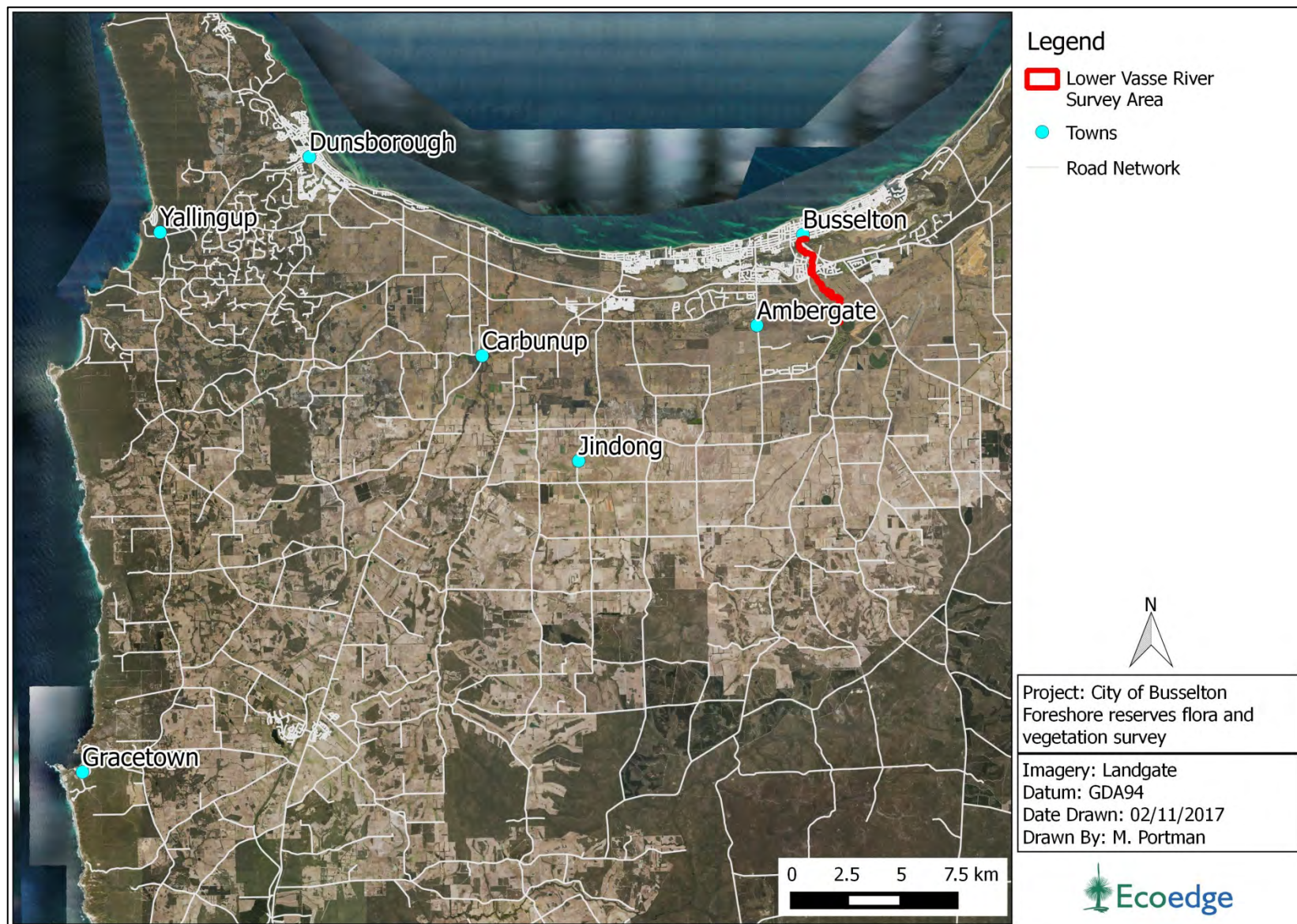


Figure 1. The location of the Survey Area in relation to the coastline, nearby towns, and road network.

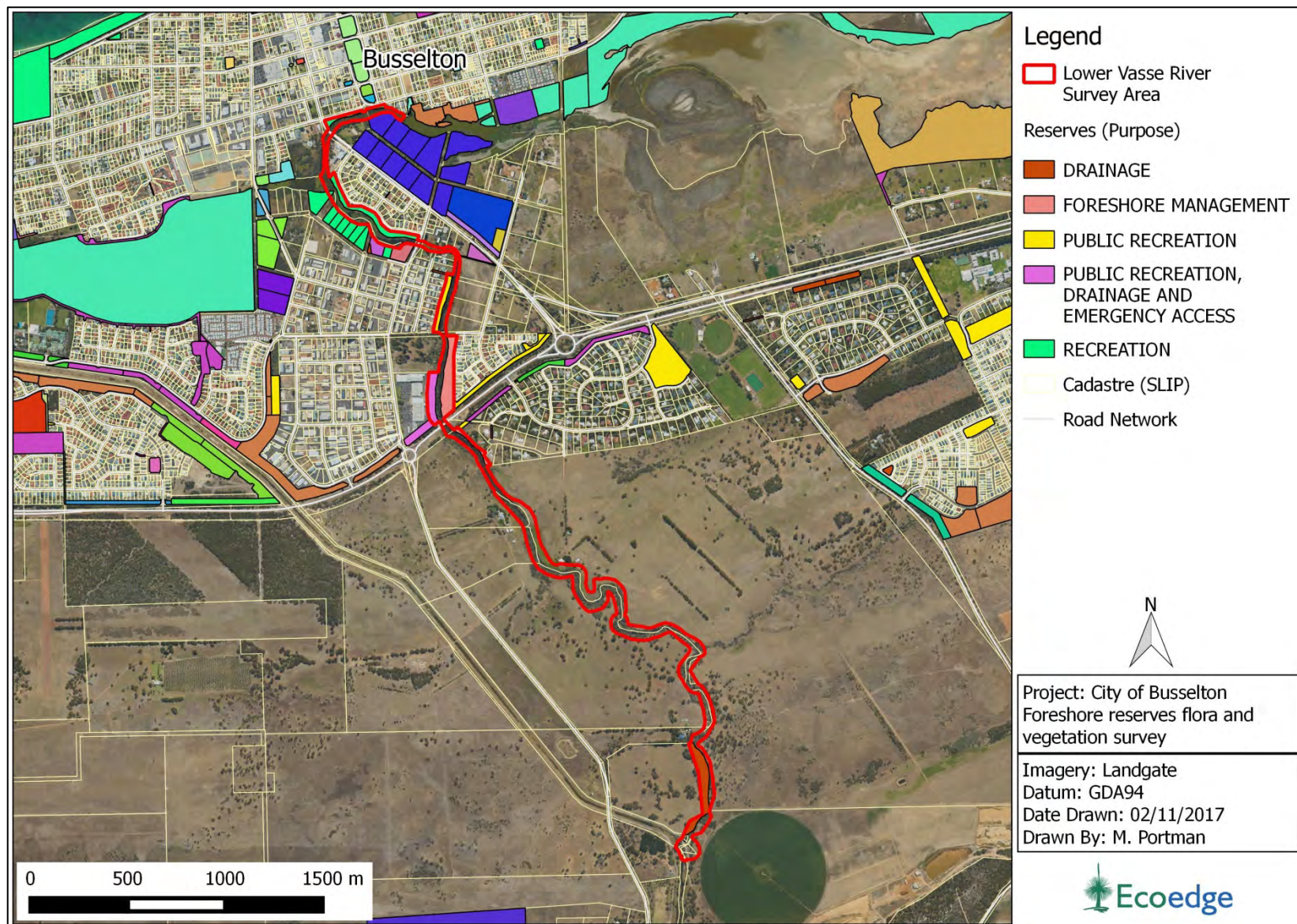


Figure 2. The Survey Area in relation to surrounding land uses and reserves.

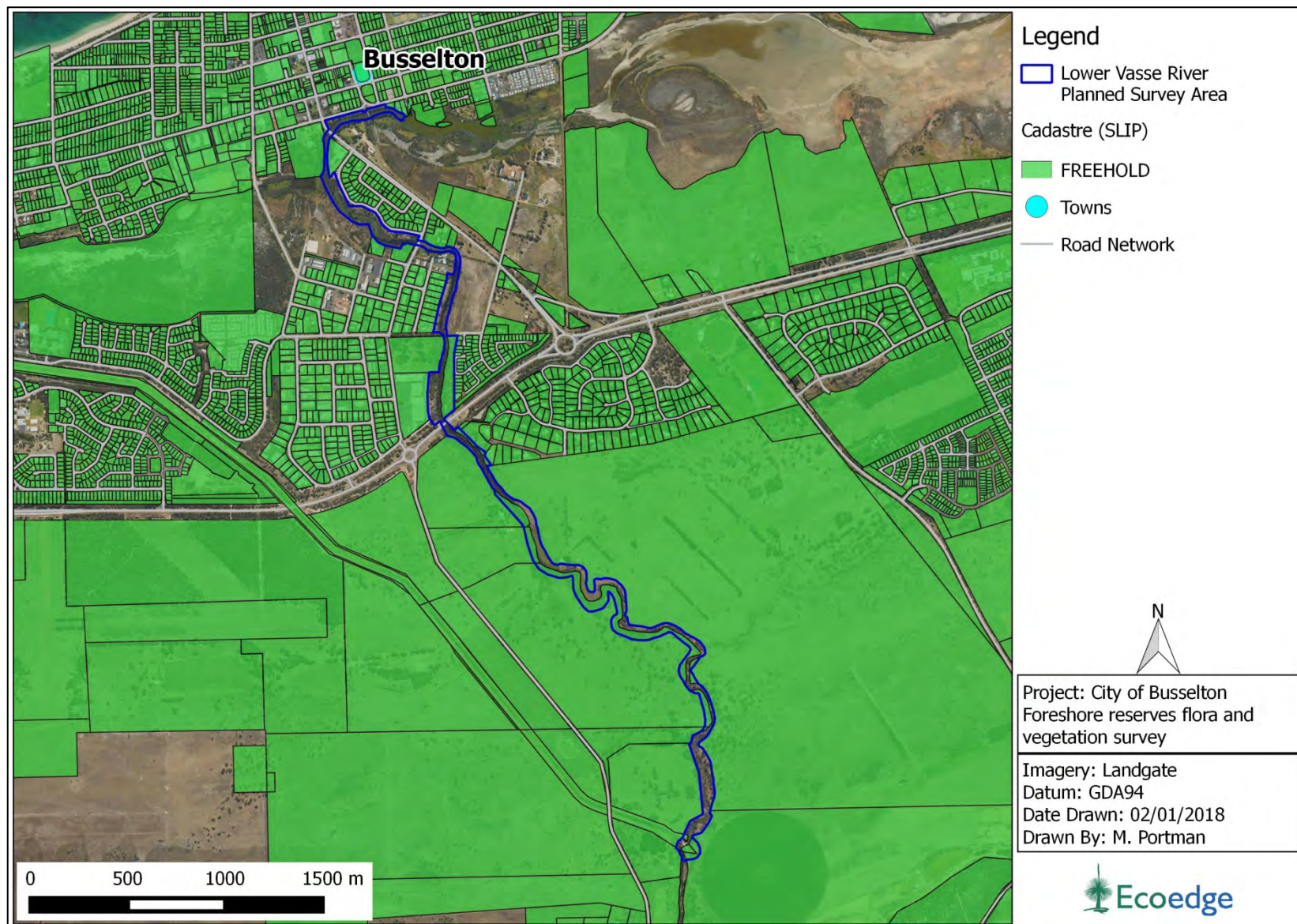


Figure 3. Freehold land within the Survey Area.

1.1 Scope and Objectives

The scope of the survey was to carry out a Flora and Vegetation survey in accordance with EPA Technical Guidance (EPA, 2016). The City's project brief also specified the following:

- Provide background information, including database searches (including Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Threatened Species and Priority Flora) and results of previous studies;
- Detail survey methodology, outlining survey limitations;
- Map broad vegetation types (and condition using the Bush Forever condition rating adapted from Keighery 1994 and Trudgen 1988- Table 2 (EPA, 2016) within the study area using a combination of recent aerial photographs and field surveys to ground-truth;
- Map weed species and weed density mapping, using the following percentage criteria :
 - Limited/Localised distribution- <10%
 - Moderate distribution- 10-40%
 - High distribution 40-80%
 - Extensive (widespread) distribution- >80%;
- Provide a description and mapping of degraded areas that may require rehabilitation, including a suggested list of native species to be used for revegetation; and
- Provide a list of native and non-native plant species recorded from representative vegetation types.

While the desktop study component of the project was required to cover the entire Survey Area, Ecoedge was only expected to ground truth areas identified in Land Tenure maps provided by the City as: City Owned Land, City Managed Reserve, Reserves Other Managed, Unmanaged Reserve, UCL, Water Corporation (Freehold), and Department of Water (Freehold). The planned, or desktop study, area and the areas accessed on foot during the field survey area are shown in **Figure 4**.

The City provided Ecoedge with an extract from DBCA Threatened and Priority flora databases (incorporating data from both the Western Australian Herbarium and Museum), and a map showing the generalised (buffered) locations of known occurrences of Threatened ecological communities (TECs) and Priority ecological communities (PECs).

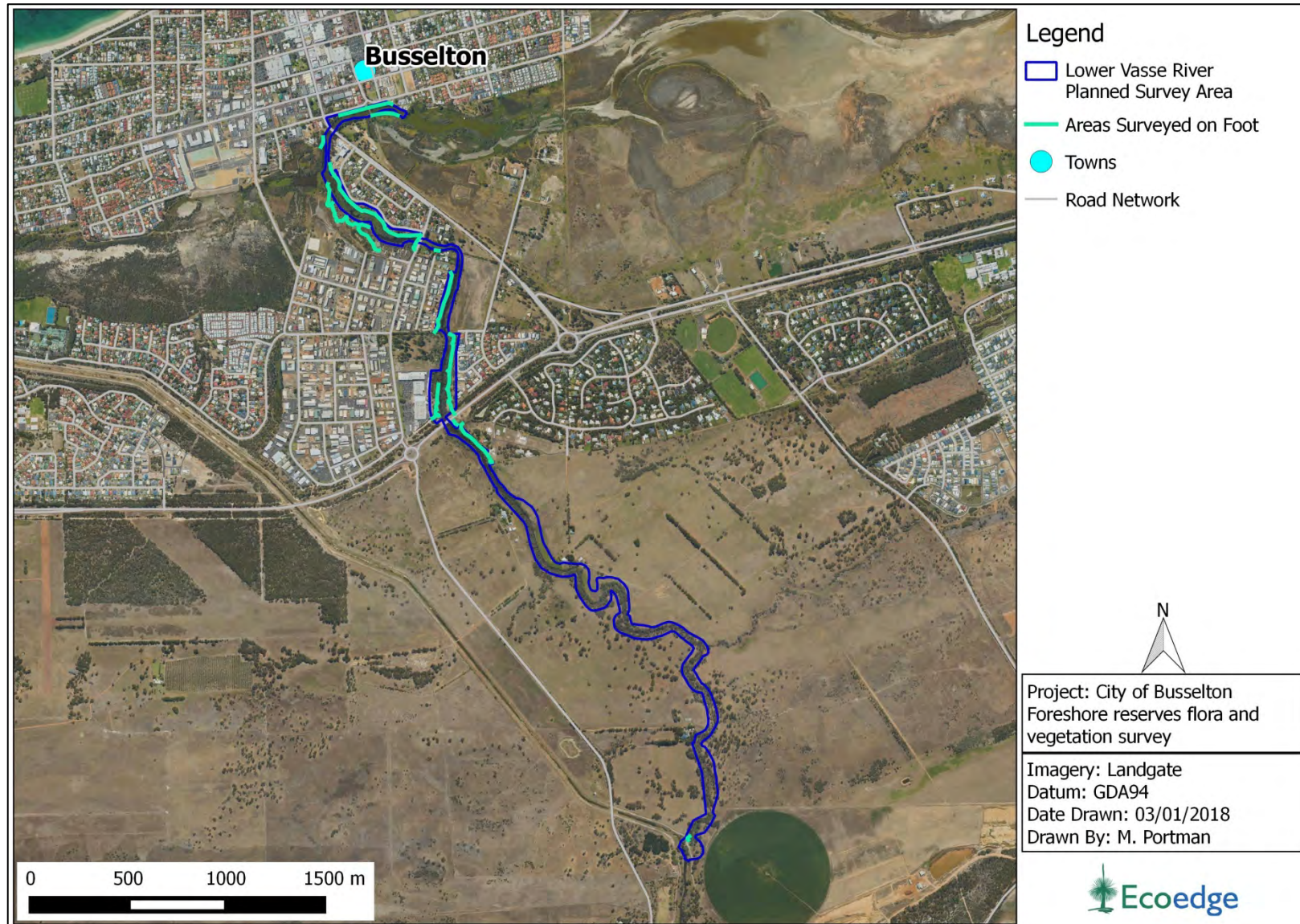


Figure 4. The desktop assessment area is marked in dark blue, the areas accessed on foot in mint green.

1.2 Biogeographic Region and Location

The Lower Vasse River Survey Area is situated within the SWA02 Southern Swan Coastal Plain sub-region of the Swan Coastal Plain biogeographic region as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia, 2016). It is located south of the Busselton townsite starting from the corner of Peel Terrace and Queen Street, extending to approximately 4.3 km south south-east of Busselton (**Figure 1 and 2**).

The Lower Vasse River Survey Area sits within wetland and urban areas on the southern edge of the Busselton townsite and degraded or cleared areas along the Vasse River.

1.3 Previous Flora Surveys

The following reports or management plans have been prepared for the Survey Area or parts of it. Information from these informed the preparation for and field survey component of the current survey.

