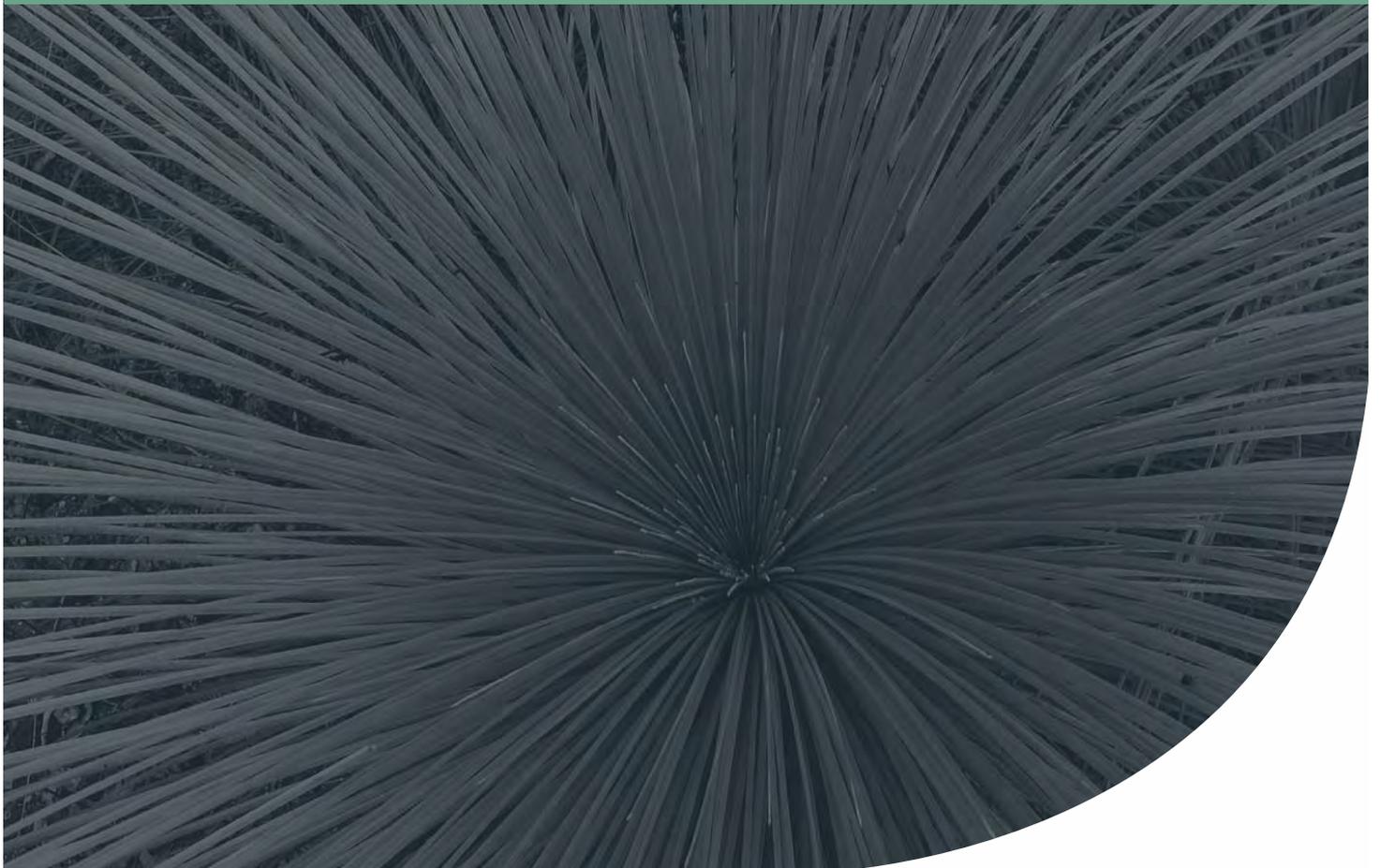


Preliminary Environmental Assessment of Planning Investigation Areas

East Wanneroo District Structure Plan

Project No: EP17-106(05)

