

# Environmental Assessment Study

## East Wanneroo District Structure Plan

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# Environmental Assessment Study

## East Wanneroo District Structure Plan



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## Executive Summary

The Department of Planning, Lands and Heritage (DPLH) are preparing the East Wanneroo District Structure Plan (DSP), which is intended to be a high-level, strategic planning framework which will provide the basis for future planning and urban development across the East Wanneroo area. The DSP will extend across 8047 ha (80 km<sup>2</sup>) incorporating parts of Gnangara, Jandabup, Mariginiup and Wanneroo, herein referred to as 'the site'.

The preparation of this Environmental Assessment Study (EAS) has been commissioned by DPLH, who defined the objective of the EAS as being *"to investigate the environmental values of the area and identify at a district level the areas of environmental significance that should be protected."*

Based on the outcomes of desktop investigations, the key environmental values identified as occurring within the site include:

- Known occurrences of threatened ecological communities (TECs), including the State listed SCP 20a 'Banksia attenuata woodland over species rich dense shrublands' and the Commonwealth listed 'Banksia Woodlands of the Swan Coastal Plain'. In addition, currently unknown further occurrences of TECs were identified as potentially occurring within the site.
- Known occurrences of threatened and priority flora. In addition, currently unknown, further occurrences of threatened and priority flora species were also identified as potentially occurring within the site.
- Threatened and priority fauna habitat, including potential foraging habitat for the threatened Carnaby's black cockatoo, which has been mapped as occurring across the site.
- Groundwater dependent ecosystems associated with the Gnangara Mound (superficial aquifer) of the Gnangara groundwater system, which underlies the site.
- Conservation category wetlands (CCWs), which represent the majority of surface water features and lakes within the site.

A number of existing land use planning and environmental considerations were also identified as being applicable to various parts of the site, including Metropolitan Region Scheme (MRS) 'Parks and Recreation' reserves, Bush Forever sites and local 'Conservation' reserves, a network of previously mapped regional ecological linkages and Public Drinking Water Sources Areas associated with the Gnangara Mound.

As part of this EAS, a preliminary vegetation assessment was undertaken, which included site-specific investigations. The original objectives of this assessment were to generally verify the results of desktop investigations and attain a general understanding of the vegetation types and condition across the site. However, completion of the desktop investigations identified that the site may support significant environmental values for which the full location and extent were currently unknown, that this could significantly influence the biodiversity conservation prioritisation approach for the DSP. Specifically, additional occurrences of the State listed SCP20a TEC (which is also part of the Commonwealth listed Banksia woodlands TEC) were identified as potentially occurring within the site, the exact extent of which was unknown given the majority of the site has not been subject to detailed flora and vegetation surveys.

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This missing information, being the extent and distribution of floristic community types which would clarify the potential extent of SCP 20a and other TECs, was identified as being critical to support the preparation of the DSP, given the potential TEC occurrences are key considerations in determining the district-level significant environmental values. On this basis, and in consultation with DPLH, the scope of site-specific flora and vegetation investigations was expanded.

The findings of the preliminary vegetation assessment confirmed that the site contains areas of vegetation which is potentially representative of the SCP 20a TEC, Banksia Woodlands TEC and the Tuart Woodlands and Forests of the SCP TEC (the nomination of which is currently being assessed pursuant to the EPBC Act).

In order to inform the preparation of the DSP, and based on the outcomes of the completed desktop and site-specific investigations, a spatial analysis of the environmental values within the site was subsequently undertaken, the outcomes of which are summarised as follows:

- Large areas of vegetation comprising a range of environmental values within the site are afforded an existing level of acknowledgement and protection through existing land use planning mechanisms and as such, are expected to facilitate biodiversity conservation outcomes (assuming these mechanisms are/continue to be implemented in the future). Areas of environmental values subject to existing protection mechanisms are shown in **Figure 18** and include:
  - Areas regionally reserved for P&R under the MRS
  - Areas locally reserved for conservation under the CoW DPS No. 2
  - Areas within Bush Forever sites
  - Areas within mapped CCWs or their nominal 50 m buffer.
- In addition to areas of environmental value subject to existing protection mechanisms, a number of areas of vegetation have been identified as potentially supporting significant environmental values. These areas have been identified as 'priority areas for further investigation', meaning detailed site specific investigations are required to confirm these environmental values and, if confirmed, are recommended to be prioritised for protection as part of the future planning process. These priority areas for further investigation are shown in **Figure 18** and have been determined based on a range of criteria including:
  - Occurrences of vegetation potentially representative of TECs, such as SCP 20a
  - Minimum patch size thresholds
  - Consideration of patch ecological viability with regard to shape and geometry.
- Of the identified priority areas for further investigation, a number of these were determined to be of highest priority due to range of factors, namely composition, size and connectivity of patches, consolidated land ownership, contribution to regional ecological linkages and alignment with identified 'Priority Local Natural Areas' (DoP 2011) and 'Local Natural Areas' (CoW 2018).



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The biodiversity conservation outcomes which could be realised across the site are summarised in **Appendix A**, which is based on the assumption that all areas subject to existing protection mechanisms (including MRS P&R reserves, Bush Forever sites, CoW local conservation reserves and CCWs (and nominal 50 m buffers)) are fully implemented, and that the following areas are further investigated and confirmed to support their identified environmental values, and are then retained through the future planning process such that all vegetation within these areas are ultimately protected for conservation:

- Vegetation within identified priority areas for further investigation
- Additional areas of vegetation potentially representative of the SCP 20a TEC in patches greater than 3 ha, and areas of the Tuart Woodlands TEC in patches greater than 3 ha (assuming this TEC is listed pursuant to the EPBC Act).

Based on the outcomes of this spatial analysis, recommendations have been provided for consideration by DPLH as part of the preparation of the DSP. These are presented in **Section 7** and should inform the DSP and the environmental considerations associated with this process, and any subsequent planning and development approvals processes within the site.

It is important to note that the recommended priority areas for further investigation were primarily identified based on their likelihood of being representative of SCP 20a, which is vegetation recognised as being a State and Commonwealth listed TEC. The occurrence of these environmental values will require confirmation through additional site specific flora and vegetation surveys. Should the Tuart Woodlands and Forests of the SCP TEC not be listed pursuant to the EPBC Act, and/or areas of vegetation thought to potentially be SCP 20a be subsequently confirmed to not be representative of SCP 20a, the information provided within the EAS would enable rationalisation of the priority areas for further investigation without compromising the overall regional biodiversity conservation outcomes.

The intention of the recommendations within this EAS are to provide a clear basis for biodiversity conservation outcomes at a regional scale within the East Wanneroo DSP. While a conservative approach has been taken in relation to the potential extent of SCP 20a across the site, there is some potential for areas of SCP 20a to occur outside of the extent identified within this EAS. There are also other flora and vegetation values that fall outside of the priority areas for further investigation, and adopting the recommendations does not mean that there will not be additional State and Commonwealth environmental approval requirements for any proposed clearing of vegetation that fall outside of these areas. However, it is intended that the information provided within this EAS will provide context to support those future approval processes. Even if the recommendations were adopted entirely, there is likely to be residual impacts to some environmental values that will require attention through these approval processes.

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## 1 Introduction

### 1.1 Background

The Department of Planning, Lands and Heritage (DPLH) are preparing the East Wanneroo District Structure Plan (DSP), which is intended to be a strategic planning document which will provide the basis for future planning and urban development of the East Wanneroo area. The DSP will provide an additional level of detail to the existing sub-regional level East Wanneroo Structure Plan (DoP 2011). The DSP will extend across 8047 ha (80 km<sup>2</sup>) incorporating parts of Gngangara, Jandabup, Mariginiup and Wanneroo, herein referred to as 'the site', the extent of which is shown in **Figure 1**.

The majority of the site is currently zoned 'Rural' under the Metropolitan Region Scheme (MRS) and supports a variety of existing rural activities. A number of MRS 'Parks and Recreation' reserves and Bush Forever sites also occur, which are generally associated with lakes and wetland features, in addition to areas of bushland. The balance of the site is reserved for 'Public Purposes' or 'State Forest' (associated with areas of historical and existing pine plantations) or zoned 'Rural – Water Protection' (associated with Water Corporation groundwater abstraction infrastructure and a water reservoir facility). The current MRS zones and reserves applicable to the site are shown in **Figure 2**.

In 2015, the Western Australian Planning Commission (WAPC) initiated MRS amendment 1308/41 to rezone part of the site from 'Rural' to 'Urban Deferred'. The proposed amendment was advertised for public comment in April 2016 and subsequently updated to include additional areas within the proposed 'Urban Deferred' zone. The updated amendment was endorsed by the Minister for Planning in May 2018 and is currently being tabled in parliament before it will take effect. The extent of the updated amendment area is shown in **Figure 2**.

### 1.2 Purpose of this report

The project scoping document issued by the DPLH identifies the purpose of this Environmental Assessment Study (EAS) as being *"to investigate the environmental values of the area and identify at a district level the areas of environmental significance that should be protected."* The scoping document also outlines that the EAS will inform the preparation of the DSP and will provide the basis for guiding regional conservation outcomes through the future land use planning process.

Therefore, this EAS identifies 'priority areas for further investigation' which, if confirmed to support the key environmental values predicted through this body of work, should then be a priority for protection through the planning process. However, it should be noted that:

- The identified priority areas for further investigation require additional site specific confirmation of values, and therefore the mapping of the priority areas for further investigation presented in this EAS should not be interpreted at this stage as being fundamentally constrained from development, or shown absolutely as such in the DSP.
- The priority areas for further investigation do not include all areas across the site which support environmental values. Values outside of identified priority areas will also require additional investigations and surveys, and most likely environmental approvals and additional conservation outcomes required to satisfy these.



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## 2 Desktop Investigations – Existing Environment

### 2.1 Landform and soils

#### 2.1.1 Regional geomorphology

The site is located in the central portion of the Swan Coastal Plain (SCP), which is approximately 20 to 30 km wide and consists of a series of geomorphic entities aligned parallel to the coastline. The youngest and western-most geomorphic entity is the Quindalup Dunes, followed by the progressively older Spearwood Dunes and the Bassendean Dunes, all of which are of aeolian origin. The alluvial Pinjarra Plain and Ridge Hill Shelf comprise the eastern portions of the Swan Coastal Plain, situated adjacent to the Darling escarpment (Seddon 2004).

The site is situated at the transition between the Spearwood Dunes and Bassendean Dunes (Gozzard 2011), as shown in **Figure 3**. The Spearwood Dunes system typically consists of siliceous sands over limestone, with hilly to undulating terrain. The older Bassendean Dune system is characterised by lower relief, with variable depth to groundwater, consisting of lower sandy hills interspersed with permanent and seasonal wetlands. A line of swamps, lakes and wetlands typically separate the two dunal systems, as is the case within the site (R. Salama *et al.* 2005).

#### 2.1.2 Soils

Soil mapping incorporating the site, as published by the Department of Primary Industries and Regional Development (DPIRD), is shown in **Figure 4**, with associated descriptions for each map unit provided in **Table 1**. In summary, the western portion of the site generally comprises yellow, sandy soils, typical of the Spearwood Dunes. The eastern half of the site is generally characterised by older, grey sandy soils, typical of the Bassendean Dunes. Poorly drained peaty and clayey soils occur in parts of the site, generally aligned with the extent of wetland features.

Table 1: Soil types occurring within the site (DPIRD 2017b)

Map unit	Soil type	Description
211Sp__Ky	Karrakatta sand yellow phase	Low hilly to gently undulating terrain. Yellow sand over limestone at 1-2 m.
211Sp__Ws	Spearwood seasonal swamps phase	Depressions with free water in winter. Humus podzols and peat.
211Sp__Wp	Spearwood permanent lakes and swamps phase	Depressions. Humus podzols and peats around the edges often with some diatomite zoned vegetation with heath on upper slopes.
212Bs__Wp	Bassendean permanent lakes and swamps phase	Depressions. Humus podzols and peats around the edges often with some diatomite zoned vegetation with heath on upper slopes.
212Bs__Ws	Bassendean seasonal swamps phase	Depressions with free water in winter. Humus podzols and peat.
212Bs__J	Bassendean, Joel phase	Poorly drained depressions. Humus podzols.
212Bs__G	Bassendean, Gavin phase	Flat or gently undulating landscape. Iron-humus podzols and some diatomite deposits.
212Bs__Ja	Bassendean, Jandakot phase	Jandakot low dunes. Slopes <10% and generally more than 5m relief. Grey sand over pale yellow sands generally underlain by humic and iron podsols.

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#### 2.1.3 Topography

The western portion of the site, associated with the Spearwood Dunes system, is characterised by hilly and undulating terrain, with relatively short but steep slopes. In contrast, the eastern portion of the site, associated with the Bassendean Dune system, is characterised by more gentle dunal formations, with comparatively flatter slopes. Low-lying areas within the site are associated with the occurrences of a number of wetland features, as mapped in the Department of Biodiversity, Conservation and Attraction's *Geomorphic Wetlands of Swan Coastal Plain* database. The topography of the site is shown in **Figure 3**.

#### 2.2 Flora, vegetation and fauna

##### 2.2.1 Native vegetation extent

The site contains approximately 1710 ha of native vegetation, as shown in **Figure 5**, which represents approximately 0.3% of the total 582,521 ha of native vegetation across the Swan Coastal Plain. This is based on the Department of Primary Industries and Regional Development (DPIRD) *Current Extent of Native Vegetation – Western Australia* spatial dataset. This dataset maps the extent of native remnant vegetation across the state and is based on aerial imagery analysis (as opposed to site-specific vegetation surveys). The dataset is updated by DPIRD on an annual basis, with the version of data used for this EAS published in August 2017.

The application of this dataset is limited to showing the spatial extent of remnant native vegetation, as it does not include any information regarding the vegetation composition or condition. As such, this vegetation does not replace vegetation mapping produced as part of site-specific flora and vegetation surveys.

Importantly, the extent of native vegetation referenced within this EAS is based on this DPIRD dataset. This is due to a lack of site-specific flora and vegetation surveys being completed across the site and this dataset being of a suitable resolution and accuracy for the purpose of informing the district-level planning process. Furthermore, the data has been ground-truthed as part of the site-specific Preliminary Vegetation Assessment to ensure general spatial accuracy, as discussed in **Section 4**.

##### 2.2.2 Regional context

Regional vegetation complex mapping undertaken by Heddlé *et al.* (1980) indicates that six broad vegetation complexes occur across the site, as described in **Table 2** and shown in **Figure 5**. Whilst each vegetation complex has its own unique characteristics, upland vegetation within the site is generally described as comprising some form of a banksia/eucalyptus-banksia woodland or forest community. Wetland associated vegetation also occurs within low-lying areas of the site.

Whilst some site-specific, detailed flora and vegetation surveys have been completed for a small number of specific land parcels within the site, detailed vegetation community and vegetation condition information is not available for the majority of the site.

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Table 2: Regional vegetation complexes

Complex	% Remaining <sup>1</sup>	Description
<b>Spearwood Dunes</b>		
Karrakatta – Central and South	23.0 %	Predominantly open forest of <i>Eucalyptus gomphocephala</i> (tuart) - <i>Eucalyptus marginata</i> (jarrah) - <i>Corymbia calophylla</i> (marri) and woodland of <i>Eucalyptus marginata</i> - Banksia species.
<b>Bassendean Dunes</b>		
Bassendean – North	71.8 %	Vegetation ranges from a low open forest and low open woodland of Banksia species - <i>Eucalyptus tottiana</i> to low woodland of Melaleuca species and sedgelands which occupy the moister sites.
Bassendean – North Transition	91.1 %	A transition complex of low open forest and low woodland of Banksia species - <i>Eucalyptus tottiana</i> on a series of high sand dunes. The understorey species reflect similarities with both the Bassendean-North and Karrakatta-North vegetation complexes.
Bassendean – Central and South	26.1 %	Vegetation ranges from woodland of <i>Eucalyptus marginata</i> (jarrah) - <i>Allocasuarina fraseriana</i> (sheoak) - Banksia species to low woodland of Melaleuca species, and sedgelands on the moister sites. This area includes the transition of <i>Eucalyptus marginata</i> to <i>Eucalyptus tottiana</i> in the vicinity of Perth.
<b>Wetlands</b>		
Pinjar	30.0 %	Vegetation ranges from woodland of <i>Eucalyptus marginata</i> (jarrah) - Banksia species to a fringing woodland of <i>Eucalyptus rudis</i> - <i>Melaleuca preissiana</i> and sedgelands.
Herdsmen	33.9 %	Sedgelands and fringing woodland of <i>Eucalyptus rudis</i> - Melaleuca species.

<sup>1</sup> percentage of original pre-European extent of vegetation complex remaining across the Swan Coastal Plain IBRA Region (EPA 2015).

Note: EPA Guidance Statement 33 Environmental Guidance for Planning and Development (EPA 2008) identifies vegetation complexes to be of 'high conservation significance' where less than 10% of its extent remains within a 'constrained area' (i.e. the Bush Forever study area, being the Swan Coastal Plain portion of the MRS). Environmental values of high conservation significance are identified by the EPA as a priority for protection (EPA 2008). More recently, the EPA have reiterated their objective to retain at least 10% of original extent of ecological communities within constrained areas, such as the Perth Metropolitan Area, and 30% in unconstrained areas (EPA 2015).

The remainder of the site which is not identified as comprising native vegetation is likely to have been subject to historical clearing to support previous or existing land uses, including rural pursuits and pine plantations. Based on spatial data published by the Forest Products Commissions (2017), historically cleared pine plantations comprise 19% of the site (1564 ha), whilst existing pine plantations comprise 7% of the site (600 ha).

### 2.2.3 Threatened and priority ecological communities

Ecological communities can be described as vegetation communities that are assemblages of species that occur together in a type of habitat. 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

At a federal level, TECs are afforded statutory protection under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). TECs listed under the EPBC Act are categorised as either 'critically endangered', 'endangered' or 'vulnerable'. Any action likely to have a significant impact on a 'critically endangered' or 'endangered' TEC listed under the EPBC Act requires approval from the federal Minister for the Environment.

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An EPBC Act Protected Matters Report was generated for the site, provided in **Appendix D**, which identified one EPBC Act listed TEC as being likely to occur within the site - *Banksia Woodlands of the Swan Coastal Plain ecological community* (herein referred to as the 'Banksia Woodlands TEC'), as detailed in **Table 3** and shown in **Figure 6**.

Table 3: EPBC Act listed TECs likely to occur within the site

Community name	Status	Type of presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area

It is also important to note that the *Tuart Woodlands and Forests of the Swan Coastal Plain ecological community* (herein referred to as the 'Tuart Woodlands TEC') was nominated to be listed as 'Critically Endangered' pursuant to the EPBC Act in October 2017, and the associated nomination assessment process is currently being completed. An outcome regarding the potential listing of this community pursuant to the EPBC Act is yet to be reached and a decision is expected during 2018.

On this basis, potential occurrences of the Tuart Woodlands TEC within the site has been considered as part of this study. Regional scale mapping for potential occurrences of vegetation comprising a tuart woodland structure (CALM 2003) was used by DoEE to inform the regional extent of the nominated Tuart Woodland TEC. The extent of vegetation within the site potentially representative of the Tuart Woodland TEC, based on CALM (2003) mapping, is shown in **Figure 6**.

At a state level, TECs were formerly not provided statutory acknowledgment or protection under the *Wildlife Conservation Act (WC Act)*. Instead, a list of TECs were endorsed by the Minister for the Environment and then considered through state approval processes, such as the environmental impact assessment process pursuant to Part IV of the *Environmental Protection Act 1986 (EP Act)* and the Clearing Permit process pursuant to Part V of the EP Act.

Where an ecological community is under consideration for listing as a TEC, but which does not yet meet survey criteria or has not been adequately defined, or which is rare but not currently threatened, it is identified as a 'priority ecological community' (PEC). PECs are also considered through the above state environmental approvals process.

The recently proclaimed *Biodiversity Conservation Act 2016 (BC Act)* replaces the WC Act and provides direct statutory acknowledgement and protection for TECs. However, the provisions of the WC Act relating to TECs are yet to be enacted under corresponding regulations. Once this component of the BC Act is enacted, it is expected that those TECs to be listed under the BC Act will be consistent with those currently endorsed by the Minister for the Environment.

A review of the Department of Biodiversity, Conservation and Attractions (DBCA) threatened and priority ecological communities' database (DBCA 2017a) identified known occurrences of 14 TECs and PECs within 10 km of the site, as shown in **Figure 6** and detailed in **Table 4**.



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Table 4: State listed TECs and PECs known to occur within 10 km of the site (DBCA 2017a)

Community code	Community name	Status	Known occurrence within site (DBCA 2017a)
SCP 02	Southern wet shrublands, Swan Coastal Plain	Endangered	Not recorded to date
SCP 10a	Shrublands on dry clay flats	Endangered	Not recorded to date
SCP 20a	<i>Banksia attenuata</i> woodland over species rich dense shrublands	Endangered	Known to occur
SCP 21c	Low lying <i>Banksia attenuata</i> woodlands or shrublands	Priority 3	Not recorded to date
SCP 22	<i>Banksia ilicifolia</i> woodlands	Priority 3	Not recorded to date
SCP 23b	Swan Coastal Plain <i>Banksia attenuata</i> - <i>Banksia menziesii</i> woodlands	Priority 3	Known to occur
SCP 24	Northern Spearwood shrublands and woodlands	Priority 3	Not recorded to date
SCP 25	Southern <i>Eucalyptus gomphocephala</i> – <i>Agonis flexuosa</i> woodlands	Priority 3	Not recorded to date
SCP 26a	<i>Melaleuca huegelii</i> - <i>Melaleuca acerosa</i> shrublands on limestone ridges	Endangered	Not recorded to date
SCP 29a	Coastal shrublands on shallow sands	Priority 3	Not recorded to date
SCP 29b	Acacia shrublands on taller dunes	Priority 3	Not recorded to date
Multiple	<i>Banksia</i> dominated woodlands of the Swan Coastal Plain IBRA Region	Priority 3	Known to occur
Muchea Limestone	Shrublands and woodlands on Muchea Limestone	Endangered	Not recorded to date
Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Critically Endangered	Not recorded to date

Given site-specific, detailed flora and vegetation surveys have not been completed across the entirety of the site, there is a high likelihood of additional, currently unknown occurrences of TECs and/or PECs to exist within the site. The known occurrences of these communities within the site, as recorded in the DBCA database and shown in **Figure 6**, should therefore not be considered exhaustive in terms of all occurrences until detailed flora and vegetation surveys are undertaken.

Furthermore, based on the distribution of known occurrences of the SCP 20a *Banksia attenuata* woodland over species rich dense shrublands (herein referred to as the 'SCP 20a TEC') within and adjacent to the site, and in consideration of the soil, landform and regional vegetation patterns across the locality, additional occurrences of this TEC are considered likely to occur within the site. This is discussed further in **Section 4**.

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#### 2.2.4 Threatened and priority flora

Certain flora species that are considered to be rare or under threat warrant special protection under state and/or federal legislation. At a federal level, flora species may be listed as 'threatened' pursuant to the EPBC Act and any action likely to have a significant impact on a listed threatened species requires approval from the Commonwealth Minister for the Environment.

At a state level, plant species could formerly be classed as threatened flora (TF) under the WC Act. Species which were potentially rare or threatened, or meet the criteria for near threatened, or have recently been removed from the threatened species list were classed as 'priority' flora (PF) species. However, the recently proclaimed BC Act will replace the WC Act and provide increased statutory protection for TF. However, the provisions of the WC Act relating to TF are yet to be enacted under corresponding regulations.

In order to identify TF and PF species which are known to occur within the site or surrounding area, an EPBC Act Protected Matters Report was generated, provided in **Appendix D**, and a review of the DBCA threatened and priority flora database (DBCA 2017b) was undertaken. The combined outcomes of these investigations are summarised in **Table 5**, which lists all PF and TF recorded as occurring within the site and/or wider locality.

Given site-specific, detailed flora and vegetation surveys have not been completed across the entirety of the site, there is a potential for additional, currently unknown occurrences of TF and/or PF to exist within the site. As such, the known occurrences of these flora within the site, as recorded in the DBCA database and shown in **Figure 6**, should not be considered exhaustive in terms of all occurrences.

Table 5: TF and PF known to occur within site and/or wider locality

Species	State listing	Federal listing	Known occurrence within site (DBCA 2017b)
<i>Acacia benthamii</i>	P2	-	Known to occur
<i>Andersonia gracilis</i>	T	EN	Not recorded to date
<i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>	P4	-	Not recorded to date
<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	T	VU	Not recorded to date
<i>Austrostipa mundula</i>	P3	-	Not recorded to date
<i>Baeckea</i> sp. Limestone (N. Gibson & M.N. Lyons 1425)	P1	-	Not recorded to date
<i>Caladenia huegelii</i>	T	EN	Known to occur
<i>Calectasia elegans</i>	P2	-	Not recorded to date
<i>Conostylis bracteata</i>	P3	-	Not recorded to date
<i>Cyathochaeta teretifolia</i>	P3	-	Known to occur
<i>Dampiera triloba</i>	P3	-	Known to occur
<i>Diuris micrantha</i>	T	VU	Not recorded to date
<i>Diuris purdiei</i>	T	EN	Not recorded to date
<i>Drakaea elastica</i>	T	EN	Not recorded to date

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Species	State listing	Federal listing	Known occurrence within site (DBCA 2017b)
<i>Drakaea micrantha</i>	T	VU	Not recorded to date
<i>Drosera x sidjamesii</i>	P1	-	Known to occur
<i>Eleocharis keigheryi</i>	T	VU	Not recorded to date
<i>Grevillea curviloba</i> subsp. <i>curviloba</i>	T	EN	Not recorded to date
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	T	EN	Not recorded to date
<i>Jacksonia sericea</i>	P4	-	Known to occur
<i>Lepidosperma rostratum</i>	T	EN	Not recorded to date
<i>Marianthus paralius</i>	T	-	Not recorded to date
<i>Pimelea calcicola</i>	P3	-	Known to occur
<i>Poranthera moorokatta</i>	P2	-	Not recorded to date
<i>Schoenus griffinianus</i>	P4	-	Not recorded to date
<i>Stenanthemum sublineare</i>	P2	-	Not recorded to date
<i>Stylidium longitubum</i>	P4	-	Not recorded to date
<i>Stylidium paludicola</i>	P3	-	Not recorded to date
<i>Styphelia filifolia</i>	P3	-	Known to occur
<i>Tetraria</i> sp. <i>Chandala</i> (G.J. Keighery 17055)	P2	-	Not recorded to date
<i>Thelymitra dedmaniarum</i>	T	EN	Not recorded to date
<i>Thelymitra variegata</i>	P2	-	Not recorded to date
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	P4	-	Not recorded to date
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	-	Not recorded to date

**Note:** Threatened and Priority Flora occurrences are based on extracts from the DBCA *Threatened (Declared Rare) and Priority Flora Database* and the WA Herbarium *Specimen Database*. These records do not necessarily represent a comprehensive listing of all threatened and priority flora of the area, nor are they necessarily spatially accurate.

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#### 2.2.5 Threatened and priority fauna

Certain fauna species that are considered to be rare or under threat warrant special protection under state and/or federal legislation. At a federal level, fauna species may be listed as 'threatened' pursuant to the EPBC Act and any action likely to have a significant impact on a listed threatened species requires approval from the Commonwealth Minister for the Environment.

At a state level, fauna species could formerly be classed as 'threatened' under the WC Act. In addition to this, DBCA maintains a list of priority fauna species which, while not considered threatened under the WC Act and therefore not protected directly, involve some concern over their long-term survival.

The recently proclaimed BC Act will replace the WC Act and provide statutory acknowledgement and increased protection for threatened fauna. The BC Act will introduce new provisions for the protection of threatened fauna habitat, which is not previously identified in the WC Act. However, the provisions of the WC Act relating to threatened fauna are yet to be enacted under corresponding regulations.

In order to identify threatened and priority fauna species which are known or likely to occur within the site or surrounding area, an EPBC Act Protected Matters Report was generated, provided in **Appendix D**, and a review of the DBCA threatened and priority fauna database (DBCA 2017c) was undertaken. The combined outcomes of these investigations are summarised in **Table 6**, which lists all priority and threatened fauna recorded as occurring or considered likely to occur within the site and/or wider locality. A review of each species known distribution and habitat preferences has also been completed to assess the likelihood of their occurrence within the site.

Regional habitat mapping for the threatened Carnaby's black cockatoo (Glossop *et al.* 2011) identifies approximately 1309 ha of potential foraging habitat within the site. In addition, a number of known and potential black cockatoo roost locations occur within the site (Peck *et al.* 2017). The extent of these habitat values within the site are shown in **Figure 7**. Part of the site is situated within the western extent of the Gnangara-Pinjar pine plantation, which provides an important roosting and foraging habitat for Carnaby's black cockatoo, with the species use of this habitat within the plantation areas reported to be increasing in recent years (Peck *et al.* 2017).

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Table 6: Threatened and priority fauna species recorded as occurring or considered likely to occur within the site and/or wider locality

Species	Common name	State listing	EPBC Act listing	Occurrence within site
<b>Mammals</b>				
<i>Dasyurus geoffroii</i>	chuditch	Vulnerable	Vulnerable	Not recorded in locality to date, however site within known range.
<i>Isoodon obesulus fusciventer</i>	quenda	Priority 4	-	Commonly recorded within site, which contains suitable habitat.
<i>Macropus irma</i>	western brush wallaby	Priority 4	-	Historically recorded in locality, site may contain potential habitat.
<b>Reptiles</b>				
<i>Neelaps calonotos</i>	black-striped snake	Priority 3	-	Historically recorded within site, which contains suitable habitat.
<b>Invertebrates</b>				
<i>Hylaeus globuliferus</i>	woolybush bee	Priority 3	-	Historically recorded in locality, site may contain potential habitat.
<i>Leioproctus contrarius</i>	a short-tongued bee	Priority 3	-	Historically recorded in locality, site may contain potential habitat.
<i>Synemon gratiosa</i>	graceful sunmoth	Priority 4	-	Historically recorded in locality, site may contain potential habitat.
<b>Birds</b>				
<i>Ardea modesta</i>	great egret	Migratory		Historically recorded within site, wetland areas provide suitable habitat.
<i>Botaurus poiciloptilus</i>	Australasian bittern	Endangered	Endangered	Historically recorded within site, wetland areas provide suitable habitat.
<i>Calidris canutus</i>	Red knot	Migratory	Endangered	Not recorded in locality to date, considered unlikely to occur.
<i>Calidris ferruginea</i>	curlew sandpiper	Vulnerable	Critically Endangered	Not recorded in locality to date, considered unlikely to occur.
<i>Calidris ruficollis</i>	red-necked stint	Migratory	Migratory	Historically recorded within site, site contains suitable habitat.
<i>Calyptorhynchus banksii naso</i>	forest red-tailed black cockatoo	Vulnerable	Vulnerable	Historically recorded within site, site supports suitable habitat and is within current species range.
<i>Calyptorhynchus baudinii</i>	Baudin's black cockatoo	Endangered	Endangered	Historically recorded within site, however considered unlikely to occur given site is outside of typical species range.
<i>Calyptorhynchus latirostris</i>	Carnaby's black cockatoo	Endangered	Endangered	Commonly recorded within site, which contains extensive suitable habitat.



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Species	Common name	State listing	EPBC Act listing	Occurrence within site
<i>Falco peregrinus macropus</i>	peregrine falcon	Schedule 7	-	Historically recorded in locality, site may form part of large home range.
<i>Leipoa ocellata</i>	malleefowl	Vulnerable	Vulnerable	Site outside of known range. Species considered unlikely to occur.
<i>Merops ornatus</i>	rainbow bee-eater	Migratory	Marine	Historically recorded within site, site contains suitable habitat.
<i>Numenius madagascariensis</i>	Eastern curlew	Vulnerable	Critically Endangered	Not recorded in locality to date, considered unlikely to occur.
<i>Oxyura australis</i>	blue-billed duck	Priority 4	-	Historically recorded in locality, site contains suitable habitat.
<i>Plegadis falcinellus</i>	glossy ibis	Migratory	Migratory	Historically recorded within site, wetland areas provide suitable habitat.
<i>Rostratula australis</i>	painted snipe	Endangered	Endangered	Not recorded in locality to date, however site contains suitable habitat.
<i>Sterna nereis</i>	fairy tern	Vulnerable	Vulnerable	May potentially utilise wetland areas within the site, however typically utilises coastal habitats.
<i>Tringa glareola</i>	wood sandpiper	Migratory	Migratory	Historically recorded within site, wetland areas provide suitable habitat.
<i>Tringa nebularia</i>	greenshank	Migratory	Migratory	Historically recorded within site, wetland areas provide suitable habitat.
<i>Tringa stagnatilis</i>	marsh sandpiper	Migratory	Migratory	Historically recorded within site, wetland areas provide suitable habitat.
<i>Tyto novaehollandiae</i>	masked owl	Priority 3	-	Historically recorded within site, site contains suitable habitat.

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## 2.3 Hydrology

### 2.3.1 Groundwater

The site is located above the Gngangara groundwater system, which extends across an area of 2200 km<sup>2</sup> north of the Swan River, west of the Darling Escarpment and up to Gingin. Locally, the site is situated at the interface between the proclaimed Wanneroo Groundwater Area and Gngangara Groundwater Area. The groundwater aquifers underlying the site comprises:

- The Superficial Swan aquifer (unconfined), commonly referred to as the Gngangara Mound.
- The Leederville aquifer (confined).
- The Yarragadee North aquifer (confined).

Historical maximum groundwater contours (2001) published by the Department of Water and Environmental Regulation (DWER) and shown in **Figure 3**, indicate that groundwater flows in a south-westerly direction beneath the site. Further information regarding groundwater is provided in a separate *District Water Management Strategy* (DWMS), which was commissioned by DPLH to be prepared concurrently with this EAS.

The Gngangara groundwater system is known to support a variety of groundwater dependent ecosystems, both aquatic and terrestrial, which rely on permanent or intermittent access to groundwater in order to maintain associated communities of plants, animals, ecosystem processes and services. Aquatic groundwater dependent ecosystems, such as wetlands, typically rely on surface expressions of groundwater, whilst terrestrial groundwater dependent ecosystems, such as certain vegetation communities, typically rely on the presence of subsurface groundwater (BoM 2018). The *Groundwater Dependent Ecosystems Atlas* (BoM 2018), which is based on national and regional-scale studies and investigations, identifies a number of groundwater dependent ecosystems as occurring within the site, as shown in **Figure 8**.