- City of Busselton (2017). *Vasse River Wetlands Trail and Busselton LIA Path Construction Layout Plan* (Preliminary map issued for comment).
- Ecosystem Solutions (2017). *Reconnaissance Flora, Vegetation and Fauna Survey for Busselton Strategic Network Corridors*. Unpublished report to Strategen Consultants. In their field survey, Ecosystem Solutions identified occurrences of the Coastal Salt Marsh Priority Ecological Communities within the Survey Area (refer to **Section 1.5**).
- Scott, M. *et al.* (2000). *Vasse River Action Plan*. Water and Rivers Commission. Bunbury, Western Australia. The purpose of the Vasse River Action Plan (2000) was to identify the condition of the Vasse River and to provide advice to the community regarding ongoing management actions to improve the quality and condition of the river. Scott, M. *et al* (2000) identifies various invasive weed species along the Vasse River.

1.4 Geology and Geomorphology

The Survey Area is situated on the Perth Coastal Zone landform, which extends along the Indian Ocean coast between Jurien Bay and Dunsborough and comprises coastal sand dunes and swamps. Within this zone, the Survey Area is situated on the soils of four soil landscape systems; the Quindalup South (211Qu), Spearwood (211Sp), Vasse (211Va), and Abba (213Ab) systems (Tille and Lantszke, 1990). These are described below, in the order they occur moving away from the coastline.

Quindalup South System: Coastal dunes of the Swan Coastal Plain with calcareous deep sands and yellow sands. The associated vegetation is coastal scrub. These are mapped for the northern-most part of the Survey Area, closest to the coast.

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. These are mapped in the northern section of the Survey Area in wetland and urban areas.

Spearwood System: Sand dunes and plains. Yellow deep sands, pale deep sands and yellow/brown shallow sands. Flats with poor subsoil drainage in winter. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands). The associated vegetation is Tuart-marri forest and woodland in south, heath and open woodland in the north. These are mapped for the mid-section of the Survey Area.

Abba System: Poorly drained flats on the southern Swan Coastal Plain. Grey deep sandy duplex and wet soil. The associated vegetation is Jarrah-marri-paperbark woodland. The Abba system is situated on the eastern and southern extent of the Swan Coastal Plain, where it adjoins the Whicher Scarp. These are mapped in the southern portion of the Survey Area.

Based on landscape position and characteristics, each of these systems has been divided into soil phases or mapping units (Tille and Lantszke, 1990). Seven are represented within the Survey Area; these are described in **Table 1** and mapped in **Figure 5**.

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

Soil Mapping Unit	Description
211Qu_Qf2	Quindalup South Qf2 Phase: Relict foredunes and gently undulating beach ridge plain with deep uniform calcareous sands. Coastal heath and peppermint scrub.
211VaWOwy	Vasse Wonnerup very wet saline flats Phase: Swampy depression and low lying terraces of the Vasse-Wonnerup Estuary. Saltmarsh and samphire flats.
211VaX_URBAN	Urban
211SpLDw	Ludlow wet flats: Flats with poor subsoil drainage in winter. Deep yellow brown siliceous sands over limestone (i.e. Spearwood Sands).
211SpLDvw	Ludlow wet vales: Narrow swampy small depressions. Sandy soils.
213AbCKv	Cokelup Vales: Narrow floodplains in small depressions along creeks and rivers. Clayey alluvial soils.
213AbABvw	Abba wet vale: Small narrow swampy depressions along drainage lines. Alluvial soils.

1.5 Vegetation Description according to pre-European Mapping Datasets

The Survey Area covers approximately 34 ha and contains approximately 28.1 ha of remnant native vegetation.

Variation in vegetation mainly reflects the variations in soil and moisture condition of a landscape. Historically, the vegetation types represented in the Survey Area would have reflected the topography and soils of that landscape.

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 Mattiske 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).

According to the 1:250,000 Swan Coastal Plain Vegetation Complexes (Heddle *et al.* 1980) mapping as updated by Webb *et al.* (2016), five vegetation complexes were mapped for the Survey Area: the Quindalup, Vasse, Yoongarillup, Cokelup and Abba complexes. 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
Quindalup	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.
Vasse	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.
Yoongarillup	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.
Cokelup	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> .
Abba	A mixture of open forest of <i>Corymbia calophylla</i> (Marri) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Banksia</i> 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) - <i>Melaleuca</i> species along creeks and on flood plains.

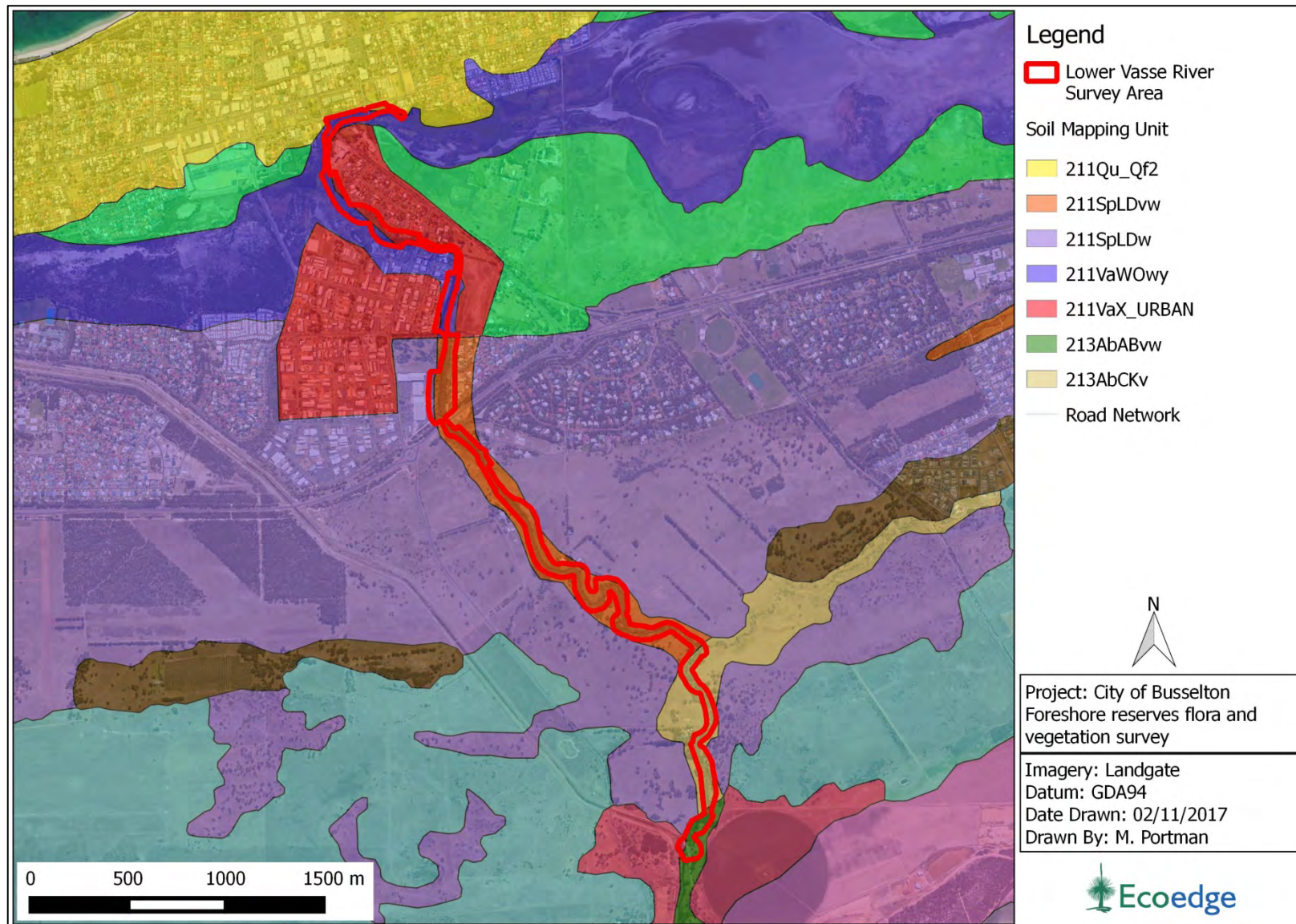


Figure 5. Soil mapping units occurring within the Survey Area (Tille and Lantszke, 1990).

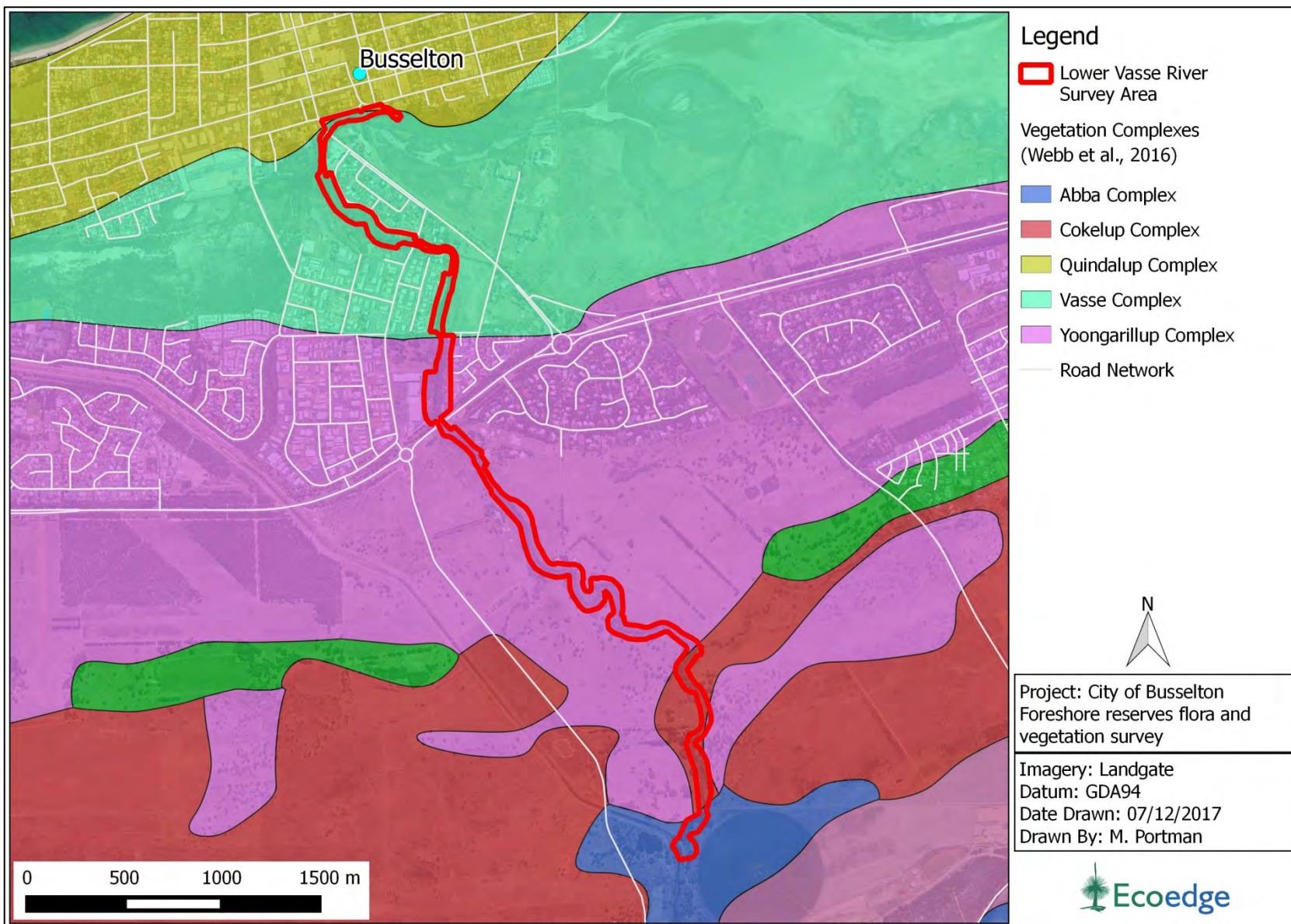


Figure 4. Vegetation Complexes mapped as occurring within the Survey Area (Webb, *et al.* 2016).

1.5.1 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 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 Comprehensive, Adequate and Representative (CAR) reserve system for WA (Government of Western Australia, 2017). 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 lists the percentage remaining of each vegetation complex and whether the Commonwealth 30% retention target is met (Environment Australia, 2001). The Cokelup and Abba complexes do not meet the 30% target.

Table 3. Vegetation Complexes mapped within the Survey Area with regard to EPA and Commonwealth retention targets (Government of Western Australia, 2017).

Vegetation Complex	% Remaining of pre-European	Is the 30% National Target Met?	% in DBCA Managed Land*
Quindalup	60.61%	Yes	9.8%
Vasse	31.38%	Yes	14.47%
Yoongarillup	35.73%	Yes	18.29%
Cokelup	10.49%	No	4.70%
Abba	6.6%	No	0.36%

1.6 Threatened and Priority Ecological Communities

Ecological communities are defined by Western Australia's Department of Biodiversity, Conservation and Attractions (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, 2010).

Through a non-statutory process, the Minister for Environment may list communities that are considered to be at threat as either Threatened or Priority Ecological Communities. A Threatened Ecological Community (TEC) is one which is found to fit into one of the following categories; Presumed Totally Destroyed (PD), Critically Endangered (CE), Endangered (E) or

Vulnerable (V) (DEC, 2010). Possible threatened ecological communities that do not meet survey criteria are added to DPaW's Priority Ecological Community Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (P5) (DEC, 2010). The current listing of Threatened and Priority Ecological Communities are specified in DPaW (2016a) and DBCA (2017a).

Threatened Ecological Communities can also be listed under the Commonwealth EPBC Act (Department of the Environment and Energy (DotEE), 2017a; 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 1** (DotEE, 2017a).

A Protected Matters Search Tool query for communities listed under the EPBC Act occurring within a 5 km radius of the Survey Area was undertaken (DotEE, 2017b, **Appendix 2**), the current TEC and PEC listings were consulted and a map showing an extract from the DBCA database for the immediate Survey Area was provided by the City (DPaW, 2016a; DBCA, 2017a).

Confirmed occurrences of the 'Coastal Salt Marsh' Threatened Ecological Community, which is listed as 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999* and as a Priority 3 Ecological Community at the State level, are mapped within the Survey Area, along with occurrences of the Priority 1 ecological community '*Eucalyptus rudis* (flooded gum), *Corymbia calophylla*, *Agonis flexuosa* Closed Low Forest (near Busselton)', as shown in **Table 4** and **Figure 6**.

Ecosystem Solutions (October 2017) found a section of the Vasse River (Eastern Link Vegetation Group 4) was dominated by samphire and is directly impacted by tidal influences of the Vasse Estuary. Discussions with DBCA has confirmed that the species and dynamics of this association are consistent with the definition of the EPBC listed TEC (WA listed PEC) – Subtropical and Temperate Coastal Saltmarsh community (A. Webb, Regional Botanist SW DBCA, pers. comm. Sept 2017).

Ecosystem Solutions (2017) also found the Strelly-West Group 4 vegetation samphire areas appeared to be connected to tidal variations and while not be considered in very good condition, it would be prudent to consider it to be consistent with the EPBC listed TEC (WA Listed PEC) Subtropical and Temperate Coastal Saltmarsh community.

Table 4. Threatened Ecological Communities occurring near to the Survey Area (Gibson *et al.*, 1994; DPaW, 2017a; DBCA, 2017a; DotEE, 2017b).

Community Name	Community Description	Status (WA)	Status (EPBC Act)
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	P3	V
Banksia Woodlands of the Swan Coastal Plain ecological community	'Banksia Woodlands of the Swan Coastal Plain' – a federally listed TEC consisting of numerous State-listed threatened and priority communities and non-listed communities	Various	EN
<i>Eucalyptus rudis</i> , Marri and Peppermint Forest	<i>Eucalyptus rudis</i> (flooded gum), <i>Corymbia calophylla</i> , <i>Agonis flexuosa</i> Closed Low Forest (near Busselton)	P1	-

Note: This table only includes TECs and PECs that are known of and mapped by DPaW/DBCA and are included in their database.

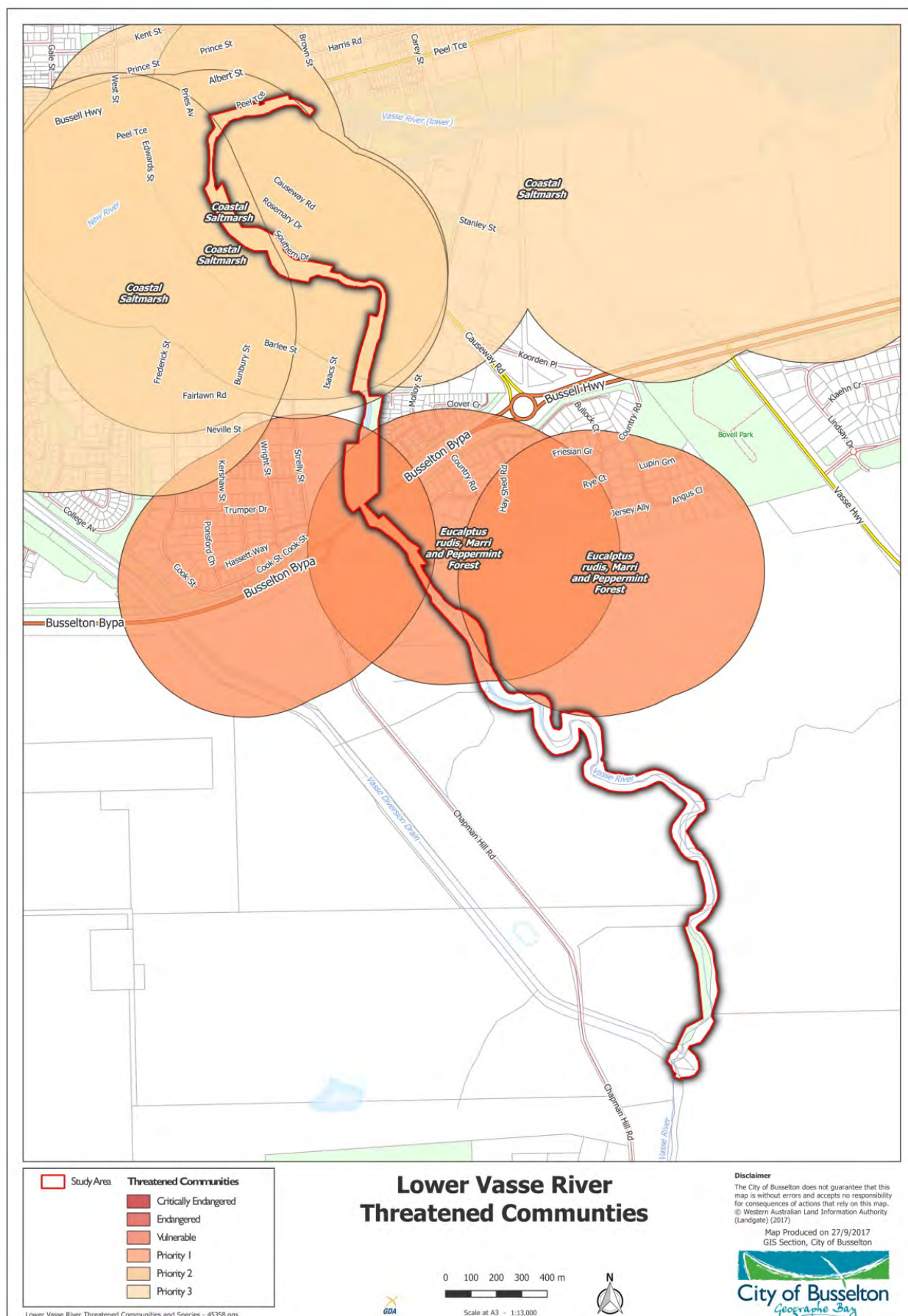


Figure 6. Known occurrences of TECs and PECs within the Survey Area (map provided by the City) .