**Prepared for Department of Planning, Lands and Heritage
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Preliminary Environmental Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan



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Executive Summary

This Preliminary Environmental Assessment has been prepared on behalf of the Department of Planning, Lands and Heritage to provide environmental recommendations for three 'Planning Investigation Areas' (PIAs) identified within the East Wanneroo locality. These recommendations consider whether any of the assessed PIAs contain environmental values (either known or potential) that are of a level of significance such that they require consideration as part of district structure planning and/or the wider regional planning process.

This report builds on the findings of the *Environmental Assessment Study* (REF), which was prepared to supporting the East Wanneroo District Structure Plan. Additional high level site inspections were conducted to inform this assessment, which focused on the 'key considerations' identified by DPLH as requiring resolution prior to any decision being made regarding future land uses for each PIA. These environmental 'key considerations' include:

- Land use transition/interface with Metropolitan Region Scheme (MRS) Parks and Recreation reserves, Bush Forever sites and conservation category wetlands.
- Protection of significant environmental values including;
 - High value Carnaby's black cockatoo (CBC) and forest red-tailed black cockatoo (FRBTC) foraging habitat
 - Threatened ecological communities (TECs)
 - Vegetation with between 10-30% remaining in the Perth and Peel regions
 - Resource enhancement wetlands.

Based on the results of the site inspection and in the context of the findings of the *Environmental Assessment Study*, a range of recommendations for each PIA have been provided in **Section 4**. An overview of these recommendations is summarised as follows:

- The environmental values of the **Wanneroo (Bebich Drive Precinct) PIA** include patches of vegetation potentially representative of the *SCP 20a Banksia attenuata woodlands over species rich dense shrublands* (SCP 20a) TEC, as well as being representative of the *Banksia Woodlands of the Swan Coastal Plain* (SCP) TEC, high quality foraging habitat for CBC and FRTBC, and the Karratta – Central and South vegetation complex. However, whilst the composition of remnant native vegetation within this PIA is potentially significant due to the potential for this vegetation to be representative of the SCP 20a TEC, the small size and highly fragmented nature of vegetation patches reduces their overall environmental significance below that which would require protection at the regional planning stage.
- The environmental values of the **Jandabup/East Gnangara PIA** are varied across its extent. The portion of the MRS State Forest reserve associated with Bush Forever Site 326 comprises a large area of intact vegetation representative of the Banksia Woodland TEC and high quality CBC foraging habitat, and given its large size is considered to support environmental values which warrant protection at the regional planning stage. Similarly, the majority of adjacent rural-residential areas within Bush Forever Site 326 support similar environmental values which may warrant protection at the regional planning stage. However, if protection of environmental values within this areas is proposed, a range of recommendations have been provided to inform this process. In contrast, the remaining areas of this PIA are generally much more disturbed from

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their natural state and as such, are not considered to support environmental values which warrant protection at the regional planning stage.

- The **East Gnangara PIA** is generally devoid of significant environmental values due to historical pine plantations and existing rural-residential land uses. As such, this PIA is not considered to support environmental values which warrant protection at the regional planning stage.

The recommendations provided are based on strategic and high-level environmental investigations and are intended to inform the regional planning process for the three PIAs.

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List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
EAS	Environmental Assessment Study
EWDSP	East Wanneroo District Structure Plan
FCT	Floristic community type
MRS	Metropolitan Region Scheme
PIA	Planning Investigation Area
SCP	Swan Coastal Plain
TEC	Threatened ecological community

Table A2: Abbreviations – Units of measurement

Units of measurement	
ha	Hectare
m	Metre
cm	Centimetre
km	Kilometre

Table A3: Abbreviations – Organisations

Organisations	
CoW	City of Wanneroo
DoEE	Department of Environment and Energy
DPLH	Department of Planning, Lands and Heritage