The site contains a number of groundwater abstraction bores operated by the Water Corporation, which supply groundwater resources to the public drinking water supply. This abstraction is managed through Ministerial Statement (MS) 819 *Gngangara Mound groundwater resources*, including consideration of environmental water requirements which must be maintained for groundwater dependent ecosystems located in proximity to the abstraction bores. Within the site, those groundwater dependent ecosystems specifically considered by MS 819 include Mariginiup Lake and Jandabup Lake.

### 2.3.2 Wetlands

Wetlands are areas which are permanently, seasonally or intermittently waterlogged or inundated with water. Naturally occurring wetland features are common across the Swan Coastal Plain and can contain fresh or salty water, which may be flowing or still. DBCA classifies wetland types based on their inundation characteristics and physical structure, as outlined in **Table 7**.

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Table 7: Wetland classifications used by DBCA (Semeniuk 1987)

	Basin	flat	channel	slope	highland
Permanently inundated	Lake	-	River	-	-
Seasonally inundated	Sumpland	Floodplain	Creek	-	-
Intermittent inundation	Playa	Barlkarra	Wadi	-	-
Seasonally waterlogged	Dampland	Palusplain	Trough	Paluslope	Palusmont

In order to provide an indication of the relative condition and conservation value of mapped geomorphic wetlands on the Swan Coastal Plain, each wetland has been evaluated and assigned one of three management categories detailed in **Table 8**.

Table 8: Geomorphic wetlands of the Swan Coastal Plain management categories (Hill et al. 1996)

Management category	description of wetland	management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource Enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

DBCA maintains the *Geomorphic Wetlands of Swan Coastal Plain* spatial dataset, which specifies the classifications and management categories of all wetland features across the Swan Coastal Plain. Based on a review of this dataset, 82 geomorphic wetlands are mapped as occurring partly or wholly within the site, as shown in **Figure 9**, including 24 CCWs, 25 REWs and 33 MUWs.

The majority of wetlands within the site support native vegetation within the wetland core or wetland fringe areas, which is typically characterised by the wetland-type Pinjar or Herdsman vegetation complexes. In addition, a number of these wetland features are known to be groundwater dependent ecosystems, as shown in **Figure 8**, and as such rely on surface expressions of groundwater, typically provided by the unconfined Superficial aquifer (the Gnangara Mound), for their ongoing viability.

### 2.3.3 Natural waterways

Based on a review of publically available datasets published by DWER, the site does not contain any mapped natural waterway features. Given some areas of the site experience minimal separation between land surfaces and groundwater levels, it is possible that artificial drainage infrastructure has been installed in some areas of the site.

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## 2.4 Summary of key environmental values

Based on the known environmental attributes and characteristics of the site identified through the undertaking of desktop investigations discussed in **Section 0**, the key existing environmental values within the site have been determined and are summarised in **Table 9**. These are the key environmental values which should inform the district structure planning process.

*Table 9: Summary of key environmental values within the site*

Factor	Key environmental values
Landform and soils	There site does not contain any key environmental values relating to landform and soils.
Vegetation	<p>The site contains 1,709 ha of native vegetation, representing 0.3% of the total vegetation extent across the Swan Coastal Plain (582,521 ha). Vegetation comprising the following regional vegetation complexes are considered key environmental values:</p> <ul style="list-style-type: none"> <li>• Karrakatta Complex – Central and South (23% remaining)</li> <li>• Bassendean Complex – Central and South (26.1% remaining)</li> <li>• Pinjar Complex (30% remaining)</li> <li>• Herdsman Complex (33.9% remaining)</li> </ul> <p>Vegetation representative of the Bassendean – North or Bassendean - North Transition complexes is not considered a key environmental value as 71.8% and 91.1% of their pre-European extent remains across the Swan Coastal Plain, respectively.</p> <p>Based on statistics published by the EPA (2015), vegetation within the site represents less than 3% of the current total extent of each complex across the Swan Coastal Plain, with the exception of the Pinjar complex, of which 40% of its remaining extent across the Swan Coastal Plain occurs within the site. These statistics are summarised in <b>Section 6.1</b> and specifically <b>Table 14</b>.</p> <p>In addition to the above, occurrences of TECs within the site represent key environmental values. This includes occurrences of the state listed SCP 20a TEC, in addition to the EPBC Act listed Banksia Woodlands TEC. However, the site has not been subject to detailed flora and vegetation investigations and as such the known occurrences of TECs within the site, as documented in the DBCA database, should not be considered exhaustive in terms of all occurrences across the site. Furthermore, based on the distribution of known occurrences of the SCP 20a TEC within and adjacent to the site, and in consideration of the soil, landform and regional vegetation patterns across the locality, additional occurrences of this TEC are considered likely to potentially occur within the site. This is discussed further in <b>Section 4.3.3</b>.</p>
Flora	Occurrences of TF and PF represent key environment values. However, the site has not been subject to detailed flora and vegetation investigations and as such the known occurrences of these flora within the site, as documented in the DBCA database, should not be considered exhaustive in terms of all occurrences across the site.
Terrestrial fauna	Threatened and priority fauna habitat within the site represent key environmental values. This includes potential foraging habitat for Carnaby's black cockatoo, which is mapped as occurring across the majority of the site. The site is mapped as containing approximately 1,309 ha of CBC foraging habitat, which represents 3% of the total predicted extent (approximately 43,964 ha) of this habitat across the Swan Coastal Plain.
Groundwater	The site is located within the Gngangara groundwater system, which incorporates the Gngangara Mound and supports a range of groundwater dependent ecosystems which occur within the site. This groundwater resource represents a key environmental value underlying the site.
Wetlands	The 24 CCWs which occur within the site, a number of which are known to be groundwater dependent ecosystems, represent key environmental values. These wetlands incorporate the major surface water features and lakes within the site. The SCP is mapped as containing over 3894 CCWs, with a total vegetated area of 31,307 ha. Vegetated areas of CCWs within the site total approximately 394.4 ha, comprising 1.3% of the total across the SCP.
Natural waterways	There site does not contain any key environmental values relating to natural waterways.

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### 3 Desktop Investigations - Land Use Planning Considerations

#### 3.1 Metropolitan Region Scheme

##### 3.1.1 Parks and Recreation Reserves

Approximately 1684 ha (21%) of the site is reserved for 'Parks and Recreation' (P&R) under the MRS, as shown in **Figure 2**. P&R reserves are typically associated with land identified for long-term conservation and/or recreational land uses. Within the site, these reserves generally align with the major lakes and wetlands, in addition to some large areas of remnant bushland. The vast majority of the land parcels which comprises the P&R reserves within the site are owned by the state, however a number of parcels are privately owned as freehold land.

##### 3.1.2 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000).

20 Bush Forever sites occur within the site, as shown in **Figure 2** and detailed in **Table 10**. The majority of Bush Forever Sites align with existing MRS P&R reserves and occur on Crown Land.

*Bush Forever - Volume 1: Policies, principles and processes* (Government of WA 2000) included a range of potential implementation options to achieve long term conservation outcomes for identified Bush Forever sites. Amongst others, some of these implementation options included reservation of sites, 'negotiated planning solutions' and 'rural complimentary mechanisms'. Given the large amount of rural zoned land within the site, a number of Bush Forever sites have been identified for implementation through 'rural complementary mechanisms'.

*Bush Forever - Volume 1: Policies, principles and processes* (Government of WA 2000) describes the implementation of Bush Forever sites through 'rural complimentary mechanisms' as a process which involves 'individually tailored agreements between landowners and government. They may include statutory conservation land covenants, management agreements, assistance and advice. The focus is on encouraging private land management to achieve the protection of bushland values.'

Within the site, Bush Forever sites 324 (part), 326 (part), 327 (part) and 471 (part) were originally identified for implementation through 'rural complementary mechanisms'. Such conservation outcomes have generally been achieved in these areas, given they have supported rural uses whilst maintaining areas of remnant bushland. However, the proposed intensification of land use across the site from rural to urban means that 'rural complementary mechanisms' are unlikely to be suitable for or relevant to the ongoing implementation of Bush Forever conservation outcomes. However, the proposed change in land uses and associated planning process provides an opportunity to reassess the current environmental values of Bush Forever sites and what an implementation mechanisms may be appropriate for the future. **Section 6.3.3** provides an assessment of where rationalisation of current Bush Forever sites and their current implementation mechanisms may be appropriate.

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Table 10: Bush Forever Sites occurring within the site

Site no.	Site name	Recorded FCTs	Originally proposed implementation method and recommendations
104-108, 433, 441	State Forest 65 – Gngangara Plantation Bushland	Not sampled or inferred	Sites with some existing protection (the existing care, control and management of these sites is endorsed)
141	Numbat Road Bushland	Not sampled or inferred	Sites with some existing protection (the existing care, control and management of these sites is endorsed)
146	Numbat Road Bushland	Not sampled or inferred	Sites with some existing protection (the existing care, control and management of these sites is endorsed)
147	Mariginiup Lake and Adjacent Bushland	Not sampled or inferred	Sites with some existing protection (the existing care, control and management of these sites is endorsed)
193	Gngangara Lake and Adjacent Bushland	S3, S17, 23a	Sites with some existing protection (the existing care, control and management of these sites is endorsed)
324	Jandabup Lake and Adjacent Bushland	S3, S17, 23a	Part A: Site with some existing protection (the existing purpose, care, control and management intent of Reserve 7349 is endorsed) Part B: Rural complementary mechanisms (to be determined)
326	Hawkins Road Bushland	4, 14, 23a, 23b	Part A: Site with some existing protection (the existing purpose, care, control and management intent of CALM managed land is endorsed) Part B: Rural complementary mechanisms (part agreement proposed, part to be determined)
327	Badgerup Lake and Adjacent Bushland	24, 28	Part A: Site with some existing protection (existing MRS P&R) Part B: Proposed Parks and Recreation reservation (agreed - existing Planning Control Area) Part C: Other government land mechanism (currently: MRS P&R) Part D: Rural complementary mechanism (to be determined)
398	Chitty Road Bushland	5, 21c, 22, 23a, 23b	Sites with some existing protection (the existing care, control and management of these sites is endorsed)
399	Melaleuca Park and Adjacent Bushland	S2, 4, 21c, 22, 23a, 23b	Part A: Site with some existing protection (the existing care, control and management of this site is endorsed)
443	Little Coogee Flat	Not sampled or inferred	Part A: Site with some existing protection (existing MRS State Forest) Part B: Other government land mechanism (currently: MRS P&R)
463	Starlight Grove Bushland	Not sampled or inferred	Basic Raw Materials Negotiated Planning Solution (agreement proposed)
469	Caporn Street Bushland	28	Other government land mechanism (currently: MRS P&R)
470	Garden Park Bushland	28	Other government land mechanism (currently: MRS P&R)
471	High Road Bushland	28	Part A: Other government land mechanisms (currently: MRS P&R) Part B: Rural complementary mechanism (to be determined) Part C: Local reserve mechanism

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### 3.2 CoW District Planning Scheme No. 2

#### 3.2.1 Local Conservation Reserves

The City of Wanneroo (CoW) District Planning Scheme (DPS) No. 2 identifies regional P&R reserves, as shown in the MRS, in addition to local P&R reserves specific to the DPS. However, both regional and local P&R reserves are not exclusively intended for conservation land uses.

On this basis, Amendment 109 to the CoW DPS No. 2 was introduced in 2016 to establish a new local 'conservation' reserve classification, the principal purpose of which is to provide protection of conservation areas in perpetuity, enabling the CoW to achieve local biodiversity conservation outcomes through the DPS. The CoW adopted *Local Planning Policy 1.1: Conservation Reserves* in May 2018, which specifies the minimum requirements for an area to be locally reserved for conservation. LPP 1.1 requires any given patch to satisfy the ecological viability criteria outlined in *Local Planning Policy 4.3: Public Open Space*, which in effect generally limits the suitability of retaining patches less than 4 ha except where they support significant environmental values and satisfy a range of other criteria.

Five land parcels within the site are locally reserved for 'Conservation' under the CoW DPS No. 2, as shown in **Figure 2** and detailed in **Table 11**. All of these reserves are vegetated and their ongoing management for conservation purposes is vested with the CoW.

Table 11: CoW DPS No. 2 local 'Conservation' reserves within the site

Reserve no.	Reserve name	Tenure and management	Current land use
26336	Damian Park	Crown land - CoW managed	Bushland
27466	Golfview Park	Crown land - CoW managed	Bushland
38656	Coogee Park	Crown land - CoW managed	Bushland
41999	Tuscan Park	Crown land - CoW managed	Bushland and drainage area
42559	Vintage Park	Crown land - CoW managed	Bushland and drainage area

#### 3.2.2 Local Biodiversity Strategy

The existing *Local Biodiversity Strategy 2011-2016* (LBS) was prepared by CoW in response to anticipated future urban growth across the City, and the need for a plan to assist in the conservation of existing biodiversity assets as part of the future development process. The biodiversity assets which are the subject of the LBS are referred to as 'local natural areas' (LNAs) and are defined as areas of remnant vegetation which are currently unprotected. This includes areas of:

- Remnant vegetation on private land
- Remnant vegetation in public or regional open space, managed by CoW, but not managed for a conservation purposes
- Remnant vegetation on state government freehold land, which is not reserved for P&R under MRS.

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The LBS maps the extent of LNAs across the City and identifies where these are likely to intersect with future development areas. Where LNAs intersect future development areas, the LBS specifies 'contribution targets' which relate to the expected retention rate/target for LNAs in these areas. The LBS states that the City will consider these contribution targets when assessing development proposals which involve the potential clearing of LNAs, to ensure they are being appropriately accommodated and that the objectives of the LBS are being achieved.

Where retention of LNAs is proposed as part of development proposals, the area of native vegetation to be retained should achieve the minimum ecological viability criteria outlined in the LBS, being:

- **Size:** greater than 4 ha
- **Shape:** compact, for example a circle or square.
- **Perimeter to area ratio:** less than 0.04
- **Condition:** 'good' or better, according to the condition scale in Keighery (1994).
- **Connectivity:** 500 to 1,000 metres from other viable natural areas to form an ecological linkage across urban/peri-urban landscapes.

An updated LBS was released by the CoW for public comment in early 2018, which does not incorporate a 'contribution targets' mechanism to achieve biodiversity outcomes and instead utilises an LNA prioritisation approach. This involves determining the relative ecological value of all LNAs within the CoW, which has been completed through a multi-criteria spatial analysis, which considers a range of ecological criteria applicable to each LNA, including:

- Regional vegetation complex (and the percentage of the complex remaining)
- Proximity to conservation areas or Bush Forever sites
- Environmentally Sensitive Areas
- Patch size
- Occurrence of/proximity to threatened or priority flora
- Occurrence of/proximity to threatened or priority ecological communities
- Black cockatoo foraging habitat
- Proximity to wetlands or wetland buffers
- Ecological linkages.

The analysis assigns each LNA a relative ecological value score between 0 and 10. Based on this score, it is understood that the draft LBS identifies those areas of the highest determined ecological value to be afforded the greatest effort to achieve biodiversity protection and conservation. The extent of LNAs within the site and their relative ecological value, based on the draft 2018 LBS provided by the CoW, is shown in **Figure 10**.

### 3.3 East Wanneroo Structure Plan (2011)

The sub-regional level East Wanneroo Structure Plan was prepared by the (former) Department of Planning (now DPLH) in 2011. A '*broad ecological assessment of native vegetation*' was undertaken by the Department of Planning and (former) Department of Environment and Conservation in 2009, which informed the East Wanneroo Structure Plan. This assessment identified areas of '*good quality natural vegetation*' outside of Bush Forever sites, which were referred to as '*Priority Local Natural Areas*'. The extent of the identified Priority Local Natural Areas is shown in **Figure 10**.

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The structure plan report outlines that the CoW Local Biodiversity Strategy contains retention targets for the identified Priority Local Natural Areas. The report also recommends that opportunities to ‘*enhance the function and integrity*’ of the Priority Local Natural Areas through the establishment of ecological linkages should be explored as part of the future district and local structure planning stages (DoP 2011). This is discussed further in **Section 6.3.4**.

### 3.4 Existing environmental approvals

A number of existing environmental approvals pursuant to both the EPBC Act and EP Act (Part IV and Part V) apply to various land parcels within the site, as summarised in **Table 12** and shown in **Figure 11**.

Existing approvals provide additional context to the known environmental values of the relevant approval area, in addition to providing an understanding of the environmental impacts which have been previously considered by decision making authorities and the resultant acceptability of these proposals. The extent to which existing approvals apply across the site will likely influence where protection of environmental values and associated conservation outcomes may or may not be achievable, given existing approvals may allow for future environmental impacts in specific areas. As such, this may influence the future structure planning process.

Table 12: Summary of existing environmental approvals

Reference no.	Title/purpose	Determination/status
<b>EP Act – Part IV</b>		
MS 759	330 MW Gas-fired power station, Neerabup	Approved (Section 38)
MS 819	Gnangara Mound groundwater resources	Approved (Section 38)
<b>EP Act – Part V (Clearing Permit)</b>		
3731/7	Various City of Wanneroo road construction/upgrades	Granted
6533/3	Lakelands Country Club landscaping	Granted
6656/1	Mineral production (Holcim Australia)	Granted
7144/1	Mineral production (Hanson Construction Materials)	Granted
7372/1	Grazing & pasture (private landholding)	Granted
<b>EPBC Act</b>		
2012/6501	Commercial development of Wangara Industrial Area	Not a Controlled Action
2012/6409	Residential development of Lots 12, 36 & 38 Capron St	Not a Controlled Action
2011/6020	Residential development of Lots 4 and 5 Mornington Drive	Controlled Action - Approval granted
2017/8011	Residential development of 118 Coogee Road	Not a Controlled Action

**Note:** the above includes only active environmental approvals and does not include approvals which have been refused, withdrawn, surrendered or have expired. Furthermore, minor approvals covering very small areas are not considered relevant to this district-structure planning exercise and have therefore not been included.

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As discussed in **Section 2.3.1** and **Section 3.7**, Ministerial Statement (MS) 819 *Gnangara Mound groundwater resources* relates to ongoing abstraction of groundwater by the Water Corporation at specific bore sites, some of which occur within the site. It also establishes environmental water requirements for groundwater dependent ecosystems known to occur within the site. As such, MS 819 differs from the remainder of existing approvals applicable to the site, as these approvals all include to the clearing of existing vegetation.

### 3.5 EPA advice and assessments

The EPA have provided environmental advice on a number of strategic planning proposals which either wholly or partly incorporate the site, including:

- Interim strategic advice on the *Draft Perth and Peel @ 3.5 Million* suite of strategic planning documents (WAPC 2015), pursuant to Section 16(e) of the EP Act (EPA 2015).
- Assessment determination and advice on MRS Amendment 1308/41, provided in February 2016 pursuant to Section 48(a) of the EP Act.

The interim strategic advice provided by the EPA on the *Draft Perth and Peel @ 3.5 Million* suite of strategic planning documents (EPA 2015) included specific reference to the East Wanneroo area. The advice outlined the EPA's concerns that the proposed East Wanneroo rail alignment identified in the *Draft North-West Sub-regional Planning Framework* intersected Bush Forever sites 398 (Chitty Road Bushland) and 382 (Lake Pinjar). It is noted that Bush Forever site 382 is situated outside of and to the west of the site and therefore not applicable to this EAS. In addition, the EPA advice also identified a range of other environmental factors and values which require ongoing consideration as part of the ongoing development of the region, which is of relevance to the East Wanneroo area.

Whilst part of Bush Forever site 398 occurs within the north-eastern extent of the site, the portion identified as being impacted by the proposed East Wanneroo rail alignment is situated outside of the site to the north. Notwithstanding this, it is noted that the original rail alignment has subsequently been updated to impact a lower total area of Bush Forever Site 398, as shown in the current version of the *North-West Sub-regional Planning Framework* (released in April 2018).

MRS Amendment 1308/41 was referred to the EPA, who determined the proposed scheme amendment and the associated environmental impacts did not warrant formal assessment under the EP Act. Notwithstanding this, the EPA identified the following environmental factors as being relevant to the scheme amendment:

- **Flora and vegetation:** with regard to the future management of TECs, TF and vegetation complexes with <30% of their original extent.
- **Terrestrial fauna:** with regard to the future management of Carnaby's black cockatoo habitat.
- **Inlands waters environmental quality:** with regard to the future management of CCWs.
- **Amenity and human health:** with regard to the application of suitable separation distances between future sensitive land uses and existing market gardens, poultry farms, mushroom farms, turf farms and plant nurseries.

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The EPA recommended that these environmental factors could be managed through the future stages of planning process, specifically through the preparation of local planning scheme provisions and structure plans. The EPA also recommended that future CoW local scheme amendments will need to *'contain specific mechanisms and provisions to adequately secure, protect and manage the environmental values within the amendment area'*.

Any future amendments to the CoW LPS No. 2, which would be required to facilitate urban development of the future, would be referred to the EPA under Section 48 of the EP Act. This will provide the EPA an opportunity to further advise on the management of environmental factors through the future urban development process.

### 3.6 Ecological linkages

Ecological or biodiversity linkages are described as areas of native vegetation which provide a corridor or linkage (typically linear) between patches of vegetation to allow movement of flora and fauna and their genetic material through the landscape, helping to maintain metapopulations. Ecological linkages are often continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association, have identified and mapped regional ecological linkages within the Perth Metropolitan Region (PBP 2007). A number of regional ecological linkages are mapped across the site, as shown in **Figure 10**, which generally extend between P&R MRS reserves, Bush Forever Sites and patches of vegetation.

There is no existing statutory mechanism to formally implement regional ecological linkages. However, the retention of vegetation identified as forming part of or supporting a regional ecological linkage is typically considered through the land use planning process, most commonly at the local structure planning stage.

### 3.7 Public Drinking Water Source Areas

PDWSAs are proclaimed by the DoW to protect identified drinking water sources, which can be surface water or groundwater sources (DoW 2009). They are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947* as Water Reserves, Catchment Areas or Underground Water Pollution Areas. PDWSAs provide Western Australia with the majority of its drinking water supplies and can be vulnerable to contamination from a range of land uses and water based activities. Once an area is identified as a PDWSA, consideration needs to be given to the intended land use and associated activities to ensure that they are appropriate in meeting the water protection quality objectives of the area.

The site intersects the western edge of the Gnangara Underground Water Pollution Control Area (UWPCA), with various portions of the site identified as Priority 1, Priority 2 or Priority 3 PDWSAs, as shown in **Figure 9**. The Water Corporation operate a number of groundwater abstraction bores across the site and wider Gnangara area, which are treated at the Wanneroo Groundwater Treatment Plant prior to entering the potable water supply. A number of associated wellhead protection zones are identified within the site, which have a 500 m radius within P1 areas and a 300 m radius within P2 and P2 areas.



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As outlined in **Section 2.3.1**, Ministerial Statement 819 *Gnangara Mound groundwater resources* relates to the management and abstraction of groundwater resources from these PDSWSAs within the site. It also includes consideration of environmental water requirements for groundwater dependent ecosystems located in proximity to the abstraction bores. Within the site, those groundwater dependent ecosystems specifically considered by MS 819 include Mariginiup Lake and Jandabup Lake.



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## 4 Preliminary Vegetation Assessment

### 4.1 Rationale

The original scope of work commissioned by DPLH incorporated a one-day reconnaissance flora and survey, the results of which were to be incorporated into the EAS. The original objectives of this site-specific survey were to generally verify the results of desktop investigations and attain a general understanding of the vegetation types and condition across the site.

However, completion of the desktop investigations identified that the site may support significant environmental values, the extent of which were currently poorly understood. Furthermore, if these values were confirmed to occur across their potential extent, this could significantly influence the future planning processes. Specifically, occurrences of the SCP 20a TEC (in addition to those occurrences recorded on the existing DBCA database) were considered to potentially occur within the site, the total extent of which is unknown given the majority of the site has not been subject to detailed flora and vegetation investigations. This information gap was identified as critical to support the preparation of the DSP, given these potential TEC occurrences could result in significant spatial considerations during the structure planning process.

On this basis, and in consultation with the key project stakeholders, the scope of the proposed flora and vegetation investigation was expanded to undertake a preliminary assessment of native vegetation within the site and surrounding areas, with specific supplementary investigations targeting the identification of vegetation potentially representative of the SCP 20a TEC within the site. The objectives of the assessment were as follows:

- Generally characterise the flora and vegetation values within the site and surrounding areas.
- Identify an appropriate provisional floristic community type (FCT) classification for all occurrences of vegetation within the site.
- Identify the possible extent of vegetation potentially representative of TECs within the site.
- Characterise vegetation condition within a selection of locations across the site.

Undertaking a detailed flora and vegetation survey across the entirety of the site was not possible given the scale of the site (80 km<sup>2</sup>) and practical constraints of the EAS (for example project timeframes, budgets, seasonality and land ownership/access). Notwithstanding this, the preliminary vegetation assessment was specifically planned and completed in order to attain broad scale information of a suitable level of detail for the purpose of informing the district structure planning process.

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## 4.2 Methods

### 4.2.1 Pre-survey desktop investigations

Prior to the completion of field surveys, desktop investigations were undertaken to formulate preliminary FCT mapping, using spatial datasets for:

- Remnant native vegetation (DPIRD 2017a)
- Regional vegetation complexes (Hedde *et al.* 1980)
- Regional floristic survey sample sites (Keighery *et al.* 2012)
- Known/recorded TEC occurrences (DBCA 2017a)
- Regional soil landscape mapping (DPIRD 2017b)
- Regional topography and elevation (DoW 2008).

Spatial analysis was conducted using these datasets to provide an indication of the potential FCT of remnant vegetation across the site. This involved contrasting regional floristic survey sample sites against regional soil mapping, to provide a frequency of sample sites for a particular FCT occurring within each soil type. Soil type information was then contrasted with remnant vegetation mapping to provide an indication of the likelihood that an occurrence of remnant vegetation represented a particular FCT. Preliminary results were further refined by selecting regional floristic survey sample sites within a similar geographic location to the site (i.e. central northern Swan Coastal Plain), incorporating known occurrences of FCTs and TECs/PECs, and through comparison to boundaries and patterns identified from regional vegetation complex and elevation data.

The outcomes of these desktop investigations informed the spatial distribution of field sample locations, which were strategically located to assist in ground-truthing the desktop findings.

### 4.2.2 Field survey

Ground-truthing was then undertaken to gauge the accuracy of desktop FCT classifications. To aid the assessment of FCTs and TECs during ground-truthing, a list of 'indicator' species was identified from the Keighery *et al.* (2012) floristic dataset for the FCTs with potential to occur in the site or surrounding areas. It is acknowledged that individual species rarely provide a conclusive indication of the presence of a specific FCT, as many native flora species are common to a variety of FCTs and it is the combination of species that enables separation of vegetation into different FCTs. Nonetheless, the presence or absence of certain species provide some ability to identify potential FCTs or groups of potential FCTs, without the need for detailed flora and vegetation survey. For example the presence of *Eucalyptus gomphocephala* (tuart) in vegetation within the site was used as an indicator that the vegetation is likely associated with FCT 28, as FCT 28 is the only FCT known to occur within the site that commonly includes tuarts (Keighery *et al.* 2012).

Two botanists from Emerge conducted the site assessment between 5-8 December 2017. A total of 83 sampling points were recorded within the site, and seven within the surrounding area. The survey area was traversed by vehicle and botanists exited the vehicle to record information at each sample point. Where a sample point was located within public land botanists could access the vegetation. Where sample points were located in private land the survey was completed from the road reserve. The position of each sample point was recorded with a hand-held GPS unit, as shown in **Figure 12**.

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A rapid assessment of vegetation values was conducted at each sampling point, including:

- Site details (site name, site number, observers, date, location)
- Dominant flora species
- Estimate of condition of vegetation using methods from Keighery (1994)
- Prediction of consistency of vegetation condition within the patch of vegetation.

Photographs were taken at each sampling point to catalogue vegetation structure and general composition and condition.

#### 4.2.3 Data analysis, mapping and review

Each sampling location was assigned a provisional FCT by comparing field sample data to the preliminary FCT mapping and through evaluation of the combination of flora species present and FCT indicator species. The preliminary FCT mapping was then updated to display provisional FCT locations. Diagnostic information for TECs was then reviewed and potential TEC occurrences were provisionally mapped across the site.

The provisional FCT and TEC mapping from the preliminary vegetation assessment were provided to Threatened Species and Communities Branch of the DBCA for initial review and discussion. No significant issues or concerns were raised by DBCA regarding the mapping results, however it was noted (and understood) that this methodology should not replace detailed flora and vegetation survey for all areas of remnant vegetation within the site as part of any future planning process.

#### 4.3 Results and discussion

Raw data collected during the preliminary vegetation assessment is provided in **Appendix C**.

##### 4.3.1 Provisional floristic community types

The following FCTs were provisionally identified within the site:

- SCP S3 'wet sedgelands on sandy clays'
- SCP S17 '*Eucalyptus rudis*/*Agonis linearifolia* wetlands in Bassendean Dunes'
- SCP 11 'wet forests and woodlands'
- SCP 20a '*Banksia attenuata* woodlands over species rich dense shrublands'
- SCP 21c 'low lying *Banksia attenuata* woodlands or shrublands'
- SCP 22 '*Banksia ilicifolia*' woodlands
- SCP 23a 'central *Banksia attenuata* – *B. menziesii* woodlands'
- SCP 23b 'northern *Banksia attenuata* – *B. menziesii* woodlands'
- SCP 28 'spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* woodlands'.

The distribution of provisional FCTs assigned to native vegetation within the site (based on DPIRD 2017a vegetation extent) is shown in **Figure 13**.

Broadly these FCTs comprise wetland and banksia/eucalypt-banksia woodland communities. As expected, a correlation between FCT, vegetation complex (Hedde *et al.* 1980) and topography was observed within the site.

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FCT 11, FCT S3 and FCT S17 are associated with wetland systems. Two Keighery *et al.* (2012) sample sites representing FCT S3 and FCT S17 respectively were located on the edge of Lake Gngangara in the south-eastern portion of the site. Vegetation surrounding the remainder of Lake Gngangara, and other lakes in the central and eastern portions of the site is likely to represent one or more of these three FCTs. In addition, a wetland system with fragmented patches of native wetland vegetation likely to represent FCT S17 occurs between these lakes in a north-west to south-east direction. Other small scattered wetlands in the northern portion of the site are considered likely to represent FCT S17, but access to these wetlands was limited due to the presence of pine plantations. Due to a lack of detailed information on species, a composite FCT 11/S17 classification was applied to this vegetation (FCT 11 is a wetland FCT that is widespread on the SCP and includes many similar species to FCT S17).

FCT 20a is a Banksia Woodland community and is considered likely to occur within the south-western and north-western portions of the site, on the eastern boundary of the Karrakatta vegetation complex (part of the Spearwood dune system). This FCT is characterised by a dense species rich shrub layer and understorey species such as *Cyathochaeta equitans*, *Dasypogon obliquifolius* and *Mesomelaena tetragona*. Broadly speaking FCT 20a is known to occur in two broad areas on the Swan Coastal Plain, including an area in the northern central SCP within the CoW and an area on the eastern SCP roughly centred on the localities of Forrestfield and Wattle Grove.

FCT 28 is a Banksia Woodland community occurring on the Spearwood system (Gibson *et al.* 1994) and is also considered likely to occur in the western extent of the site, as it also exists on the eastern boundary of the Karrakatta vegetation complex. FCT 28 was identified as being likely to occur between the two areas of FCT 20a provisionally identified in FCT mapping. The higher elevation and differences in flora species composition and vegetation structure in this area were the primary reasons for provisionally allocating patches of vegetation to FCT 28 rather than FCT 20a. For example, vegetation considered likely to be FCT 28 often included *Eucalyptus gomphocephala* (tuart) in the canopy layer, which was not recorded in any Keighery *et al.* (2012) sample sites assigned to FCT 20a. However, the transition boundary between FCT 20a and FCT 28 on the western side of the site is unclear and a portion of 'FCT 20a/28' was mapped to indicate that an intergrade is expected.

FCT 21c and FCT 22 are Banksia Woodland communities which occur in lower lying areas on the Bassendean complex (Gibson *et al.* 1994) and so their provisional location in the site could not easily be separated based on landform position. Within the site these FCTs are considered likely to occur between other banksia woodland FCTs (FCTs 20a, 28, 23a and 23b), in addition to wetland FCTs (FCTs 11, S17 and S3) identified in the central portion of the site within the Pinjar complex, given this complex has strong affinities with the Bassendean complex (Churchward and McArthur 1980). The presence of these FCTs would be part of natural vegetation pattern or ecotone surrounding wetland areas. As FCTs 21c and 22 could not be separated based on the results of this preliminary assessment, a composite label FCT 21c/22 was provisionally applied to vegetation in these areas.

FCT 23a and FCT 23b are Banksia Woodland communities. FCT 23a occurs on the Bassendean complex (Gibson *et al.* 1994) and two Keighery *et al.* (2012) sample sites assigned to FCT 23a occur in the eastern extent of the site. Vegetation in the south-eastern portion of the site is considered likely to represent this FCT. In contrast, FCT 23b has a more northern distribution than FCT 23a (Gibson *et al.* 1994) and accordingly is considered likely to occur in the north-eastern portion of the site. Although few sampling points were located in this portion of the site, multiple Keighery *et al.* (2012) sites representing FCT 23b are located nearby to the site in this area.

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#### 4.3.2 Vegetation condition

The site supports vegetation in varying condition. Generally, the vegetation in the eastern portion of the site comprises larger, more connected patches, whilst vegetation on the western side is generally more fragmented. The estimated condition of vegetation recorded at each sample location is shown in **Figure 13**.

Whilst wetland areas were not assessed in detail due to survey constraints, signs of significant disturbance were evident in fringing wetland vegetation. The vegetation within the interior of some wetlands appeared more intact.

The majority of banksia woodland vegetation is present in 'good' or better condition, which is typically applied as threshold for the identification of a Banksia woodland TEC occurrence (as discussed in **Section 4.3.3**). Many of the patches of banksia woodland vegetation sampled had an outer edge in 'degraded' condition with moderate to high cover of non-native grasses and lower native species diversity. In contrast, the interior of patches of vegetation were observed to be of generally higher condition.