1.7 Threatened and Priority Flora

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

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

Priority Flora are under consideration for future declaration as “rare 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 require monitoring every 5-10 years. Under the WC Act, Threatened Flora are ranked according to their level of threat using IUCN Red List categories and criteria of Extinct (EX), Critically Endangered (CE), Endangered (EN) or Vulnerable (VU). **Appendix 3** presents the categories of Declared Rare and Priority Flora as defined by the WC Act (DBCA, 2017b).

Under the EPBC Act, a species may be listed in one of six categories; the definitions of these categories are summarised in **Appendix 4** (DotEE, 2017c).

Threatened or Priority flora occurring within 5 km of the Survey Area generated from a DBCA data search (DBCA, 2017c) and NatureMap search (DBCA, 2017d, **Appendix 2**) are listed in **Table 5**. Taxa listed under the EPBC Act (based on results of the Protected Matters Search Tool query (DotEE, 2017b, **Appendix 2**)) are noted. Some of the species listed in **Table 5** could potentially occur within the Survey Area, based on an assessment of their preferred habitats. All species listed would have either been flowering at the time of survey or could be identified in the field without flowers.

The DBCA datasearch results are shown in **Figure 7**.

Table 5. List of Threatened and Priority flora known to occur within 5 km of the Survey Area (DBCA, 2017c, 2017d; DotEE, 2017b).

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
<i>Brachyscias verecundus</i>	T(CE)	Nov	Annual (or ephemeral), herb, 0.012-0.022 m high, entirely glabrous. Fl. white/cream. In a moss sward. On a granite outcrop.	None
<i>Caladenia procera</i>	T(CE)	Sep-Oct	Tuberous, perennial, herb, 0.35-0.9 m high. Fl. yellow. Rich clay loam. Alluvial loamy flats, jarrah/marri/peppermint woodland, dense heath, sedges.	Low
<i>Banksia nivea</i> subsp. <i>uliginosa</i>	T(EN)	Aug-Sep	Dense, erect, non-lignotuberous shrub, 0.2–1.5 m high. Fl. yellow, brown. Sandy clay, gravel.	None
<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
<i>Gastrolobium modestum</i>	T(EN)	Sep-Nov	Prostrate to clumped shrub, to 0.5 m high. Fl. cream-green-pink, Sep to Nov. Shallow red clay-loam or grey sand, ironstone. Gullies and edges of flats	None
<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.	None
<i>Chamelaucium</i> sp. S Coastal Plain (R.D. Royce 4872)	T(VU)	Oct-Dec	Winter-wet areas, loams and ironstone.	None
<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.	None
<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>Eucalyptus x phylacis</i>	T	May	Mallee or tree, to 5 m high, bark rough & flaky on trunk. Fl. cream. Laterite, loam over granite. Coastal areas.	None
<i>Grevillea brachystylis</i> subsp. <i>grandis</i>	T	Aug - Sep	Shrubs, 0.3–1 m high. Fl red, very irregular. Amongst medium trees, or tall (sclerophyll) shrubland; in sand, or loam.	None

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
<i>Kennedia lateritia</i>	T	Oct	Climbing shrub to 1.5 m. Fl. red.	None
<i>Lambertia orbifolia</i> subsp. Scott River Plains (L.W. Sage 684)	T	Oct-Jan	Small tree or shrub, to 5 m high. Fl. red-orange. Yellow-brown sandy clay, grey sand, sandy gravel, laterite.	None
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	T	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.	None
<i>Tetraria australiensis</i>	T	Nov - Dec	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown.	Low
<i>Verticordia plumosa</i> var. <i>ananeotes</i>	T	Nov-Dec	Erect, sparsely branched shrub, 0.3-0.5 m high. Fl. pink-purple/white. Sandy loam. Seasonally inundated plains.	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	Moderate
<i>Stachystemon</i> sp. Keysbrook (R. Archer 17/11/99)	P1		Shrub/herb to 0.2 m high.	Low
<i>Amperea micrantha</i>	P2	Oct-Nov	Low, spreading, bushy perennial, herb, 0.1–0.3 m high. Fl. brown. Sandy soils.	Low
<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.	
<i>Eucalyptus relict</i>	P2	Jan-Feb	Mallee or tree, to 7 m high, bark rough all the way to branchlets. Fl. cream. Grey clay-loam. Undulating upper slopes, along creeklines.	None
<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.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
<i>Leucopogon</i> sp. Busselton (D. Cooper 243)	P2	Aug-Sep	Slender, erect shrub to 70 cm; flowers white. Pericalymma ellipticum wet shrubland, Marri-Jarrah woodland.	None
<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.	None
<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.	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.	Low
<i>Boronia capitata</i> subsp. <i>gracilis</i>	P3	Jun-Nov	Slender shrub, 0.3-0.6(-3) m high, branches pilose. Fl. pink. White/grey or black sand. Winter-wet swamps,	None
<i>Boronia tetragona</i>	P3	Oct-Dec	Perennial, herb, 0.3–0.7 m high. Fl. pink, red. Black/white sand, laterite, brown sandy loam. Winter-wet flats, swamps, open woodland.	None
<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.	None
<i>Chordifex gracilior</i>	P3	Sep-Dec	Rhizomatous, erect perennial, herb, 0.3-0.5 m high. Fl. brown. Peaty sand. Swamps.	Low
<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.	None

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
<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.	None
<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	Jarrah forest, lateritic soils. 2-3 ft high. Mauve flowers. Brown on underside of leaf.	Low
<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>Myriophyllum echinatum</i>	P3	Nov	Erect annual, herb, 0.02-0.03 m high. Fl. red. Clay. Winter-wet flats.	Low
<i>Orobanche cernua</i> var. <i>australiana</i>	P3			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>Pithocarpa corymbulosa</i>	P3	Jan-Apr	Erect to scrambling perennial, herb, 0.5-1 m high. Fl. white. Gravelly or sandy loam. Amongst granite outcrops.	None
<i>Pultenaea pinifolia</i>	P3	Oct-Nov	Erect, slender shrub, 1-3 m high. Fl. yellow, orange. Loam or clay. Floodplains, swampy areas.	None
<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

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
<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.	Low
<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.	Low
<i>Astartea onycis</i>	P4			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
<i>Chamelaucium</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>Eucalyptus rudis</i> subsp. <i>cratyantha</i>	P4	Jul-Sep	Tree, 5-20 m high, bark rough, box-type. Fl. white. Loam. Flats, hillsides.	High
<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>Laxmannia jamesii</i>	P4	May-Jul	Tufted, stilt-rooted perennial, herb, 0.05–0.2 m high. Fl. red, white. Grey sand. Winter-wet locations.	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)	Moderate
<i>Schoenus natans</i>	P4	Oct	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown. Winter-wet depressions.	Moderate
<i>Stylidium longitubum</i>	P4	Oct-Dec	Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. Pink. Sandy clay, clay. Seasonal wetlands.	Low

Species	Cons Status*	Flowering	Description and Habitat	Likelihood of Occurrence
<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 WC Act Conservation Status is shown, EPBC Act status, where relevant, is in brackets.

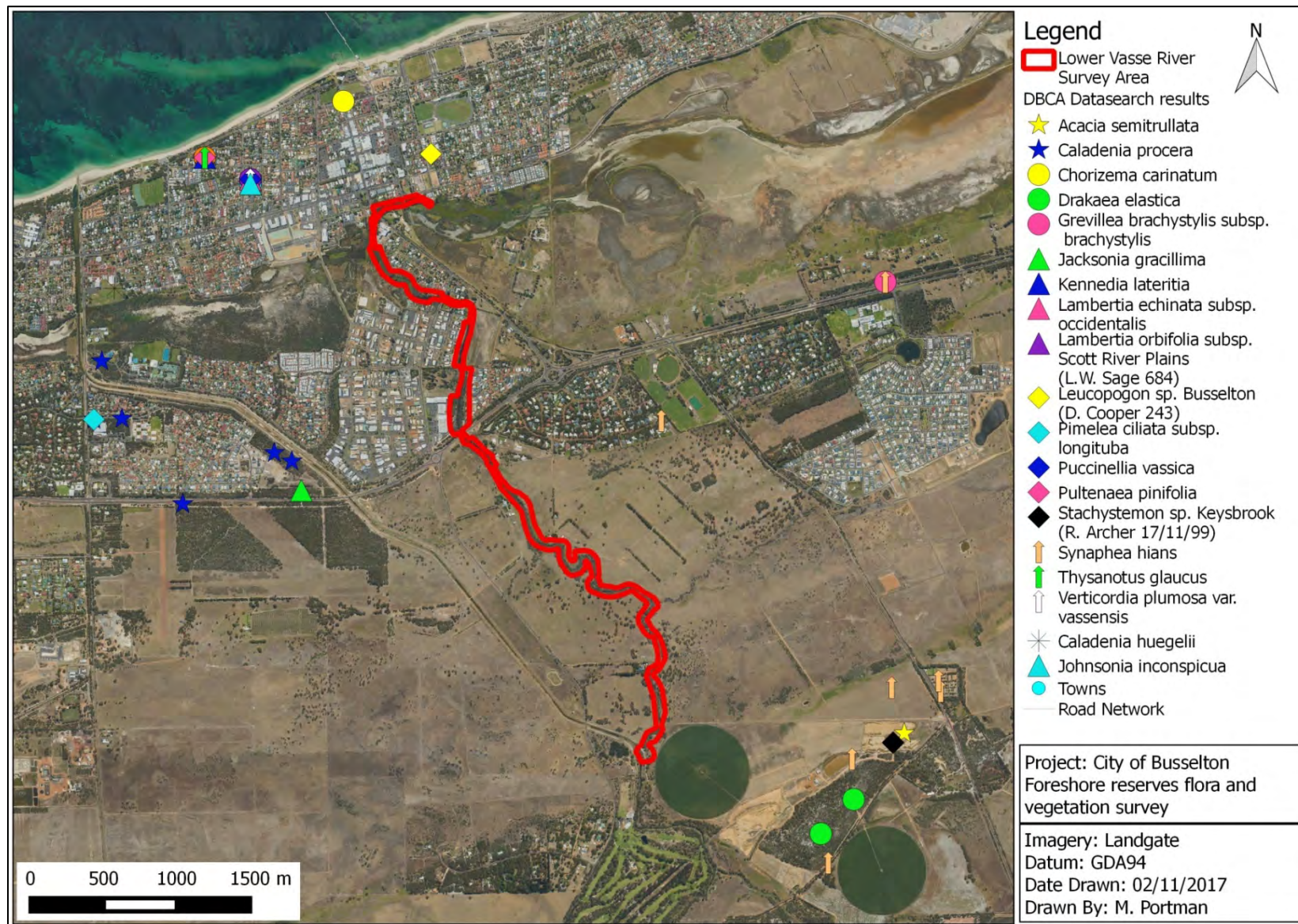


Figure 7. Known locations of Threatened and Priority flora in the vicinity of the Survey Area (DBCA, 2017c).

1.8 Ecological Linkages

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

Ecological linkages are defined as:

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

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

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

Molloy *et al.* (2009) assessed and assigned “proximity value ratings” to all patches of remnant native vegetation as a way of indicating their distance from the nearest regional ecological linkage axis line. These values are defined in **Figure 8**. It should be noted however, that the proximity value of a patch of remnant vegetation to an ecological linkage is not intended to replace the need to consider the other biodiversity conservation values of that patch of remnant vegetation.

A regional ecological linkage axis line has been mapped along the entire length of the Survey Area (**Figure 9**), resulting in Survey Area vegetation being assigned a proximity rating value of 1a, which is the highest rating. Vegetation in the Survey Area directly forms part of a regional ecological linkage.

While there is no statutory basis for regional ecological linkages identified through the SWREL project, the importance of ecological linkages have been recognised as an environmental policy consideration in EPA and Planning policy over the last decade (EPA, 2009 and references therein). In its statement regarding the SWREL Project, the EPA stated that even though Ecological Linkages are just one measure of the conservation values of a patch of remnant vegetation it expected that:

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

Figure 8. 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

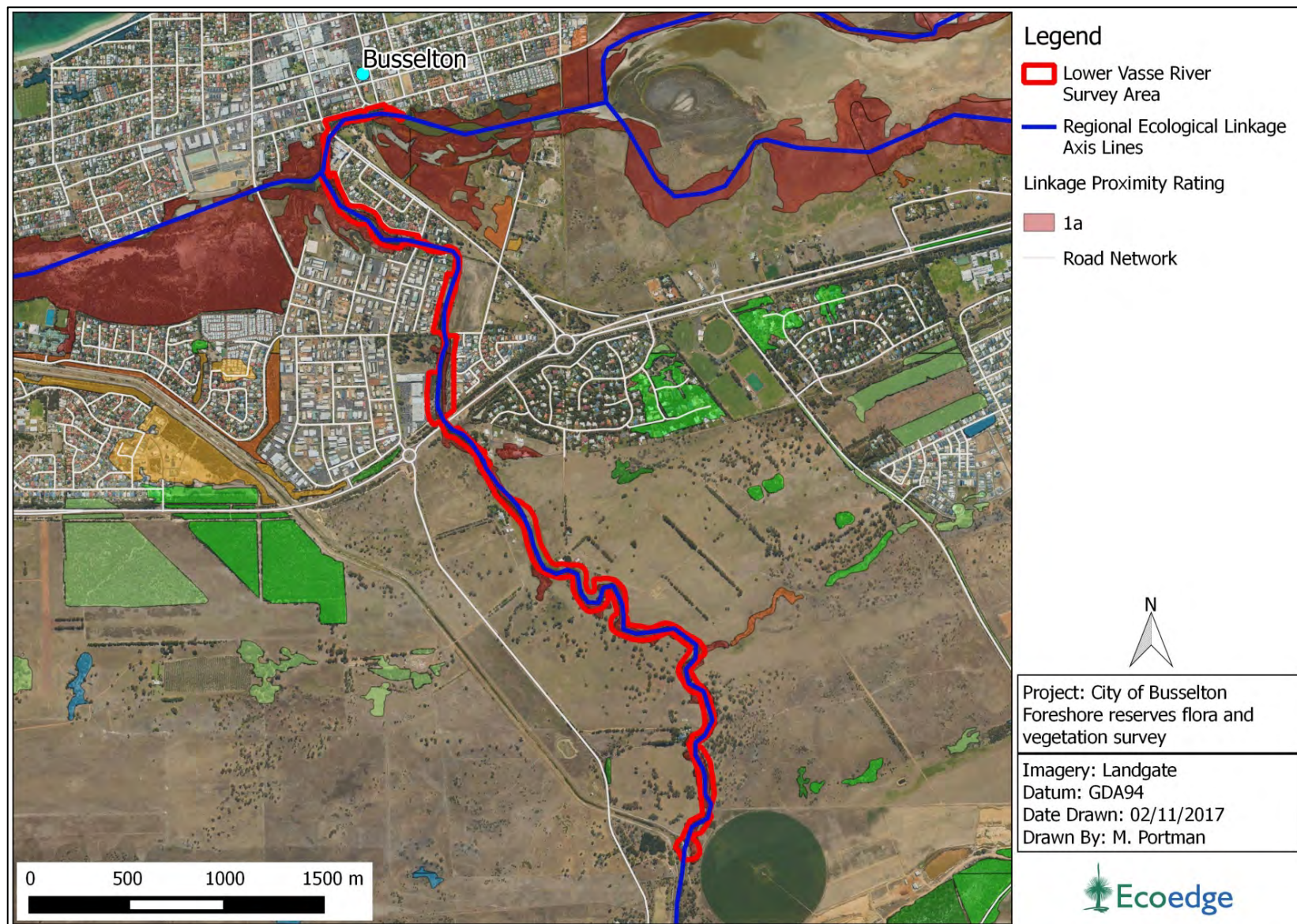


Figure 9. A regional ecological linkage axis line is mapped along the entire length of the Survey Area (Molloy et al., 2009).

1.9 Geomorphic Wetlands

Wetlands on the Swan Coastal Plain have been classified into types using the geomorphic wetland classification system of Semeniuk & Semeniuk (1995), which is based on the characteristics of landform and water permanence, for example. lake, sumpland and dampland. The Swan Coastal Plain wetlands have also been evaluated and assigned an appropriate management category and corresponding category objective, providing guidance on the nature of the management and protection the wetland should be afforded. These categories are described in **Table 6**.