Table A4: Abbreviations – Legislation

Planning terms	
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP Act	<i>Environmental Protection Act 1986</i>

1 Introduction

1.1 Background

The Department of Planning, Lands and Heritage (DPLH) are preparing the East Wanneroo District Structure Plan (EWDSP), which is intended to be a high-level, strategic planning document which will provide the basis for future planning and urban development of the East Wanneroo area, the extent of which is shown in **Figure 1**. An *Environmental Assessment Study* (EAS) (Emerge Associates 2018) has been prepared to inform the district structure planning process, which included a high-level assessment of environmental values across the structure plan area and identification of ‘priority areas for further environmental investigation’. These identified areas require detailed site specific investigations and, if confirmed to support the identified significant environmental values, are recommended to be prioritised for protection as part of future planning.

In March 2018, DPLH published the Sub-Regional Planning Frameworks (herein referred to as ‘the Frameworks’) as part of the *Perth and Peel @ 3.5 Million* suite of strategic planning documents. The Frameworks set out the intended future land uses for the Perth and Peel regions in order to accommodate the anticipated population growth up to 2050. The Frameworks identify a number of ‘Planning Investigation Areas’ (PIAs) that will be subject to further planning investigation to determine their suitability for any potential modification to their existing land use.

Three PIAs have been identified within or directly adjacent to the EWDSP area, as shown in **Figure 1**. DPLH have identified a number of ‘key considerations’ that need to be addressed as part of the planning process for each PIA to determine their future land use suitability. The ‘key considerations’ associated with environmental matters which are applicable the three PIAs are outlined in **Table 1**.

Table 1: Summary of PIAs and associated environmental ‘key considerations’ for further investigation

PIA	Area	Environmental ‘key considerations’ ¹
Wanneroo (Bebich Drive Precinct)	90 ha	<ul style="list-style-type: none"> • Land use transition/interface with Parks and Recreation reserve (Badgerup Lake) and Bush Forever areas. • Protection of significant environmental values including; <ul style="list-style-type: none"> ○ High value Carnaby’s black cockatoo and forest red-tailed black cockatoo foraging habitat ○ Vegetation with between 10-30% remaining in the Perth and Peel regions ○ Threatened ecological communities.
Jandabup / East Gngalara	514 ha	<ul style="list-style-type: none"> • Land use transition/interface with Parks and Recreation reserve, Bush Forever areas and conservation category wetlands. • Protection of significant environmental values including; <ul style="list-style-type: none"> ○ High value Carnaby’s black cockatoo and forest red-tailed black cockatoo foraging habitat ○ Vegetation with between 10-30% remaining in the Perth and Peel regions ○ Resource enhancement wetlands ○ Threatened ecological communities.
East Gngalara (Gngalara Road)	491 ha	<ul style="list-style-type: none"> • Land use transition/interface with Parks and Recreation reserve and Bush Forever areas. • Protection of significant environmental values including; <ul style="list-style-type: none"> ○ High value Carnaby’s black cockatoo and forest red-tailed black cockatoo foraging habitat ○ Vegetation with between 10-30% remaining in the Perth and Peel regions ○ Resource enhancement wetlands ○ Threatened ecological communities.

1.2 Purpose of this report

The purpose of this report is to provide the findings and recommendations arising from a preliminary environmental assessment of the three PIAs relevant to the EWDSP area. This report focuses on the specific 'key considerations' identified by DPLH for each PIA which are related to environmental matters, as listed in **Table 1**.

This report has been prepared on behalf of DPLH and provides recommendations for each PIA with regard to their environmental values, which will likely inform the future strategic-level planning process to resolve each of the three PIAs. The scope, detail and intensity of environmental investigations completed as part of this work reflect the strategic and high-level nature of PIAs, and as such further, more detailed, environmental investigations will likely be required to support future planning processes (for example, any subsequent amendments to the Metropolitan Region Scheme).