#### 4.3.3 Provisional threatened and priority ecological communities

Two existing TECs and one community that is nominated to be considered for listing as a TEC under the EPBC Act are considered likely to occur in the site, including:

- Banksia woodlands of the Swan Coastal Plain TEC (listed under the EPBC Act)
- *Banksia attenuata* woodlands over species rich dense shrublands TEC (State listed)
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain (nominated for listing under the EPBC Act).

##### 4.3.3.1 Banksia Woodlands of the Swan Coastal Plain

The Banksia Woodlands TEC is directly associated with a range of FCTs including FCTs 20a, 21c, 22, 23a, 23b and 28. However, to be considered as a patch of this TEC for the purposes of the EPBC Act, areas of remnant vegetation must satisfy specific criteria for vegetation condition and patch size (as outlined in DoEE (2016b)). Given the high level of this assessment, these criteria were not specifically applied across vegetation within the site. Notwithstanding this, vegetation condition was informally assessed during the preliminary vegetation assessment and generally indicated the majority of banksia woodland vegetation is present in 'good' or better condition.

On this basis, and in order to identify the maximum potential extent of this TEC across the site, all patches of vegetation considered likely to comprise FCTs 20a, 21c, 22, 23a, 23b or 28 were provisionally identified as being potentially representative of this TEC, totaling approximately 1,167 ha within the site as shown in **Figure 14**. This represents approximately 0.3% of the total current extent of the TEC across the Swan Coastal Plain (336,490 ha) (DoEE 2016a).

This is likely to overestimate the actual extent of the TEC within the site and additional, detailed flora and vegetation surveys completed at a finer-scale would be required to confirm this. It is also important to note that while a 'good' condition threshold applies to the Banksia Woodlands TEC, patches of lower quality vegetation may still represent the TEC, where they form part of a contiguous patch that includes vegetation in 'good' or better condition.

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The Banksia Woodlands TEC is synonymous with the 'banksia dominated woodlands of the Swan Coastal Plain IBRA region' state PEC (P3), and therefore areas of vegetation in the site which represent the Banksia Woodland TEC would also be considered to represent the 'banksia dominated woodlands of the Swan Coastal Plain IBRA region' PEC.

#### 4.3.3.2 SCP 20a *Banksia attenuata* woodlands over species rich dense shrublands

The '*Banksia attenuata* woodlands over species rich dense shrublands' TEC is directly associated with occurrences of FCT 20a. The potential extent of this TEC was therefore identified where provisional FCT mapping results identified that FCT 20a may be present; in the southwestern and central-western portions of the site. In addition, since the field survey sampling was broad scale, a conservative approach was taken and areas of vegetation in the transition zone between FCT 20a and FCT 28 are categorized as potential TEC 20a. It is predicted that up to a total of 323.6 ha of the '*Banksia attenuata* woodlands over species rich dense shrublands TEC' has potential to occur in the site, as shown in **Figure 14**. This likely over estimates the extent of the TEC within the site and additional, detailed flora and vegetation surveys completed at a finer-scale would be required to confirm the actual extent of this community.

Whilst this TEC is listed at a state level, it is also associated with the EPBC Act listed Banksia Woodlands TEC. Therefore, vegetation that represents the State listed SCP 20a TEC would also be representative of the Commonwealth listed Banksia Woodlands TEC.

A total of 585 ha of the SCP 20a TEC is currently known to occur across the Swan Coastal Plain in 69 occurrences (DoEE 2016b). The majority (97%) of vegetation determined to be potentially representative of this TEC within the site (through this assessment) is not currently recorded within the TEC database maintained by DBCA as it has not been formally confirmed to be SCP 20a. As such, if all the identified potential occurrences of SCP 20a were confirmed through future detailed flora and vegetation surveys, this would represent an increase of 55% to the current total area of the TEC across the Swan Coastal Plain, although as stated above this is most likely an overstatement of the actual extent of SCP 20a within the site.

Confirming the extent of SCP 20a within the site could lead to a significant increase in the total known extent of the TEC. In the very least, it is expected that there will be some increase in the total known extent. Based on the results of this assessment, the maximum potential increase would be to 900.8 ha, of which the site could potentially contain 35.9% (323.6 ha). Given only a limited amount of this TEC remains across the Swan Coastal Plain, a large proportion of which potentially occurs within the site, its likely occurrence within the site is therefore considered to be of high regional significance.



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#### 4.3.3.3 Tuart Woodlands and Forests of the Swan Coastal Plain

Based on information provided in the draft conservation advice for the nominated Tuart Woodlands TEC, vegetation in the site that was provisionally identified to represent FCT 28 was also considered to potentially represent this TEC. Specific thresholds regarding the density of tuart trees have been suggested in the draft conservation advice for this community. However, the broad scale assessment and unconfirmed status of the conservation advice meant that FCT 28 vegetation in the site was not assessed against these thresholds. A total of 53.1 ha of vegetation within the site was determined to potentially represent the Tuart Woodlands TEC, the extent of which is shown in **Figure 14**. This represents approximately 0.2% of the total current extent of the TEC across the Swan Coastal Plain (25,410 ha) (DoEE 2017).

This likely over estimates the extent of the TEC within the site and additional, detailed flora and vegetation surveys completed at a finer-scale would be required to confirm the actual extent of this community.

#### 4.4 Assessment limitations

The initial desktop investigations which informed the preliminary vegetation assessment are limited by the accuracy of regional datasets used. In addition, areas of mapped native vegetation within the site are based on state-wide mapping published by DPIRD (2017a). The detail of this mapping is considered suitable for the scale of this assessment, however should be refined through future, more detailed flora and vegetation surveys.

The preliminary vegetation assessment aimed to provide high-level regional information, which is suitable for the purpose of informing the district structure planning process. The preliminary vegetation assessment was not a detailed flora and vegetation survey (i.e. the preliminary vegetation assessment does not meet the EPA criteria for a reconnaissance or a detailed vegetation survey (EPA 2016)). Access into many areas of vegetation was limited by private land ownership and other practical constraints.

The sample data obtained during the preliminary vegetation assessment does not provide a complete inventory of species present within the site or sample locations. Provisional FCT and potential TEC mapping prepared from the preliminary vegetation assessment does not provide a verified account of community distribution or condition and requires confirmation through future detailed flora and vegetation surveys, completed at a finer scale.

However, as the field survey was undertaken by botanists with experience on the Swan Coastal Plain, including specifically in identifying local flora, FCTs and assessing vegetation condition using the Keighery (1994) scale, the results provide reliable information on the potential presence and likely distribution of FCTs and TECs in the site. Further surveys will nonetheless be required to collect detailed information on flora and vegetation within individual lots or vegetation patches to provide confirmation of the ultimately recommended priority areas discussed in **Section 6**.

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## 5 Consultation

Based on the requirements of the scope of work commissioned by DPLH, Emerge Associates have undertaken a suite of communications, meetings and interactions with the key state and local government stakeholders throughout the development of this EAS to ensure it addresses all stakeholder requirements and includes all relevant information that was available.

In addition, further consultation have been undertaken by Emerge Associates as the preparation of the EAS has progressed and additional considerations have been identified. This has enabled additional input to be sought from key stakeholders on various considerations where this was required. A summary of the consultation undertaken to date is provided in **Table 13**.

*Table 13: Consultation summary*

Date	Consulted parties	Purpose of consultation
27 October 2017	DPLH, DBCA and DWER	Start-up meeting to discuss objectives of EAS to inform preparation of the East Wanneroo District Structure Plan.
7 November 2017	DPLH, RPS	Meeting to discuss coordination between the EAS & DWMS.
14 December 2017	DPLH, DBCA and DWER	Meeting to discuss the preliminary outcomes of environmental investigations completed to date and to obtain feedback from agencies on these outcomes.
20 December 2017	EWDSP Steering Group	Presentation of the preliminary outcomes of environmental investigations completed to date to the Steering Group, providing an opportunity for feedback.
11 January 2018	DBCA	Correspondence to present the preliminary results of the preliminary vegetation assessment to the Threatened Species and Communities Branch for their review and comment. The outcomes of this consultation is discussed in <b>Section 4.2.3</b> .
2 February 2018	CoW	Meeting to discuss the preliminary outcomes of environmental investigations completed to date and how the EAS will incorporate the outcomes of the existing CoW LBS and draft 2018 LBS.
9 February 2018	DPLH	Meeting to discuss the preliminary outcomes of environmental investigations completed to date and how the EAS will provide an appropriate level of information to inform the DSP planning and preparation process.
17 May 2018	DPLH	Meeting to discuss comments on Draft EAS document provided by DPLH, DPAW and CoW.

# Environmental Assessment Study

## East Wanneroo District Structure Plan



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## 6 District Structure Planning Environmental Analysis

### 6.1 Principles

Based on the outcomes of the completed desktop investigations and the subsequent site-specific preliminary vegetation assessment, an understanding of the key environmental values known or likely to occur within the site has been developed to inform the DSP.

Spatial analysis was undertaken to determine the areas of highest relative environmental value which require specific consideration in line with existing State and Commonwealth legislation and policy frameworks. This was based on the following principles:

- Native vegetation mapping published by DPIRD (2017a) has been used to spatially represent the likely extent of remnant vegetation and any associated environmental values within the site, as identified through the completed desktop and site-specific investigations.
- The site contains vegetation determined to be potentially representative of the SCP 20a TEC, which is considered to be one of the most significant environmental values within the site and of high regional significance. Protection of intact occurrences of this vegetation within the site was deemed to be a priority.
- A number of other key environmental values known to occur within the site should also be considered, as acceptable conservation outcomes for these key values will also ultimately need to be achieved, including:
  - Banksia Woodlands TEC
  - Tuart Woodlands TEC (based on the assumption it will be EPBC Act listed)
  - Carnaby's black cockatoo foraging habitat
  - Regional vegetation complexes
  - CCWs.
- Existing land use planning mechanisms applicable to the site, such as regional and local reserves, Bush Forever Sites and CCWs, provide an existing level of acknowledgement and in some cases protection of environmental values, assuming they are/continue to be implemented and/or acknowledged into the future.
- Protection of significant environmental values should be prioritised where these occur in larger, more intact patches of remnant vegetation to maximise ecological viability and resilience. In addition, connectivity of vegetation patches and their contribution to identified regional ecological linkages should also inform the prioritisation process.
- Further detailed and site-specific investigations will be required to confirm the results of the preliminary investigations which have informed this environmental analysis.

Based on the results of the environmental analysis, completed based on the above principles, a number of 'priority areas for further investigation' have been identified within the site. These areas of vegetation have been identified as requiring further detailed investigation of their values, and if confirmed, should then be a priority for protection through the planning process, due to the environmental values they support. Confirmed priority areas should be considered during the preparation of the East Wanneroo District Structure Plan and throughout the subsequent stages of the planning process.

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## 6.2 Identification of priority areas for further investigation

### 6.2.1 Current extent of environmental values

The current extent of the key environmental values within the site is outlined in **Table 14**, in addition to their known regional extent across the Swan Coastal Plain. This is based on native vegetation mapping (DPIRD 2017a), which has been attributed with the provisional FCTs and associated potential TECs determined based on the outcomes of the site-specific preliminary vegetation assessment. It should be noted that these environmental values commonly overlap are not spatially mutually exclusive (i.e. areas can support more than one of these environmental values).

Table 14: Extent of existing environmental values within site

Environmental value	Extent across SCP (ha) <sup>1</sup>	Extent within site (ha)	Percentage of SCP extent within site
Native vegetation (DPIRD 2017a)	582,521	1,709.7	0.3%
Potential TEC - SCP 20a <sup>2</sup>	585	(up to) 323.6	(up to) 35.9%
Potential TEC - Tuart Woodlands	25,410	(up to) 53.1	(up to) 0.2%
Potential TEC - Banksia Woodlands	336,490	1,167.2	0.3%
Fauna habitat - Potential CBC foraging habitat (Glossop <i>et al.</i> 2011)	43,964	1,309.3	3.0%
Vegetation complex - Bassendean Central and South (26.1% remaining)	22,846	185.4	0.8%
Vegetation complex - Bassendean North (71.8% remaining)	53,218	238.4	0.4%
Vegetation complex - Bassendean North Transition (91.1% remaining)	16,069	346.9	2.2%
Vegetation complex - Karrakatta Central and South (23.0% remaining)	11,518	314.3	2.7%
Vegetation complex - Herdsman (33.9% remaining)	2,821	32.7	1.2%
Vegetation complex - Pinjar (30.0% remaining)	1,467	588.2	40.1%
Conservation Category Wetlands <sup>3</sup>	31,307	394.4	1.3%

<sup>1</sup> Based on various information sources, discussed in **Table 9**.

<sup>2</sup> Note that of the 585 ha of this TEC known to occur across the SCP, only 7.5 ha of this is currently mapped within the site. As such, this total does not account for any potential increase in the total known extent of the TEC due to any additional occurrences confirmed within the site, which could potentially be up to a maximum of 323.6 ha.

<sup>3</sup> Where these value intersect existing native vegetation.

In the context of this EAS, the most important piece of information presented in **Table 14** is the extent of potential SCP 20a TEC occurring within the site, given this was identified as one of the most significant environmental values within the site. Currently, there is a total of 585 ha of this TEC known to occur (across its entire distribution), of which 7.5 ha occurs within the site. However, based on the results of the Preliminary Vegetation Assessment, an additional (currently unrecorded) 316.1 ha of vegetation within the site has been determined to be potentially representative of the SCP 20a TEC. If all of these additional, currently unrecorded, occurrences of vegetation are confirmed to be representative of the SCP 20a TEC during future site-specific flora and vegetation investigations, this would increase the total known extent of this TEC by 154% (to a total extent of 900.9 ha, of which 35.9% would occur within the site). This would represent a significant change in the total known extent of the TEC and as such, would significantly alter its regional environmental context.

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Based on **Table 14**, two key environmental values identified within the site are considered to be of high regional significance:

- Vegetation potentially representative of the SCP 20a TEC, of which currently unknown occurrences are considered likely to occur within the site.
- Vegetation representative of the Pinjar complex, given only 30.1% (1,467 ha) of its original extent remains across the Swan Coastal Plain of which 40.1% (588.2 ha) occurs within the site.

The regional context of these key environmental values provides important context in the process of identifying priority areas for further investigation.

#### 6.2.2 Existing protection mechanisms

Large areas of remnant vegetation with environmental values within the site are already afforded a level of acknowledgement and protection through existing land use planning mechanisms and as such, are likely support biodiversity conservation outcomes (assuming these mechanisms are/continue to be implemented) or be easier to effect such outcomes in the future.

Specifically, areas of the site which are currently regionally reserved for P&R under the MRS, locally reserved for conservation under the CoW DPS No. 2 and/or occur within Bush Forever sites are afforded a higher level of existing (acknowledged) protection, and under these existing mechanisms it is unlikely these areas will be considered for future development. As such, it has been assumed that all identified environmental values occurring within these areas can be subject to a higher level of protection as part of the future DSP implementation.

Conservation Category Wetlands are also typically and routinely protected from development, to enable their retention and ongoing conservation. A buffer is also typically applied to assist in maintaining their ecological functionality and resilience, and to ensure development does not directly encroach on wetland features. As such, it has been assumed that all identified environmental values occurring within the extent of mapped CCWs and a nominal 50 m buffer can be the subject of future protection through the DSP and beyond.

Notwithstanding this, it is acknowledged that there is some potential for existing protection mechanisms to be reconsidered in the future, for example the rationalisation of Bush Forever site boundaries or their implementation mechanisms (such as shifting from existing 'rural complementary mechanisms' to reflect the proposed intensification of land uses) or the reclassification of Conservation Category Wetlands if they do not in fact represent this management category. However, these would only occur if these areas didn't support or contain significant environmental values and therefore, the overall conservation outcome would not be compromised. This is discussed further in **Section 6.3**.

The extent of existing environmental values which are afforded existing protections are outlined in **Table 15** and shown in **Figure 15**. These areas are not identified as priority areas for further investigation, as they have been assumed to achieve a biodiversity conservation outcome through the existing planning and urban development process.

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Table 15: Environmental values afforded some protection under existing mechanisms

Environmental value	Total extent within site (ha)	Extent subject to existing protection mechanism (ha)				Total extent subject to existing protection mechanism/s (ha)	
		MRS P&R Reserves	Bush Forever Sites	Local conservation reserves	CCW and 50 m buffer		
Native vegetation (DPIRD 2017)	1709.7	990.9	1192.4	11.4	467.1	1270.7	74.3%
Potential TEC – SCP 20a	323.6	97.6	135.3	0.6	10.2	136.2	42.1%
Potential TEC – Tuart Woodlands	53.1	7.9	19.6	0.0	0.0	19.6	37.0%
Potential TEC - Banksia Woodlands	1167.2	615.8	816.6	5.9	62.0	824.6	70.6%
Fauna habitat - CBC foraging habitat	1309.3	684.2	886.5	9.4	144.7	920.6	70.3%
Bassendean Complex - Central and South	185.4	133.6	143.3	1.5	39.5	155.6	83.9%
Bassendean Complex - North	238.4	211.2	219.2	0.0	32.4	219.4	92.0%
Bassendean Complex - North Transition	346.9	186.7	299.7	0.0	27.4	301.0	86.8%
Karrakatta Complex - Central and South	314.3	82.0	131.3	0.0	3.2	131.3	41.8%
Herdsman Complex	32.7	25.8	25.9	0.0	11.6	26.2	80.3%
Pinjar Complex	588.2	351.6	372.9	9.9	352.9	437.1	74.3%
Conservation Category Wetlands	394.4	350.5	338.1	0.0	394.4	394.4	100.0%

As shown in **Table 15**, significant biodiversity conservation outcomes can be achieved for the majority of the key environmental values within the site if existing protection mechanisms continue to be implemented into the future. Based on the respective regional context of these values (as outlined in Section 6.2.1), this is considered an acceptable outcome at the DSP level of planning. Notwithstanding this, the following environmental values are considered to be under-represented within areas subject to existing protection mechanisms:

- Vegetation potentially representative of the SCP 20a TEC, of which only 41.9% of the total potential occurrence within the site is subject to existing protection mechanisms.
- Vegetation potentially representative of the Tuart Woodlands TEC, of which only 37% of the total potential occurrence within the site is subject to existing protection mechanisms.
- Vegetation representative of the Karrakatta Complex - Central and South, of which only 41.8% of the total occurrence within the site is subject to existing protection mechanisms.

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As outlined in **Section 6.2.1**, vegetation within the site potentially representative of the SCP 20a TEC is considered to be of high regional significance, given only a small area of this community is currently known to occur on the Swan Coastal Plain. Notwithstanding this, it is likely that additional occurrences of this vegetation exist throughout its natural range, which extends from Koondoola to Yarloop (DPaW 2016), however are currently unknown due to the absence of detailed flora and vegetation survey information. Where additional areas of this environmental value are confirmed to occur within the site, but outside of areas subject to existing protection mechanisms, these areas are recommended to be prioritised for protection, discussed further below.

### 6.2.3 Potential SCP 20a TEC

Large and intact patches of vegetation potentially representative of SCP 20a TEC not currently subject to existing protection mechanisms have been identified, which are recommended to be further investigated and then if confirmed, prioritised for protection given their regional significance.

#### 6.2.3.1 Minimum patch size

For the purpose of identifying priority areas for further investigation, a minimum patch threshold of 4 ha or greater has been applied, consistent with the minimum ecological criteria outlined in the CoW LBS, as discussed in **Section 3.2.2**. This aligns with the *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (Del Marco et al. 2004), which outlines that where clearing has not occurred, local reserves for vegetation conservation should not be less than 4 ha.

This is based on the principle that as the size of retained patches of native vegetation decrease below 4 ha, the maintenance costs become increasingly higher to ensure the ongoing ecological viability of the patch is preserved, given smaller and more isolated patches of remnant vegetation are subject to greater fragmentation impacts, such as reduced native species diversity and increased occurrences of invasive species (Ramalho 2012; C. Ramalho *et al.* 2014). These increased maintenance costs are generally not practicable and as such, retention of native vegetation should focus on larger patches to both maximise the ecological viability of the patch, and minimise maintenance costs associated with preserving the original ecological viability of the patch.

#### 6.2.3.2 Delineation of patches

The delineation of native vegetation patches within the site (as opposed to discrete GIS polygons in the underlying native vegetation extent dataset) was undertaken consistent with the methodology described in the *Approved Conservation Advice for the Banksia Woodlands of the Swan Coastal Plain ecological community* (DoEE 2016b). This was considered to be a suitable approach, given the vast majority of vegetation within the site is potentially representative of the Banksia Woodlands of the SCP TEC (assuming the required minimum condition and patch size thresholds are satisfied).

On this basis, areas of vegetation within 30 m of one another have been determined to represent a single patch, with the exception of splitting patches where existing sealed, public roads dissect areas of vegetation. These roads represent existing physical and practical barriers, separating connectively between vegetation, which are likely to remain as part of any future development. Where areas of vegetation have been grouped into a combined patch, it has not been assumed that infill planting would occur between these. Whilst this could be undertaken in the future to consolidate sub-areas of vegetation within a patch, this is not a critical assumption of this analysis.

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#### 6.2.3.3 Identified priority areas for further investigation

An additional 116.4 ha of vegetation potentially representative of the SCP 20a TEC occurs within the site which satisfies the above criteria (minimum 4 ha combined patch size and not subject to existing protection mechanisms). These priority areas for further investigation are shown in **Figure 16**.

When combined with those areas of vegetation subject to existing protection mechanisms (as previously identified), this captures 252.6 ha of the total 323.6 ha (78%) of vegetation within the site potentially representative of the SCP 20a TEC, as summarised in **Table 16**.

The additional vegetation identified through the above criteria also includes 90.6 ha of vegetation representative of the Karrakatta Complex – Central and South, given there is a strong spatial correlation in occurrence of these environmental values within the site. The combined extent of these identified priority areas for further investigation and areas subject to existing protection mechanisms accounts for 70.6% of the total extent of the Karrakatta Complex – Central and South complex within the site.

*Table 16: Additional areas identified within priority areas for further investigation*

Environmental value	Total extent within site (ha)	Area protected through existing mechanisms (ha)	Area included within identified priority areas (ha)	Combined total (ha)	
Native vegetation (DPIRD)	1709.7	1270.7	116.4	1387.0	81.1%
Potential TEC – SCP 20a	323.6	136.2	116.4	252.6	78.1%
Potential TEC – Tuart Woodlands	53.1	19.6	0.0	19.6	37.0%
Potential TEC – Banksia Woodlands	1167.2	824.6	116.4	941.0	80.6%
Fauna habitat - CBC foraging habitat	1309.3	920.6	114.5	1035.1	79.1%
Bassendean Complex - Central and South	185.4	155.6	1.0	156.6	84.5%
Bassendean Complex - North	238.4	219.4	0.0	219.4	92.0%
Bassendean Complex - North Transition	346.9	301.0	0.0	301.0	86.8%
Karrakatta Complex - Central and South	314.3	131.3	90.6	221.9	70.6%
Herdsmen Complex	32.7	26.2	1.9	28.1	86.1%
Pinjar Complex	588.2	437.1	22.9	460.0	78.2%
Conservation Category Wetlands	394.4	394.4	0.0	394.4	100.0%



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#### 6.2.4 Other considerations

##### 6.2.4.1 Smaller patches of potential SCP 20a TEC

While the use of a 4 ha patch threshold is consistent with the CoW LBS and the *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (Del Marco et al. 2004), the intention of this threshold was to identify a minimum patch size which is suitable for the retention of native vegetation more generally and as such, it may be appropriate to reduce this threshold where the vegetation within the patch is of higher environmental significance.

As discussed above, vegetation potentially representative of the SCP 20a TEC within the site is considered to be of high regional significance, given only a relatively small area of this community remains across the Swan Coastal Plain. On this basis, protection of patches of this vegetation between 3 and 4 ha (if confirmed to be representative of the TEC) may be considered appropriate if management resources permit. These areas have therefore been identified, as shown in **Figure 17**.

Based on these criteria, an additional 23.6 ha of vegetation potentially representative of the SCP 20a TEC is identified. Whilst these additional areas have not been directly included within the identified priority areas for further investigation, they have been identified in order to allow for future consideration of their protection, if determined to be appropriate. However, if protection of these areas is proposed to be implemented, it is likely that management costs associated with the maintenance of the ecological viability of these vegetation patches would be higher compared to larger patches, consistent with the principles outlined in **Section 6.2.3.1**.

##### 6.2.4.2 Patches of Tuart Woodlands TEC

Of the 53.1 ha of vegetation potentially representative of the Tuart Woodlands TEC within the site, 19.6 ha (37%) is represented within areas subject to existing protection mechanisms, as outlined in **Table 16**. Once a determination regarding the potential listing of this community as a TEC pursuant to the EPBC Act has been made, it is likely this will influence the extent to which protection of this community is considered necessary. As such, for the purpose of this EAS, these areas have not been included within the identified priority areas for further protection.

If additional areas of this vegetation were proposed to be prioritised for future protection, it is recommended that larger, intact areas are targeted. On this basis, patches of vegetation greater than 3 ha which are potentially representative of the Tuart Woodlands TEC have been identified, as shown in **Figure 17**. Patches greater than 4 ha were originally identified, however the criteria was expanded to a 3 ha minimum patch size due to poor representation of patches greater than 4 ha. These areas account for an additional 17.6 ha of vegetation potentially representative of the Tuart Woodlands TEC outside of areas subject to existing protection mechanisms. If combined with areas subject to existing protection mechanisms, this would account for 31.4 ha (59.1%) of the total 51.3 ha of this vegetation within the site.

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#### 6.2.4.3 Perimeter to area ratio and ecological viability of patch

The patch definition criteria utilised for the purpose of this assessment, as discussed in **Section 6.2.3.2**, resulted in a number of adjacent, yet separated, areas of vegetation contributing to the same patch of vegetation, provided they were within 30 m of one another. When a number of smaller, individual areas collectively form a patch, it is likely to have a high perimeter to area ratio. Such patches generally have reduced ecological viability (Del Marco et al. 2004) and can be more difficult to establish and maintain as conservation areas, given they are more susceptible to detrimental edge effects and may occur over a number of separate land parcels.

As such, a review of identified priority areas for further investigation was undertaken to refine and remove portions where this allows for a more consolidated area to be delineated. This has also included consideration of where native vegetation mapping (DPIRD 2017a) does not accurately represent an intact occurrence of native vegetation. This has resulted in refinement of the priority areas for further investigation, as shown in **Figure 17**.

#### 6.2.4.4 Rationalisation of priority areas for further investigation

Following identification of priority areas for further investigation using the above criteria, a rationalisation process was completed to identify any areas which potentially warrant prioritisation for protection, but were not identified in environmental analysis criteria. The following areas containing environmental values were which considered logical for inclusion as priority areas for further investigation:

- Lot 19 Ashby Street
- Lot 1 Benmuni Road
- Lot 2 Ranch Road.

The environmental values within these land parcels were added to the priority areas for further investigation given they comprise largely intact native vegetation potentially representative of the SCP 20a TEC, are between 3-4 ha in area and occur adjacent to other priority areas for further investigation. These areas are shown in **Figure 17**.

#### 6.2.4.5 Alignment with PDWSAs

As discussed in **Section 3.7** and shown in **Figure 9**, the eastern portion of the site is identified as a combination of priority 1 and priority 2 PDWSAs. Priority 1 PDWSAs are typically limited to areas of Crown land and there is a general objective for 'risk avoidance' when determining suitable land uses. Priority 2 PDWSAs typically incorporate 'rural' zoned land and there is a general objective for 'risk minimisation', meaning low levels of rural development are generally appropriate. (DoW 2016)

It is currently not known whether modifications to the existing PDSWA boundaries and/or classifications will be proposed to facilitate future urban development of the site. However, the extent of native vegetation within the areas, including where these areas are subject to existing protections mechanisms or have been identified within priority areas for further investigation, has been summarised in **Table 17** to provide context to any such proposals.

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Table 17: Summary of native vegetation occurring with PDSWAs within the site

	P1 PDWSA	P2 PDWSA	P3 PDWSA	Total
Native vegetation subject to existing protection mechanisms (ha)	530.5	63.9	0.0	594.4
Native vegetation within identified priority areas (ha)	0.0	0.0	0.0	0.0
Other native vegetation not subject to existing protection mechanisms or within priority areas (ha)	20.1	44.3	0.0	64.5
Total (ha)	550.6	108.2	0.0	658.8

Of the 20.1 ha of other native vegetation not subject to existing protection mechanisms or within identified within priority areas for further investigation which occur within P1 PDSWAs:

- 17.4 ha comprises potential CBC foraging habitat
- 18.5 ha comprises vegetation potentially representative of the Banksia Woodlands TEC.

Of the 44.3 ha of other native vegetation not subject to existing protection mechanisms or within identified within priority areas for further investigation which occur within P2 PDSWAs:

- 38.5 ha comprises potential CBC foraging habitat
- 30.6 ha comprises vegetation potentially representative of the Banksia Woodlands TEC.

## 6.3 Further investigation requirements

### 6.3.1 Detailed flora and vegetation surveys

The results of the preliminary vegetation assessment are a key input into the environmental analysis completed as part of this EAS and as such have been critical for the identification of priority areas for further investigation within the site. As stated in the methodology, this did not involve detailed flora and vegetation surveys and therefore such investigations should be completed to confirm the outcomes of the preliminary vegetation assessment. The identified priority areas for further investigation should be refined based on the results of detailed flora and vegetation surveys.

These investigations would most likely initially focus on the identified priority areas, however would ultimately be completed for all remaining vegetation across the site (with the exception of areas subject to existing protection mechanisms) as part of the future local structure planning process.

It is likely that these detailed flora and vegetation surveys will be completed by a large number of separate proponents, across different land parcels, across an extended period of time. Given the potential for areas of the site to potentially contain vegetation representative of the SCP 20a TEC, which if confirmed could increase the total known extent of the TEC, it is recommended that DPLH and DBCA maintain a register of all such surveys as they are completed across various portions of the site. This will allow the tracking of all confirmed occurrences of the SCP 20a TEC within the site to be maintained, which can then be compared to the statistics presented in this EAS and inform future planning decisions (including potential refinement of identified priority areas).

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#### 6.3.2 Geomorphic wetlands

The site currently contains 82 geomorphic wetland features, including 24 CCWs, 25 REWs and 33 MUWs. A desktop review of these wetlands has been completed, identifying where wetland features may warrant reclassification or modification to their mapped extent. The recommendations of this assessment are provided in **Table 18**. Detailed site-specific assessments would be required to confirm whether reclassification or remapping is appropriate. This would be undertaken by individual landowners, most likely as part of the future structure planning process.

*Table 18: Wetlands identified as requiring further investigation*

UFI	Existing management category (DBCA 2018)	Recommendation based on preliminary desktop assessment
7959	Conservation	Management category may be overstated.
8077	Conservation	Management category may be overstated.
8088	Conservation	Management category may be overstated.
8119	Conservation	Management category may be overstated.
8154	Conservation	Management category may be overstated.
8161	Conservation	Management category may be overstated.
8093	Conservation	Management category may be overstated in portions (west of Hawkins Road).
15006	Conservation	Management category may be overstated in portions (south-eastern extent).
7941	Resource Enhancement	Management category may be overstated.
7943	Resource Enhancement	Management category may be overstated.
8094	Resource Enhancement	Management category may be overstated.
14254	Resource Enhancement	Management category may be overstated.
8123	Resource Enhancement	Management category and extent of wetland may be overstated.
8105	Resource Enhancement	Management category may be overstated in portions (within rural lots).
8127	Resource Enhancement	Management category may be overstated in portions (within rural lots).
8121	Resource Enhancement	Management category may be overstated in portions (within cropped areas).
8081	Resource Enhancement	Management category may be overstated in portions (southern extent).
8120	Resource Enhancement	Management category may be understated.
14244	Resource Enhancement	Management category may be understated.
14253	Resource Enhancement	Management category may be understated.
14261	Resource Enhancement	Management category may be understated.
15443	Resource Enhancement	Management category may be understated.
8095	Resource Enhancement	Management category may be understated in portions and overstated in other areas.
8114	Resource Enhancement	Management category may be understated in portions and overstated in other areas.
14245	Resource Enhancement	Management category may be understated in portions and overstated in other areas.
14247	Resource Enhancement	Management category may be understated in portions and overstated in other areas.

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UFI	Existing management category (DBCA 2018)	Recommendation based on preliminary desktop assessment
8341	Multiple Use	May not represent a wetland.
8128	Multiple Use	Management category may be understated.
8134	Multiple Use	Management category may be understated.
8340	Multiple Use	Management category may be understated.
8138	Multiple Use	Management category and extent of wetland may be understated.
7957	Multiple Use	Management category may be understated in portions.
8110	Multiple Use	Management category may be understated in portions.
8116	Multiple Use	Management category may be understated in portions.
8117	Multiple Use	Management category may be understated in portions.

### 6.3.3 Bush Forever sites

A number of Bush Forever sites are distributed across the extent of the site, as shown in **Figure 2**, which individually vary in size from 0.5 ha up to 508 ha. Overall, the vast majority of these Bush Forever Sites intersect areas of high environmental value, including but not limited to:

- Occurrences of CCWs
- Occurrences of intact vegetation potentially representative of TECs, including SCP 20a, Banksia Woodlands and Tuart Woodlands (assuming it is listed under the EPBC Act).
- Occurrences of linear, intact native vegetation which provide ecological linkage functionality.

However, based on the outcomes of desktop investigations and the preliminary vegetation assessment, some portions of existing Bush Forever sites do not appear to support significant environmental values and may require review. These include:

#### Bush Forever sites 104, 105, 106, 107, 108, 146, 433, 441 & 443

All of these Bush Forever sites incorporate small patches of native vegetation and are all located in the northern extent of the site, amongst areas of existing or historical pine plantations. As a result of this, these Bush Forever sites are highly isolated from other patches of native vegetation, with surrounding areas either completely cleared or comprising non-native pine plantation.

#### Bush Forever site 147 (part)

The portion of Bush Forever site 147 comprising Lot 802 (associated with Little Mariginiup Lake) does not appear to contain intact native vegetation beyond some scattered trees. Whilst Little Mariginiup Lake is classified as a Conservation Category Wetland, it appears that it is comprised of grass species and is actively mown. The environmental values of this area appear to be limited.