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

Much of the Survey Area has been mapped as a Conservation category wetland (DEC, 2008) (**Figure 10**).

1.10 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 Declared Rare Flora;
- Bush Forever sites; and
- Declared World Heritage property sites.

One Environmentally Sensitive Area has been designated within the Survey Area, associated with the Ramsar listed Vasse-Wonnerup wetland (**Figure 11**).

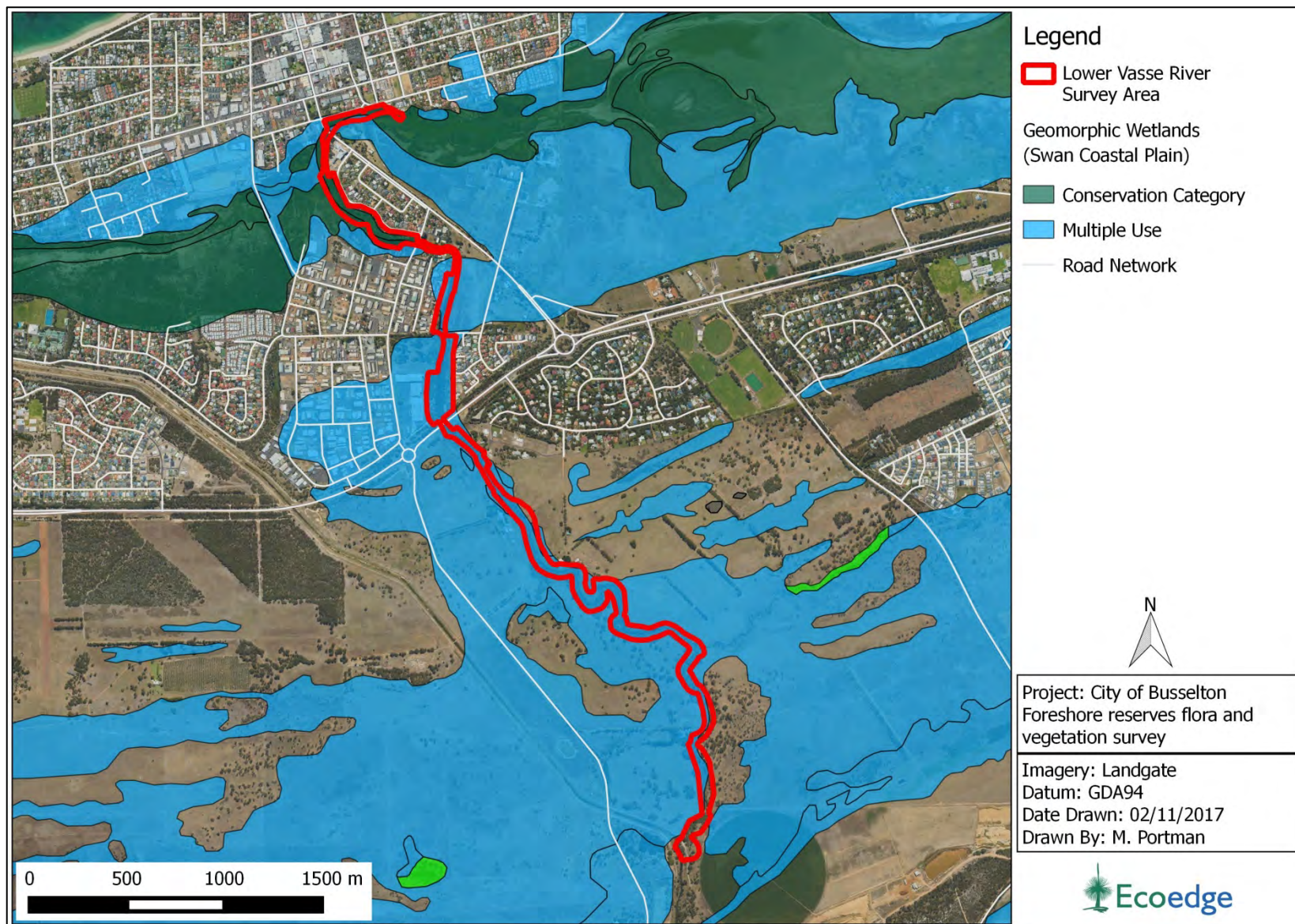


Figure 10. The Survey area contains Conservation and Multiple Use category wetlands

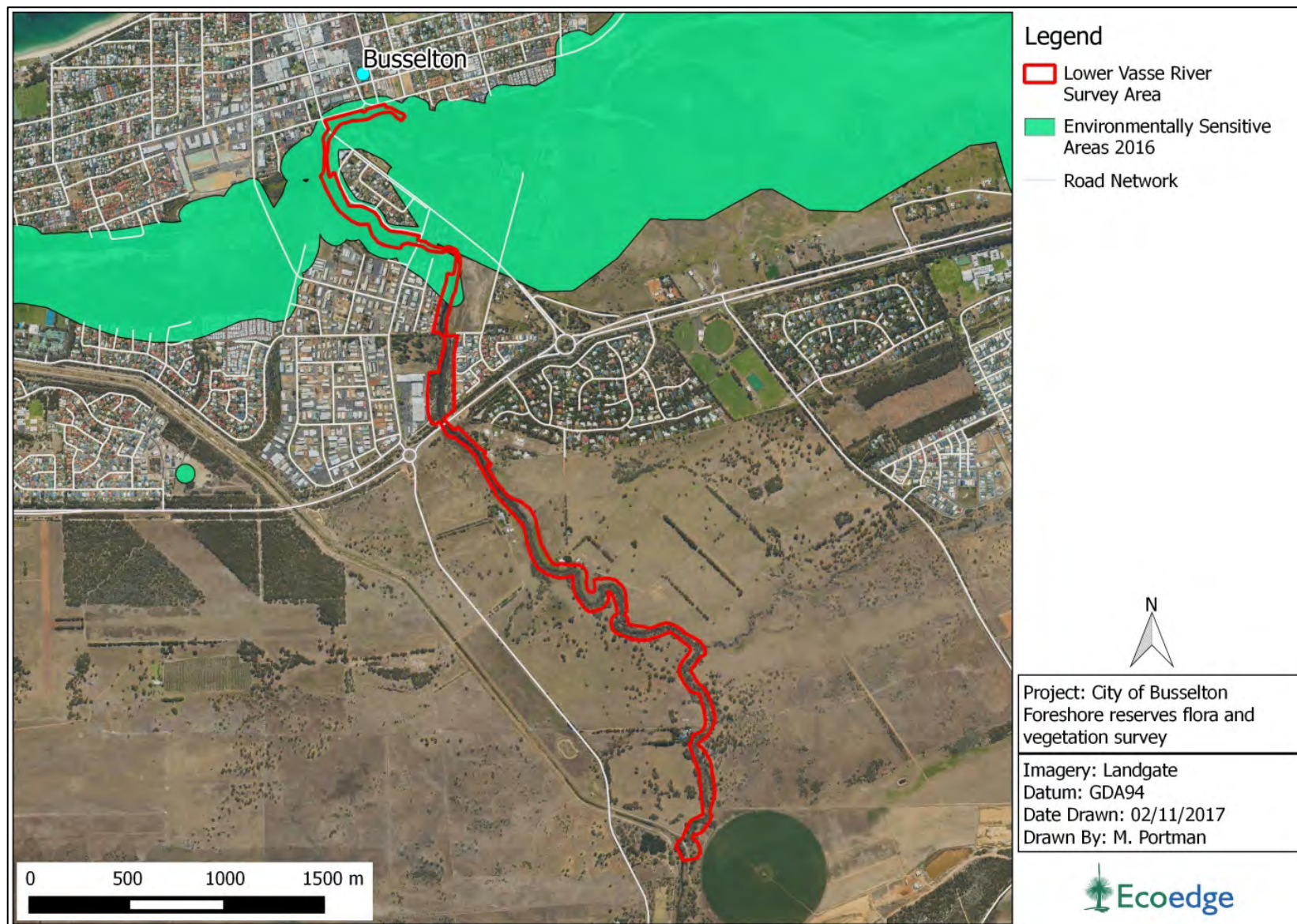


Figure 11. An Environmentally Sensitive Area has been designated over the northern end of the Survey Area.

2 Methods

2.1 Desktop Assessment

Prior to the field survey, a “desktop assessment” was carried out, involving an analysis of an extract from the Threatened (Declared Rare) and Priority Flora (TPFL) and W.A. Herbarium databases (dated 6th October 2017) of records occurring within 5 km of the Survey Area; a NatureMap (DBCA, 2017d, **Appendix 2**) report which listed all flora (including rare flora) occurring within 5 km of the Survey Area; a map showing an extract from the DBCA threatened and Priority ecological community database that was provided by the City, and; a Protected Matters Search Tool report which detailed all species listed under the EPBC Act (DotEE, 2017b) (**Appendix 2**) known to occur, possibly occurring or possibly having habitat occurring, within the Survey Area. This data was used to establish the list of DRF 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.

Vegetation condition was assessed against the method of the EPA (2016) (**Appendix 5**).

2.2 Field Survey

The survey was carried out on 19 and 31 October 2017 by walking through the remnant vegetation adjacent to the river where there was access across public reserves, or accessing the river via public roads and footpaths where there was no reserve. The areas surveyed on foot in relation to the Desktop Assessment area are shown in **Figure 4**.

Details on the structure and dominant plant species in the overstorey, shrub layer and understorey were collected at 20 assessment sites within the Survey Area. At most assessment sites note was also taken of the vegetation and weeds across the river if that side was inaccessible. Photographs were also taken at each assessment site to assist with interpreting the data.

In addition, information on the presence of weeds, particularly weeds of environmental significance, was collected at each of the assessment sites. An estimate of weed density within 50 m of the observer was collected using the following scale;

- Limited/Localised distribution- <10% (Code “L”)
- Moderate distribution- 10-40% (Code “M”)
- High distribution 40-80% (Code “H”)
- Extensive (widespread) distribution- >80%; (Code “E”)

Compilation of a comprehensive list of plant species within the Survey Area was outside the scope of the project, however a list of all native and non-native flora recorded at the 20 assessment sites was produced. Taxonomy and conservation status was checked against (DBCA, 2017e, 2017f).

Much of the river south of the Busselton Bypass is inaccessible because it runs through private property. However, a 250 m length south of the bypass adjacent to ‘Little Holland House’ is accessible as well as a section at the southern end reached via a drainage reserve (**Figure 4**).

Recent (2017) aerial photography was used in conjunction with the field based data to prepare maps of vegetation types (referred to as vegetation units in this report) and vegetation condition. In areas where physical access was not possible, recent high resolution aerial photography plus whatever information could be gleaned from viewing these areas from accessible points was used to interpret vegetation type and condition. As such, especially for the section of the Survey Area south of the Bypass, vegetation unit and condition information is presented here but information on the presence and diversity of weeds is not.

2.3 Survey Limitations

Potential limitations with regard to the assessment are addressed in **Table 7**.

Table 7. Limitations 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 the client’s requirements.
Timing of survey	Negligible	The survey was carried out in mid and late October, a time when most native and introduced species are flowering and easily identifiable.
Climatic and seasonal effects	Minor	Rainfall for the wet season in the Busselton area (1st April – 31st October) was below average. This may have resulted in a lower proportion of some annual species germinating, however rainfall over the “spring” growing season was about average.
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	Moderate	Not all the vegetation along the edge of the Lower Vasse River is publicly accessible. A 3 km length of the river is inaccessible south of the Busselton Bypass. However, the availability of recent aerial photography alleviated this problem to some extent.
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.

3 Results

For mapping purposes, the Survey Area has been divided into two sections, as shown in **Figure 12**.

3.1 Flora

Only 48 vascular plant species were identified within the Survey Area, of which 20 (42%) were naturalised species (**Appendix 6**). Two or three of the 'native' species were a result of plantings of species that probably did not originally occur along the Lower Vasse River. While the number of native species is a fairly accurate reflection of the total number in the Survey Area, there are many other naturalised or non-native species, mostly small annuals, that occurred within the Survey Area, but were not considered to be actual or potential environmental weeds.

3.2 Pest Plants and Environmental Weeds

Ten weed species that are currently a problem or potentially troublesome to the remnant vegetation along the Lower Vasse River were identified in the Survey Area. These are listed in **Table 8**, below, along with the distribution of the various density categories for each species, and are mapped in **Figure 13** and **14**. As reported in **Section 3.1**, naturalised or non-locally native plants make up a high proportion of the species recorded at assessment sites in the Survey Area. This is attributable to the high level of disturbance that has taken place within the riverine vegetation over many years, and the long history of settlement and clearing for agriculture in the Survey Area. Some of the weeds, particularly Arum Lily, would have been introduced to the area more than 150 years ago.

Table 8. The occurrences of "environmental significant weeds" at the four density classes.

Name	Weed Density Codes				No. Sites
	Localised	Moderate	High	Extensive	
<i>Calothamnus quadrifidus</i>	1	3			4
<i>Carex divisa</i>	1				1
<i>Cenchrus clandestinus</i>	1	2	4	3	10
<i>Ehrharta calycina</i>			1		1
<i>Salix babylonica</i>	2				2
<i>Schinus terebinthifolius</i>	5	1	1		7
<i>Solanum linnaeanum</i>	1				1
<i>Vinca major</i>		2			2
<i>Watsonia meriana</i>		1			1
<i>Zantedeschia aethiopica</i>	12	5			17

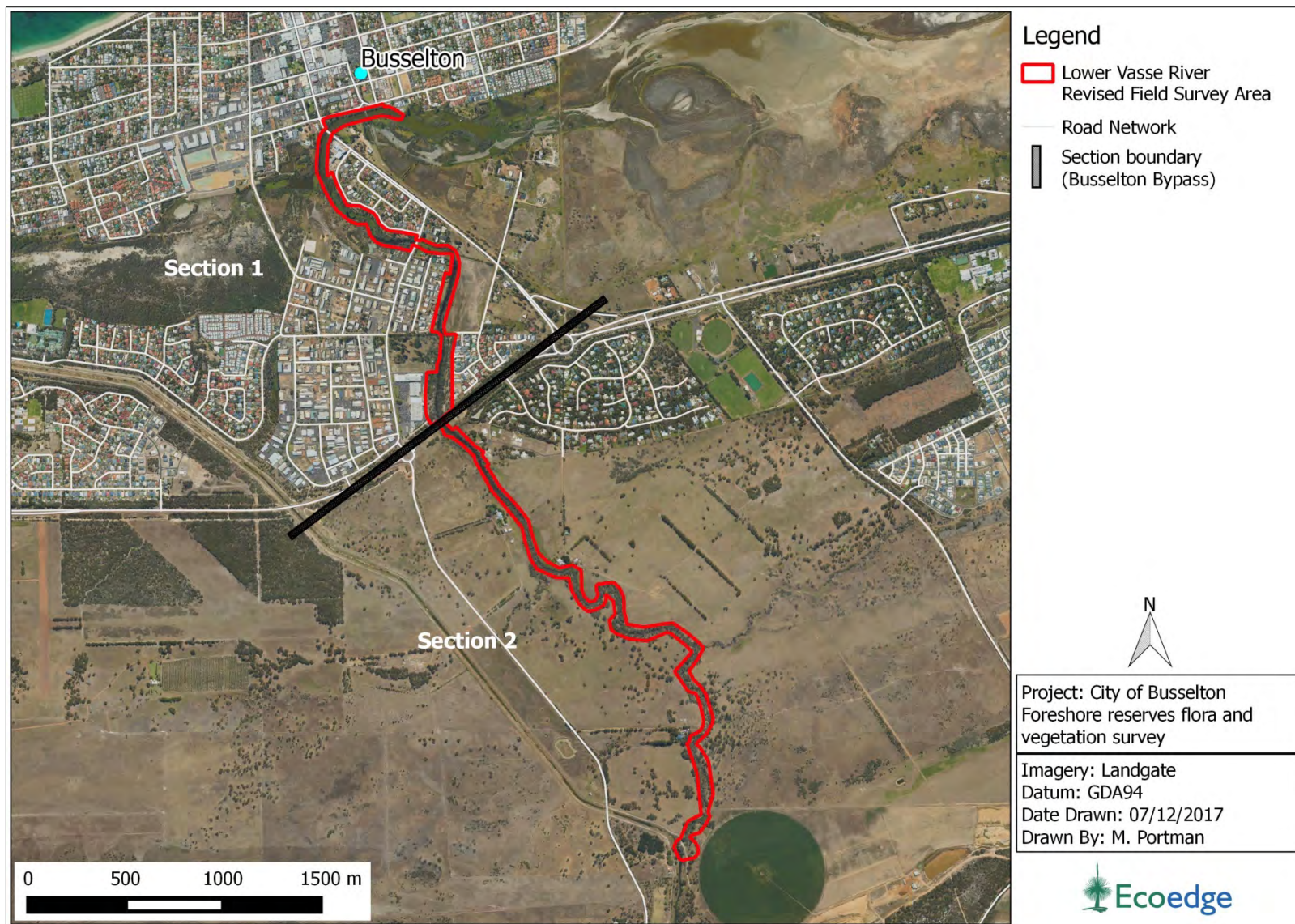


Figure 12. The Survey Area is divided into two sections at the Busselton Bypass for mapping purposes.