2 Summary of *Environmental Assessment Study* Findings

A high-level environmental assessment of the EWDSP area was completed in 2018, as documented in the *Environmental Assessment Study* (Emerge Associates 2018). As such, the EAS should be referred to for detailed information regarding the existing environmental values of each PIA, with the exception of the eastern portions of the East Gnangara PIA as these areas do not form part of the EWDSP area and as such were not assessed in the EAS. A summary of the existing environmental values for each PIA based on the findings of the EAS has been provided in **Table 2** for the purpose of this report.

The EAS also included an environmental analysis to inform the preparation of the EWDSP, which identified the following areas:

- ‘Areas subject to existing protection mechanisms’, including existing Metropolitan Region Scheme (MRS) Parks and Recreation (P&R) reserves, Bush Forever sites and conservation category wetlands. A key assumption of the EAS was that all remnant vegetation within these areas is retained through future planning processes and is ultimately protected for conservation purposes.
- ‘Priority areas for further investigation’, which require detailed environmental investigations given they may support significant environmental values. If confirmed to support these significant environmental values, these areas are recommended to be prioritised for protection as part of future planning. These areas are shown in **Figure 2**, **Figure 3** and **Figure 4**.

A summary of how these areas align with each of the PIAs has also been included in **Table 2**.

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Table 2: Summary of existing environmental values for each PIA, based on EAS (Emerge Associates 2018)

Factor	Wanneroo (Bebich Drive Precinct) PIA	Jandabup / East Gngangara PIA	East Gngangara (Gngangara Road) PIA ¹
Land use planning context	<ul style="list-style-type: none"> This PIA supports existing rural residential land uses, comprising approximately 75 land parcels with an average lot size of 1.09 ha. The majority of rural residential lots contain some retained native vegetation. However, individual patches of vegetation within lots are relatively small (<1 ha) and as such vegetation across this PIA is highly fragmented. This PIA interfaces the western boundary of an MRS P&R reserve associated with Badgerup Lake and Bush Forever Site 327. Eastern portions of this PIA are identified as contributing to a regional ecological linkage. The City of Wanneroo (CoW) <i>Draft Local Biodiversity Plan 2018/19 – 2023/24</i> identifies local natural areas as occurring within this PIA. 	<ul style="list-style-type: none"> This PIA supports a range of existing land uses, including: <ul style="list-style-type: none"> Areas of existing and historical pine plantation Rural residential lots largely cleared of vegetation Land parcels within Bush Forever Site 326 which are primarily comprised of retained native vegetation, including 40 rural residential lots with an average lot size of 4.0 ha and a State owned land parcel reserved for 'State Forests' with a patch of native vegetation of approximately 50 ha. This PIA interfaces existing MRS P&R reserves to the north and south (which are also part of Bush Forever Sites 193 and 326), in addition to adjacent areas of existing and historical pine plantations to the east. Portions of this PIA are identified as contributing to a regional ecological linkage. The City of Wanneroo (CoW) <i>Draft Local Biodiversity Plan 2018/19 – 2023/24</i> identifies local natural areas as occurring within this PIA. 	<ul style="list-style-type: none"> The majority of this PIA is comprised of historical and existing pine plantation. In addition, this PIA includes a row of 29 lots along Gngangara Road which support rural residential and market garden land uses, with an average lot size of 3.0 ha. The majority of these lots are largely cleared of native vegetation. This PIA interfaces with the eastern boundary of the Lake Gngangara MRS P&R reserve and associated Bush Forever Site 193. The western portion of this PIA is identified as contributing to a regional ecological linkage. The City of Wanneroo (CoW) <i>Draft Local Biodiversity Plan 2018/19 – 2023/24</i> identifies local natural areas as occurring within this PIA.
Landform and soils	<ul style="list-style-type: none"> This PIA is situated on the Spearwood Dune system, which is characterised by siliceous yellow sands over limestone, with hilly to undulating terrain. 	<ul style="list-style-type: none"> These PIAs are situated on the Bassendean Dune system, which is an older formation than the Spearwood Dune system and is generally characterised by lower relief, with variable depth to groundwater, consisting of lower sandy hills interspersed with permanent and seasonal wetlands. Soils are typically grey sands. 	
Hydrology	<ul style="list-style-type: none"> No natural waterways or wetlands are mapped as occurring within this PIA. This PIA is not situated within any proclaimed public drinking water source areas (PDWSAs). 	<ul style="list-style-type: none"> No natural waterways are mapped as occurring within this PIA. DBCAs geomorphic wetland mapping identifies two conservation category wetlands (CCWs), two resource enhancement wetlands (REWs) and two multiple use wetlands (MUWs) as occurring within this PIA. Portions of this PIA are situated within proclaimed Priority 1 and Priority 2 PDWSAs. 	<ul style="list-style-type: none"> No natural waterways are mapped as occurring within this PIA. DBCAs geomorphic wetland mapping identifies one REW and two MUWs as occurring within this PIA. This PIA is situated wholly within a Priority 1 proclaimed PDWSA.
Fauna	<ul style="list-style-type: none"> A range of threatened and priority fauna species are listed in DBCA records as occurring across the locality, including but not limited to Carnaby's black cockatoo, forest red-tailed black cockatoo, Baudin's black cockatoo, chuditch, quenda, western brush wallaby, black-striped snake and a range of migratory bird species. Potential foraging habitat for Carnaby's black cockatoo (Glossop <i>et al.</i> 2011) is mapped as occurring within portions of all three PIAs. 		