#### Bush Forever site 327 (part)

Bush Forever site 327 is comprised of a number of sub-areas across a number of land parcels, with the western portion of the Bush Forever site situated within Lots 5 and 6 Mary Street isolated from the remainder of the Bush Forever site. This isolated portion is small in area (approximately 3.5 ha)

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and has limited connectivity with other areas of native vegetation. The original Bush Forever document recommended implementation of this portion of Bush Forever site 327 to be facilitated through a 'rural complementary mechanism', which is consistent with the current rural land uses of the surrounding area. However, the proposed urban land uses of the site will no longer be consistent with the 'rural complementary mechanism' originally identified to implement this Bush Forever site. This is not a constraint to intensification of land uses across the site, but provides an opportunity to review whether achieving a conservation outcome in these areas is still desired and if so, what an appropriate implementation mechanism may be. Other portions of Bush Forever 327 site within lots 9 and 10 Mary Street were similarly originally identified to be implemented through 'rural complementary mechanisms', but whilst it is a summarily small-sized patch to that within Lot 5 and 6, it is more connected with larger areas of the Bush Forever site to the east.

#### Bush Forever site 326 (part)

Bush Forever Site 326 in the eastern extent of the site incorporates large, generally contiguous areas of bushland which extends across a number of land parcels, some of which are reserved under the MRS for P&R or State Forest, whilst others support existing rural-residential land uses. Vegetation within the majority of Bush Forever site 326 is representative of the Bassendean Complex – North Transition, of which 91.3% of the pre-European extent remains across the Swan Coastal Plain. Vegetation across the remainder of the site is representative of other regional vegetation complexes, the majority of which have in the order of 30% of their original pre-European extent remaining across the Swan Coastal Plain. As such, the protection of vegetation representative of the Bassendean Complex – North Transition complex could be considered a lesser priority than that of vegetation representative of other vegetation complexes within the site. Notwithstanding the above, the relative environmental value of this vegetation is increased due to the large area and generally contiguous nature of this vegetation, which is uncommon across the remainder of the site.

It is also important to note that the originally proposed implementation mechanisms for BF 326 have generally been achieved based on existing land uses, specifically:

- The portions reserved for P&R or State Forest were identified in the original Bush Forever documents for the existing reserves and associated control and management intent to continue, which is understood to occur.
- The remaining areas which currently support rural-residential land uses were identified to be resolved through 'rural complementary mechanisms' in the original Bush Forever documents. Rural land uses in this area generally incorporate large areas of retained vegetation within private lots, which is generally consistent with the intended implementation outcomes. However, similar to site 327, the proposed intensification of land uses provides an opportunity to review whether achieving a conservation outcome in these areas is still desired and if so, what an appropriate implementation mechanism may be.

#### 6.3.4 Priority Local Natural Areas

As discussed in **Section 3.3**, the former DoP identified a number of Priority Local Natural Areas as part of the East Wanneroo Structure Plan in 2011. These were defined as areas of '*good quality natural vegetation*' outside of Bush Forever sites.

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The majority of the priority areas for further investigation identified in this EAS align with previously mapped Priority Local Natural Areas (CoW 2011), as shown in **Figure 18**. However, a number of Priority Local Natural Areas are mapped as occurring in portions of the site which have not been identified as priority areas for further investigation in this EAS. Whilst a number of these areas did were potentially representative of the SCP 20a TEC, they did not satisfy the remaining criteria to be identified as priority areas for further investigation. These areas have been considered as part of this EAS, as discussed in **Section 6.2.4**.

Other Priority Local Natural Areas which do not align with identified priority areas for further investigation occur in the north-east (generally associated with wetland areas) and eastern (within the mapped regional ecological linkage) extents of the site. These Priority Local Natural Areas were considered as part of this EAS, however did not satisfy the criteria to be identified as priority areas for further investigation, primarily due to the likely absence of SCP 20a in these areas. Where these Priority Local Natural Areas form large, intact areas of vegetation, it is recommended that they are subject to detailed site-specific investigations as part of local structure planning. These areas are shown in **Figure 18**.

## 6.4 Ranking of priority areas for further investigation

### 6.4.1 Principles

Based on the criteria discussed in **Section 6.2**, priority areas for further investigation have been identified within the site, as shown in **Figure 18**. Whilst protection of all priority areas is recommended (subject to confirmation of their environmental values through further investigations), certain areas may be of relatively higher environmental value than others, and as such may warrant a higher level of prioritisation for protection compared to others.

The following factors have been considered in determining the higher priority areas for further investigation and potential protection:

- Where a priority area for further investigation is of larger size or has greater connectivity, both within the patch itself (less gaps in vegetation) and with other patches of vegetation (less distance between other patches).
- Where priority areas for further investigation occur wholly within a single (or low number of) land parcel/s compared to those spread across a number of cadastral boundaries, given:
  - These patches generally have greater connectivity (as discussed above), with less gaps in vegetation due to factors such as additional firebreaks and access tracks.
  - Conservation outcomes are typically easier to be realised when the values to be protected occur within in a single landholding, as this reduces complexity of dealing with multiple landowners.

(Detailed mapping providing in **Appendix B** shows the extent to which priority areas occur across cadastral boundaries).

- Where priority areas for further investigation contribute to mapped regional ecological linkages.
- Where priority areas for further investigation align with identified Priority Local Natural Areas.
- Where priority areas for further investigation align with identified high-value LNAs.



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- Where a low relative likelihood of a priority area for further investigation containing SCP 20a can be determined based on known FCTs of directly adjacent Bush Forever sites. For example, if a Bush Forever site is recorded as containing FCTs which do not include SCP 20a, then extensions or directly adjacent occurrences of vegetation identified as priority areas for further investigation are unlikely to contain the SCP 20a TEC and as such are not considered to be of a high priority.

#### 6.4.2 High priority areas for further investigation

Based on the above principles, an assessment has been completed of the identified priority areas for further investigation to determine which have a higher comparative priority compared to others. These areas are shown in **Figure 18** and are listed as follows:

- **Area A** which forms a relatively contiguous patch, close to a regional ecological linkage, across a small number of land parcels, within a high-value LNA and partly within a PLNA.
- **Area B** which forms a compact patch, across two land parcels, within a high-value LNA and partly within a PLNA.
- **Area C** which forms an extension of the adjacent Bush Forever site, is compact, part of a regional ecological linkage, within a high-value LNA and within a PLNA.
- **Area D** forms a large, consolidated, contiguous patch, within a regional ecological linkage, a high-value LNA and a PLNA.
- **Area E** which forms an extension of the adjacent Bush Forever site, is a compact, part of a regional ecological linkage, within a high-value LNA and a PLNA.
- **Area F** which forms an extension of the adjacent Bush Forever site, is a compact, part of a regional ecological linkage, within a high-value LNA and a PLNA.
- **Area G** which can be consolidated into a large contiguous patch, and is within a PLNA and partly within a high value LNA.
- **Area H** which forms part of a regional linkage, is within a single land parcel and a PLNA.
- **Area I** which forms an extension of the adjacent Bush Forever site, is within a single land parcel, forms part of a regional ecological linkage, is within a high value LNA and a PLNA.
- **Area J** which is within a single land parcel, is within a PLNA and forms a large consolidated patch.
- **Area K** which incorporates a large contiguous patch within a regional ecological linkage within a PLNA and high value LNA.
- **Area L** which is within a single land parcel, a regional ecological linkage, a PLNA, a high value LNA and forms a large consolidated patch. However, it is noted that existing environmental approvals apply to this area.

Detailed mapping of the above high priority areas for further investigation is provided in **Appendix B**.

#### 6.5 Summary of priority areas for further investigation

The outcomes of the spatial environmental analysis completed as part of this EAS are summarised as follows:

- Large areas of vegetation comprising a range of environmental values within the site are afforded an existing level of acknowledgement and protection through existing land use planning mechanisms and as such, are expected to facilitate biodiversity conservation outcomes



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(assuming these mechanisms are/continue to be implemented in the future). Areas of environmental values subject to existing protection mechanisms are shown in **Figure 18** and include:

- Areas regionally reserved for P&R under the MRS
- Areas locally reserved for conservation under the CoW DPS No. 2
- Areas within Bush Forever sites
- Areas within a mapped CCW or its nominal 50 m buffer.
- In addition to areas of environmental value subject to existing protection mechanisms, a number of areas of vegetation have been identified as potentially supporting significant environmental values. These areas have been identified as 'priority areas for further investigation', meaning detailed site specific investigations are required to confirm these environmental values and, if confirmed, are recommended to be prioritised for protection as part of the future planning process. These priority areas for further investigation are shown in **Figure 18** and have been determined based on a range of criteria including:
  - Occurrences of vegetation potentially representative of TECs, such as SCP 20a
  - Minimum patch size thresholds
  - Consideration of patch ecological viability with regard to shape and geometry.
- Of the identified priority areas for further investigation, a number of these were determined to be of highest priority due to range of factors, namely composition, size and connectivity of patches, consolidated land ownership, contribution to regional ecological linkages and alignment with identified 'Priority Local Natural Areas' (DoP 2011) and 'Local Natural Areas' (CoW 2018).

More detailed mapping of priority areas for further investigation is provided in **Appendix B**, which includes consideration of existing environmental approvals.

The biodiversity conservation outcomes which could be realised across the site are summarised in **Table 19** and **Appendix A**, which is based on the assumption that all areas subject to existing protection mechanisms (including MRS P&R reserves, Bush Forever sites, CoW local conservation reserves and CCWs (and nominal 50 m buffers)) are implemented, and that the following areas are further investigated and confirmed to support their identified environmental values, and are then retained through the future planning process such that all vegetation within these areas are ultimately protected for conservation:

- Vegetation within identified priority areas for further investigation
- Additional areas of vegetation potentially representative of the SCP 20a TEC in patches greater than 3 ha, and areas of the Tuart Woodlands TEC in patches greater than 3 ha (assuming this TEC is listed pursuant to the EPBC Act).

This scenario provides a strong basis for achieving biodiversity conservation outcomes for the key environmental values within the site for the purposes of regional level planning. However, this should not be interpreted to suggest that vegetation outside of these areas will be subject to future clearing, as there will be additional stages of the planning process, which may result in the protection of additional areas (for example, through the strategic location of public open space areas).

Notwithstanding this, the statistics provided in **Table 19** could be considered to represent a worst-case scenario to demonstrate that the DSP alone could achieve a reasonably robust environmental outcome.

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Table 19: Summary of potential protection outcomes\*

Environmental value	Extent across SCP (ha)	Extent within site (ha)	Percentage of SCP extent within site	Total extent potentially protected (ha) <sup>1</sup>	Percentage potentially protected – relative to site	Percentage potentially protected – relative to SCP
Native vegetation (DPIRD 2017a)	582,521	1,709.7	0.3%	1412.0	82.6%	0.2%
Potential TEC - SCP 20a <sup>2</sup>	585	323.6	35.9%	265.8	82.1%	29.5%
Potential TEC - Tuart Woodlands	25,410	53.1	0.2%	31.4	59.2%	0.1%
Potential TEC - Banksia Woodlands	336,490	1,167.2	0.3%	965.9	82.8%	0.3%
Fauna habitat - Potential CBC foraging habitat (Glossop <i>et al.</i> 2011)	43,964	1,309.3	3.0%	1059.6	80.9%	2.4%
Vegetation complex - Bassendean Central and South (26.1% remaining)	22,846	185.4	0.8%	159.3	85.9%	0.7%
Vegetation complex - Bassendean North (71.8% remaining)	53,218	238.4	0.4%	219.4	92.0%	0.4%
Vegetation complex - Bassendean North Transition (91.1% remaining)	16,069	346.9	2.2%	301.0	86.8%	1.9%
Vegetation complex - Karrakatta Central and South (23.0% remaining)	11,518	314.3	2.7%	242.8	77.3%	2.1%
Vegetation complex - Herdsman (33.9% remaining)	2,821	32.7	1.2%	32.1	98.2%	1.1%
Vegetation complex - Pinjar (30.0% remaining)	1,467	588.2	40.1%	457.4	77.8%	31.2%
Conservation Category Wetlands <sup>3</sup>	31,307	394.4	1.3%	394.4	100.0%	1.3%

\*Subject to confirmation of environmental values across the site through detailed surveys and investigations.

<sup>1</sup> If the following areas are protected: areas subject to existing protection mechanisms, identified priority areas, other areas (3+ ha patches of potential SCP 20a TEC, 3+ ha patches of potential Tuart Woodlands TEC).

<sup>2</sup> Note that of the 585 ha of this TEC known to occur across the SCP, only 7.5 ha of this is currently mapped within the site. As such, this total does not account for any increase in the total known extent of the TEC due to any additional occurrences confirmed within the site, which could potentially be up to a maximum of 323.6 ha.

<sup>3</sup> Where these value intersect existing native vegetation.

## 7 Implementation and Recommendations

It is possible that urbanisation can provide a mechanism to deliver conservation outcomes that wouldn't normally be realised in the absence of this process. This process can facilitate the transfer of land supporting significant environmental values from private ownership to the public conservation estate, which typically increases the long-term viability of these environmental values through increased management and funding, in addition to limiting permissible uses of the land only to those associated with its conservation. Whilst existing planning mechanisms seemingly provide substantial coverage of environmental values across the site, the future urbanisation could provide the opportunity to revisit and confirm (or otherwise) these values and also give means to implementation of their originally intended conservation outcomes. However, the ultimate tenure and ongoing management of these areas will be a key consideration that will need to be resolved.

The following are the key implementation considerations and recommendations arising from this EAS for the purposes of the preparation of the East Wanneroo DSP:

- This EAS has identified priority areas for further investigation, which have been identified as requiring further detailed investigation of their values, and if confirmed, should then be a priority for protection through the preparation of the East Wanneroo DSP and the future planning process, due to the environmental values they support. It is important to note:
  - Remnant vegetation within the identified priority areas for further investigation should be subject to verification, and these priority areas refined based on the results of detailed flora and vegetation surveys.
  - The recommendations do not presume or specify the planning mechanism to achieve the biodiversity conservation outcomes for the priority areas, and this will need to be considered as part of preparing the East Wanneroo DSP.
  - The identification of priority areas for further investigations does not assume that all environmental values across the site are captured within these, or that there will not be additional environmental assessments and approvals required for areas of remnant vegetation falling outside of the priority areas for further investigation.
- A key assumption is that all remnant vegetation within MRS P&R reserves, Bush Forever sites, CoW local conservation reserves and CCWs (and nominal 50 m buffers) is retained through the future planning process such that all vegetation within these areas is ultimately protected for conservation. It is therefore recommended that in addition to the East Wanneroo DSP preparation process, these existing protection mechanisms should be progressed to ensure biodiversity conservation outcomes can be achieved, noting that there may be some revisions of these mechanisms based on additional investigations recommended in this EAS.
- A desktop assessment of existing Bush Forever sites and geomorphic wetlands within the site has been completed, which has identified a number of Bush Forever sites which may require review and a number of geomorphic wetlands which may require reclassification. Further investigation of these values are recommended.

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- The predicted extent of potential TEC occurrences across the site, based on the outcomes of the preliminary vegetation assessment, are a key input to this assessment and have critically informed the recommendations on priority areas for further investigation. Site-specific flora and vegetation surveys should be completed to confirm the outcomes of the preliminary vegetation assessment and to verify the actual extent to which TECs occur within these areas.
- The likely occurrence of SCP 20a TEC is a significant environmental value within the site. This is based its State TEC listing, Commonwealth listing as part of the Banksia woodland TEC and its limited known extent. Protection of vegetation confirmed to be representative of this TEC should therefore be prioritised, which is a key principal underpinning the recommendations within this EAS and the identification of the priority areas for further investigation.
- This assessment has assumed that the Tuart Woodland TEC will be listed pursuant to the EPBC Act. Whilst areas potentially representative of this TEC are not included within the identified priority areas for further investigation, other areas of this vegetation which are potentially suitable for protection have been identified, should they be required to be implemented.
- Assuming that site-specific flora and vegetation surveys confirm the TEC assumptions from which this assessment is based, the protection of the priority areas identified as part of this EAS, as shown in **Figure 18**, provides a strong basis for achieving biodiversity conservation outcomes for the key environmental values within the site for the purposes of the DSP. Specifically, **Table 19** summarises the extent and proportion of each key environmental value occurring within the site which is identified within the priority areas for further investigation.
- Of the identified priority areas for further investigation, a number of these have been determined to have a higher comparative priority based on composition, size and connectivity of patches, consolidated land ownership, contribution to regional ecological linkages and alignment with identified 'Priority Local Natural Areas' (DoP 2011) and 'Local Natural Areas' (CoW 2018).
- Existing environmental approvals pursuant to the EPBC Act and EP Act should be considered when determining areas of environmental value to be protected, given such approvals may provide a basis to impact upon existing environmental values, or affect the ability to achieve biodiversity conservation outcomes.
- The identified priority areas for further investigation commonly extend across more than a single land ownership boundary. As such, consideration should be given as to how cadastral boundaries and associated fragmented land ownership may impact upon implementing the priority areas for further investigation identified in this EAS. **Appendix B** provides detailed plans showing the extent of environmental values identified for protection at a lot-specific scale.
- Additional environmental investigations are likely to be required as part of future local structure planning exercises, in order to determine environmental approval requirements and/or further retention requirements of biodiversity values within the site. These investigations should include site-specific flora and vegetation surveys to confirm the outcomes of the preliminary vegetation assessment, and should also consider:
  - The extent of FCT 20a that falls outside of the priority areas
  - The facilitation of regional ecological linkages
  - EP Act and/or EPBC Act approval requirements

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- It is recommended that DPLH and DBCA maintain a register of all detailed flora and vegetation surveys as they are completed across the site. This will allow the tracking of all confirmed occurrences of the SCP 20a TEC within the site, which can then be compared to the statistics presented in this EAS and inform future planning decisions.
- The methodology of this EAS is not inconsistent with the draft *Perth and Peel Green Growth Plan* (GGP). Whilst it is acknowledged the future of the draft GGP is currently under review, if such a strategic mechanism was ultimately approved and implemented in the future, it may provide a basis for managing environmental values outside of the identified priority areas without the need for additional environmental approvals.

## Environmental Assessment Study

### East Wanneroo District Structure Plan



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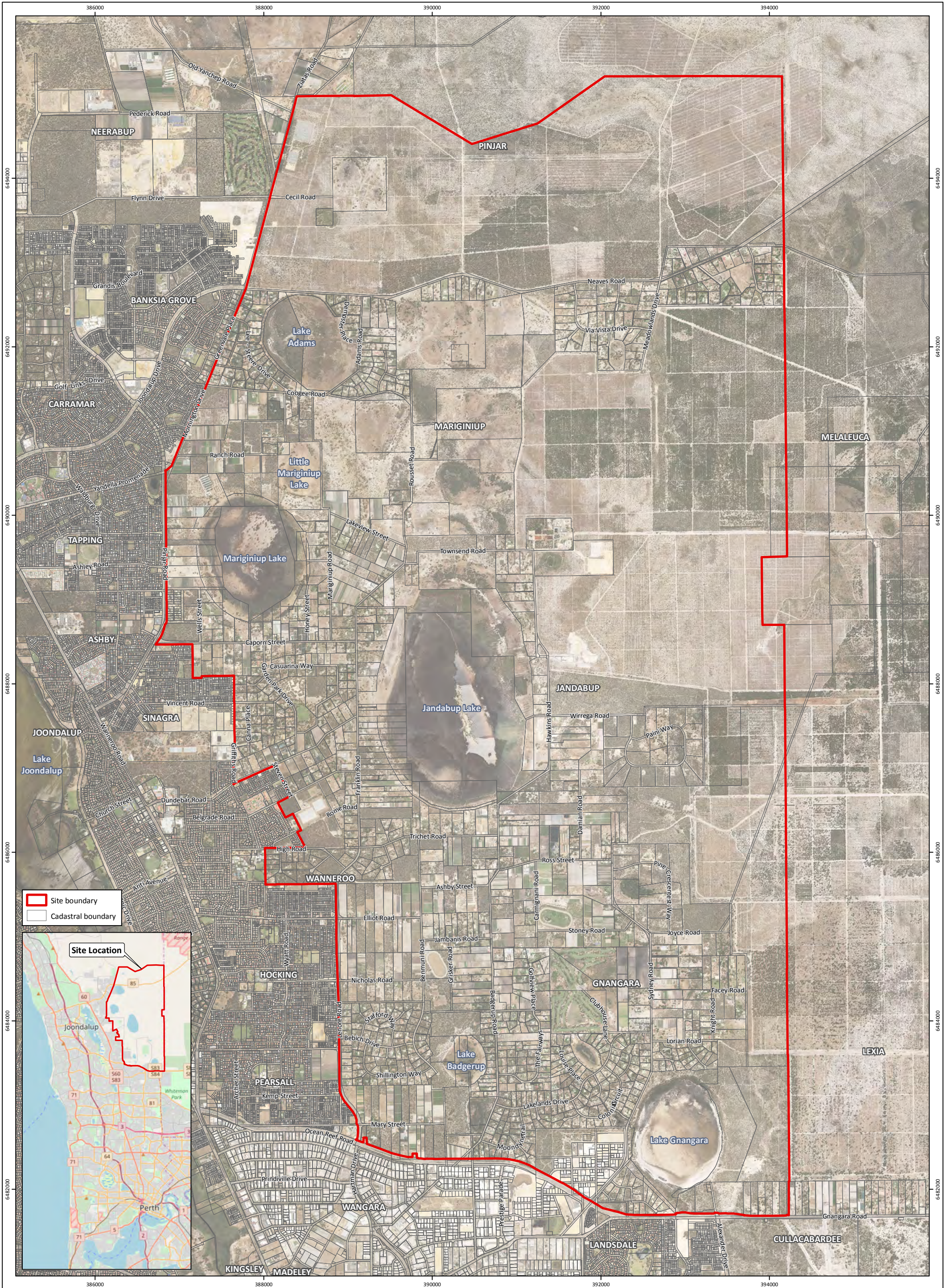


Figure 1: Site Location

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F13

**Drawn:** KNM

**Date:** 14/12/2017

**Checked:** ADB

**Approved:** JDH

**Date:** 21/02/2018



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GDA 1994 MGA Zone 50



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







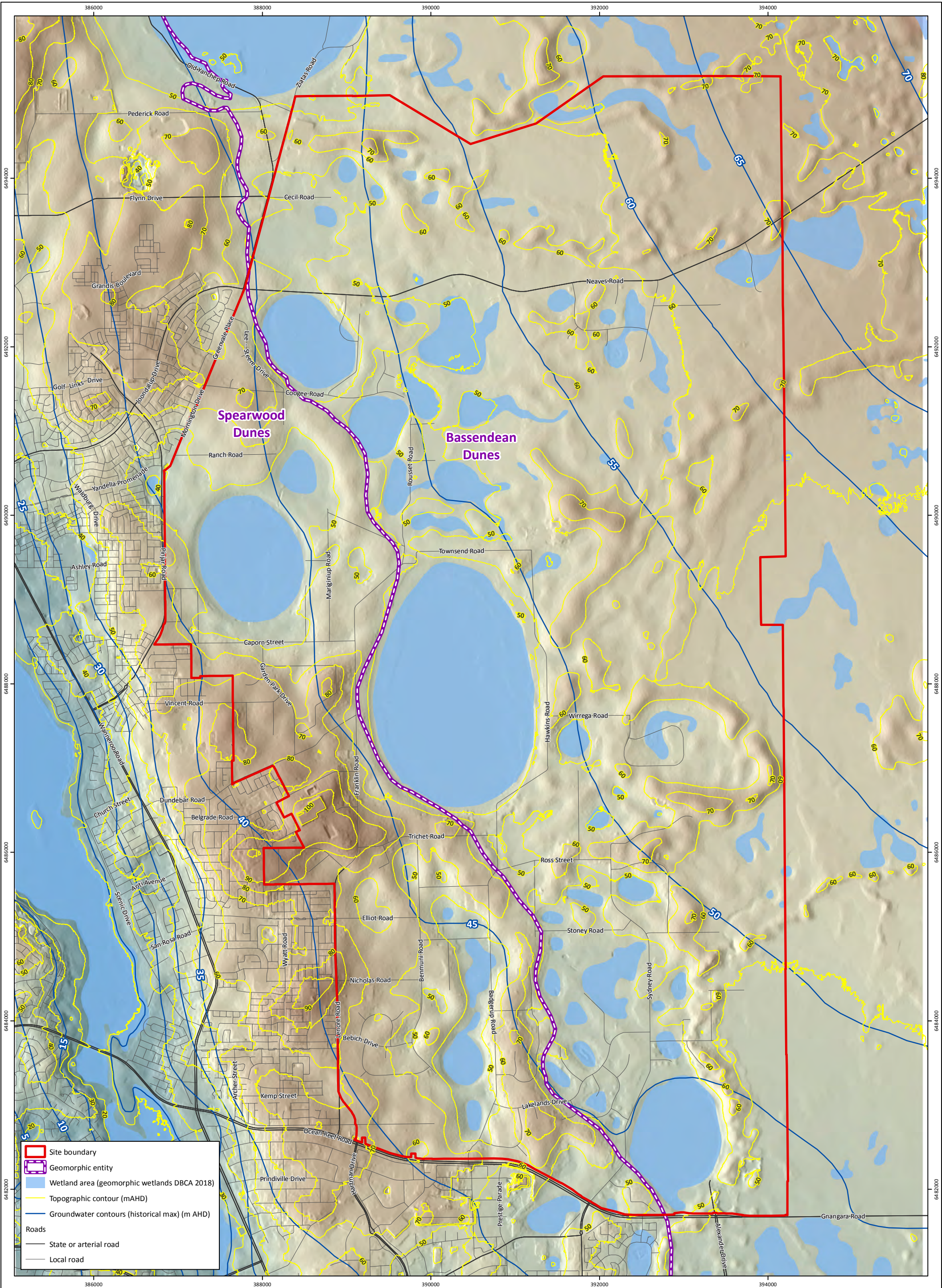


Figure 3: Landforms and Topography

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F15a  
**Drawn:** ADB  
**Date:** 04/10/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 04/10/2018



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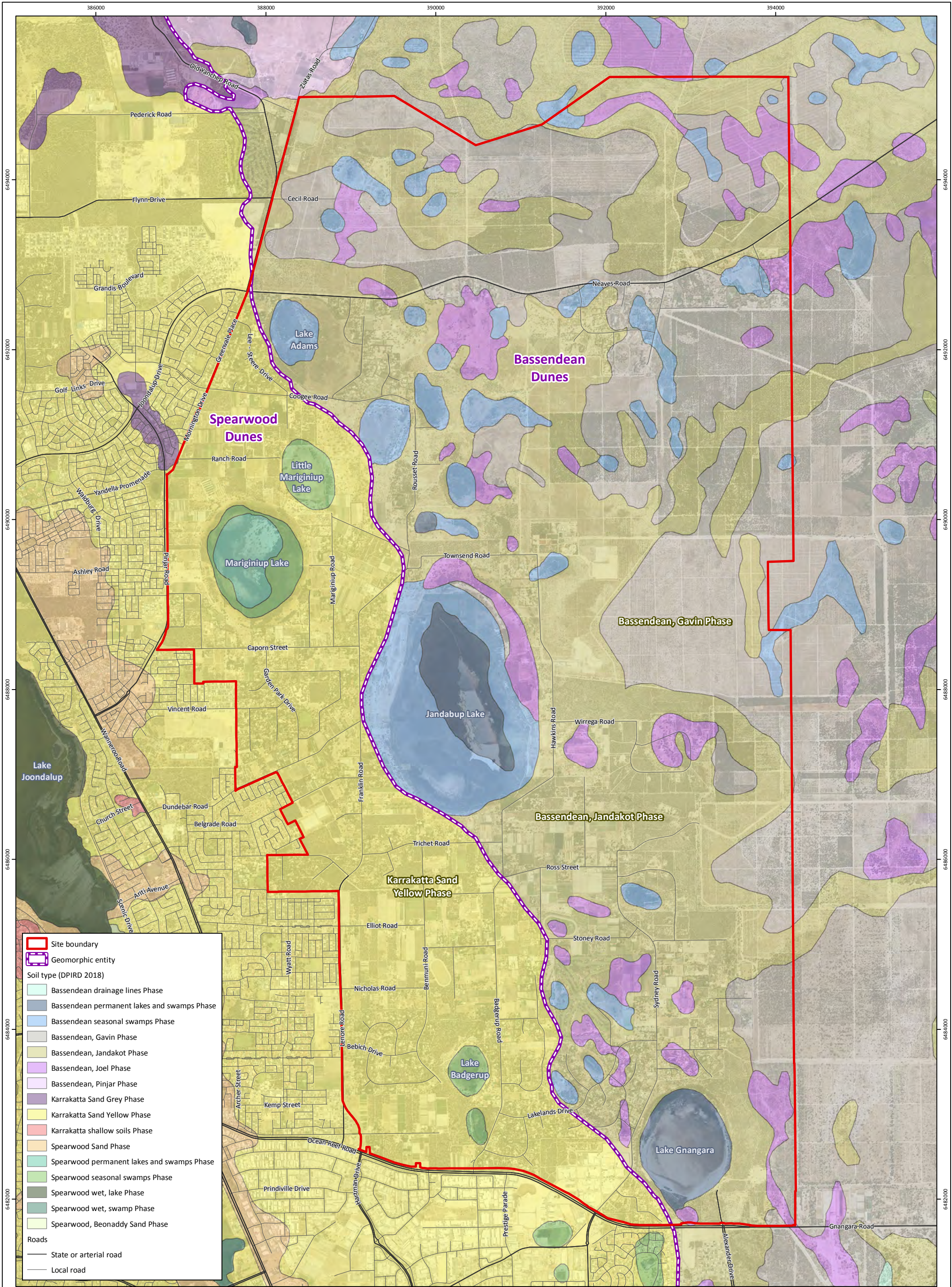


Figure 4: Soils

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F31  
**Drawn:** KNM  
**Date:** 16/02/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 21/02/2018

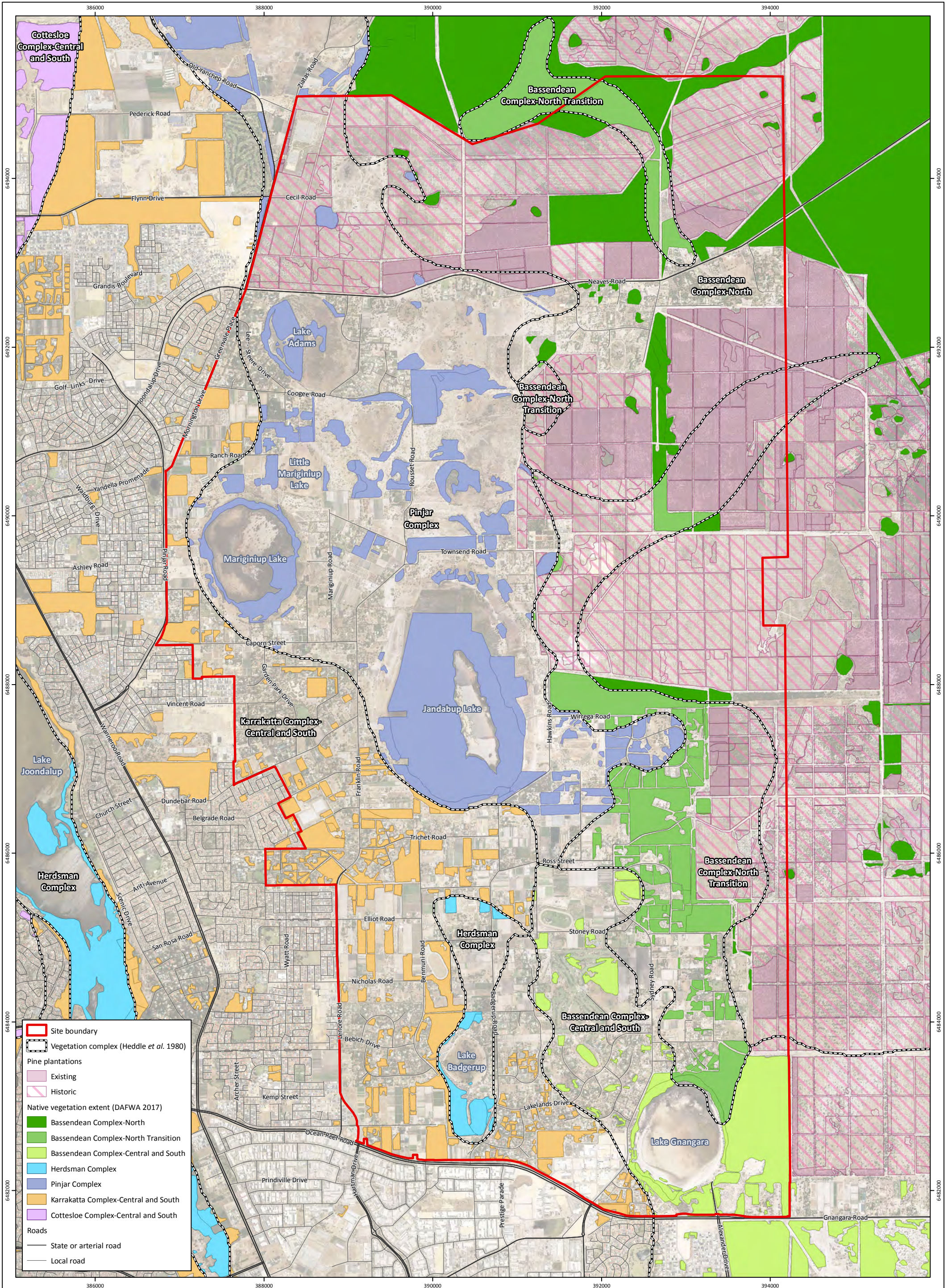


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GDA 1994 MGA Zone 50



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





**Figure 5: Regional Vegetation Complexes and Extent**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F16  
**Drawn:** KNM  
**Date:** 14/12/2017  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 21/02/2018