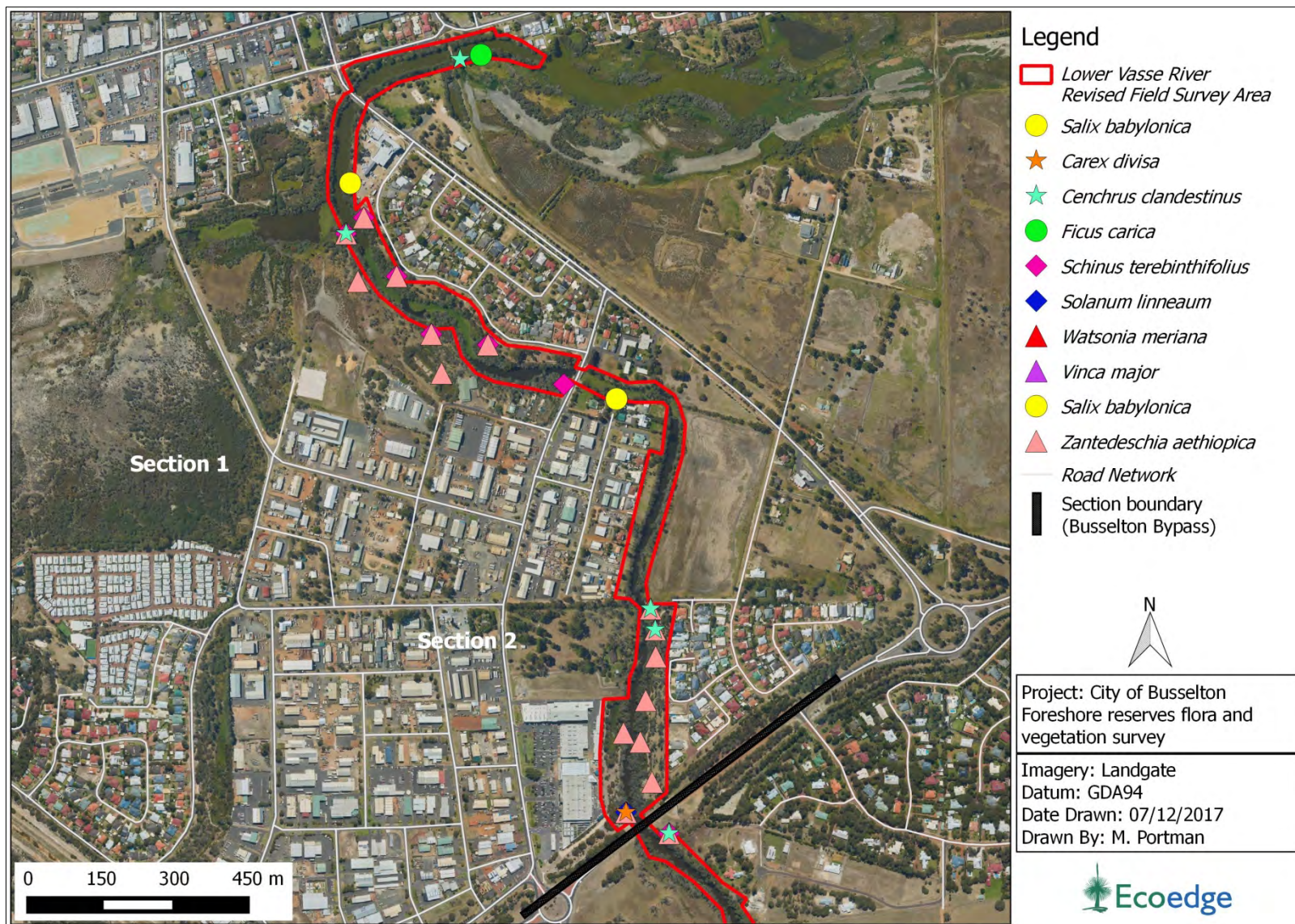


Figure 13. Pest plants and environmental weeds mapped in Section 1 of the Survey Area.

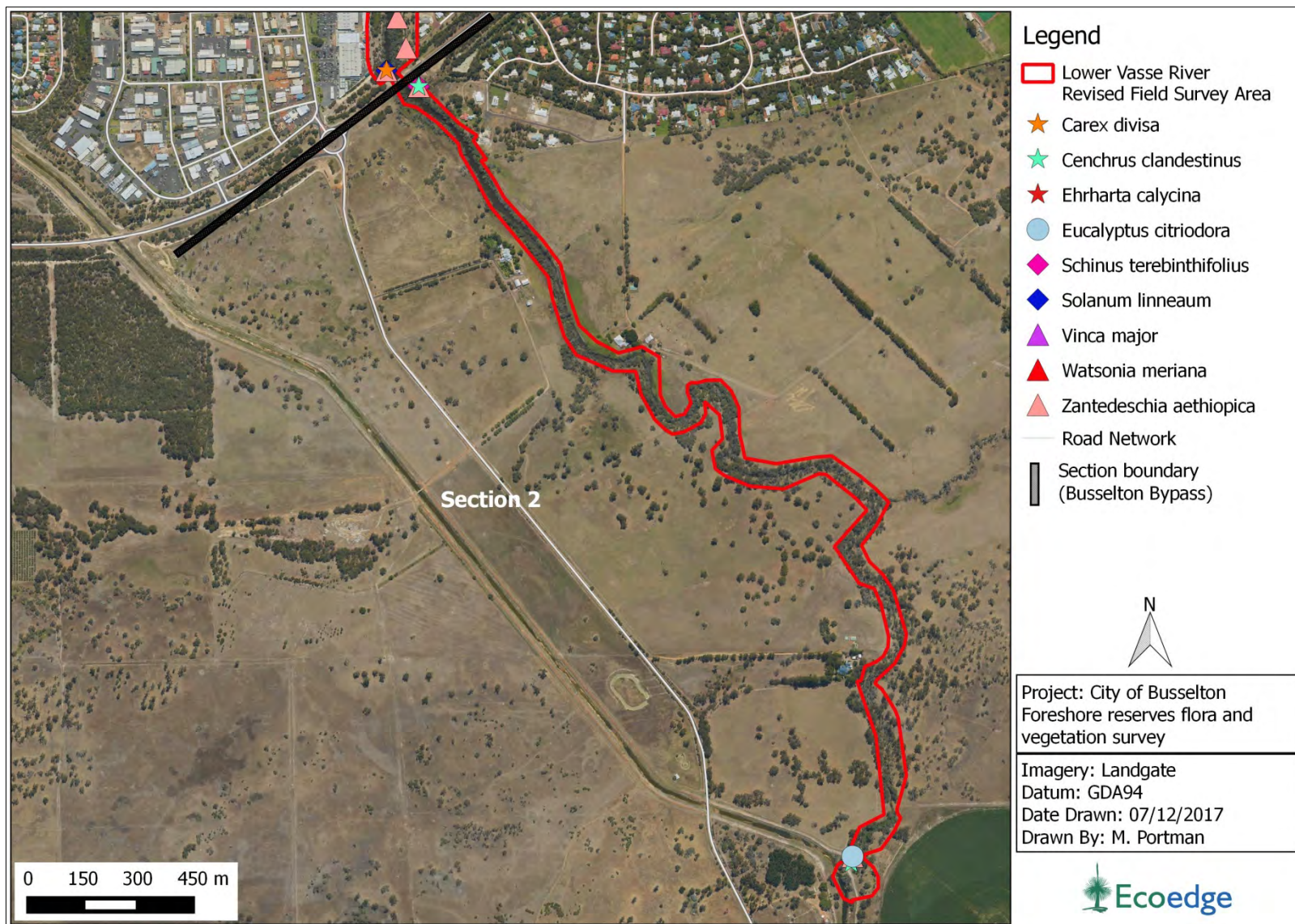


Figure 14. Pest plants and environmental weeds mapped in Section 2 of the Survey Area.

Arum lilies (*Zantedeschia aethiopica*) were the most widespread environmental weed, occurring at 17 of the 25 assessment sites, at “Localised” or “Moderate” densities. However, at many of the assessment sites north of the Busselton Bypass bridge, dense infestations of this species could be seen across the river on land that was not publicly accessible. In fact, Arum Lily is present as an almost continuous infestation from the Busselton Bypass bridge to the Causeway bridge. In some areas Arum Lily forms the only understorey species. The weed is mainly spread by bird-dropped seed (Scott, 2012) and is considered naturalised in southern Australia. Long-term control is difficult because of continuous re-introduction from other infestations.

The next most widespread introduced species was Kikuyu (*Cenchrus clandestinus*) which is a commonly planted lawn or pasture species, but may invade bushland and become a troublesome weed (**Figure 15**). Kikuyu grows rapidly forming dense mats and may shade and inhibit the growth of herbs and shrubs in bushland (Brown and Bettink, 2009).

Brazilian Pepper tree (*Schinus terebinthifolius*) was recorded (mostly as a localised occurrence) at seven assessment sites, but is more common in the Survey Area than that statistic would imply. It is not generally regarded to be a serious environmental weed, but because of its suckering habit it is difficult to control.

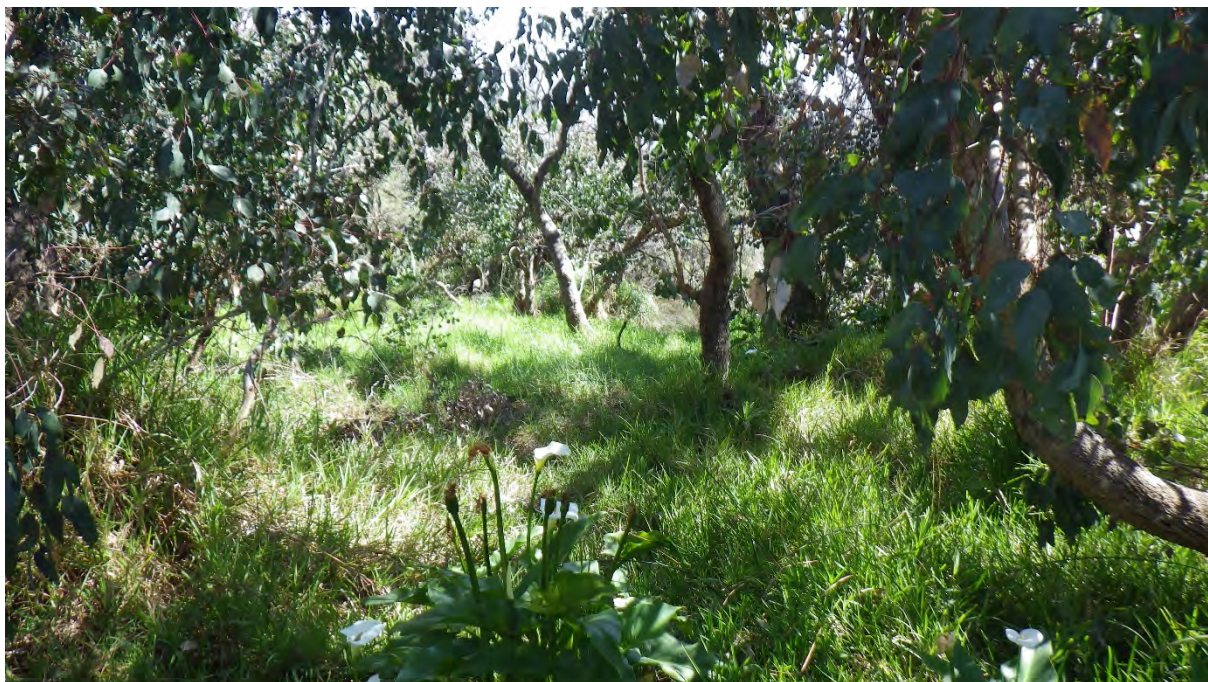


Figure 15. A dense Kikuyu infestation, together with some Arum Lilies on the banks of the Lower Vasse River.

The Western Australian native One-sided Bottlebrush (*Calothamnus quadrifidus*) was recorded at four sites. This species has been used in amenity plantings along the river north of Busselton Bypass. It is not locally-native and is among a number of unsuitable amenity plants identified by Keighery (2002) as being highly invasive in very short time periods.

There were several other potentially serious environmental weeds; Blue Periwinkle (*Vinca major*), Weeping Willow (*Salix babylonica*) and *Watsonia meriana* that were present at a few sites.

The Mexican Waterlily (*Nymphaea mexicana*) exists in a more or less continuous infestation from 200 m southeast of the Strelly Street Bridge to around 500 m northwest of it. This aquatic weed has been recognised as a significant concern for the Vasse River ecosystem (Huffer and Assoc., 2016). It is recognised as being an important user of excess nutrients in the eutrophic river and that its removal would require replacement by a suitable native aquatic plant.

Aside from the above individual environmental weeds, the long history of settlement and anthropogenically-caused disturbances within the Survey Area have led to the invasion of the river environs by a large number of mostly annual weeds from adjacent pasture. These are touched on further in **Section 3.4**, below.

3.3 Vegetation Units

The Survey Area contains approximately 28.1 ha of remnant native vegetation of which approximately 26% was classified as “Parkland cleared” with little or no native understorey, and a further 7% consisted of rehabilitated vegetation.

Five vegetation mapping units were identified in the Survey Area, although only the first three listed have something like their original structure. The level of degradation through replacement of native species by introduced species is high in all of them. Only two small areas were classified as Good condition, with anything like the original component of native species. Vegetation units mapped are described below and shown in **Figure 16** and **17**. None of the vegetation units mapped for the Survey Area is an occurrence of a Threatened or Priority ecological community. An occurrence of the ‘Coastal Saltmarsh’ TEC occurs 50 m west of the Survey Area just south of the junction with New River (this is indicated in **Figure 6**).

Eucalyptus rudis – *Melaleuca raphiophylla* open forest or woodland (ErMrOF)

Forms a fringe along the river on alluvial floodplain soils. Dominated by mature trees of *E. rudis* and *M. raphiophylla* with occasional *Agonis flexuosa*, *Banksia littoralis* small trees over an open shrubland that may include *Astartea scoparia*, *M. viminea* and on sandier soils *Banksia grandis* and *Hibbertia cuneiformis*. In damper areas the understorey is often a herbland dominated by **Zantedeschia aethiopica*. The native rush *Juncus pallidus* and the fern *Pteridium esculentum* are common components in drier soils. This vegetation unit has been invaded by a range of other introduced species such as the small trees **Schinus terebinthifolius* and many pasture species, such as **Cenchrus clandestinus* and **Rumex* spp. (**Figure 18**).

Corymbia calophylla – *Eucalyptus rudis* open forest (CcErOF)

Found on alluvial soils along the river in the southern part of the survey area. *Agonis flexuosa* and *Melaleuca raphiophylla* may also form a component of the tree layer. The understorey is almost completely comprised of introduced taxa, such as **Bromus diandrus*, **Cenchrus clandestinus*, **Ehrharta calycina* and **Zantedeschia aethiopica* (**Figure 19**).

Rehabilitated Areas (RA)

This is riverine vegetation comprised of an overstorey of the original *Eucalyptus rudis* and *Melaleuca raphiophylla* trees with an understorey of mainly planted trees and shrubs, such as *Agonis flexuosa* and *Acacia saligna* and in some areas non-locally native species such as *Allocasuarina fraseriana*, *Calothamnus quadrifidus* and *Melaleuca huegelii*.

Parkland Cleared (PC)

Areas of parkland and grazing land with scattered *Eucalyptus rudis*, *Agonis flexuosa* or *Corymbia calophylla*.

Cleared Areas (CL)

Areas devoid of native vegetation.

There is no vegetation fitting the description of the ‘Coastal Saltmarsh’ TEC (refer **Section 1.6**) nor the ‘*Eucalyptus rudis*, Marri and Peppermint’ forest PEC within the Survey Area. The presence of *Eucalyptus rudis*, Marri or *Agonis flexuosa* does not equate to the presence of the PEC. A description of the PEC is provided below – this description does not match any of the vegetation units in the Survey Area:

The dominant plant community of this area is a Closed Low Forest dominated by *Eucalyptus rudis*, *Corymbia calophylla*, *Agonis flexuosa* over a diverse understorey including the shrubs *Kunzea glabrescens*, *Hibbertia hypericoides*, *Logania vaginalis*, *Conospermum caeruleum* subsp. *marginatum*; over the herbs *Agrostocrinum hirsutum*, *Thysanotus arenarius*, and *Lomandra micrantha*; sedge *Tetraria octandra*; and grasses *Microlaena stipoides* and *Austrostipa flavescens*. Scattered throughout the community, and dominant in areas, are the wetland dependent tree species *Melaleuca raphiophylla* and *Banksia littoralis*. The shrub *Hakea varia* and the sedges *Baumea juncea* and *Gahnia trifida* are other wetland species found in this community.

Instead, the vegetation unit of the northern part of the Lower Vasse River Survey Area (*Eucalyptus rudis* – *Melaleuca raphiophylla* open forest or woodland’) matches the ‘Riverine Sandy Soil Plant Communities’ of Webb *et al.* (2009).