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Factor	Wanneroo (Bebich Drive Precinct) PIA	Jandabup / East Gngangara PIA	East Gngangara (Gngangara Road) PIA ¹
Flora and vegetation	<ul style="list-style-type: none"> This PIA is situated within the Karrakatta – Central and South regional vegetation complex, of which 23% of its original extent across the Swan Coastal Plain (SCP) remains and 16.8% of its original extent across the Perth and Peel (P&P) regions remains (EPA 2015). The <i>Banksia Woodlands of the SCP</i> threatened ecological community (TEC) is recorded by the Department of Biodiversity, Conservation and Attractions (DBCA) as occurring within this PIA. The preliminary vegetation assessment completed as part of the EAS identified intact vegetation within this PIA as potentially representing the <i>SCP 20a Banksia attenuata woodlands over species rich dense shrublands</i> (SCP 20a) TEC. However, further detailed flora and vegetation surveys were recommended as being required to confirm this. No occurrences of threatened or priority flora are recorded by DBCA as occurring within this PIA. 	<ul style="list-style-type: none"> This PIA is situated across a number of mapped regional vegetation complexes, including: <ul style="list-style-type: none"> Bassendean Complex – North Transition (91% remaining SCP, 67% remaining P&P regions). Bassendean Complex – Central and South (26% remaining SCP, 21% remaining P&P regions). Pinjar Complex (30% remaining SCP, 30% remaining P&P regions). The <i>Banksia Woodlands of the SCP</i> TEC is recorded by the DBCA as occurring within this PIA. No occurrences of threatened or priority flora are recorded by DBCA as occurring within this PIA. 	<ul style="list-style-type: none"> This PIA is situated within the mapped extent of the Bassendean Complex – Central and South, of which 26% of its original extent across the SCP remains and 21% of its original extent across the Perth and Peel regions remains (EPA 2015). However, the majority of this PIA does not comprise native vegetation, as a result of historical clearing to facilitate pine plantations. Remnant vegetation is generally limited to small patches within a small number of rural residential lots along Gngangara Road. The <i>Banksia Woodlands of the SCP</i> TEC is recorded by the DBCA as occurring within a small number of rural residential lots within this PIA. No occurrences of threatened or priority flora are recorded by DBCA as occurring within this PIA.
EAS environmental analysis	<ul style="list-style-type: none"> The majority of this PIA was not identified in the EAS as supporting ‘areas subject to existing protection mechanisms’ or ‘priority areas for further investigation’. However, select areas of vegetation within a small number of land parcels east of Benmuni Road were identified as in the EAS as ‘priority areas for further investigation’, given this vegetation was determined to be potentially representative of the SCP 20a TEC and was identified as being generally contiguous with similar vegetation within the adjacent MRS P&R reserve. 	<ul style="list-style-type: none"> The majority of this PIA was identified in the EAS as supporting ‘areas subject to existing protection mechanisms’, given these areas form part of Bush Forever Site 326. No portion of this PIA was identified in the EAS as supporting ‘priority areas for further investigation’. 	<ul style="list-style-type: none"> Only a small portion of this PIA is situated within the EWDSP area and as such was considered as part of the EAS. Within this area, no ‘areas subject to existing protection mechanisms’ or ‘priority areas for further investigation’ were identified.