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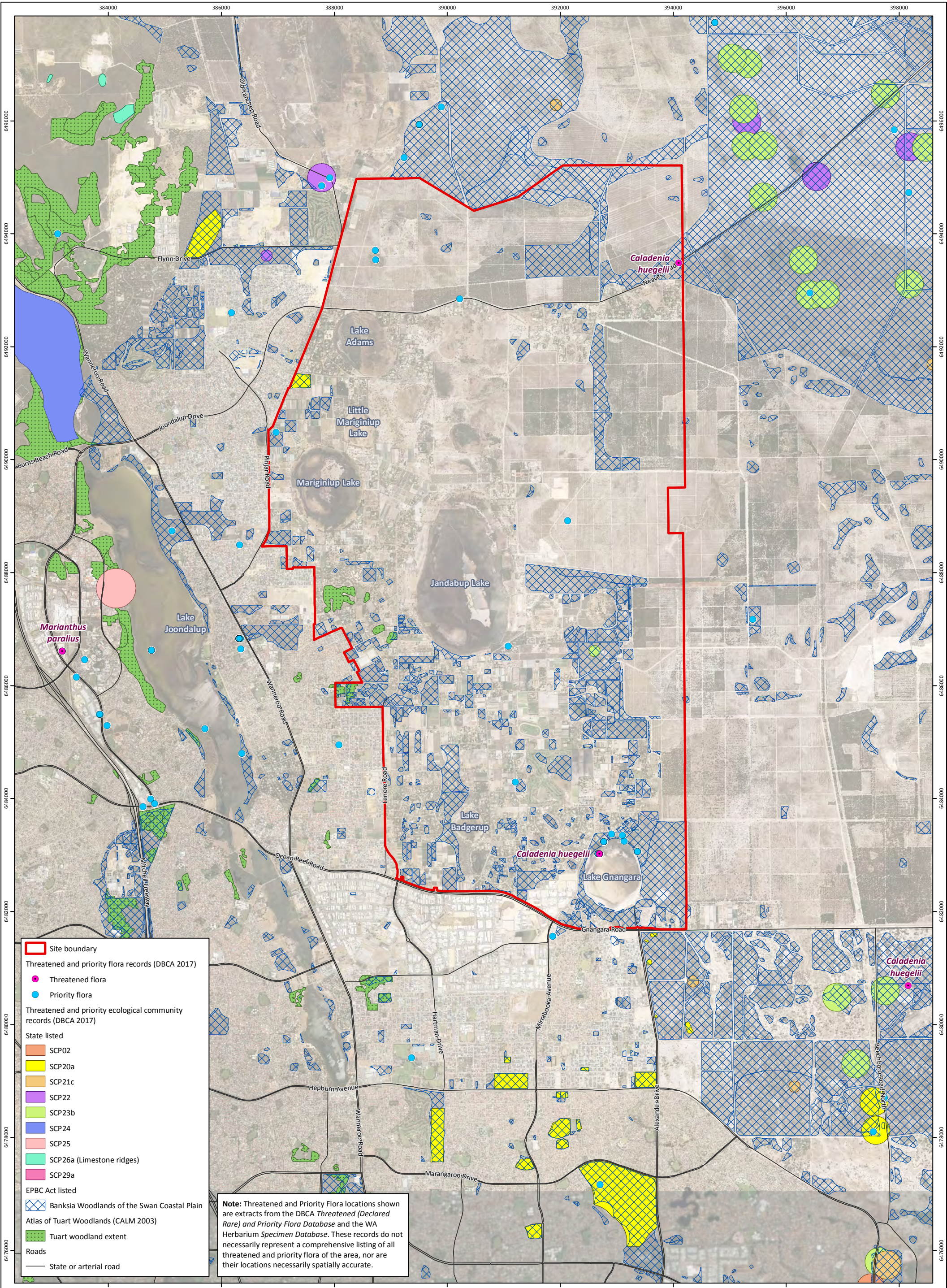


Figure 6: Conservation Significant Flora and Vegetation (DBCA Records)

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F17b  
**Drawn:** ADB  
**Date:** 28/09/2018  
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**Approved:** JDH  
**Date:** 28/09/2018



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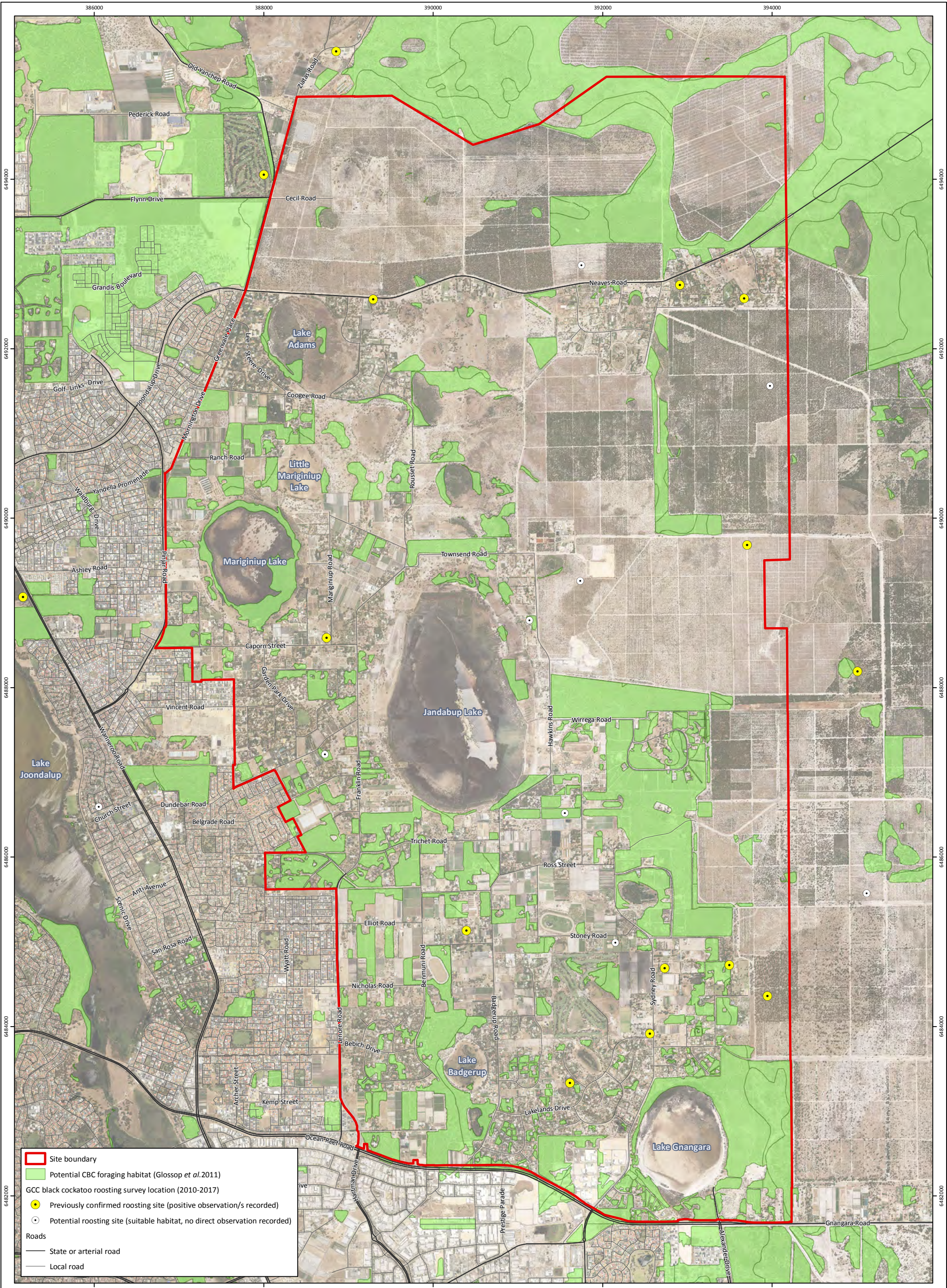


Figure 7: Carnaby's Black Cockatoo Habitat

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F32a  
**Drawn:** KNM  
**Date:** 15/06/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 15/06/2018

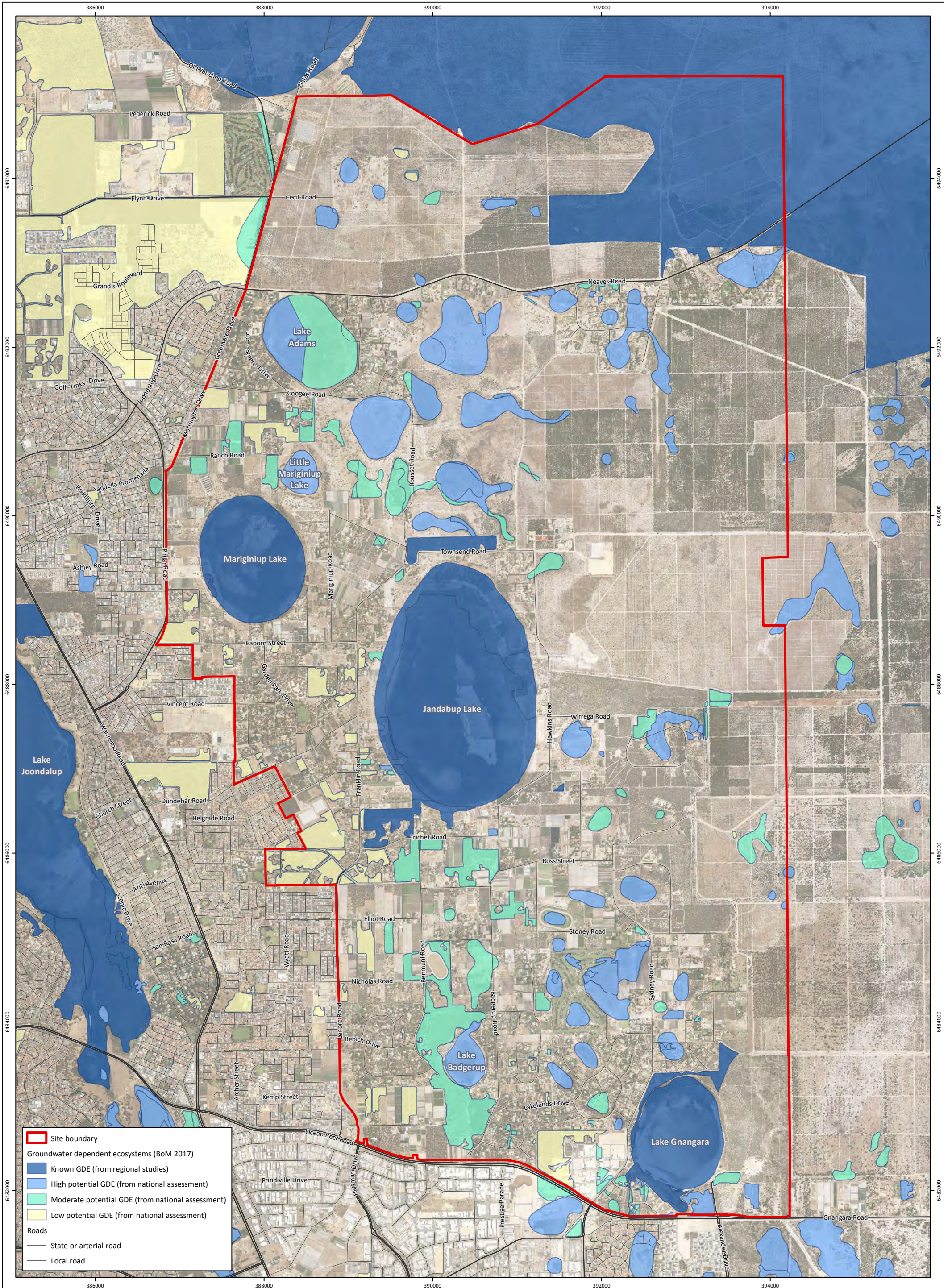


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GDA 1994 MGA Zone 50



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





**Figure 8: Groundwater Dependent Ecosystems**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F35

**Drawn:** KNM

**Date:** 16/02/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 21/02/2018



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Metres

**Scale: 1:40,000@A3**

GDA 1994 MGA Zone 50



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



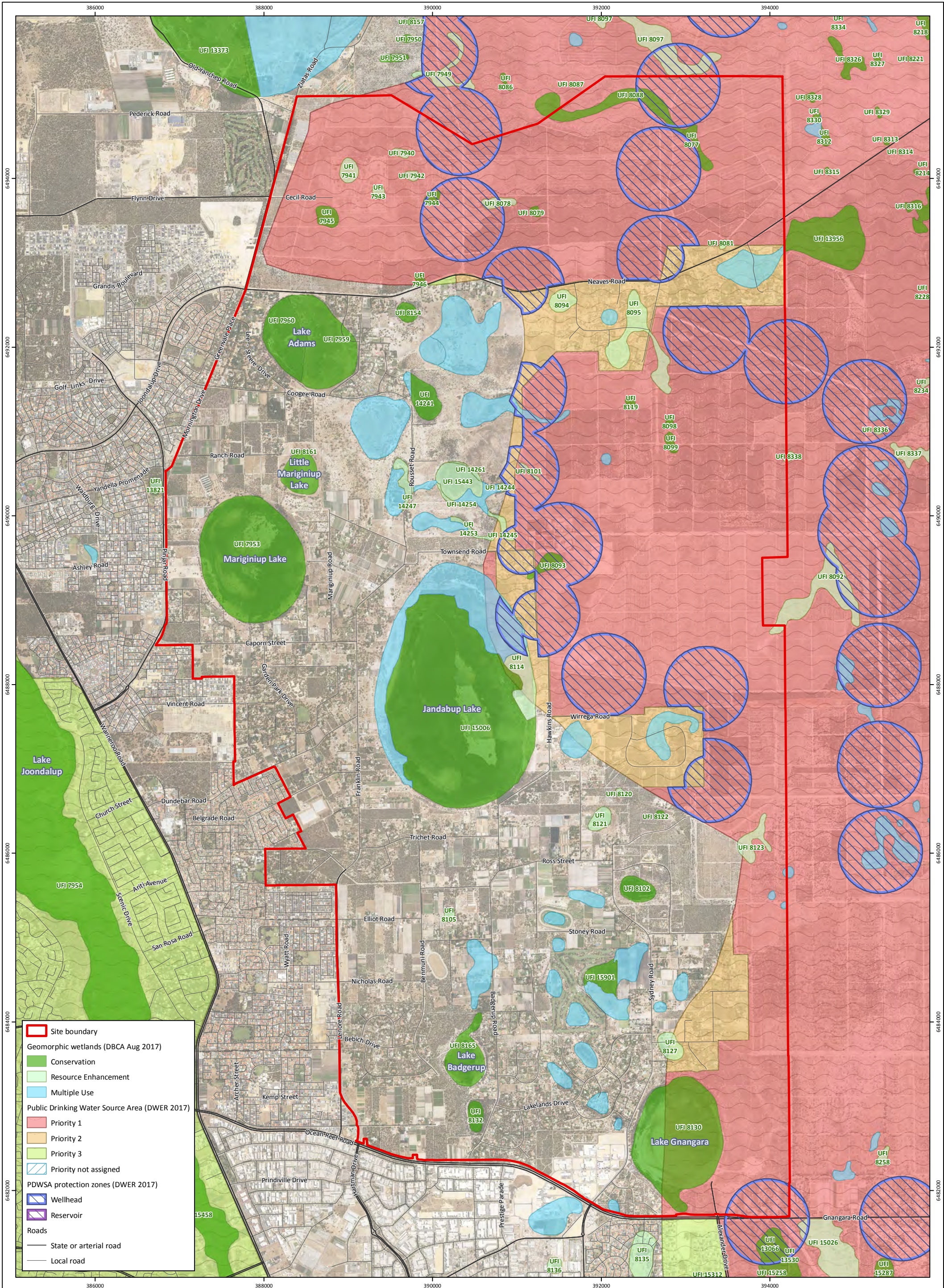


Figure 9: Geomorphic Wetlands and Public Drinking Water Source Areas

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F22  
**Drawn:** KNM  
**Date:** 14/12/2017  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 21/02/2018



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GDA 1994 MGA Zone 50



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



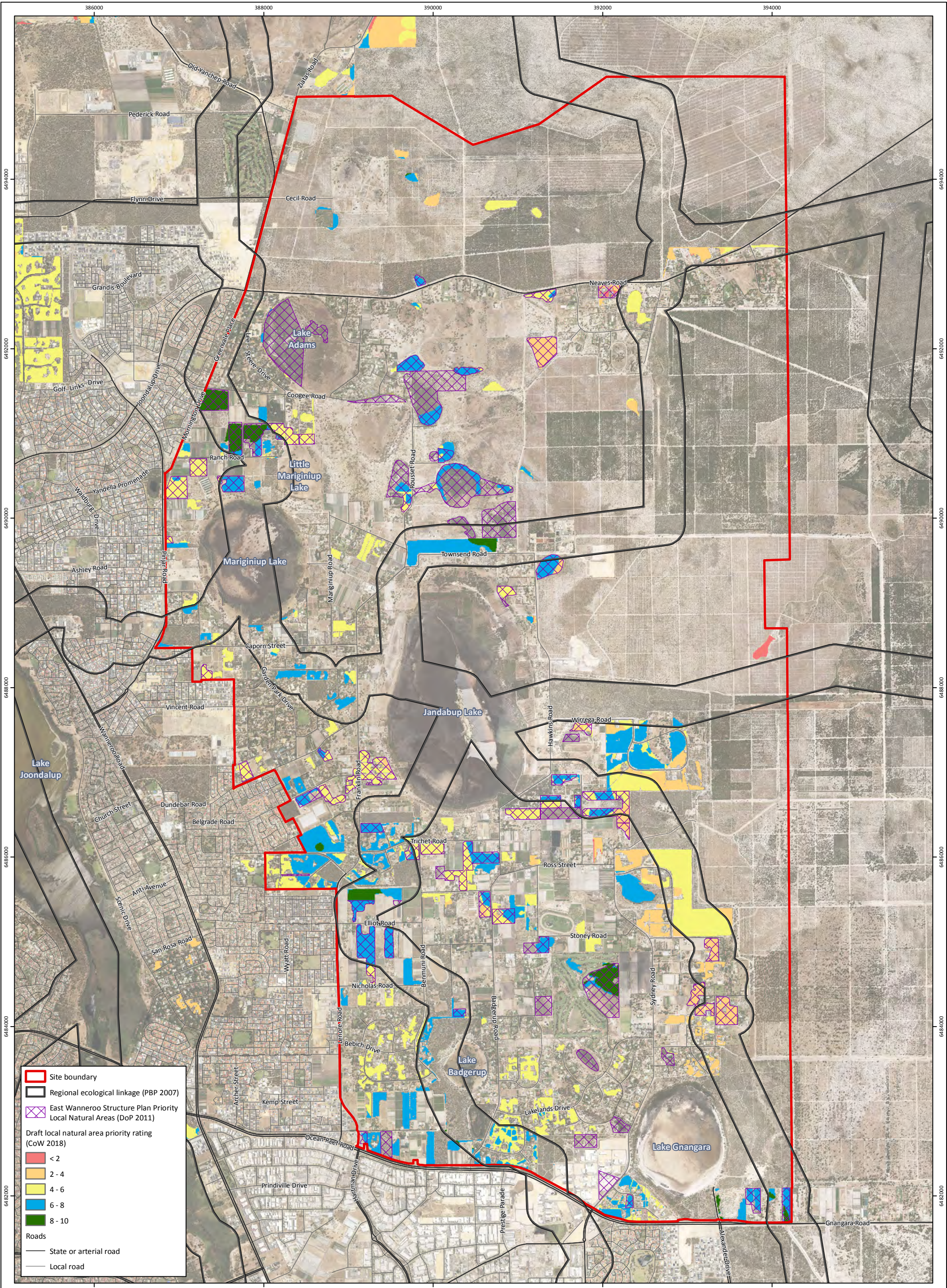


Figure 10: Local Natural Areas and Regional Ecological Linkages

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F33a  
**Drawn:** KNM  
**Date:** 07/06/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 15/06/2018



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GDA 1994 MGA Zone 50



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



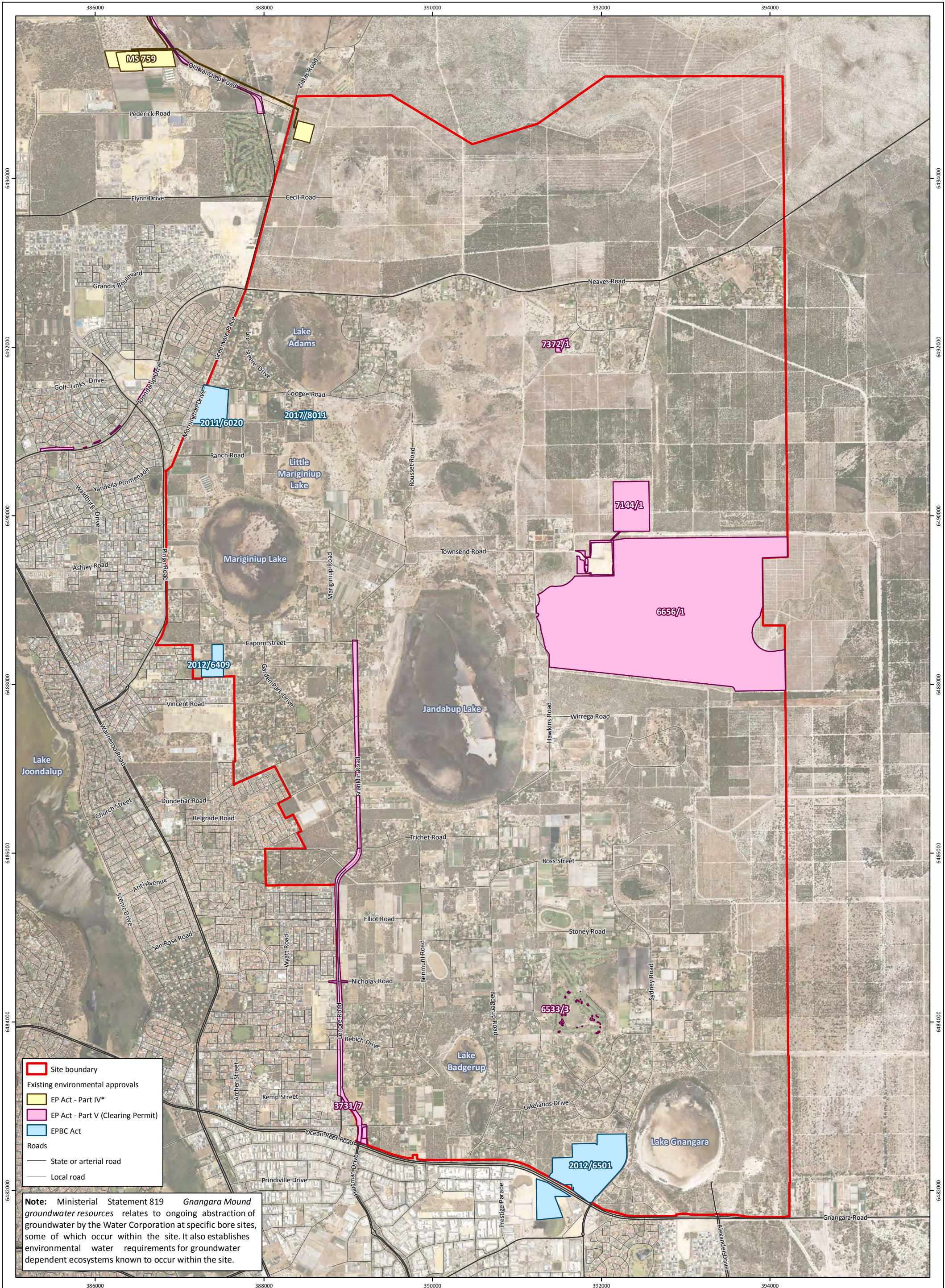


Figure 11: Existing Environmental Approvals

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F34  
**Drawn:** KNM  
**Date:** 16/02/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 21/02/2018



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GDA 1994 MGA Zone 50



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



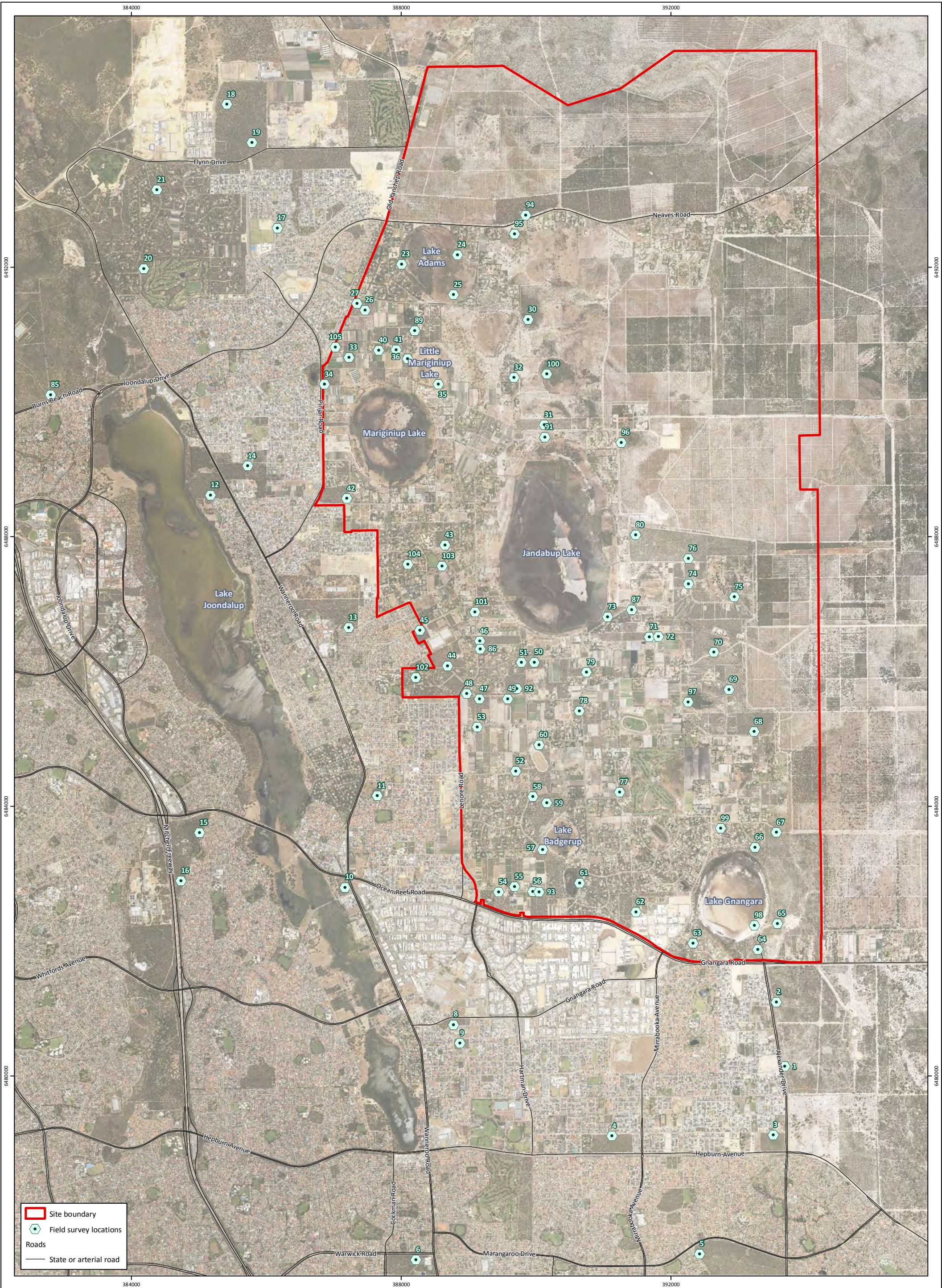


Figure 12: Preliminary Vegetation Assessment – Sample Locations

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)–F36  
**Drawn:** KNM  
**Date:** 16/02/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 21/02/2018



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GDA 1994 MGA Zone 50





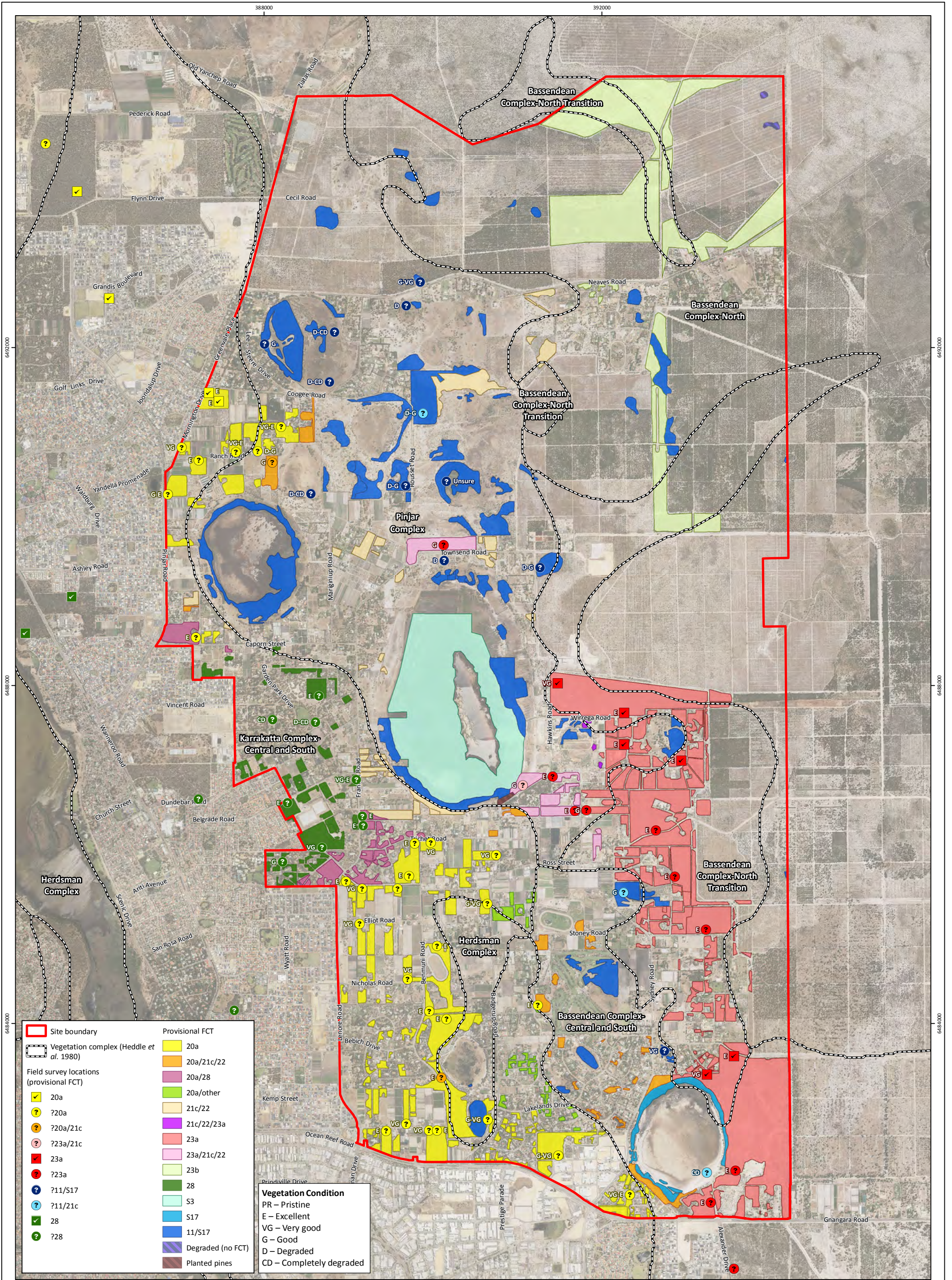


Figure 13: Preliminary Vegetation Assessment – Provisional Floristic Community Types

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

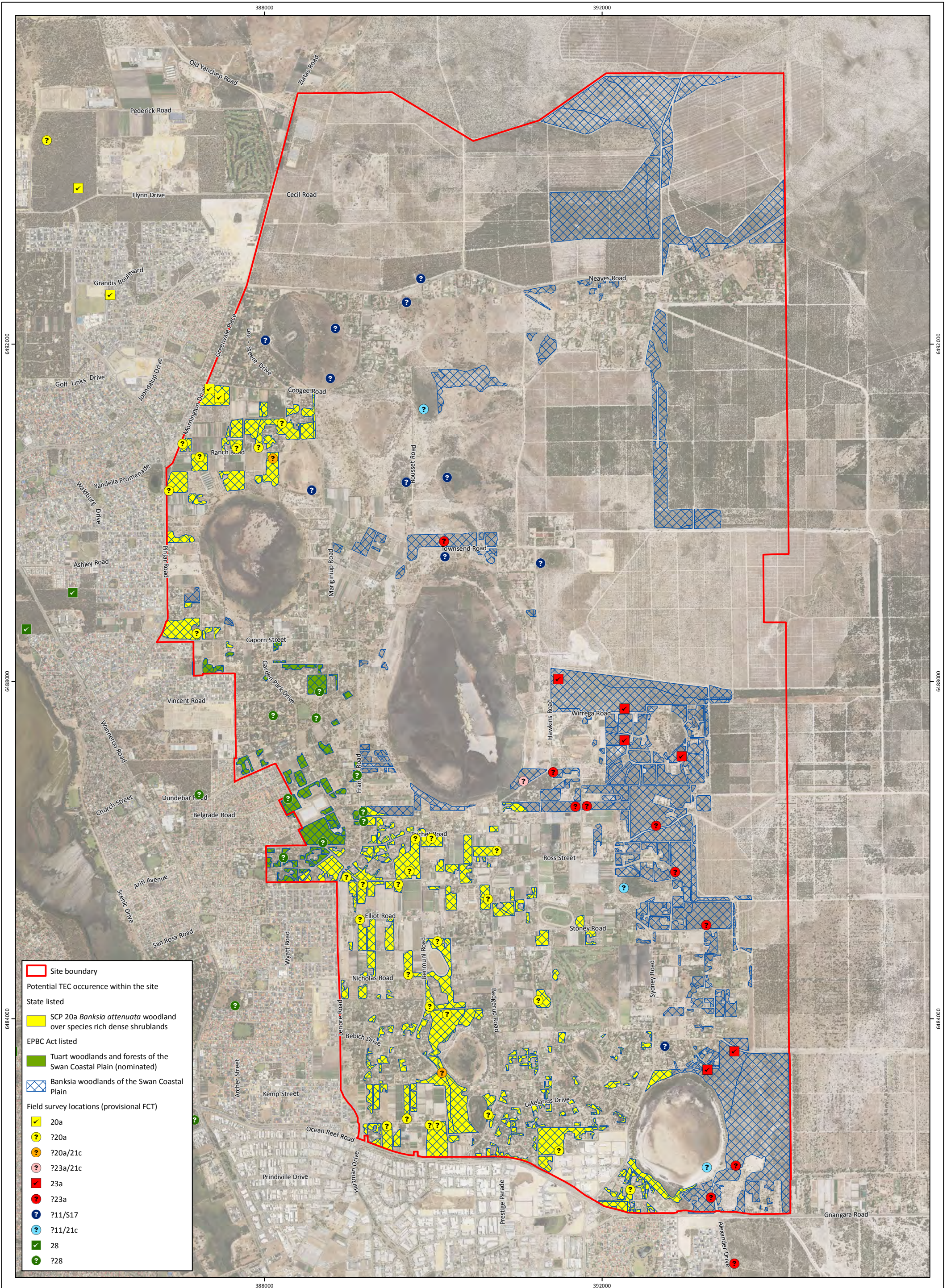
**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F37b  
**Drawn:** KNM  
**Date:** 01/08/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 01/08/2018