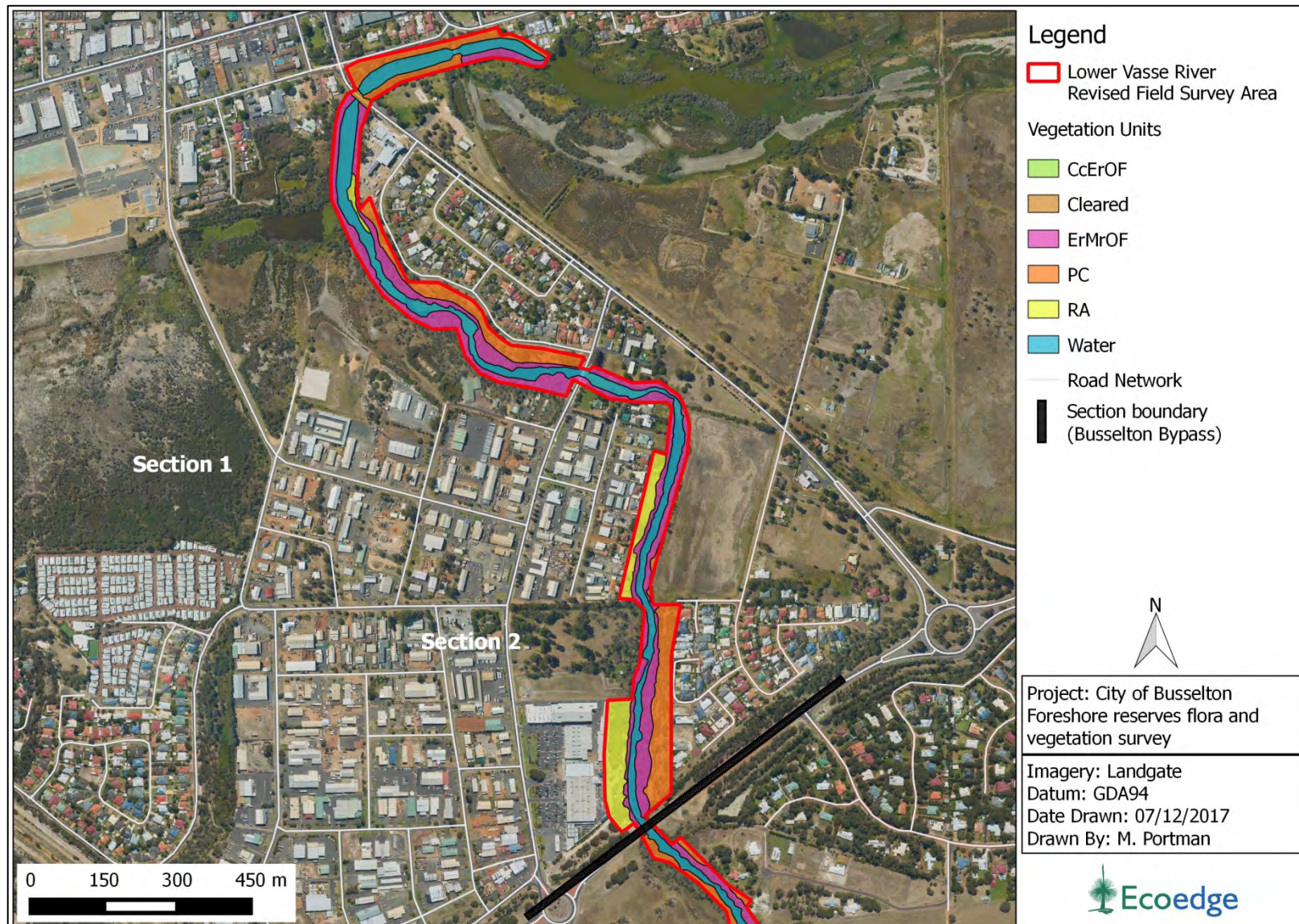


Figure 16. Vegetation units mapped during the field survey for Section 1 of the Survey Area.

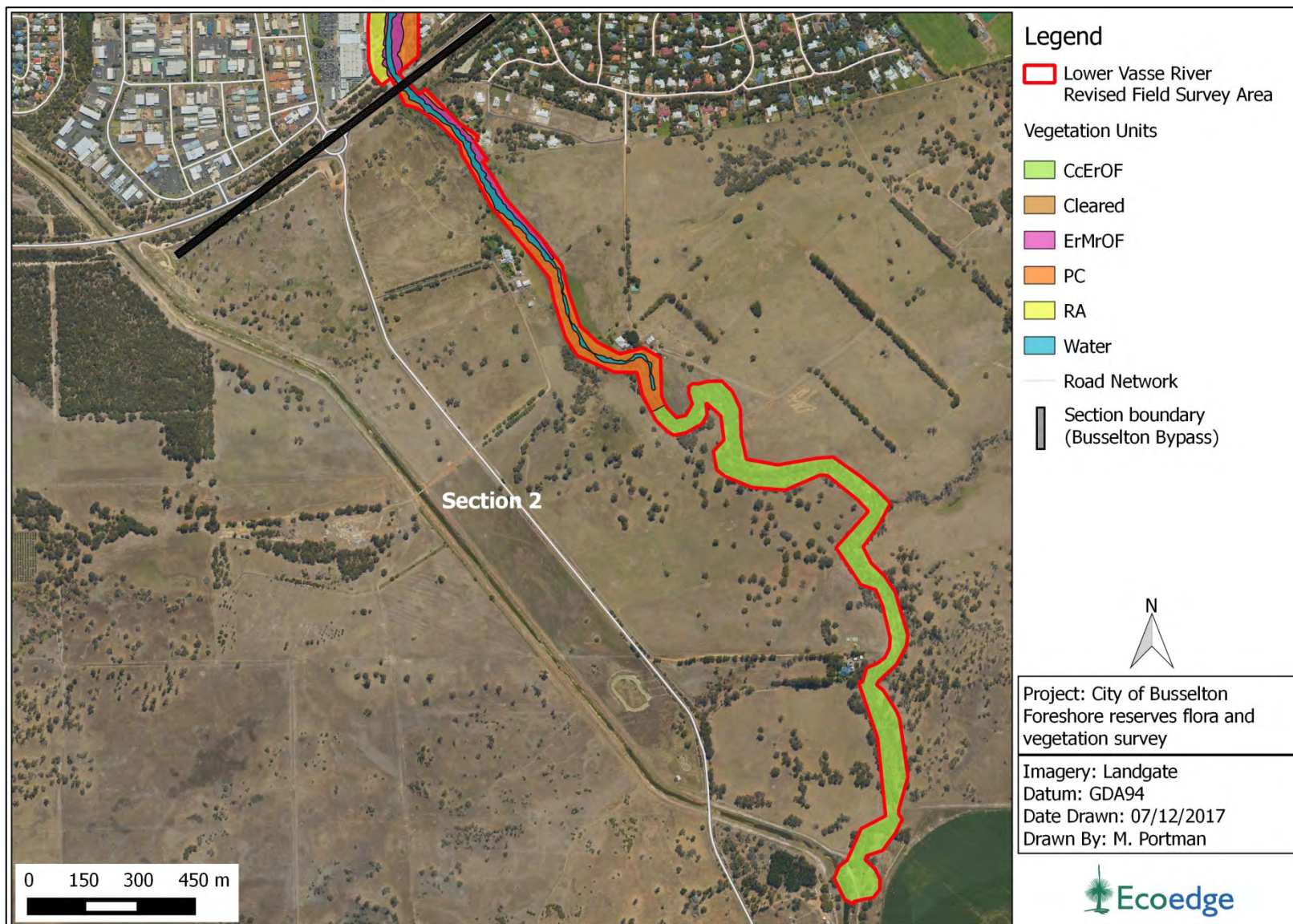


Figure 17. Vegetation units mapped during the field survey for Section 2 of the Survey Area.



Figure 18. *Eucalyptus rudis* – *Melaleuca raphiophylla* open forest or woodland.

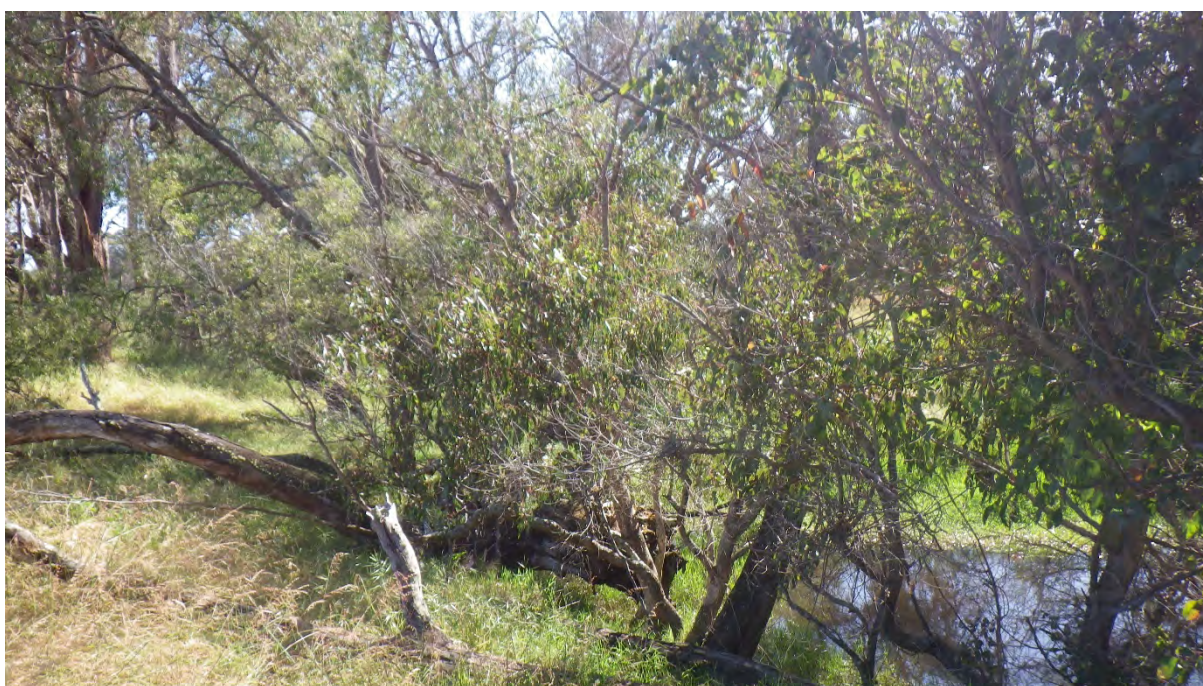


Figure 19. *Corymbia calophylla* – *Eucalyptus rudis* open forest.

3.4 Vegetation Condition

The total Survey Area was 34.5 ha, of which 5.9 ha was water (the Lower Vasse River) and a further 0.1 ha was mapped as roadway. Vegetation condition according to the method of EPA (2016) is summarised in **Table 9** and mapped in **Figure 20** and **22**.

Most of the vegetation was classed as Degraded or Completely Degraded. Only small percentage of the vegetation was classed as Good, of which part was partially rehabilitated riverine vegetation.

As mentioned in **Section 3.2**, the high level of degradation of vegetation along the Lower Vasse River is a result of over 150 years of influx of agricultural and garden weeds into the littoral vegetation, along with a high level of disturbance caused by livestock grazing, partial clearing and other anthropogenic changes.

Condition assessment of 3 km of the riverine vegetation where there was no public access south of Busselton Bypass was done using aerial photography. The Vasse River Action Plan (Scott *et al.*, 2000) reported that a substantial portion of this 3 km length was fenced to allow exclusion of livestock. How much of the fenced off area actually had stock excluded from it in the intervening 17 years is unknown. Sections of the river upstream from the Bypass had several native understorey species in 2000, and if livestock has been excluded from these areas then these sections would probably now be rated as Good condition.

Table 9. Summary of vegetation condition classes within the Survey Area.

Category	Area (ha)	%
Good	1.8	5.2
Degraded	20.6	59.8
Completely Degraded	6.1	17.7
Cleared	0.1	0.3
Water	5.9	17.0
Total	34.5	100.0

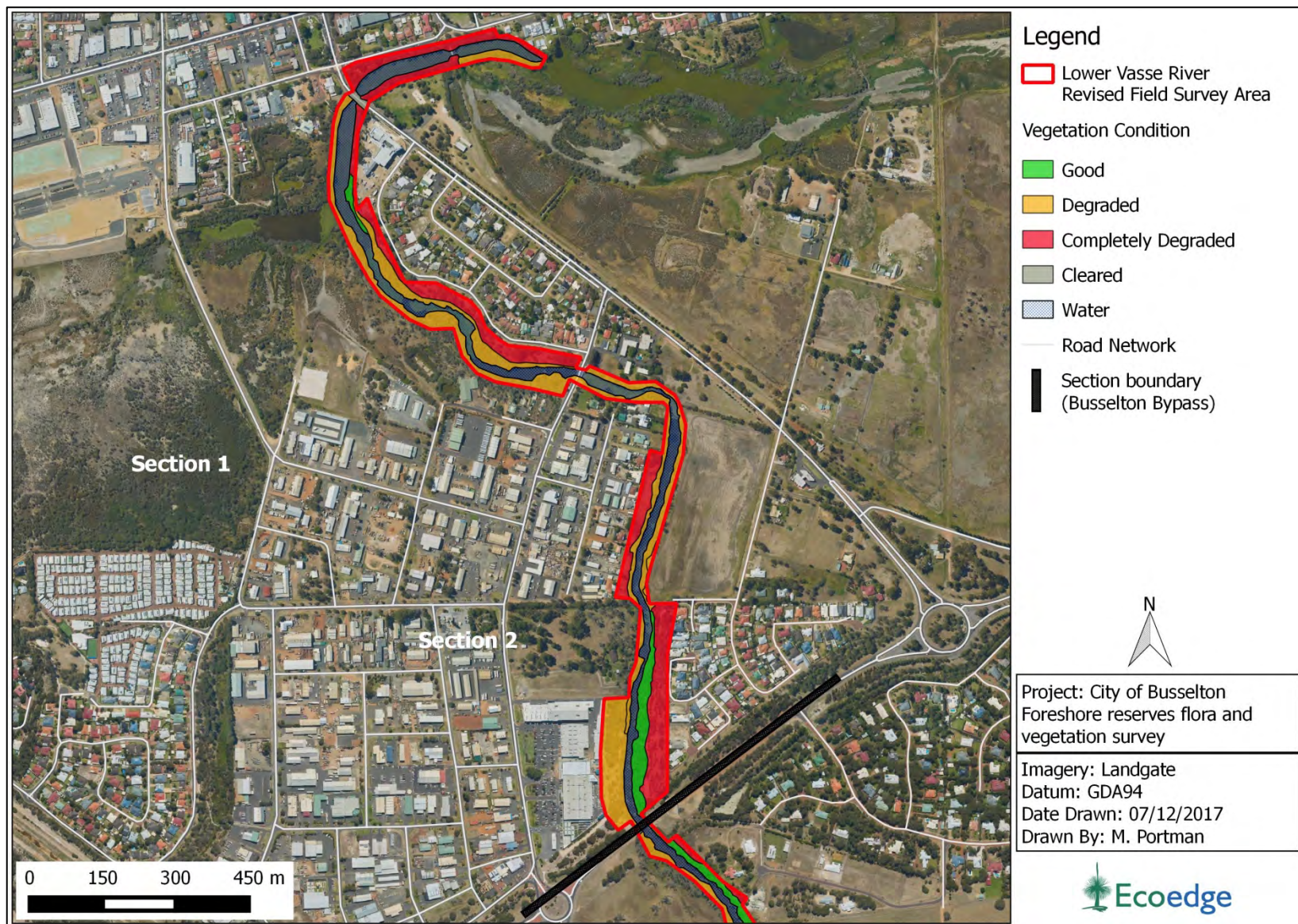


Figure 20. Condition of vegetation within Section 1 of the Survey Area.

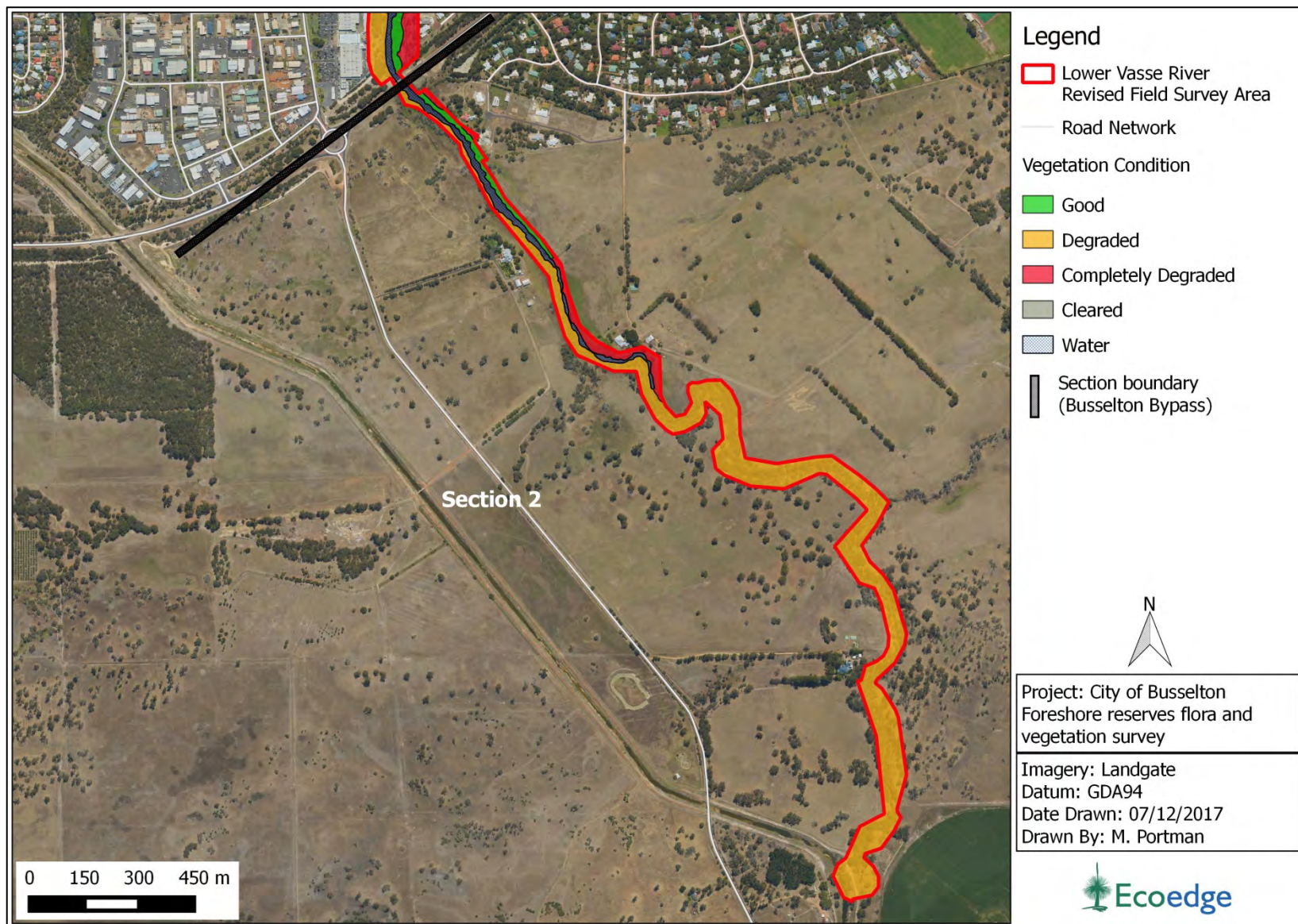


Figure 21. Condition of vegetation within Section 2 of the Survey Area.