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





**Figure 14: Preliminary Vegetation Assessment – Potential Extent of Threatened Ecological Communities**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)–F38a  
**Drawn:** ADB  
**Date:** 15/06/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 15/06/2018



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GDA 1994 MGA Zone 50



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



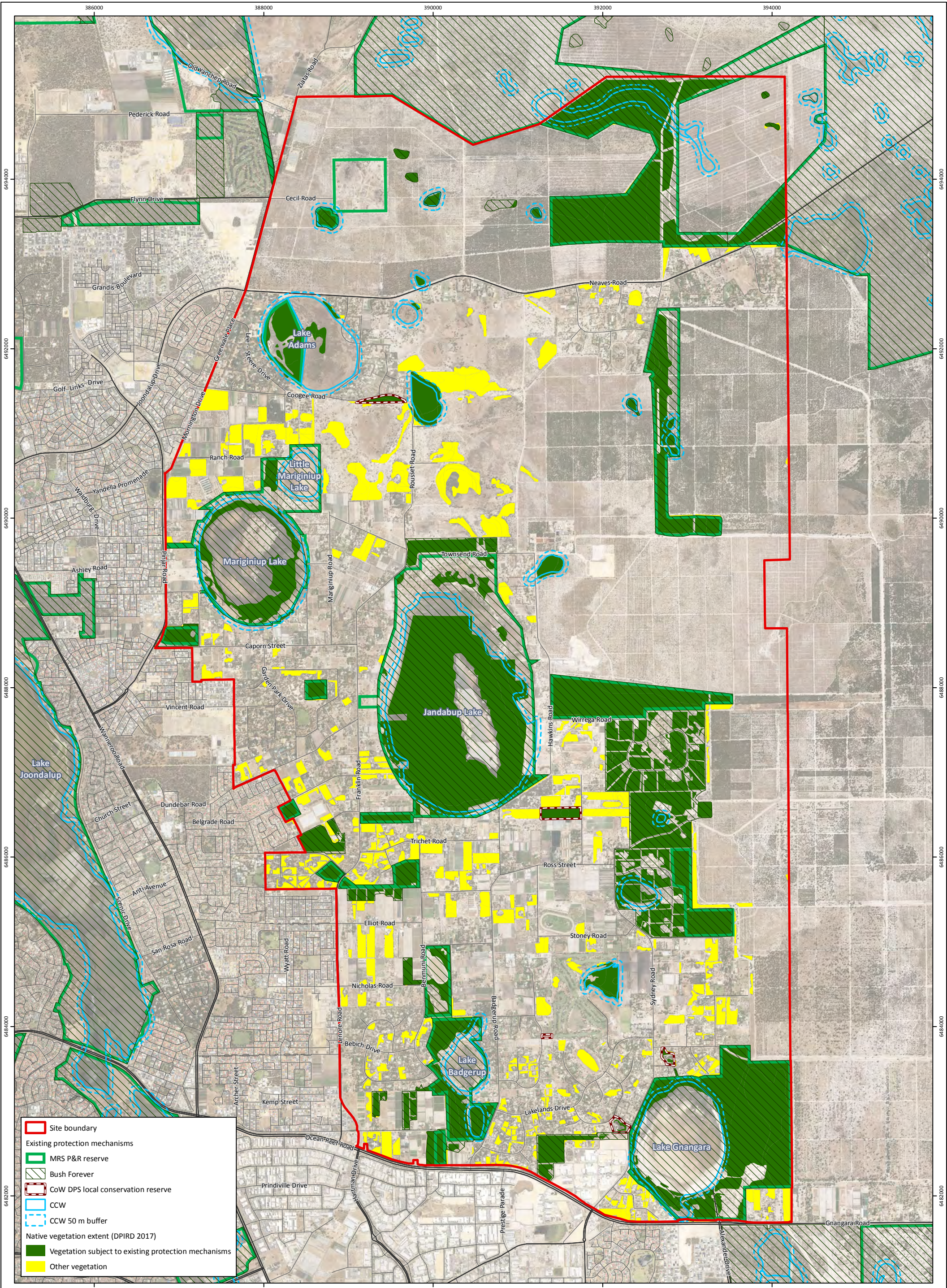


Figure 15: Existing Protection Mechanisms

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F39  
**Drawn:** ADB  
**Date:** 20/02/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 21/02/2018



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GDA 1994 MGA Zone 50



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



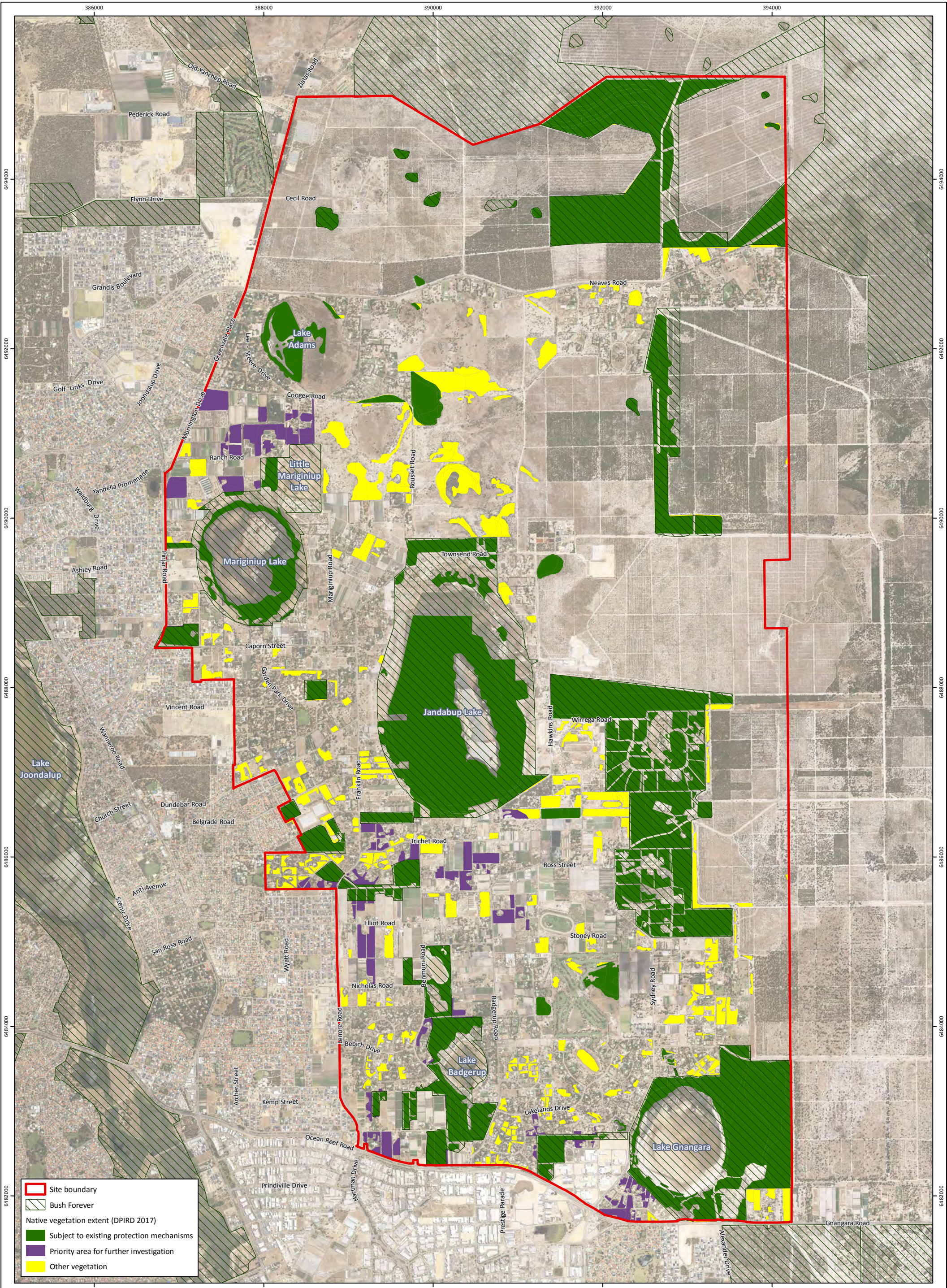


Figure 16: Identification of Priority Areas for Further Investigation

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F40b  
**Drawn:** ADB  
**Date:** 28/09/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 28/09/2018

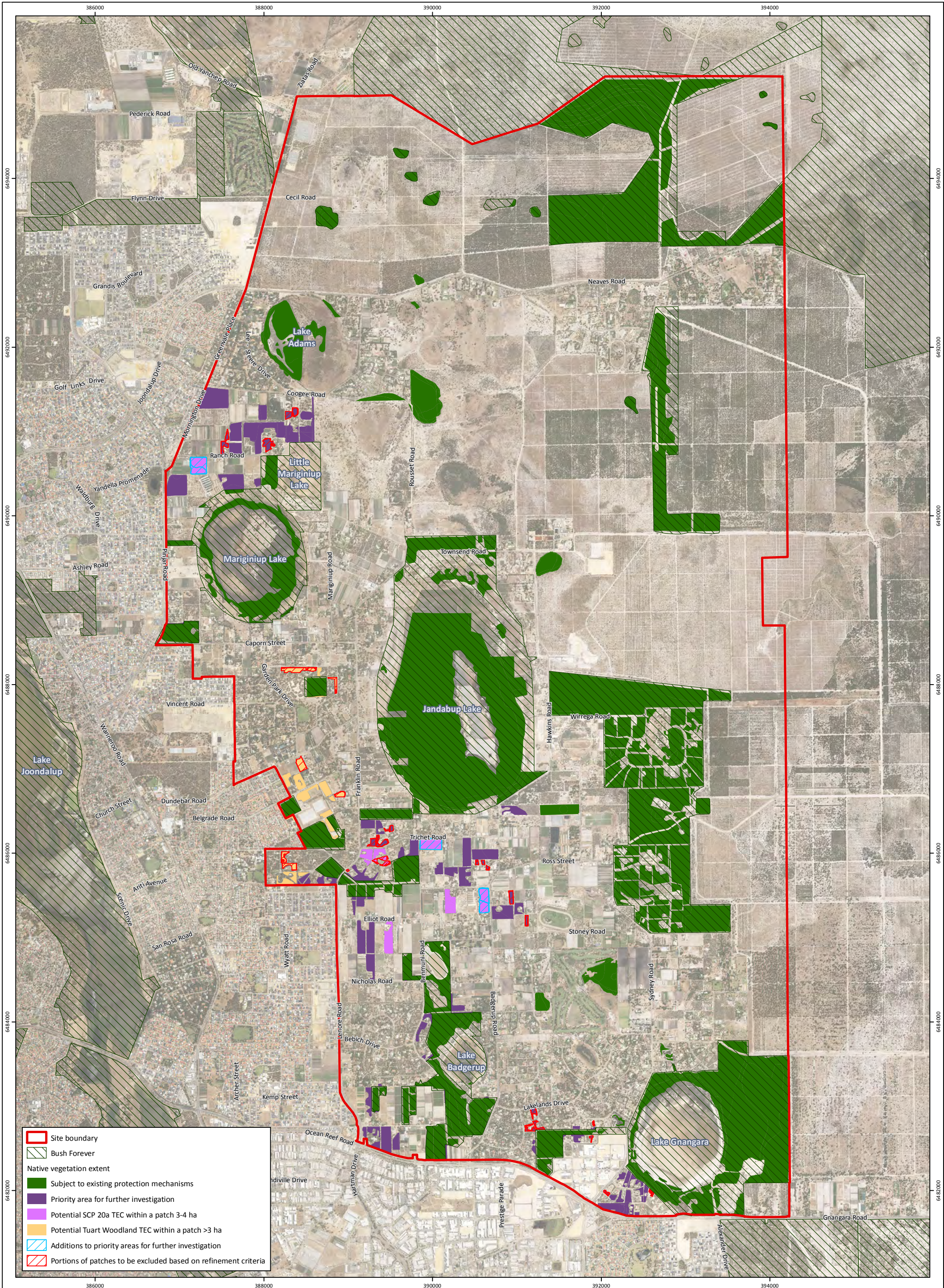


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Scale: 1:40,000@A3  
GDA 1994 MGA Zone 50



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





**Figure 17: Other Patch Considerations**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F41b  
**Drawn:** ADB  
**Date:** 28/09/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 28/09/2018

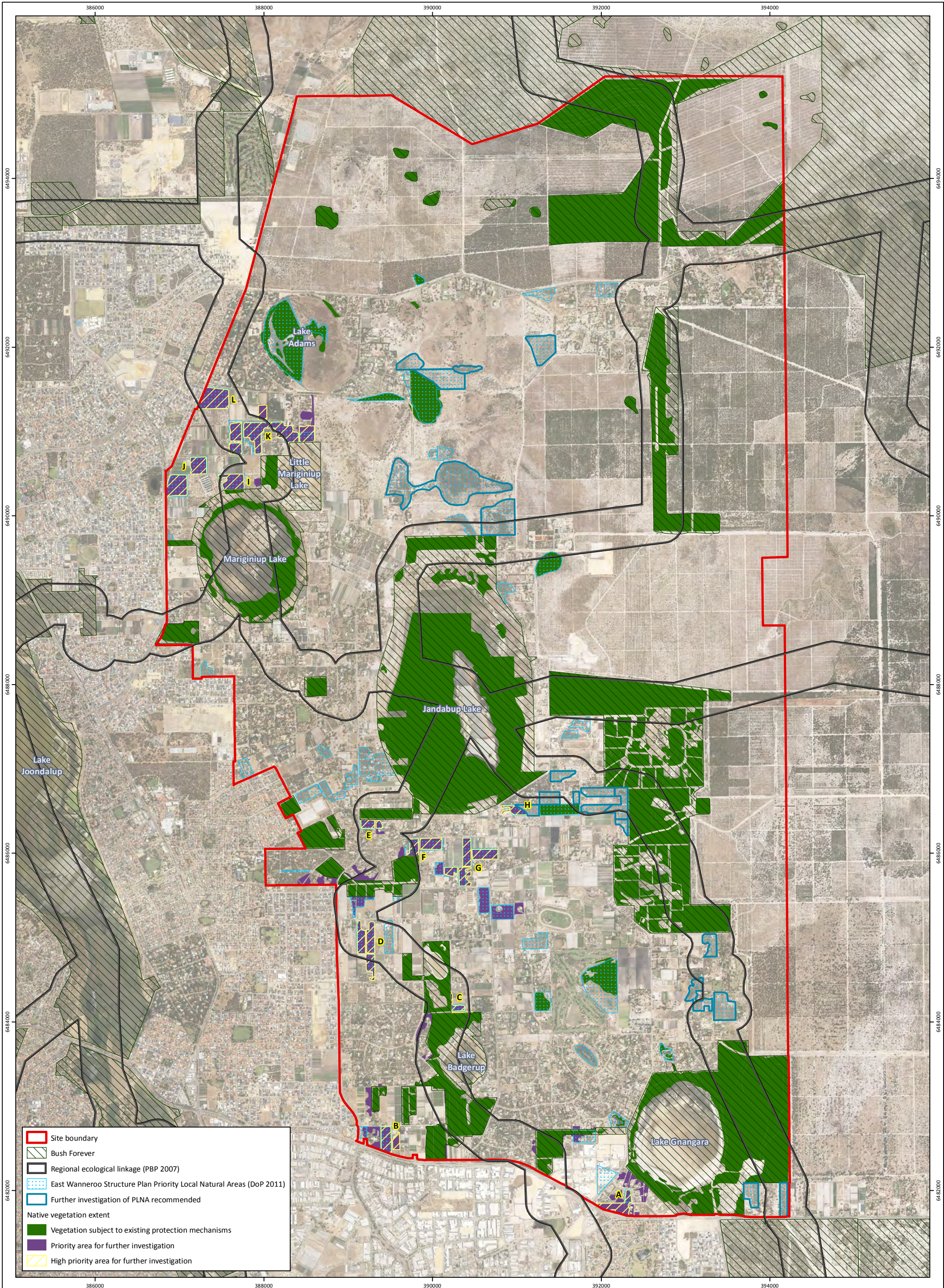


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Metres  
Scale: 1:40,000@A3  
GDA 1994 MGA Zone 50



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





**Figure 18: High Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:** EP17-106(04)-F42b  
**Drawn:** ADB  
**Date:** 28/09/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 28/09/2018



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Metres  
Scale: 1:40,000@A3  
GDA 1994 MGA Zone 50





# Appendix A

Priority Areas Summary Table





		Vegetation subject to existing protection mechanisms								Priority Areas				Other potential patch additions/refinement			Potential protection outcomes	
Environmental Value	Total extent within site (ha)	MRS P&R reserves (ha)	Bush Forever Sites (ha)	Local conservation reserves (ha)	CCW and 50m buffer (ha)	Total (ha)	Total (%)	Extent NOT subject to existing protection mechanisms (ha)	Vegetation within >4 ha patch, potential to contain SCP 20a	Adjusted total (ha)	Adjusted total (%)	Total remaining	Potential SCP 20a 3-4 ha patches	Potential Tuart Woodland >3 ha patches	Perimiter to Area ratio removal	Final total (ha)	Final total (%)	
Native vegetation extent (DAFWA 2017)	1709.7	990.9	1192.4	11.4	467.1	1270.7	74.3%	439.0	116.4	1387.0	81.1%	322.7	23.6	17.6	16.2	1412.0	82.6%	
Likely TEC - FCT 20a (Emerge 2017)	323.6	97.6	135.3	0.6	10.2	136.2	42.1%	187.4	116.4	252.6	78.1%	71.0	23.6	0.0	10.4	265.8	82.1%	
Likely TEC - Tuart Woodlands (Emerge 2017)	53.1	7.9	19.6	0.0	0.0	19.6	37.0%	33.5	0.0	19.6	37.0%	33.5	0.0	17.6	5.8	31.4	59.2%	
Likely TEC - Banksia Woodlands (Emerge 2017)	1167.2	615.8	816.6	5.9	62.0	824.6	70.6%	342.6	116.4	941.0	80.6%	226.2	23.6	17.6	16.2	965.9	82.8%	
Fauna habitat - Potential CBC foraging habitat (Glossop)	1309.3	684.2	886.5	9.4	144.7	920.6	70.3%	388.7	114.5	1035.1	79.1%	274.2	23.0	16.4	15.0	1059.6	80.9%	
Veg complex - Bassendean Central and South (27.7% rem.)	185.4	133.6	143.3	1.5	39.5	155.6	83.9%	29.8	1.0	156.6	84.5%	28.8	2.9	0.0	0.2	159.3	85.9%	
Veg complex - Bassendean North (72.2% rem.)	238.4	211.2	219.2	0.0	32.4	219.4	92.0%	19.0	0.0	219.4	92.0%	19.0	0.0	0.0	0.0	219.4	92.0%	
Veg complex - Bassendean North Transition (91.4% rem.)	346.9	186.7	299.7	0.0	27.4	301.0	86.8%	45.9	0.0	301.0	86.8%	45.9	0.0	0.0	0.0	301.0	86.8%	
Veg complex - Karrakatta Central and South (23.9% rem.)	314.3	82.0	131.3	0.0	3.2	131.3	41.8%	183.0	90.6	221.9	70.6%	92.4	16.7	17.6	13.4	242.8	77.3%	
Veg complex - Herdsman (34.6% rem.)	32.7	25.8	25.9	0.0	11.6	26.2	80.3%	6.5	1.9	28.1	86.1%	4.6	4.0	0.0	0.0	32.1	98.2%	
Veg complex - Pinjar (30.1% rem.)	588.2	351.6	372.9	9.9	352.9	437.1	74.3%	151.1	22.9	460.0	78.2%	128.2	0.0	0.0	2.6	457.4	77.8%	
Conservation Category Wetland (where vegetated)	394.4	350.5	338.1	0.0	394.4	394.4	100.0%	0.0	0.0	394.4	100.0%	0.0	0.0	0.0	0.0	394.4	100.0%	

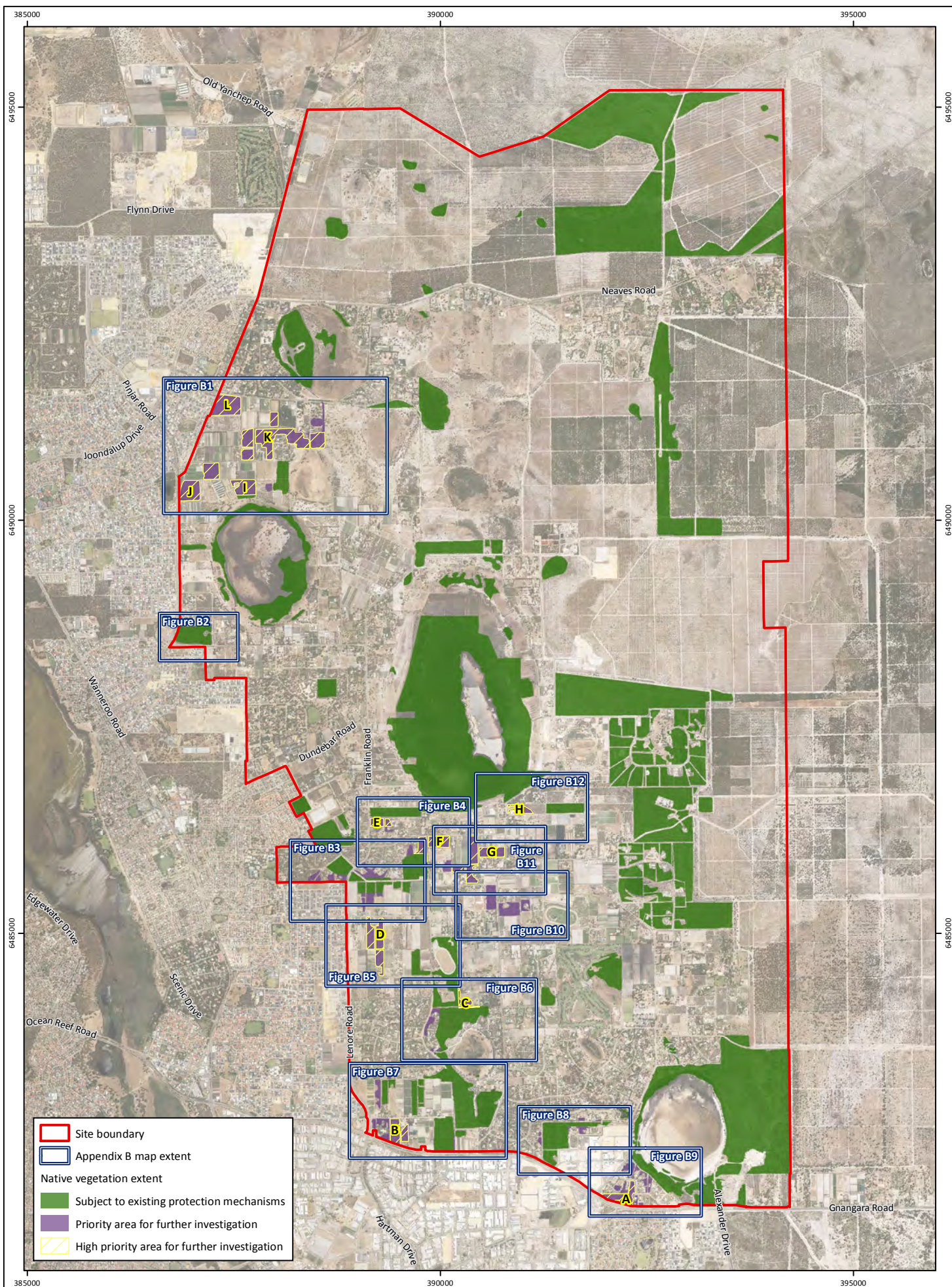
# Appendix B

Detailed Mapping









**Index: Appendix B Map Extents**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

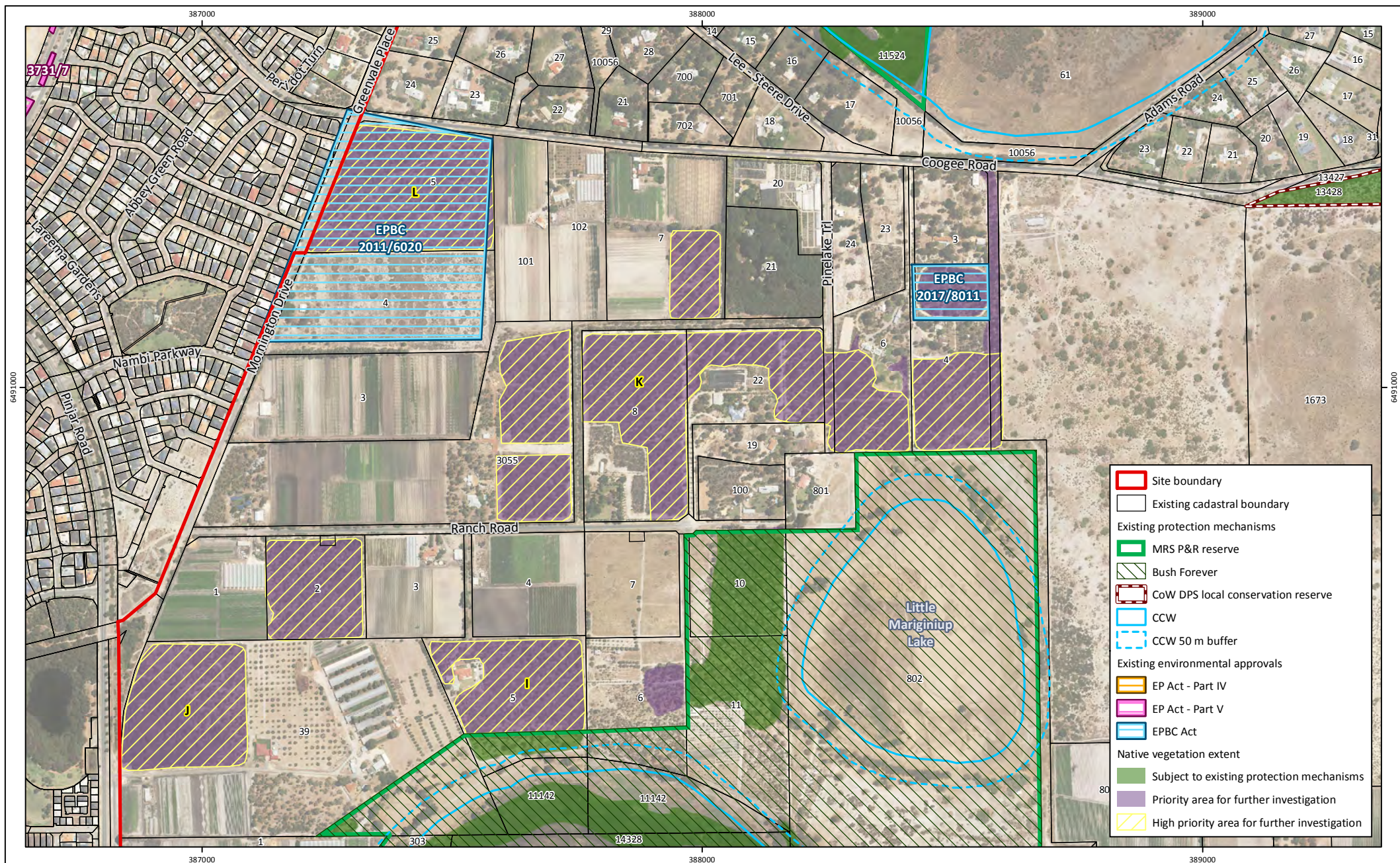
**Plan Number:** EP17-106(04)-F66  
**Drawn:** KNM  
**Date:** 01/08/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 28/09/2018



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Metres  
Scale: 1:60,000@A4  
GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B1: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F43b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018

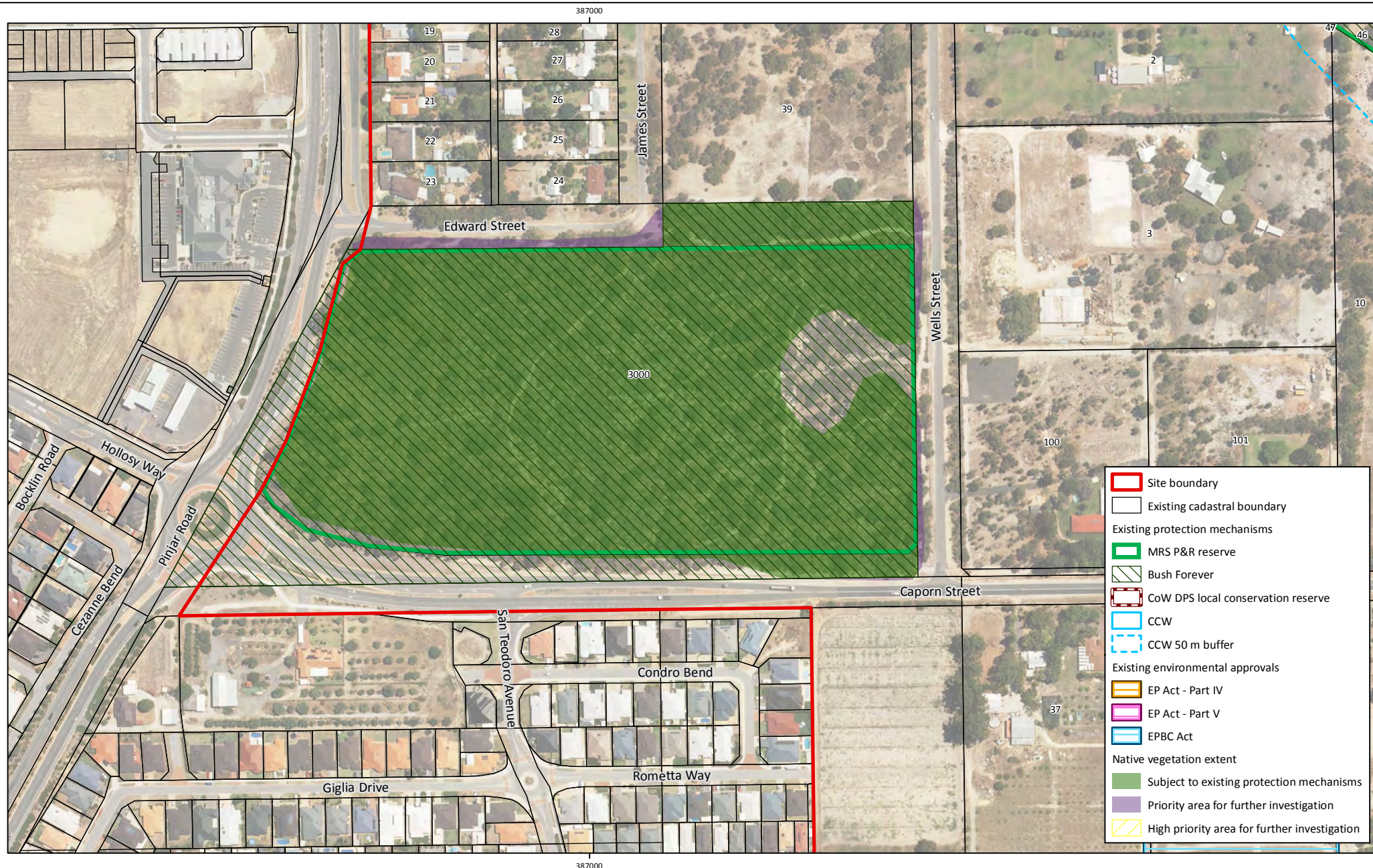


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Metres

Scale: 1:10,000@A4  
GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B2: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F44b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