4 Discussion and Conclusions

A vegetation and weed survey was conducted over approximately 28.5 ha of riverine vegetation along a 5.6 km stretch of the Lower Vasse River. Very little of the vegetation was classified as being in Good condition. Most of it has been severely degraded over the last 150 years, mainly because the narrow strip of riverine vegetation has been surrounded by agricultural land or urban areas, and most of the river has been subject to livestock grazing for much of that period. Consequently, most of the remnant vegetation is very poor in native species. At only one of the 20 assessment sites was there more than 5 native species (including overstorey), and this was a site in a stretch of riverine vegetation that had been partly restored by the planting of native species.

Several exotic species are well-established as environmental weeds along a large part of the Lower Vasse River, particularly downstream of the Busselton Bypass. In particular, Arum Lily (*Z. aethiopica*) and Kikuyu (*C. clandestinum*) are present in dense infestations. Several other introduced plants have the potential to become troublesome environmental weeds, including the non-locally native One-sided Bottlebrush (*Calothamnus quadrifidus*) which has been planted as part of rehabilitation efforts along part of the river just north of Busselton Bypass.

Rehabilitation, or restoration of vegetation along the Lower Vasse River with appropriately selected local natives is possible with a well planned and executed program of works. A proposed site and list of suitable species is provided below.

5 Suggested Rehabilitation Area and Species List

A large part of the Crown land within the Survey Area is potentially suitable for vegetation rehabilitation or restoration. In selecting areas to be suggested for rehabilitation, several factors have been considered, as follows;

1. A minimum area of 1,500 m²;
2. Ease of access for vehicles; and
3. A relatively low density of established trees or shrubs to reduce competition with planted seedlings

All the five suggested rehabilitation areas (**Figure 22**) are adjacent to the Vasse River and successful rehabilitation with locally native vegetation can be expected to contribute to improving water quality.

The original species composition of the understorey of the *Eucalyptus rudis* dominated open forest or woodland along the Lower Vasse River is largely unknown. Over 150 years of degradation and invasion of exotic species means that the current vegetation is only a shadow of what it once was. Using the NatureMap online database (DBCA, 2017d), a list of taxa that are recorded for the northern part of the Lower Vasse River (i.e. near the river

within the current Busselton urban area) can be obtained. However, a substantial portion of these are early-collected specimens where “Busselton” was given as the nearest named place, but where the specimen may have been collected tens of kilometres from this part of the Survey Area. Nevertheless, judicious use of the species list, taking account of the species’ normal distribution and its likely habitat, can enable a likely “short-list” of taxa.

This list of taxa (including most of those found during the current survey), together with a note on the best habitat within the proposed rehabilitation areas is provided in **Table 10**, below. It is proposed that the list of species in **Table 10** be used for each of the proposed rehabilitation areas shown in **Figure 22**.

Area A. This proposed rehabilitation area comprises five C-class and uncategorised reserves within the Busselton urban area, adjacent to a previous restoration project west of Bunbury Street, between Roe Terrace and the river. The western-most part of the proposed rehabilitation area contains an area of Coastal Saltmarsh threatened ecological community, and while this saltmarsh vegetation would benefit from being fenced off to remove vehicle traffic which has damaged it in the past. It is not proposed to actively rehabilitate the saltmarsh at this stage.

The total size of Area A is about 2.8 ha. The current vegetation type is grassland (former pasture) (**Figure 23**) and patches of *Eucalyptus rudis* woodland (**Figure 24**). The soil is mainly sandy loam, and apart from near the riverbank where there is a dense Kikuyu infestation, the weeds are predominantly annual, and therefore relatively easily controlled.

Area B. This is an area of approx. 0.8 ha on the west bank of the river and accessed from Isaacs Street. Most of it is devoid of trees and shrubs and the vegetation except for a narrow fringe along the river consists mainly of perennial grass. Once the grass is successfully controlled it should be relatively easy to establish locally native trees and shrub species drawn from Table 10 in this area.

Areas C and D. These proposed rehabilitation areas total almost 1.5 ha, and are situated either side of the river near the Busselton Bypass bridge. The current vegetation is comprised mainly of introduced species with a scattering of *Eucalyptus rudis* or *Corymbia calophylla* trees. Generally, the riverbank is bare or vegetated with species such as Arum Lily and Pampas Grass (**Figure 25**). These foreshore areas would be suitable for planting with species such as *Juncus kraussii* or *Gahnia trifida* (Meney, 1999)

Area E. Totalling just over 1500m², Area E lies just west of the Strelley Street Bridge. The current vegetation comprises *Eucalyptus rudis* trees in a narrow band along the river with a thick scrubby undergrowth of Brazilian Peppertree (*Schinus terebinthifolius*) (**Figure 26**) and lawn grass. One of the first tasks for rehabilitation of Area E would be to remove the Peppertree and other weeds and replace it with suitable species drawn from **Table 10**.

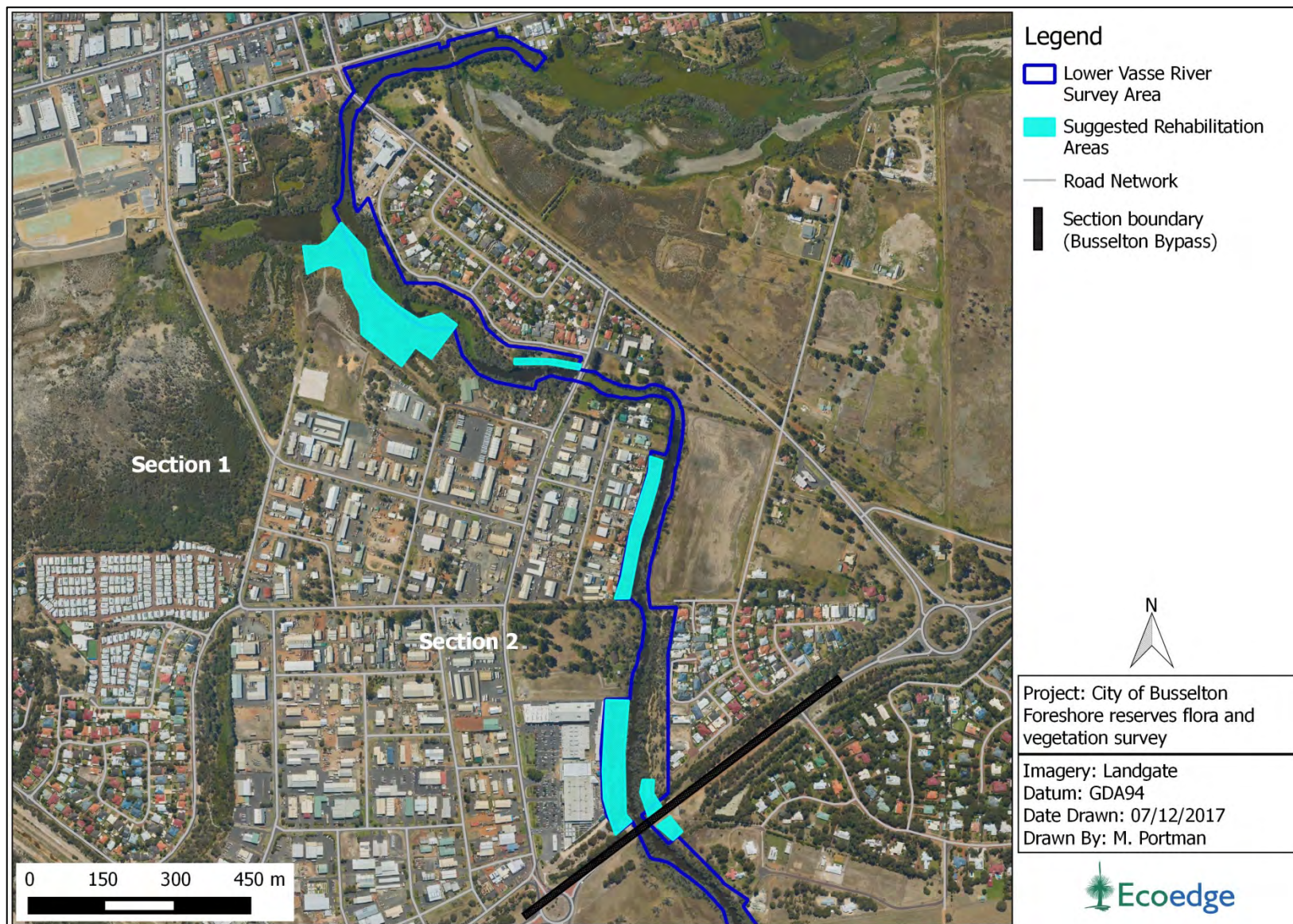


Figure 22. The proposed rehabilitation areas in the Survey Area.

Table 10. List of taxa for use in the suggested rehabilitation areas.

Family	Species	Common Name	Habitat	Form
Cyperaceae	<i>Ficinia nodosa</i>	Knotted Club Rush	Damp	Rush
Cyperaceae	<i>Gahnia trifida</i>	Coast Saw-sedge	Damp	Sedge
Cyperaceae	<i>Lepidosperma gladiatum</i>	Coast Sword-sedge	Damp	Sedge
Cyperaceae	<i>Lepidosperma squamatum</i>		Dry	Sedge
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken	Dry	Herb
Dilleniaceae	<i>Hibbertia cuneiformis</i>	Cutleaf Hibbertia	Dry	Shrub
Dilleniaceae	<i>Hibbertia diamesogenos</i>		Dry	Shrub
Ericaceae	<i>Astroloma ciliatum</i>	Candle Cranberry	Dry	Shrub
Fabaceae	<i>Acacia saligna</i>	Orange Wattle	Damp	Shrub
Fabaceae	<i>Hardenbergia comptoniana</i>	Native Wisteria	Dry	Climber
Fabaceae	<i>Jacksonia gracillima</i>		Dry	Shrub
Fabaceae	<i>Viminaria juncea</i>	Swishbush	Damp	Shrub
Goodeniaceae	<i>Dampiera alata</i>	Winged-stem Dampiera	Damp	Shrub
Haemodoraceae	<i>Anigozanthos flavidus</i>	Tall Kangaroo Paw	Dry	Herb
Hemerocallidaceae	<i>Agrostocrinum scabrum</i>	Blue Grass Lily	Dry	Herb
Juncaceae	<i>Juncus kraussii</i>	Sea Rush	Damp	Rush
Juncaceae	<i>Juncus pallidus</i>	Pale Rush	Damp	Rush
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint	Dry	Tree
Myrtaceae	<i>Astartea scoparia</i>	Common Astartea	Damp	Shrub
Myrtaceae	<i>Calothamnus sanguineus</i>	Silky-leaved Blood flower	Dry	Shrub
Myrtaceae	<i>Eucalyptus rudis</i>	Flooded Gum	Damp	Tree
Myrtaceae	<i>Hypocalymma angustifolium</i>	White Myrtle	Damp	Shrub
Myrtaceae	<i>Kunzea glabrescens</i>	Spearwood	Dry	Shrub
Myrtaceae	<i>Melaleuca cuticularis</i>	Saltwater Paperbark	Damp/ Saline	Tree
Poaceae	<i>Austrostipa flavescens</i>		Dry	Herb
Proteaceae	<i>Conospermum caeruleum ssp. marginatum</i>	Blue Brother	Dry	Shrub
Proteaceae	<i>Xylomelum occidentale</i>	Woody Pear	Dry	Tree
Santalaceae	<i>Exocarpos odoratus</i>	Scented Ballart	Damp	Shrub
Thymelaeaceae	<i>Pimelea angustifolia</i>	Narrow-leaved Pimelea	Dry	Shrub



Figure 23. Proposed grassland rehabilitation area (Area A).



Figure 24. Proposed *Eucalyptus rudis* woodland rehabilitation area (Area A).



Figure 25. Foreshore in Area C.

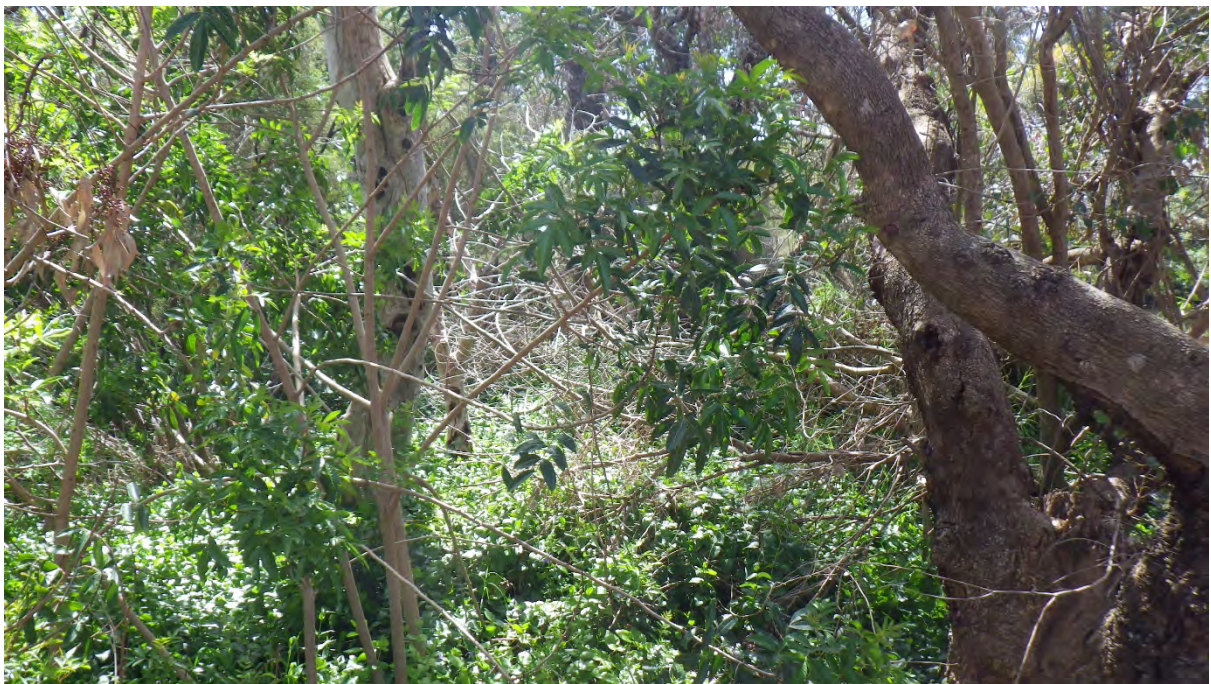


Figure 26. Thick undergrowth of Brazilian Peppertree (*S. terebinthifolius*) in Area E.

6 References

- Beeston, G.R., Hopkins, A.J.M. and Shepherd, D.P. (eds) (2001). *Land-use and Vegetation, Western Australia*. Agriculture Western Australia, South Perth and National Land and Water Resources Audit, Canberra. <http://www.agriculture.gov.au/abares/aclump/Documents/WA%20Luse%201997%20Report.pdf>
- Brown, K.L. and Bettink, K.A. (2009) *Swan Weeds: Management Notes, FloraBase — The Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. <https://florabase.dpaw.wa.gov.au/weeds/swanweeds/>
- City of Busselton (2017). *Vasse River Wetlands Footpath Construction Project Map*.
- Commonwealth of Australia (2001). *National Objectives and Targets for Biodiversity Conservation 2001-2005*. Environment Australia, Department of Environment and Heritage, Canberra, Australian Capital Territory.
- Commonwealth of Australia (2016). *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions)*. Department of the Environment and Energy. <https://data.gov.au/dataset/interim-biogeographic-regionalisation-for-australia-ibra-version-7-subregions>
- Department of Biodiversity Conservation and Attractions (DBCA) (2017a). *Priority ecological communities list (June 2017)*. Department of Biodiversity Conservation and Attractions. http://www.dbca.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2017.pdf
- Department of Biodiversity Conservation and Attractions (DBCA) (2017b). *Conservation Codes for Western Australian Flora and fauna*. http://www.dbca.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions.pdf
- Department of Biodiversity Conservation and Attractions (2017c). *Extract from the Department's Threatened (Declared Rare) Flora database and the Western Australian Herbarium*. DBCA Species and Communities Branch dated 10 October 2017.
- Department of Biodiversity Conservation and Attractions (2017d). *NatureMap, Western Australian Herbarium*. <http://naturemap.dpaw.wa.gov.au/default.aspx>. Generated 14 November 2017.
- Department of Biodiversity Conservation and Attractions (2017e). *The WA Herbarium Census of WA Plants Database (WACENSUS: 'Max')*.

- Department of Biodiversity Conservation and Attractions (2017f). *Florabase*, Western Australian Herbarium. <http://florabase.dbca.wa.gov.au/>
- Department of Environment and Conservation (DEC) (2007). *Reservation levels of vegetation complexes and systems with reserve status as at June 2007*. Excel spreadsheet.
- Department of Environment Regulation (DER) (2015). *Environmentally Sensitive Areas*. <http://www.der.wa.gov.au/your-environment/environmentally-sensitive-areas>
- Department of Environment, Water, Heritage and the Arts (DEWHA) (1999) *Environment Protection and Biodiversity Conservation Act 1999*. Department of Environment, Water, Heritage and the Arts. Canberra, Australian Capital Territory.
- Department of Parks and Wildlife (2016a). *Threatened ecological communities endorsed by the Minister for the Environment (October 2016)*.
[https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened ecological communities endorsed by the minister october 2016.pdf](https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_october_2016.pdf)
- Department of Parks and Wildlife (DPaW) (2016b). *Environmentally Sensitive Areas GIS Mapping Dataset*. 2016 Version. Perth, Western Australia <https://www2.landgate.wa.gov.au/web/guest/57> (DER016).
- Department of the Environment and Energy (DotEE) (2017a). *Threatened ecological communities under the EPBC Act*. <http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl>
- Department of the Environment and Energy (DotEE) (2017b). *Protected Matters Search Tool query*. Generated 14 November 2017
- Department of the Environment (DotEE) (2017c). *Categories of Threatened species under the EPBC Act*. <http://www.environment.gov.au/biodiversity/threatened/species.html>
- Department of the Environment (DotEE) (2017d). *Environment Protection and Biodiversity Conservation Act. Species Profile and Threats Database*. <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl> accessed
- Ecosystem Solutions (2017). *Reconnaissance Flora, Vegetation and Fauna Survey of Busselton Strategic Network Corridors*. Unpublished report to Strategen for the City of Bunbury.