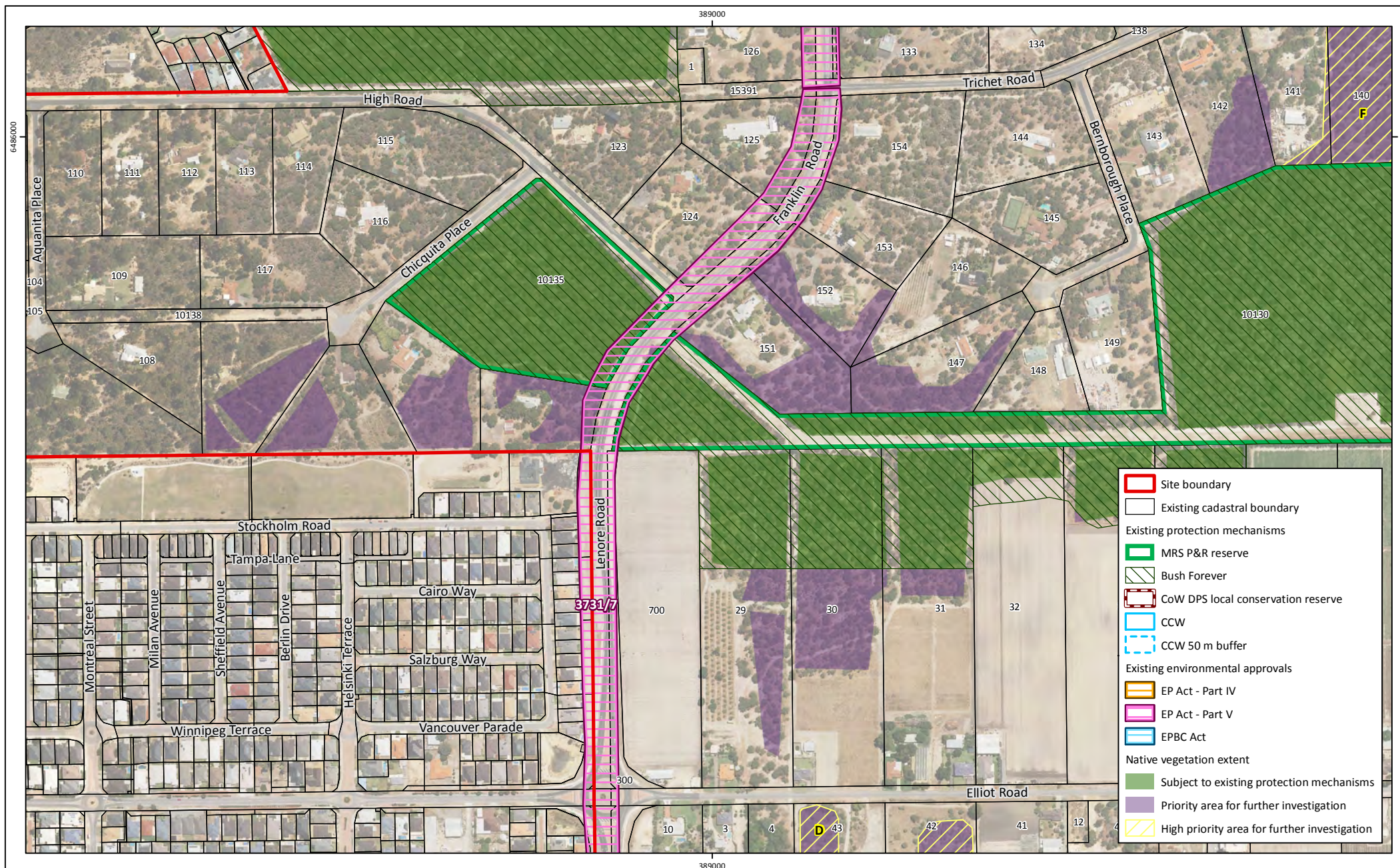
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**Scale: 1:3,500@A4**

GDA 1994 MGA Zone 50

**emerge**  
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**Figure B3: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F47b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



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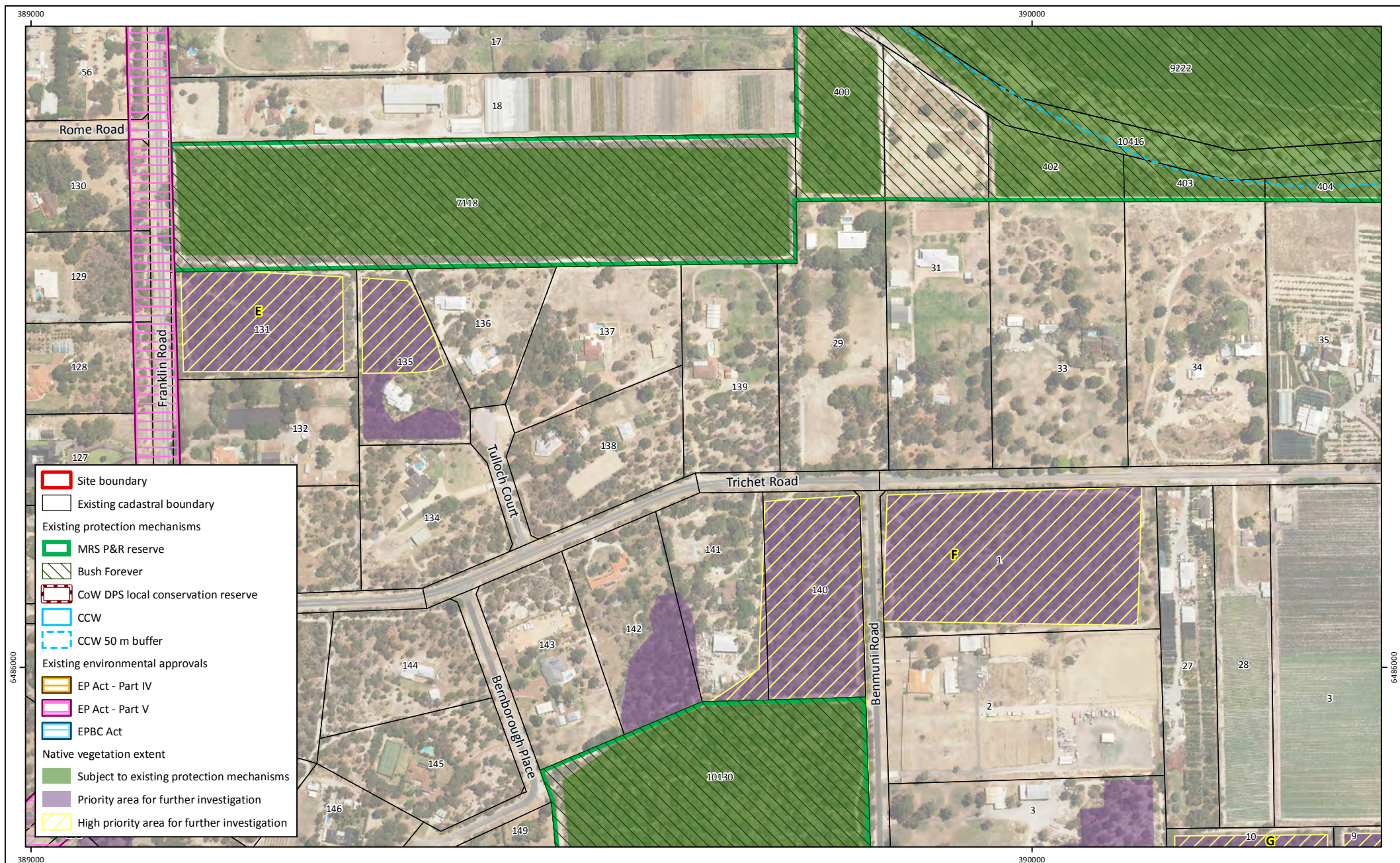
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**Scale: 1:6,000@A4**

GDA 1994 MGA Zone 50

**emerge**  
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**Figure B4: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F48b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



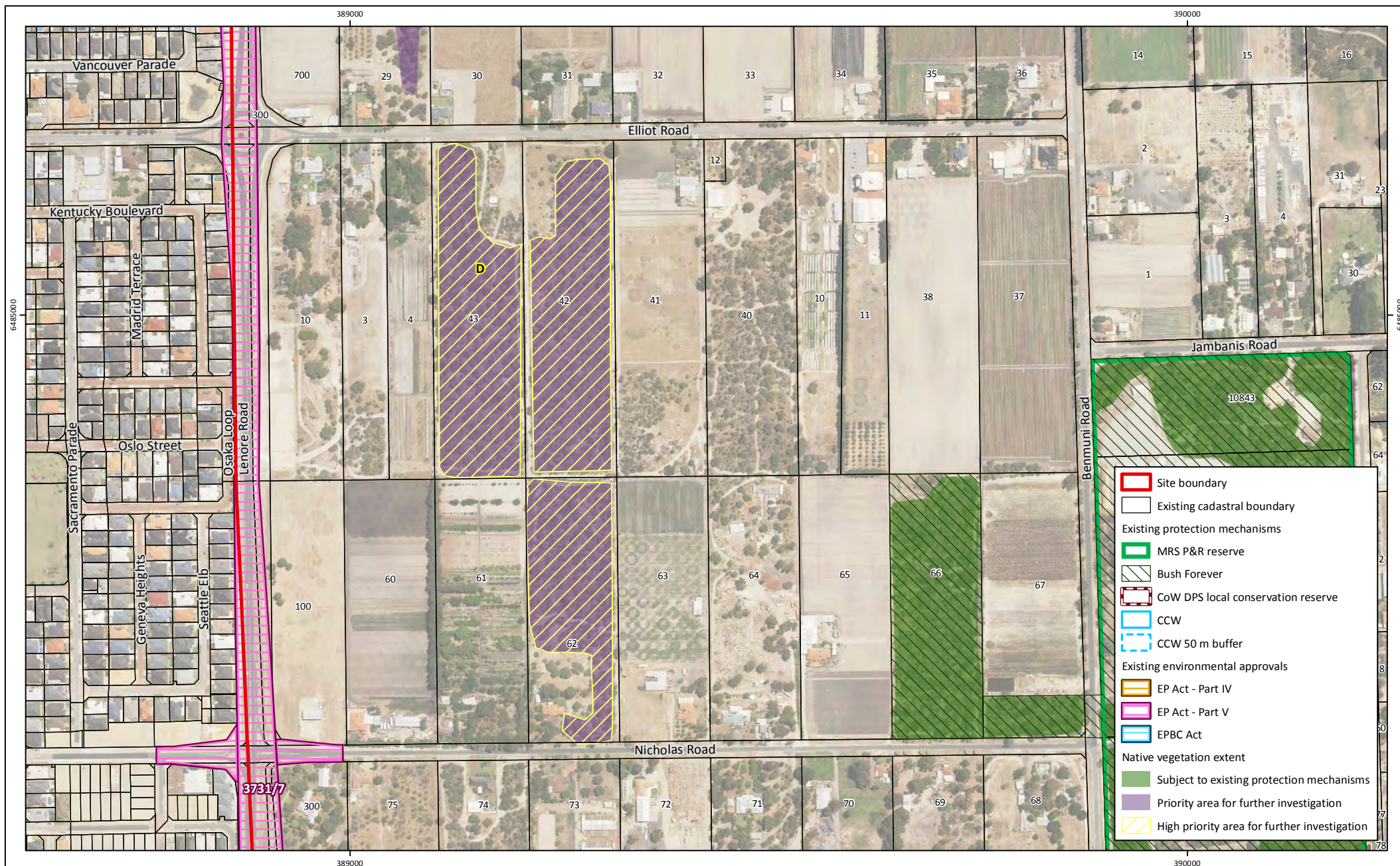
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GDA 1994 MGA Zone 50







**Figure B5: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F52b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



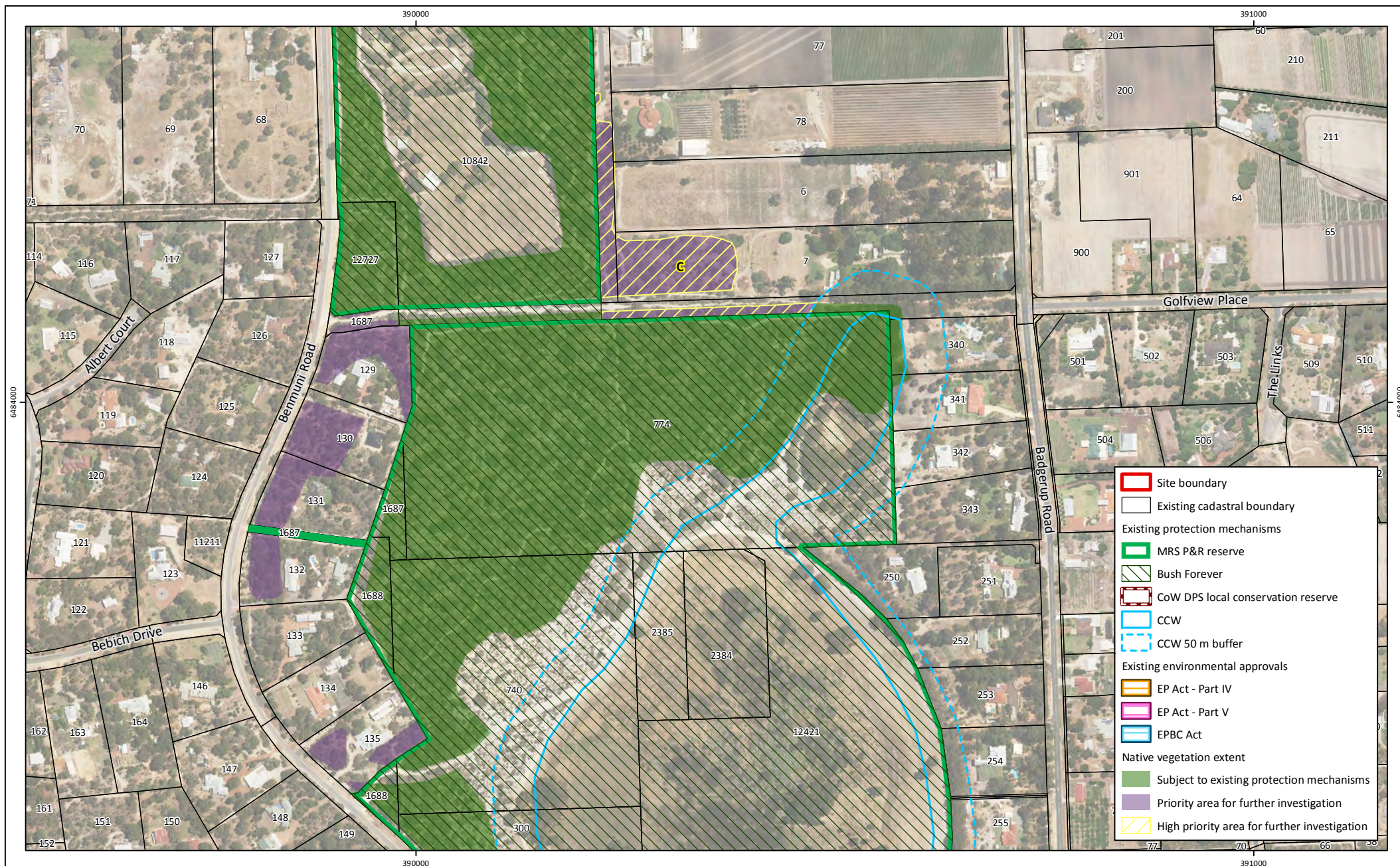
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GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B6: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F53b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



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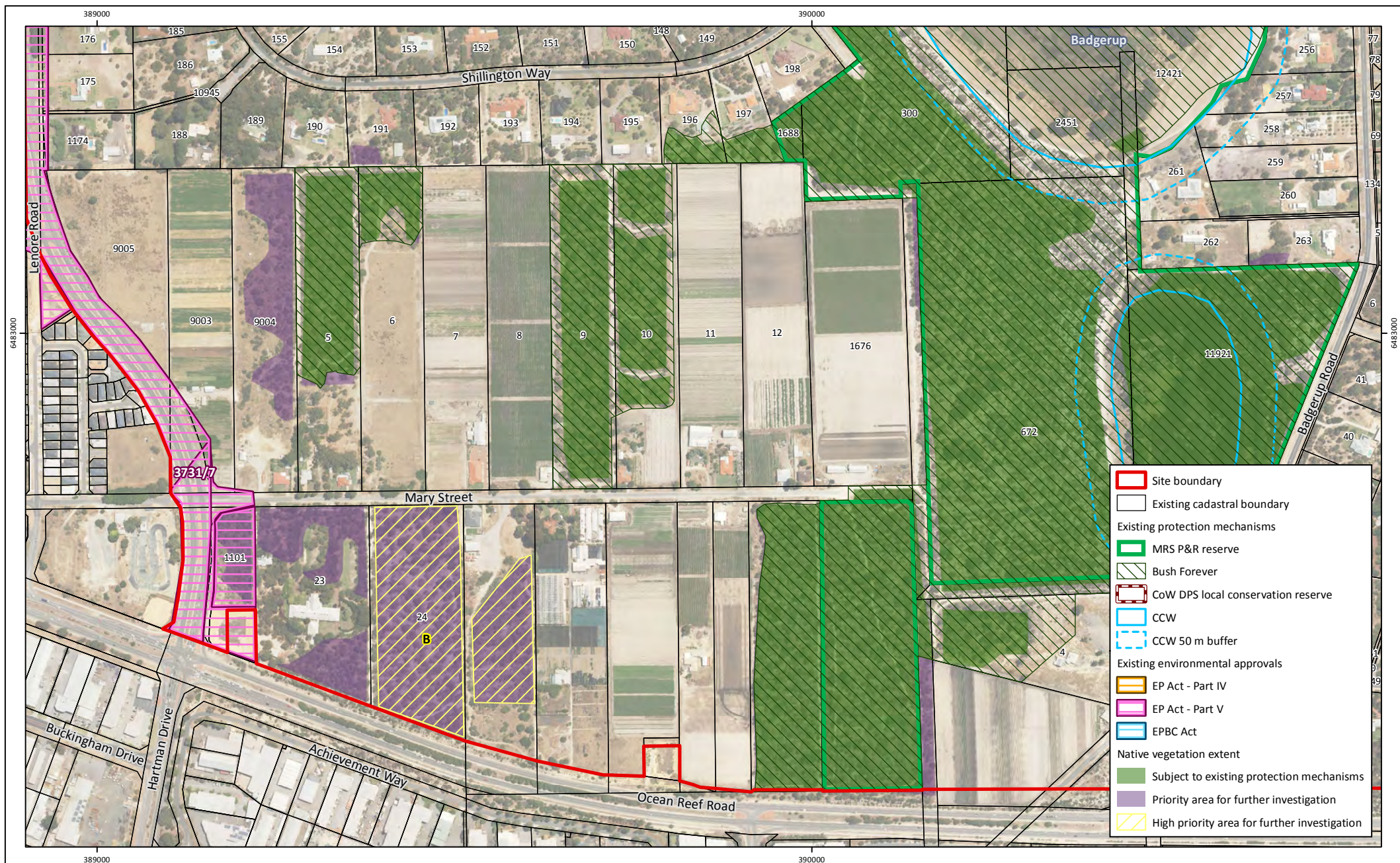
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GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B7: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

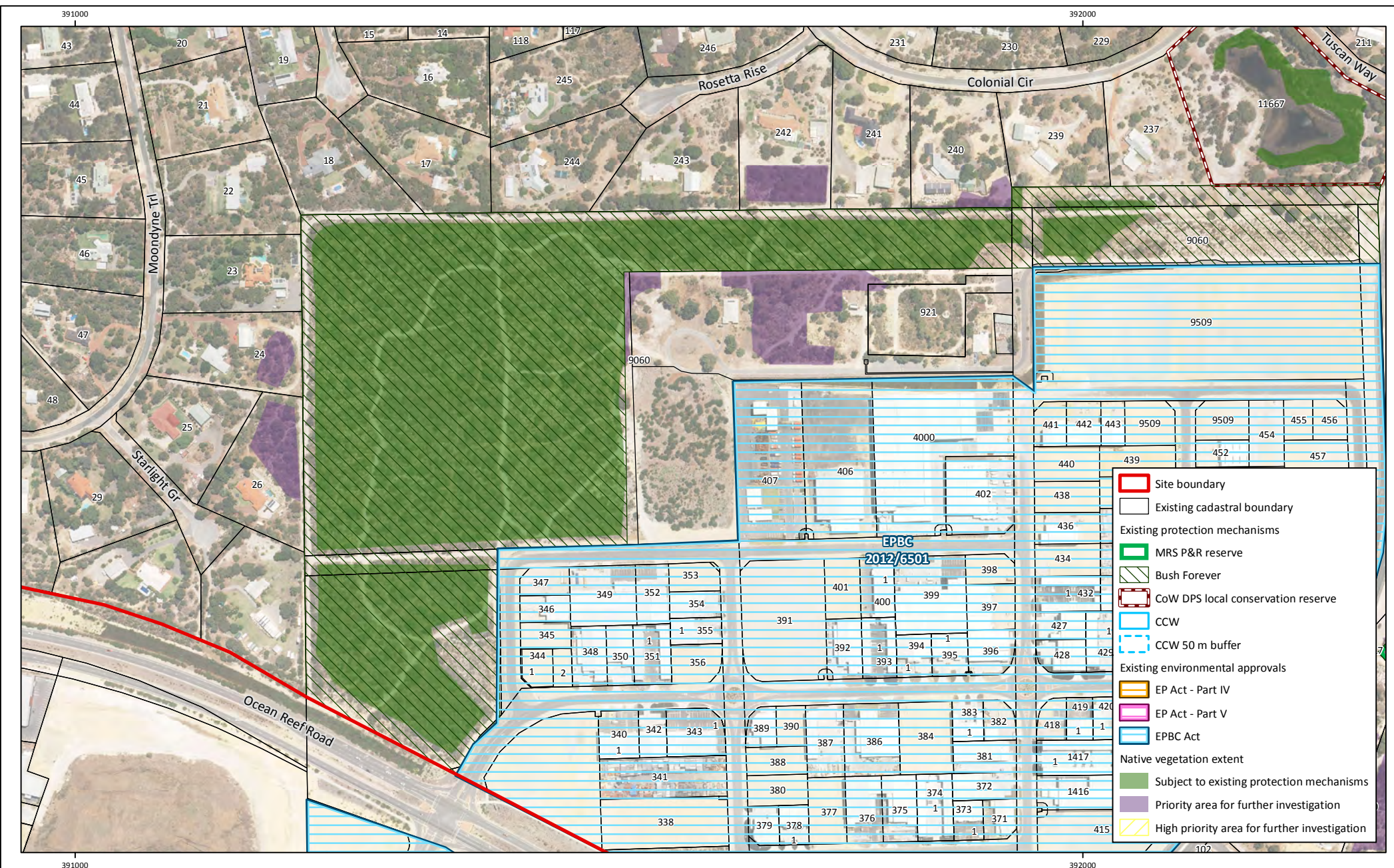
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**Drawn:** ADB  
**Date:** 28/09/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 28/09/2018



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Scale: 1:7,000@A4  
GDA 1994 MGA Zone 50







**Figure B8: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan  
**Client:** Department of Planning, Lands and Heritage

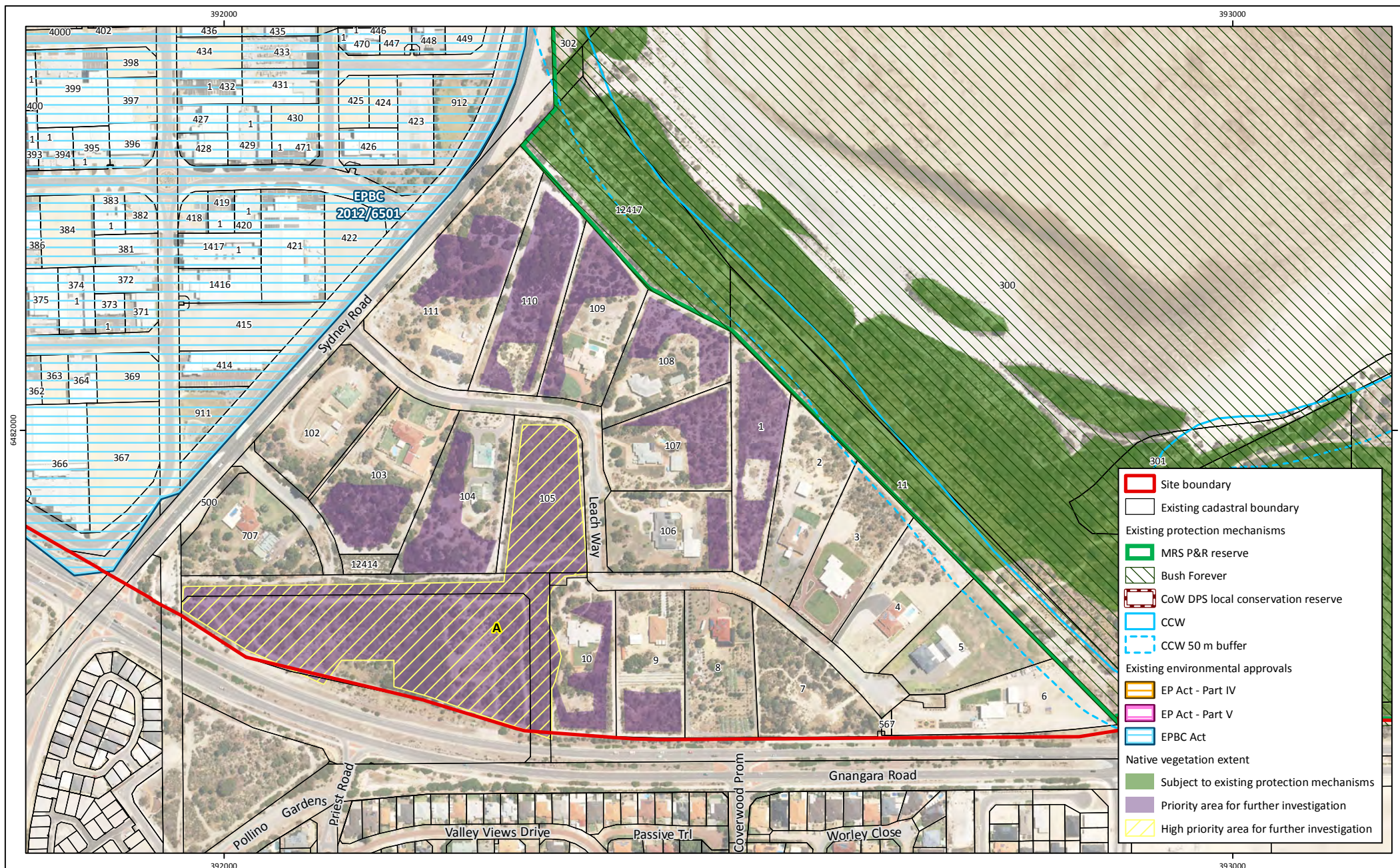
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EP17-106(04)-F55b  
**Drawn:** ADB  
**Date:** 28/09/2018  
**Checked:** ADB  
**Approved:** JDH  
**Date:** 28/09/2018



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Metres  
Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B9: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F56b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



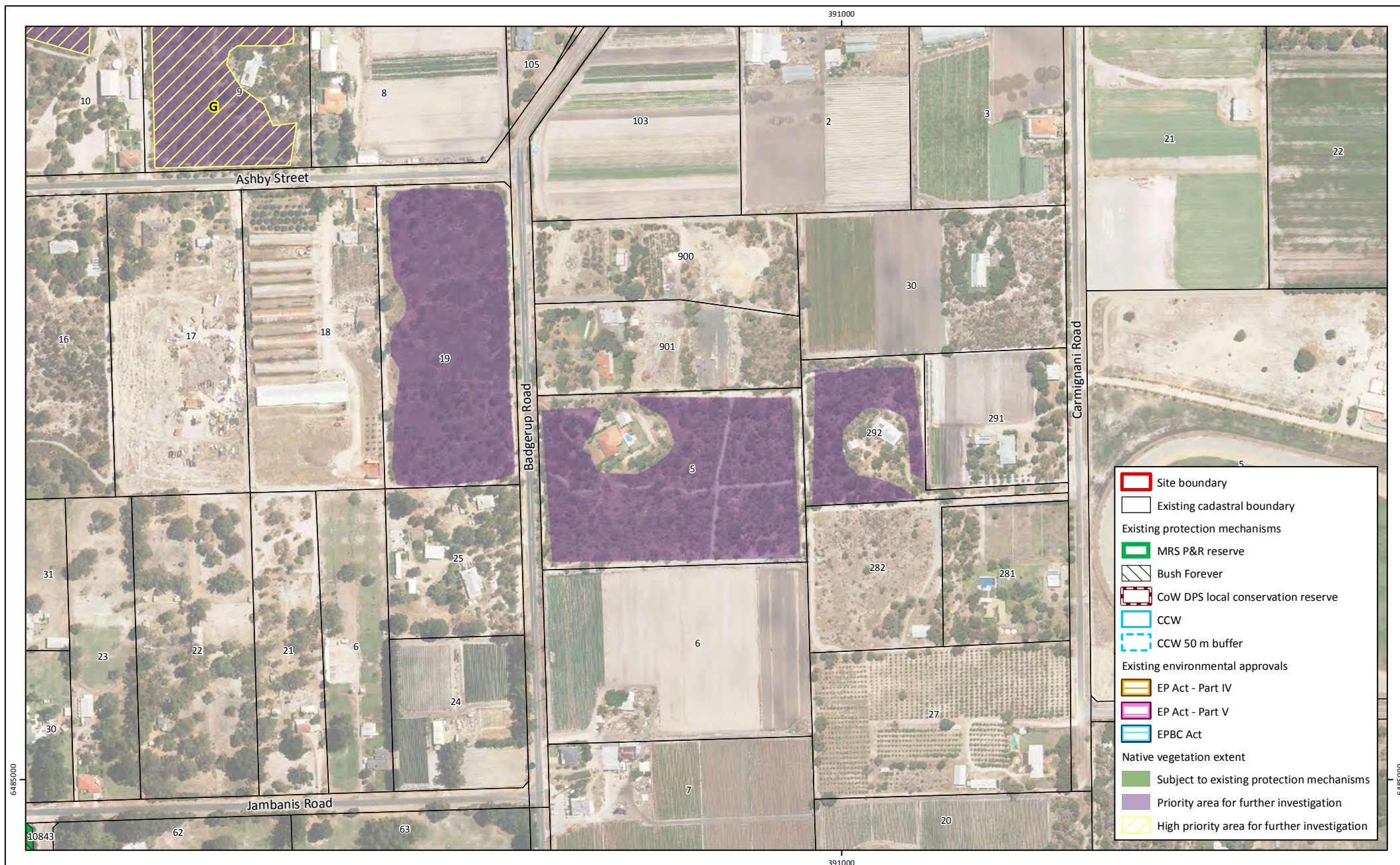
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GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B10: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F60b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



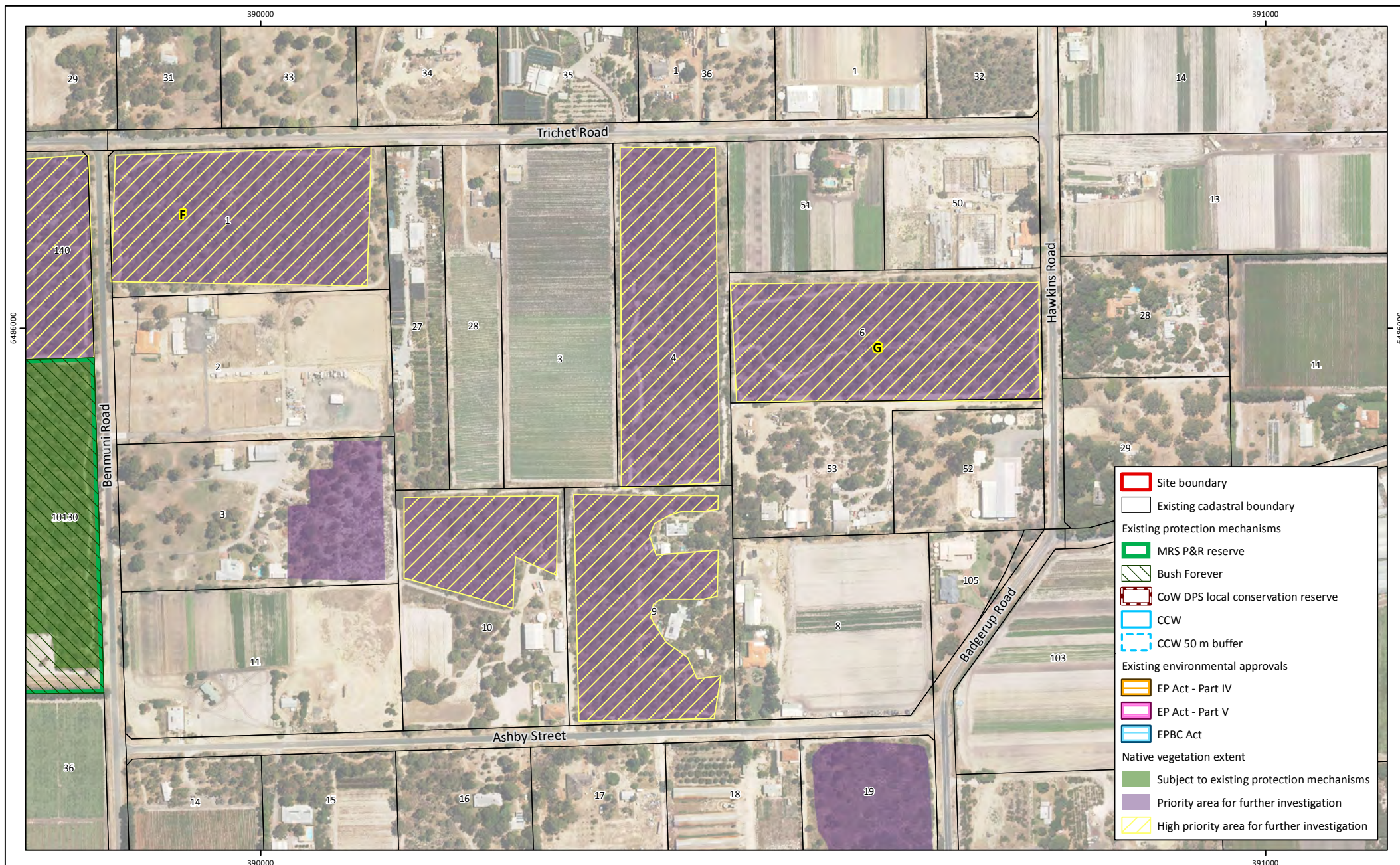
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GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B11: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F61b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



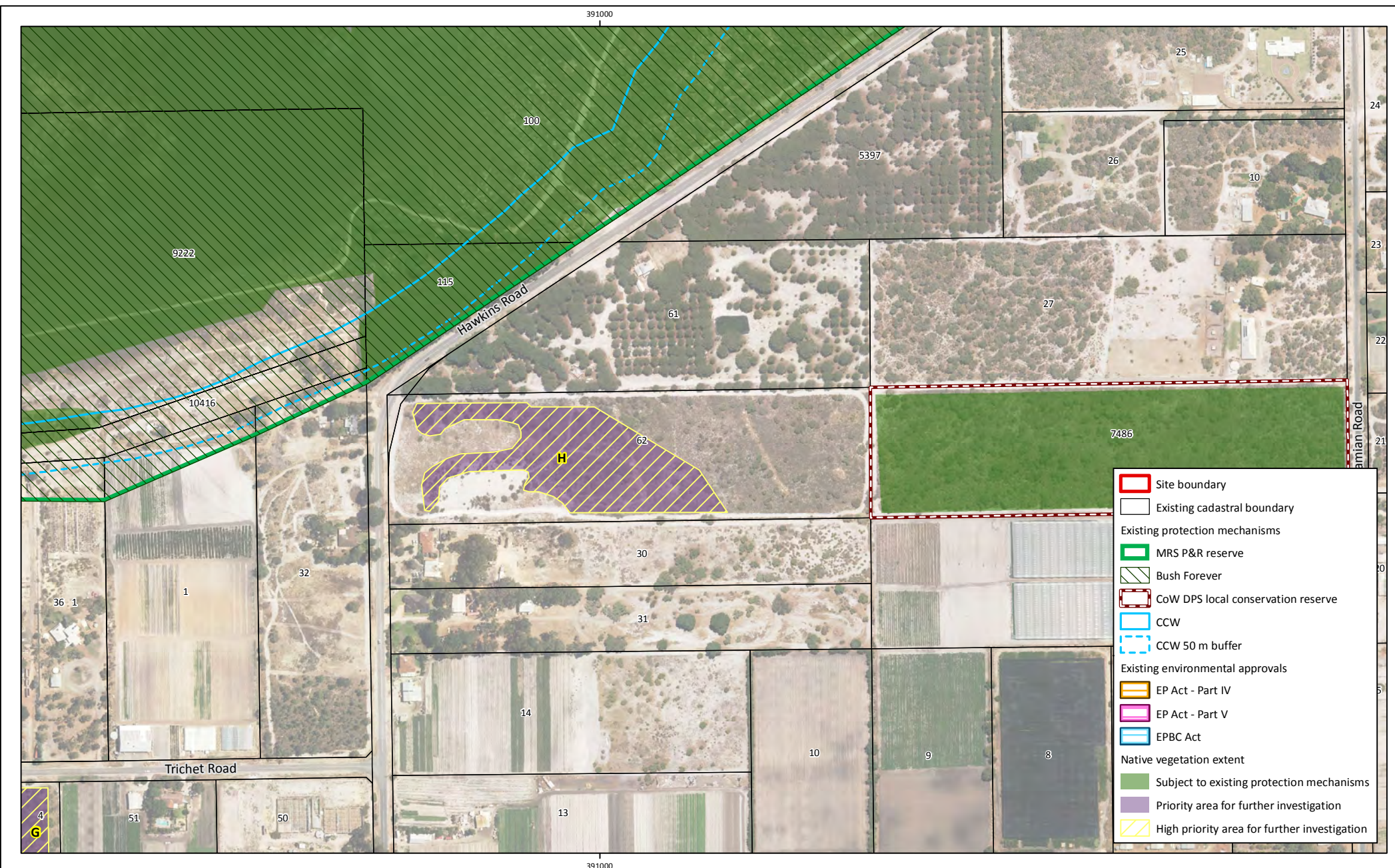
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GDA 1994 MGA Zone 50

**emerge**  
ASSOCIATES





**Figure B12: Detailed Summary of Priority Areas for Further Investigation**

**Project:** Environmental Assessment Study  
East Wanneroo District Structure Plan

**Client:** Department of Planning, Lands and Heritage

**Plan Number:**  
EP17-106(04)-F62b

**Drawn:** ADB

**Date:** 28/09/2018

**Checked:** ADB

**Approved:** JDH

**Date:** 28/09/2018



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Metres

**Scale: 1:5,000@A4**

GDA 1994 MGA Zone 50

**emerge**  
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# Appendix C

Preliminary Vegetation Assessment – Results Table

















# East Wanneroo District Structure Plan – Assessment Sample Data

Table 1: Sampling data undertaken 5<sup>th</sup>-8<sup>th</sup> December 2017

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
1	8/12/2017	393690	6480143	Ba, Bm, Et, Hs, Hhue, Calspp, Vn, Pl, Ah, Xp, Ms, Ep, Vn, Jfl, Ah, Mf, Cs, Po, Bc, Si	?23a	<ul style="list-style-type: none"> <li>Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent	Low shrub layer, high bare ground	
2	8/12/2017	393567	6481096	Ba, Bm, Et, Hs, Hhu, Cf, Cang, Vn, Pl, Ps, Ah, Xp, Vn, Mf, Gconf, Bi, Sl, Ac, Ap, Dt, Arp, Hh, Ah, Po	?23a	<ul style="list-style-type: none"> <li>Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent	Low shrub layer, high bare ground	
3	5/12/2017	393523	6479125	Ba, Bm, Em, Ah, Ep, Hh, Nf, Bi, Mf, Jfl, Hp	20a	<ul style="list-style-type: none"> <li><i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
4	5/12/2017	391129	6479109	Ba, Ah, Bi, Em, Ep, Hr, Xp, Nf, Hh	20a	<ul style="list-style-type: none"> <li><i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		







# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
5	6/12/2017	392428	6477360	Em, Ba, Bm, Af, Ah, Xp, Ep, Nf, Li, Hh, Hr, Hhu, Pl, An, Sl, Cang, Db, Ap, Sr, Cp, Hru, Jfl, Dfa, Mp, Po, Dd, Dl, Cang, Bo, Hp, Am, Hsp, Hpu	20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
6	8/12/2017	388218	6477270	Em, Eg, Ba, Bp, Bm, Jf, Xp, Db, Mp, Po, Hh, Ap, Sl, Dt, Sl	20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Disturbed boundary but otherwise consistent	Scattered tuarts	
8	6/12/2017	388778	6480763	Eg, Em, Ba, Bm, Af, Bg, Mf, Xp, Cm, Dd, Cang	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	VG	Consistent		No photo
9	6/12/2017	388873	6480487	Em, Bm, Ba, Xp, Af, Ep, Hp, Mf, Ap, Cang, Hh, Mp, Ap, Lb, Sl, An	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent	No tuarts	
10	8/12/2017	387168	6482800	Af, Ba, Bp, Em, Ap, Bm, Jf	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	D	Consistent	Understorey species diversity low	



# East Wanneroo District Structure Plan – Assessment Sample Data






No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
11	8/12/2017	387650	6484156	Eg, Cc, Af, Bp, Ba, Bg, Mr, Jf, Xp, Hh	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Consistent	Scattered tuarts	
12	8/12/2017	385175	6488620	Em, Cc, Ba, Bm, Xp, Mr, Jf, Dfl, Dr, Hhu, Ap, Hh, Hp, Ptm	28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Consistent	Tuarts nearby	
13	6/12/2017	387223	6486657	Cc, Mf, Ba, Xsp, Em, Bg, Js, Ms, Dd, Cm,	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	D-G	Disturbed boundary but otherwise consistent		
14	8/12/2017	385724	6489052	Cc, Em, Ba, Bm, Af, Mr, Xp, Js, Bg, Dfl, Hsp, Hc, Dfl	28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Consistent		



# East Wanneroo District Structure Plan – Assessment Sample Data






No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
15	5/12/2017	385011	6483612	Eg, Em, Asal, Xp, Af, Jf, Ba, Mf	28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Undetermined - no visibility		
16	5/12/2017	384734	6482895	Eg, Eba, Xp, Em, Asal, Af, Bg	28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Undetermined - no visibility		
18	5/12/2017	385415	6494418	Em, Ba, Af, Bg, Js, Bm, Kg, To, Xp, Sl, An, Mp, Hc, Hh, Nf, Hl, Hc, Pl, Dfa, Bd	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		







# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
19	5/12/2017	385789	6493849	Em, Ba, Af, Bg, Js, Bm, Kg, Ac, Ep, To, Ca, Sl, Dfl, Hh, Ap, Sr, Hc, Li, Dt, Cs, Bd, Dl, Hru	20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
20	5/12/2017	384183	6491982	Em, Js, Af, Hl, Cc, Ba, Bm, Xp, Mf, To, Mp, Pm, Ptm, An, Sr, Dt, Scan, Pl, Hh	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	E	Consistent		
21	5/12/2017	384378	6493151	Eg, Em, Js, Bg, Xp, Hh	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	VG	Potentially inconsistent		
23	8/12/2017	388007	6492046	Er	?11/S17	N/A	G	Undetermined - no visibility		No photo







# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
24	8/12/2017	388838	6492185	Er over weeds	?11/S17	N/A	D-CD	Consistent		
25	8/12/2017	388777	6491595	Er over weeds	?11/S17	N/A	D-CD	Consistent		
26	8/12/2017	387467	6491364	Dt, Ba, Bm, Bg, Em, Af, Dn, Ah, Xp, Csan, An, Sl	20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Potentially inconsistent	Recently burnt	
27	8/12/2017	387346	6491467	Nf, Dt, Ba, Bm, Em, Af, Dn, Ah, Xp, Csan, An, Sl	20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		








# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
30	8/12/2017	389886	6491226	Mp, Ac, Xp, Nf	?23a/21c	• Banksia woodlands of the Swan Coastal Plain	D-G	Undetermined - no visibility		
31	8/12/2017	390126	6489664	Bm, Bm, Ac, Mr, Si, Cang, Ep, An, Arp, Lb, Cm, Dl, Po, Ca, Hr, Hh, Li, Mf, Arp, Ms, Gt, Dr, Cang, Na, Hsp	?23a	• Banksia woodlands of the Swan Coastal Plain	G	Disturbed boundary but otherwise consistent		
32	8/12/2017	389677	6490364	Kg, Er	?11/S17	N/A	D-G	Disturbed boundary but otherwise consistent		No photo
33	8/12/2017	387229	6490665	Em, Ba, Bm, Xp, Mp, Mr, Af, Pm, An, Am, Cang, Ms, Js, Ah, Te, Dd, Hh, Dfl, Hp, Gt, Pm, Dr, Jf	?20a	• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain	E	Consistent		
34	8/12/2017	386863	6490264	Ba, Bm, Xp, Mp(near road, down hill), Bi	?20a	• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain	G-E	Undetermined - no visibility		







# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
35	8/12/2017	388556	6490269	Er, weeds	?11/S17	N/A	D-CD	Consistent		
36	8/12/2017	388098	6490644	Ba, Bm, Bi, Em, Af, Et, Js, Jf, Xp, Mr, Cm, An, Pl, Hhu, Cm, Hh, Mp	?23a	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	G	Disturbed boundary but otherwise consistent		
40	8/12/2017	387667	6490766	Em, Ba, Bm, Jf, Xp, Af, Ac, Mr, Js, Mp, Dfl, Sl, Cm, Hh	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG-E	Disturbed boundary but otherwise consistent		
41	8/12/2017	387926	6490775	Af, Jf, Ac, Bm, Dd, Js, Sl	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	G-D	Disturbed boundary but otherwise consistent		
42	8/12/2017	387194	6488570	Em, Ba, Bm, Js, Xp, Mr, Sg, Dfl, An, Dn, Mp, Dt, Dd, Hh, Gt, Pl, Hp, Sr, Hc, Arp, Am, Po, Sl, Kg	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		








# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
43	6/12/2017	388650	6487879	Eg, Ba, Bm, Af, Cm, Hc, Sg, Tt, Dr, An, Hh, Ah, Po, Mp, Cm, Js, Hc, Gt, Gv, Hr, Jser	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	E	Consistent	Tuarts present	
44	6/12/2017	388688	6486088	Eg, Em, Ba, Bm, Bp, Js, Af, Ap, Gt, Mp, Cf	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	VG	Disturbed boundary but otherwise consistent	Understorey species diversity low	
45	6/12/2017	388277	6486611	Eg, Em, Ba, Af, Js, Hp, Hh, Gv, Cm, Sr, Hap, Dn, Gt, Hc, Cm, Pm, Gv	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	E	Consistent	Low banksia and jarrah cover	
46	6/12/2017	389167	6486454	Ba, Bm, Af, Cm, Am, Hh, Hr, Sl, Sg, Te, Gt, Mp, Cd	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	E	Consistent	Scattered tuarts	
47	6/12/2017	389162	6485595	Bm, Bi, Af, Ba, Dt, Ah, Js, Cm	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		No photo







# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
48	6/12/2017	388972	6485679	Em ,Af, Bm, Ba, Xspp, Ah, Hh, Mp, Dr, Cf, Hr, Hpu, Dd, Sl, Mp, Dfl, An	?20a	<i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) Banksia woodlands of the Swan Coastal Plain	E	Consistent		
50	6/12/2017	389976	6486141	Ba, Bm, Af, Em, Dd, Bi, Kg, Arp, Jser, Po, Mp	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		
51	6/12/2017	389787	6486134	Af, Ba, Jf, Bm, Bi, Sg, Jser, Hh, Em	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
52	6/12/2017	389701	6484523	Af, Bm, Ba, Xp, Dt, Dn, Js, Em, Sr, Mp, Ap, Db, Hh	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		
53	6/12/2017	389131	6485177	Em, Af, Ba, Bm, Xp, Ah, Xspp, Dd, Mp, Sl	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		






# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
54	6/12/2017	389446	6482730	Af, Ba, Bm, Em, Xp, Bg, Hr, Ah, Ep, Dn, Mp, An, Hh, Dr, Hrus, Sl	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent	Recently burnt	
55	6/12/2017	389684	6482812	Af, Ba, Em, Bm, Mp, Al	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Disturbed boundary but otherwise consistent		
56	6/12/2017	389956	6482737	Af, Ba, Bm, Cs, Mp, Ac, Sl, Jf, Cf, Cang, Ep, An, Pl, Hh, Dr, Hhu, Aa, Cm, Dfl, Lh, Kp, Hr, Hsp, Li, Arp, Xp, Am, Pm, Hpu, Tm, Sr	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Disturbed boundary but otherwise consistent		No photo
57	6/12/2017	390102	6483358	Ba, Bm, Xp, Jf, Af, Em, Cm, Pg, Et, Bi, Mf, Hh, Sg, Dr, Li, Mp, Jser, Dfa, Js, Hc, Ts, Ep	?20a/21c	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
58	6/12/2017	389957	6484144	Ba, Bm, Af, Em, Jf, Dt, Gt, Mp, Js, Ep, Jser, Mf, Dfl, Dl, An, Af, Gc, Sl, Hpu,	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
59	6/12/2017	390164	6484053	Jf, Am, Ba, Bm, Nf,	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands</li> </ul>	E	Consistent		No photo



# East Wanneroo District Structure Plan – Assessment Sample Data








No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
	2017			Af, Js		over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain				
60	6/12/2017	390048	6484917	Ba, Bm, Af, Hp, Hr, Em, Sg, Cm, Dr, Jser, Mp, Mf, Dn, Dfl, Af, Sr, Hr, Cp, Kp, Hp, Hhu, Gt, Sg, Pm, Ca, An, Dl, Ptm, Hh	?20a	• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain	E	Consistent		
61	8/12/2017	390583	6482834	Er, Ba, Bm, Af, Ac, Jf, Mp, Mp, An, Cf, Dfa, Hh, Cm, Dr, Lb, Ah, Lf, Dfl, Db	?20a	• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain	G-VG	Consistent	Banksia woodland going into wetland	
62	8/12/2017	391486	6482433	Ba, Em, Bm, Af, Nf	?20a	• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain	G-VG	Undetermined - no visibility		No photo
63	8/12/2017	392333	6481974	Ba, Bm, Jser, Xp, Em, Cs, Mp, Am, Js, Ac, Gt, Dt, Dr, Ep, An, Hh, Gt, Ts	?20a	• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a) • Banksia woodlands of the Swan Coastal Plain	VG-E	Consistent		



# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
64	8/12/2017	393291	6481879	Ba, Bm, Nf, Et, Xp, Dt, Dd, Cf, Cang, Ah, Jf, Mp, Si, An, Po, Cm, Lb, Ep, Pl, Hsp, Jfl, Mf, Dl, Arp, Ms, Sr, Sl, Hr, Be, Ca, Li, Sz, Ts, Cp, Lr, Pm, Gt	?23a	• Banksia woodlands of the Swan Coastal Plain	E	Consistent	Canopy cover low	
65	8/12/2017	393585	6482259	Ba, Bm, Nf, Et, Xp, Dt, Dd, Db, Cf, Cang, Ah, Jf, Mp, Si, An, Po, Cm, Lb, Sl, Hh, Hc, Ah, Hsp, Ca, Pm, Sr, Db, Cphily, Ac	?23a	• Banksia woodlands of the Swan Coastal Plain	E	Consistent	Canopy cover low	
66	6/12/2017	393249	6483396	Et, Ba, Bm, Mf, Jfl, Js, Dd, Gcri, Sl, Bo, Cm, Hh	23a	• Banksia woodlands of the Swan Coastal Plain	VG	Potentially inconsistent		
67	6/12/2017	393567	6483614	Et, Ba, Bm, Acyg, Ah, Xp, Ep, Jfl, Em, Nf, Sl, Dfl, An, Lb, Db, Cm, Vd, Hsp, Sl, Arp, Cang, Hh, Ps, Db, Ap, Hp, Ms, Hovp, Hhu, Hc	23a	• Banksia woodlands of the Swan Coastal Plain	E	Consistent	Banksia woodland going into wetland	
68	6/12/2017	393236	6485111	Em, Ba, Bm, Kg, Xp, Et, Cf, Ms, An, Dd, Gc, Pm, Mp, Cm, Dl, Pl, Sr, Jfl, Hpu, Sl, Cp, Arp	?23a	• Banksia woodlands of the Swan Coastal Plain	E	Consistent		



# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
69	6/12/2017	392865	6485738	Em, Et, Ba, Bm, Af, Bi, Anf, Acyg, Dd, Xp, Er, Sl	?23a	• Banksia woodlands of the Swan Coastal Plain	E	Consistent		
70	6/12/2017	392640	6486288	Ba, Bm, Af, Ac, Et, Ms, Mf, Jfl, Ca, Li, Hh, Arp, Ap, Nf	?23a	• Banksia woodlands of the Swan Coastal Plain	E	Disturbed boundary but otherwise consistent		
71	6/12/2017	391683	6486516	Em, Et, Ba, Bm, Mr, Xp, Jf, Nf, Hh, Mttri?, Ac, Af, Ap, Ms, Dt, Arp, Ca, Gc, Ah, Dfa, Li, An	?23a	• Banksia woodlands of the Swan Coastal Plain	E	Consistent	More E. todtiana than banksias	
72	6/12/2017	391818	6486523	Em, Et, Ba, Bm, Mr, Xp, Jf, Nf, Ac, Af, Pl, Hh, Ca, Cp, Ms, Dl, An	?23a	• Banksia woodlands of the Swan Coastal Plain	G	Potentially inconsistent	More E. todtiana than banksias	
73	6/12/2017	391066	6486818	Ba, Bm, Bi, Nf, Mp, Xp, Etod, Mf, Hsp, Li, An, Dfl, Bc, Jf, Dl	?23a/21c	• Banksia woodlands of the Swan Coastal Plain	G	Potentially inconsistent		







# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
74	6/12/2017	392265	6487302	Ba, Bm, Af, Xp, Et, Js, Ac, Mf, Bi, Arp, Pl, Cm, Mp, Sg, Ps, Lr, Lf, Vn, Ri, Dr, Cang	23a	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
75	6/12/2017	392944	6487113	Mp, Ba, Ac, Bm, Nf, Hs, Ri, Po, Vn	23a	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Disturbed boundary but otherwise consistent		
76	6/12/2017	392265	6487679	Ba, Bi, Bm, Mp, Xp, Jf, Ac, Jfl, Nf, Po, Ap, An, Dl, Po, Pl, Db, Ms, Hs, Scurv, Jser	23a	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	Excellent	Disturbed boundary but otherwise consistent		
77	8/12/2017	391243	6484216	Ba, Bm, Ah, Jser, Dr, Dd, Mp, Dl, Am, Bi, Gc, An, Dfa, Em, Xp, Ms, Cang, Af, Dt, Cs, Ca, Arp, Be, Hc, Na, Hpu, Hp, Hh, Sr, Dn	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
78	6/12/2017	390646	6485420	Ba, Bm, Em, Af, Db, Nf, Xspp, Ah, Gt	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a),</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	G-VG	Potentially inconsistent		



# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
79	6/12/2017	390752	6485991	Ba, Bm, Em, Af, Mf, Cm, Sl, Jf, Jfl, Mp	?20a/21c	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		
80	6/12/2017	391479	6488027	Em, Et, Ba, Af, Jf, Ac, Xp, Ah, An, Po, Mf, Hsp, Nf, Cphily, Dr, Lf,	23a	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		
85	5/12/2017	382803	6490113	Eg, Js, Af, Asal, Hl, Em, Ba, Xp, Hh, Mf, Bs, Hh	28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Undetermined - no visibility		
86	6/12/2017	389175	6486340	Bi, Ba, Bm, Af, Mf, Em, Js	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	E	Consistent		
87	6/12/2017	391420	6486923	Ba, Bm, Bi, Nf, Xp, Et, Cf	?23a	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		No photo



# East Wanneroo District Structure Plan – Assessment Sample Data







No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
89	8/12/2017	388351	6490911	Ac, Em, Ba, Bm, Cm, An, Af, Sl, Dd, Js, Xp, Db	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG-E	Consistent		
91	8/12/2017	390135	6489480	Er	?11/S17	N/A	D	Consistent	Low native species cover and diversity	
92	6/12/2017	389717	6485749	Ba, Bm, Xp, Xspp, Bi, Em, Ep, Hh, Dl, Hsp, Gt, Dl, Sr, Cset, An, Hap, Dt, Styr, Dn, Dfl, Xh, Hh, Aa	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent	Recently burnt	
93	6/12/2017	390049	6482736	Af, Ba, Bm, Cs, Mp, Ac, Sl, Jf, Cf, Cang, Ep, An, Pl, Hh, Dr, Hhu, Aa, Cm, Dfl, Lh, Kp, Hr, Hsp, Li, Arp, Xp, Am, Pm, Hpu, Tm, Sr	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	E	Consistent		
94	8/12/2017	389851	6492776	Mp, Ac, Nf, Jf, Ha, As, Kg, Lb	?11/S17	N/A	G-VG	Consistent		







# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
95	8/12/2017	389683	6492494	Er, Mp, Xp, Jf, Af	?11/ S17	N/A	D	Consistent		
96	8/12/2017	391270	6489401	Mp, Kg, Bl, Ac, Jf, As, Ha, Ss, Bj, Dr, Js	?11/ S17	N/A	D-G	Consistent		
97	6/12/2017	392258	6485551	Mp, Pinus, Xp, Mf	?11/ S17	N/A	G	Undetermined - no visibility	Burnt recently	No photo
98	8/12/2017	393243	6482236	Ac, Ba, Mp, weeds	?11/ S17	N/A	CD	Consistent	Edge of wetland	
99	6/12/2017	392744	6483675	Mp, As, Er, Vj, Ha, Dr, Ri, Ac, He	?11/ S17	N/A	VG	Potentially inconsistent		
100	8/12/2017	390163	6490417	Er, Nf, Mp, Xp	?11/ S17	N/A	Unsure	Undetermined - no visibility		No photo



# East Wanneroo District Structure Plan – Assessment Sample Data

No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
101	6/12/2017	389095	6486887	Eg, Af, Bm, Js, Sg	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	VG-E	Consistent	Tuarts present	
102	6/12/2017	388221	6485913	Eg, Js, Cc, Ba, Hp, Em, Af, Xp over non native grass	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	G	Consistent		
103	6/12/2017	388611	6487566	Eg, Em and planted	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	CD-D	Consistent		
104	6/12/2017	388101	6487597	Some scattered Eg parkland cleared and some Em, remainder planted	?28	<ul style="list-style-type: none"> <li>• Banksia woodlands of the Swan Coastal Plain</li> <li>• Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain</li> </ul>	CD	Consistent		No photo
105	8/12/2017	387025	6490819	Ba, Bm, Xp, Mp, Mr, Af, Pm, An, Am, Cang, Bi, Js, Ah, Jf, Ep	?20a	<ul style="list-style-type: none"> <li>• <i>Banksia attenuata</i> woodlands over species rich dense shrublands (SCP 20a)</li> <li>• Banksia woodlands of the Swan Coastal Plain</li> </ul>	VG	Consistent		



# East Wanneroo District Structure Plan – Assessment Sample Data



No.	Date	Easting	Northing	Dominant species <sup>1</sup>	Prov. FCT <sup>2</sup>	Potential TEC <sup>3</sup>	Condition <sup>4</sup>	Condition consistency <sup>5</sup>	Notes	Photo
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<sup>1</sup> Species abbreviations: Aa=Acacia applanata, Ac=Adenanthos cygnorum, Af=Allocasuarina fraseriana, Ah=Allocasuarina humilis, Al=Acacia lasiocarpa, Am=Anigozanthos manglesii, An=Alexgeorgea nitens, Ap=Acacia pulchella, Arp=Arnocrinum preissii, As=Astartea scoparia, Asal=Acacia saligna, Ba=Banksia attenuata, Bc=Burchardia congesta, Bd= Banksia dallanneyi, Be=Bossiaea eriocarpa, Bg=Banksia grandis, Bi=Banksia ilicifolia, Bj= Baumea juncea, Bl= Banksia littoralis, Bm=Banksia menziesii, Bo=Bossiaea ornata, Bp=Banksia prionotes, Bs= Banksia sessilis, Ca=Conostylis aculeata, Calspp=Calytrix spp., Cang=Calytrix angulata, Cd=Caustis dioica, Cf=Calytrix flavescens, Cm=Corynotheca micrantha, Cc=Corymbia calophylla, Cp=Conostephium pendulum, Cphily= Cartonema philydroides, Cs=Conospermum stoechadis, Csan=Calothamnus sanguineus, Cset= Conostylis setigera, Db=Dasyogon bromeliifolius, Dd= Daviesia divaricata, Dfa=Desmocladius fascicularis, Dfl=Desmocladius flexuosus, Dl=Dampiera linearis, Dn=Daviesia nudiflora, Dr=Dianella revoluta, Dt=Daviesia triflora, Eg=Eucalyptus gomphocephala, Em=Eucalyptus marginata, Ep=Eremaea pauciflora var. pauciflora, Er=Eucalyptus rudis, Et=Eucalyptus todiana, Gc=Gastrolobium capitatum, Gcomf=Gompholobium confertum, Gcri= Grevillea crithmifolia, Gt=Gompholobium tomentosum, Gv=Grevillea vestita subsp. vestita, Ha=Hypocalymma angustifolium, Hap=Hakea prostrata, Hc=Hyalosperma cotula, He= Hypolaena exsulca, Hh=Hibbertia hypericoides , Hhue=Hibbertia huegelii, Hl=Hakea lissocarpha, Hovp=Hovea pungens, Hp=Haemodorum paniculatum, Hr=Hypocalymma robustum, Hru=Hakea ruscifolia, Hs=Hibbertia subvaginata, Hsp=Haemodorum spicatum, Jf=Jacksonia furcellata, Jfl=Jacksonia floribunda, Js=Jacksonia sternbergiana, Js=Jacksonia sericea, Kg=Kunzea glabrescens, Kp=Kennedia prostrata, Lb=Lyginia barbata, Lf=Lechenaultia floribunda, Lh=Lomandra hermaphrodita, Li=Lyginia imberbis, Lr=Laxmannia ?ramosa, Mf=Macrozamia fraseri, Mp=Mesomelaena pseudostygia, Mr=Macrozamia riedlei, Ms=Melaleuca seriata, Na=Neurachne alopecuroides, Nf=Nuytsia floribunda, Pg=Podotheca gnaphalioides, Pinus=Pinus sp., Pl=Petrophile linearis, Pm=Petrophile macrostachya, Po=Patersonia occidentalis, Ps=Persoonia saccata, Ptm=Ptilotus manglesii, Ri= Regelia inops, Scan=Scaevola canescens, Scurv= Schoenus curvifolius, Sg=Schoenus grandiflorus, Si=Scholtzia involucrata, Sl=Stirlingia latifolia, Sr=Scaevola repens var. repens, Styr= Stylidium repens, Ss=Schoenus subfascicularis, Te=Tricoryne elatior, To=Tetraria octandra, Ts=Thysanotus sparteus, Tt=Thomasia triphylla, Ttri=Thysanotus triandrus, Vd=Verticordia densiflora var. densiflora, Vj= Viminaria juncea, Vn=Verticordia nitens, Xh= Xanthosia huegelii, Xp=Xanthorrhoea preissii, Xsp=Xanthorrhoea spp.

<sup>2</sup> Provisional FCTs based on comparisons to Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, *A Floristic survey of the southern Swan Coastal Plain*, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth, and regional environmental datasets.

<sup>3</sup> Based on Threatened Species Scientific Committee (TSSC), 2017, *Tuart (Eucalyptus gomphocephala) woodlands and forests of the swan coastal plain ecological community draft conservation advice including draft listing advice*, Canberra, Department of Environment and Energy (DoEE) 2016, *Approved Conservation Advice for the Banksia Woodlands of the Swan Coastal Plain ecological community*, Canberra and Department of Parks and Wildlife (DPAW), 2016, *Banksia attenuata woodlands over species rich dense shrublands (Swan Coastal Plain community type 20a – Gibson et al. 1994)*, Interim Recovery Plan No. 359. DPAW, Kensington, Western Australia.

<sup>4</sup> Based on the condition scale within Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

<sup>5</sup> Level to which assigned vegetation condition is continuous over the whole patch.



# Appendix D

EPBC Act Protected Matters Report







# EPBC Act Protected Matters Report

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

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

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

Report created: 19/02/18 14:56:43

[Summary](#)

[Details](#)

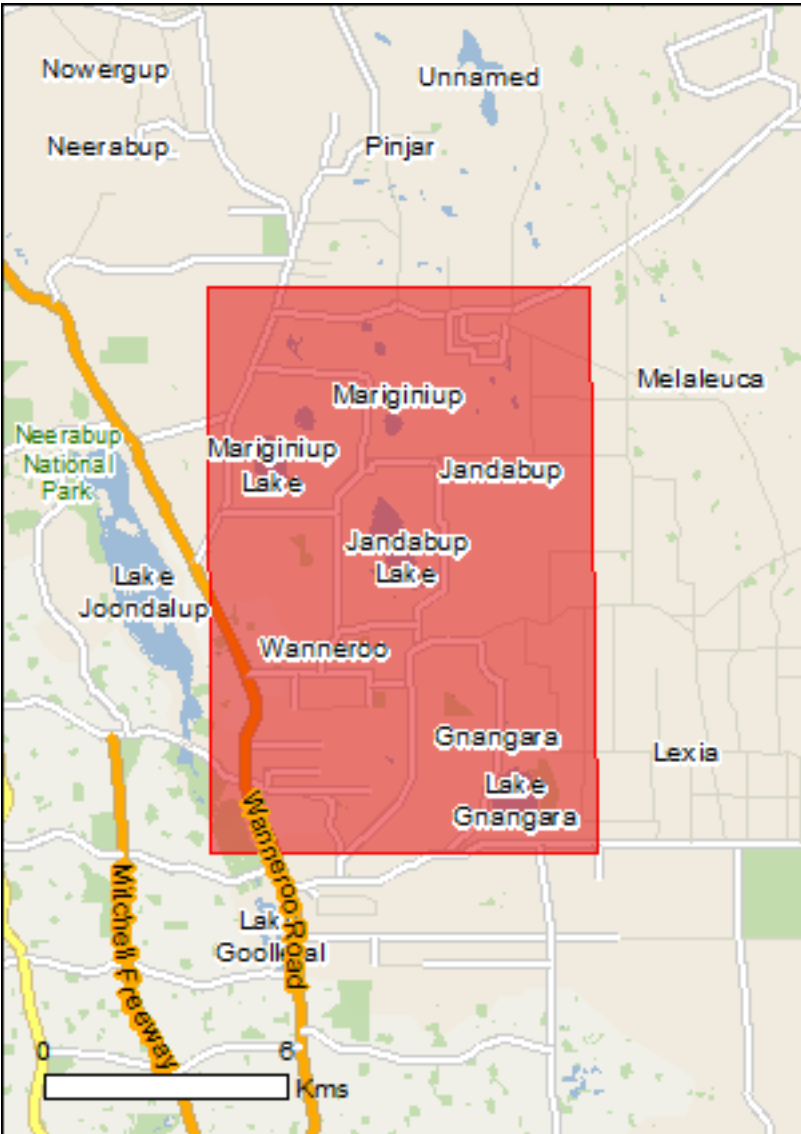
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

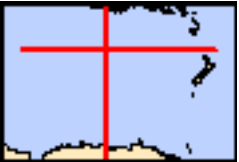
[Acknowledgements](#)



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[Coordinates](#)

[Buffer: 1.0Km](#)





# 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](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	1
<a href="#">Listed Threatened Species:</a>	20
<a href="#">Listed Migratory Species:</a>	13

## 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.

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	22
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	3
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	41
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">Key Ecological Features (Marine)</a>	None



# Details

## Matters of National Environmental Significance

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
<a href="#">Banksia Woodlands of the Swan Coastal Plain ecological community</a>	Endangered	Community likely to occur within area

Listed Threatened Species

[ Resource Information ]

Name	Status	Type of Presence
Birds		

<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
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<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
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<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
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<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
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<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
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<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
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<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
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Mammals

<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
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Plants

<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
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<a href="#">Anigozanthos viridis subsp. terraspectans</a> Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area
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Name	Status	Type of Presence
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
<a href="#">Drakaea elastica</a> Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
<a href="#">Grevillea curviloba subsp. curviloba</a> Curved-leaf Grevillea [64908]	Endangered	Species or species habitat may occur within area
<a href="#">Grevillea curviloba subsp. incurva</a> Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
<a href="#">Lepidosperma rostratum</a> Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
<a href="#">Thelymitra dedmaniarum</a> Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat likely to 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		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area

Migratory Wetlands Species		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area



Name	Threatened	Type of Presence
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Species or species habitat known to occur within area
<a href="#">Calidris subminuta</a> Long-toed Stint [861]		Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[ <a href="#">Resource Information</a> ]
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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	[ <a href="#">Resource Information</a> ]
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\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species



Name	Threatened	Type of Presence
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		habitat known to occur within area  Species or species habitat likely to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Species or species habitat known to occur within area
<a href="#">Calidris subminuta</a> Long-toed Stint [861]		Species or species habitat known to occur within area
<a href="#">Charadrius ruficapillus</a> Red-capped Plover [881]		Species or species habitat known to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Himantopus himantopus</a> Black-winged Stilt [870]		Species or species habitat known to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Recurvirostra novaehollandiae</a> Red-necked Avocet [871]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat may occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area



Extra Information

State and Territory Reserves		[ Resource Information ]
Name		State
Jandabup		WA
Lake Joondalup		WA
Unnamed WA46926		WA

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area



Name	Status	Type of Presence
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		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
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area
Nationally Important Wetlands		[ Resource Information ]
Name	State	
<a href="#">Joondalup Lake</a>	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

-31.690773 115.800904,-31.690773 115.884847,-31.796757 115.886735,-31.796903 115.801591,-31.690773 115.800904

# Acknowledgements

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- [-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.