- Environment Australia (2001). *National objectives and targets for biodiversity conservation 2001–2005*. <http://www.environment.gov.au/resource/national-objectives-and-targets-biodiversity-conservation-2001%E2%80%932005>
- Environmental Protection Authority (2000). *Environmental Protection of Native Vegetation in Western Australia. EPA Position Statement No. 2*. EPA, Perth, Western Australia.
- Environmental Protection Authority (EPA) (2016). *Technical Guidance Flora and Vegetation Surveys for Environmental Impact*. Environmental Protection Authority. Perth, Western Australia
- Environmental Protection Authority (EPA) (2009). *South West Regional Ecological Linkages. Environmental protection Bulletin No. 8*. EPA, Perth, Western Australia.
- Essential Environmental Services (2005). *Guideline for the Determination of Wetland Buffer Requirements: Draft for Comment*. Prepared for the Department for Planning and Infrastructure on behalf of the Western Australian Planning Commission. Western Australian Planning Commission, Perth, Western Australia.
- Government of Western Australia (1950). *Wildlife Conservation Act 1950*. Perth, Western Australia.
- Government of Western Australia (1984). *Conservation and Land Management Act 1984*. Perth, Western Australia.
- Government of Western Australia (2005). *Environmental Protection (Environmentally Sensitive Areas) Notice 2005 (Environmental Protection Act 1986)*. Government Gazette, No.55.
- Government of Western Australia (2013b). *Wildlife Conservation Act 1950*. Government Gazette, 29 November 2016. https://www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_1080_home_page.html
- Huffer A. and Associates, (2016). *Lower Vasse River Report – Final*. A Vision and Management Objectives for the Lower Vasse River and Toby Inlet. Unpublished report to the City of Busselton.
- Keighery, G. (2002). *The enemy within: native environmental weeds in Western Australia*. In 13th Australian Weeds Conference: papers & proceedings: 8-13 September 2002, Sheraton Hotel, Perth, Western Australia Plant Protection Society of Western Australia, Perth. pp. 93–95

- Meney, K. (1999). Revegetating riparian zone in south-west Western Australia. Water and Rivers Commission, Report No. RR4, August 1999.
- Molloy, S., O'Connor, T., Wood, J. and Wallrodt, S. (2007). *Reservation levels of vegetation complexes and systems with reserve status as at June 2006*. Local Government Biodiversity Planning Guidelines: Addendum to the South West Biodiversity Project Area, Western Australian Local Government Association, West Perth.
- Molloy, S., O'Connor, T., Wood, J. and Wallrodt, S. (2009). *South West Regional Ecological Linkages Technical Report*. Western Australian Local Government Association (WALGA) and the Department of Environment and Conservation (DEC). West Perth.
- Scott, M. *et al.* (2000). *Vasse River Action Plan*. Water and Rivers Commission. Bunbury, Western Australia.
- Scott, J.K. (2012). *Zantedeschia aethiopica* (L.) Spreng. – arum lily. Biological Control of Weeds in Australia, eds. Mic Julian, Rachel McFadyen, Jim Cullen.
- Semeniuk C. A. and Semeniuk V. (1995). A geomorphic approach to global classification for inland wetlands. In *Vegetation*. 118:103 – 124.
- Tille, P.J. and Lantzke, N.C. (1990) *Busselton-Margaret River-Augusta Land Capability Study Land Resources Series No. 5*. Department of Agriculture, Perth, Western Australia
- Webb, A., Kinloch, J., Keighery, G., Pitt, G. (2016). *The extension of vegetation complex mapping to landform boundaries within the Swan Coastal Plain landform and forested region of south-west Western Australia*. Department of Parks & Wildlife. Bunbury, Western Australia.

Appendix 1. Categories of Threatened Ecological Communities under the EPBC Act (DotEE, 2017a).

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 2. Protected Matters Search Tool and NatureMap Reports for the Survey Area.

Lower Vasse Cons sig spp NatureMap Report

Created By Guest user on 14/11/2017

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 21' 15" E, 33° 40' 21" S
Buffer 5km

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
1.	3339 <i>Acacia flagelliformis</i>		P4	
2.	3537 <i>Acacia semitrullata</i>		P4	
3.	4586 <i>Amperea micrantha</i>		P2	
4.	32204 <i>Banksia nivea</i> subsp. <i>uliginosa</i>		T	
5.	1596 <i>Caladenia huegelii</i> (Grand Spider Orchid)		T	
6.	18038 <i>Caladenia procera</i>		T	
7.	35796 <i>Calothamnus quadrifidus</i> subsp. <i>teretifolius</i>		P4	
8.	43142 <i>Calystegia sepium</i> subsp. <i>roseata</i>		P2	Y
9.	43980 <i>Chamelaucium</i> sp. <i>S coastal plain (R.D.Royce 4872)</i>		T	
10.	35657 <i>Chamelaucium</i> sp. <i>Yoongarillup (G.J. Keighery 3635)</i>		P4	
11.	13113 <i>Chorizema carinatum</i>		P3	
12.	1639 <i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
13.	1945 <i>Franklandia triaristata</i> (Lanoline Bush)		P4	
14.	30453 <i>Gastrolobium</i> sp. <i>Yoongarillup (S.Dilkes s.n. 1/9/1969)</i>		P1	
15.	14011 <i>Grevillea brachystylis</i> subsp. <i>brachystylis</i>		P3	
16.	12219 <i>Grevillea bronwenae</i>		P3	
17.	14526 <i>Grevillea elongata</i>		T	
18.	2190 <i>Hakea oldfieldii</i>		P3	
19.	16522 <i>Isopogon formosus</i> subsp. <i>dasylepis</i>		P3	
20.	20462 <i>Jacksonia gracillima</i>		P3	
21.	1296 <i>Johnsonia inconspicua</i>		P3	
22.	33518 <i>Kennedia lateritia</i> (Augusta Kennedia)		T	
23.	17734 <i>Lambertia echinata</i> subsp. <i>occidentalis</i>		T	
24.	19186 <i>Lambertia orbifolia</i> subsp. <i>Scott River Plains (L.W. Sage 684)</i>		T	
25.	45084 <i>Lasiopetalum laxiflorum</i>		P3	
26.	1302 <i>Laxmannia jamesii</i> (James' Paperlily)		P4	
27.	17702 <i>Leptomeria furtiva</i>		P2	
28.	29492 <i>Leucopogon</i> sp. <i>Busselton (D. Cooper 243)</i>		P2	
29.	13779 <i>Loxocarya magna</i>		P3	
30.	36200 <i>Ornduffia submersa</i>		P4	
31.	12077 <i>Pimelea ciliata</i> subsp. <i>longituba</i>		P3	
32.	31673 <i>Puccinellia vassica</i>		P1	
33.	4179 <i>Pultenaea pinifolia</i>		P3	
34.	974 <i>Schoenus benthamii</i>		P3	
35.	20666 <i>Stachystemon</i> sp. <i>Keysbrook (R. Archer 17/11/99)</i>		P1	
36.	16769 <i>Synaphea hians</i>		P3	
37.	16862 <i>Synaphea petiolaris</i> subsp. <i>simplex</i>		P3	
38.	1033 <i>Tetraria australiensis</i>		T	
39.	1334 <i>Thysanotus glaucus</i>		P4	
40.	12412 <i>Verticordia densiflora</i> var. <i>pedunculata</i>		T	
41.	6093 <i>Verticordia lehmannii</i>		P4	
42.	12448 <i>Verticordia plumosa</i> var. <i>ananeotes</i>		T	
43.	12453 <i>Verticordia plumosa</i> var. <i>vassensis</i>		T	

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

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
---------	--------------	-------------	-------------------	------------------------------------

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



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: 14/11/17 13:08:24

[Summary](#)

[Details](#)

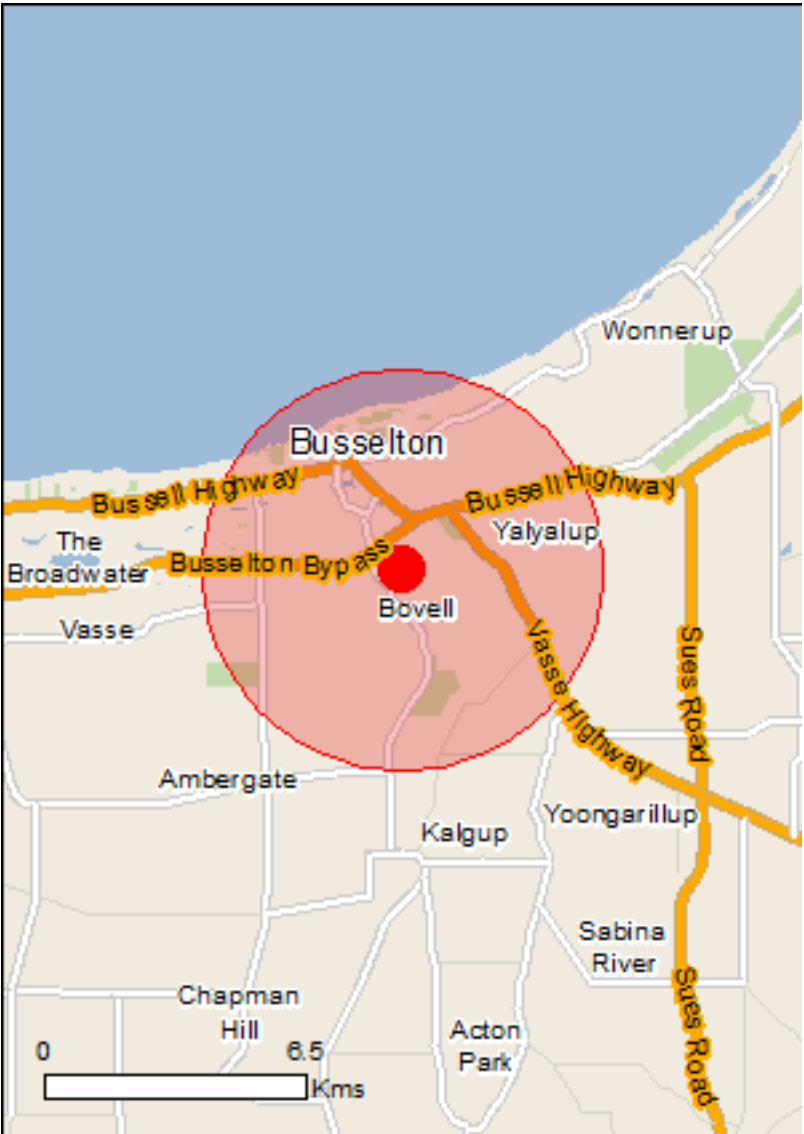
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

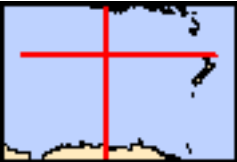
[Acknowledgements](#)



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

[Coordinates](#)

[Buffer: 5.0Km](#)



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	58
Listed Migratory Species:	41

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:	71
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	24
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)		[Resource Information]
Name		Proximity
Vasse-wonnerup system		Within Ramsar site

Listed Threatened Ecological Communities	[Resource Information]
--	--------------------------

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	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 may 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 habitat known to occur within area
--	------------	---

Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	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
--	------------	---

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
---	------------	---

Name	Status	Type of Presence
		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
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
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to 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

Name	Status	Type of Presence
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]	Vulnerable	Breeding 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
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to 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
Darwinia whicherensis Abba Bell [83193]	Endangered	Species or species habitat may 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 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

Name	Status	Type of Presence
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	habitat likely to occur within area Species or species habitat may occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat may occur within area
Verticordia plumosa var. ananeotes Tufted Plumed Featherflower [23871]	Endangered	Species or species habitat likely to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat known to 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

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 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

Name	Threatened	Type of Presence
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
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 cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may 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
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 Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or

Name	Threatened	Type of Presence	
Natator depressus Flatback Turtle [59257]	Vulnerable	aggregation known to occur within area	
Orcinus orca Killer Whale, Orca [46]		Foraging, feeding or related behaviour known to occur within area	
Rhincodon typus Whale Shark [66680]		Species or species habitat may occur within area	
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]	Vulnerable	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]	Endangered	Species or species habitat known to occur within area	
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area	
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area	
Calidris melanotos Pectoral Sandpiper [858]	Critically Endangered	Species or species habitat likely to occur within area	
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area	
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area	
Limosa lapponica Bar-tailed Godwit [844]	Critically Endangered	Species or species habitat known to occur within area	
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]		Species or species habitat likely to occur within area	
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	
Tringa glareola Wood Sandpiper [829]	Vulnerable	Species or species habitat known to occur within area	
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area	
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area	

Other Matters Protected by the EPBC Act

Commonwealth Land

[Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species

[Resource Information]

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

Name	Threatened	Type of Presence
Birds		
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 likely to occur within area
Calidris ruficollis Red-necked Stint [860]		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 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

Name	Threatened	Type of Presence
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
Himantopus himantopus 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
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]		Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	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

Name	Threatened	Type of Presence
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to 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 may occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
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

Name	Threatened	Type of Presence
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 habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		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
Stigmatopora olivacea a pipefish [74966]		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

Name	Threatened	Type of Presence
		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
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

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Sabina	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

Invasive Species

[Resource Information]

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

Name	Status	Type of Presence
Birds		
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

Name	Status	Type of Presence
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 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

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

-33.67273 115.35686

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 3. Definitions of Threatened and Priority List flora under the WC Act (DBCA, 2017b).

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

Appendix 4. Categories of Threatened Species under the EPBC Act (DotEE, 2017c).

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 5. 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 6. List of vascular flora found within the Survey Area at Lower Vasse River.

FAMILY	LATIN NAME	COMMON NAME	NATURALISED	PLANTED
Anacardiaceae	<i>Schinus terebinthifolius</i>	Pepper Tree	*	
Apiaceae	<i>Centella asiatica</i>	Centella		
Apocynaceae	<i>Vinca major</i>	Blue Periwinkle	*	
Araceae	<i>Zantedeschia aethiopica</i>	Arum Lily	*	
Asteraceae	<i>Lactuca saligna</i>	Wild Lettuce	*	
Asteraceae	<i>Sonchus asper</i>	Rough Sowthistle	*	
Casuarinaceae	<i>Allocasuarina fraseriana</i>	Sheoak		
Cyperaceae	<i>Carex divisa</i>	Divided Sedge	*	
Cyperaceae	<i>Ficinia nodosa</i>	Knotted Club Rush		
Cyperaceae	<i>Gahnia trifida</i>	Coast Saw-sedge		
Cyperaceae	<i>Lepidosperma gladiatum</i>	Coast Sword-sedge		
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken		
Dilleniaceae	<i>Hibbertia cuneiformis</i>	Cutleaf Hibbertia		
Euphorbiaceae	<i>Euphorbia terracina</i>	Geraldton Carnation Weed	*	
Fabaceae	<i>Acacia saligna</i>	Orange Wattle		
Fabaceae	<i>Lupinus cosentinii</i>	Blue Lupin	*	
Fabaceae	<i>Vicia sativa</i>	Common Vetch	*	
Fabaceae	<i>Viminaria juncea</i>	Swishbush		
Goodeniaceae	<i>Dampiera alata</i>	Winged-stem Dampiera		
Haemodoraceae	<i>Anigozanthos flavidus</i>	Tall Kangaroo Paw		
Juncaceae	<i>Juncus kraussii</i>	Sea Rush		
Juncaceae	<i>Juncus pallidus</i>	Pale Rush		
Menyanthaceae	<i>Liparophyllum lasiospermum</i>			
Moraceae	<i>Ficus carica</i>	Common Fig	*	
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint		
Myrtaceae	<i>Astartea scoparia</i>	Common Astartea		
Myrtaceae	<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush		x
Myrtaceae	<i>Corymbia calophylla</i>	Marri		
Myrtaceae	<i>Eucalyptus citriodora</i>	Lemon-scented Gum	*	x
Myrtaceae	<i>Eucalyptus rudis</i>	Flooded Gum		
Myrtaceae	<i>Kunzea glabrescens</i>	Spearwood		?
Myrtaceae	<i>Melaleuca cuticularis</i>	Saltwater Paperbark		
Myrtaceae	<i>Melaleuca huegelii</i>	Chenille Honeymyrtle		x
Myrtaceae	<i>Melaleuca raphiophylla</i>	Swamp Paperbark		
Myrtaceae	<i>Melaleuca viminea</i>	Mohan		
Myrtaceae	<i>Taxandria parviceps</i>			
Papaveraceae	<i>Fumaria muralis</i>	Wall Fumitory	*	
Poaceae	<i>Bromus diandrus</i>	Great Brome	*	
Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu Grass	*	
Poaceae	<i>Cortaderia selloana</i>	Pampas Grass	*	
Poaceae	<i>Cynodon dactylon</i>	Couch	*	
Poaceae	<i>Ehrharta calycina</i>	Perennial Veldt Grass	*	
Poaceae	<i>Ehrharta longiflora</i>	Annual Veldt Grass	*	
Poaceae	<i>Holcus lanatus</i>	Yorkshire Fog	*	
Poaceae	<i>Phleum pratense</i>	Timothy	*	
Polygonaceae	<i>Persicaria hydropiper</i>	Water Pepper		

FAMILY	LATIN NAME	COMMON NAME	NATURALISED	PLANTED
Polygonaceae	<i>Rumex conglomeratus</i>	Clustered Dock	*	
Proteaceae	<i>Banksia grandis</i>	Bull Banksia		
Proteaceae	<i>Banksia littoralis</i>	Swamp Banksia		
Salicaceae	<i>Salix babylonica</i>	Weeping Willow	*	
Solanaceae	<i>Solanum linnaeanum</i>	Apple of Sodom	*	
Typhaceae	<i>Typha orientalis</i>	Typha		