¹ the majority of the East Gngangara (Gngangara Road) PIA is situated outside of the EWDSP boundary and as such, was not specifically considered in the EAS. However the vast majority of the area not included in the EAS is characterised by cleared areas associated with historical pine plantations.

3 Site Inspection

3.1 Rationale

The high level investigations completed as part of the EAS provide a general understanding of the environmental values across the EWDSP area and by extension, within the majority of the three PIAs. However, additional information was determined to be required to inform this preliminary environmental assessment of the PIAs, particularly to address each of the applicable 'key considerations' identified in the Frameworks. On this basis, an additional site inspection was conducted across all three PIAs, focusing on the assessment of the following values:

- Native vegetation, to determine whether it is representative of mapped regional vegetation complexes and potentially representative of threatened ecological communities.
- Potential foraging habitat for Carnaby's black cockatoo (CBC) and forest red-tailed black cockatoo (FRTBC).
- Mapped geomorphic wetlands.
- Land use interfaces with MRS P&R reserves, Bush Forever sites and CCWs.

3.2 Methods

A desktop spatial assessment of each PIA was completed to determine optimal site inspection locations to address the relevant environmental 'key considerations', which included review of the following sources of information:

- Native vegetation extent mapping (DPIRD 2017a)
- Regional vegetation complex mapping (Hedde *et al.* 1980)
- MRS zones and reserves mapping (DPLH 2018)
- Cadastral boundaries and land tenure (Landgate 2018)
- Geomorphic wetland mapping (DBCA 2018)
- Potential threatened ecological community mapping (Emerge Associates 2018).

Based on the desktop spatial analysis, 71 inspection locations were identified across the three PIAs. Two botanists from Emerge Associates conducted the site inspection on 14 August 2018. The PIAs were traversed by vehicle and botanists exited the vehicle to record information at each of the pre-determined inspection locations. Where an inspection location was within public land, botanists could access the vegetation directly and completed a semi-formal vegetation sample (comparable to a standard botanical quadrat). However, where an inspection location was within private land, assessments were completed from the adjacent public road reserve, and as such provided more general information.

The type of information recorded at each inspection location was dependent on the relevant environmental values in that area and the applicable 'key considerations' for each PIA. For example, wetland assessments were not required within the Wanneroo (Bebich Drive Precinct) PIA given no such features occur. The types of inspections completed and the associated recorded information is outlined in **Table 3**, whilst inspection locations are shown in **Figure 2**, **Figure 3** and **Figure 4**. **Table 4** outlines the number of inspection locations which were assessed within each PIA.

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Table 3: Information recorded at each inspection location

Inspection type	Information recorded [^]	No. locations
Flora and vegetation (semi-formal)	<ul style="list-style-type: none"> List of flora species present from relevé completed over an approximate 10 x 10 m area Presence/absence of high quality foraging habitat for forest red-tailed black cockatoo and/or Carnaby's black cockatoo Likely Heddlé <i>et al.</i> (1980) vegetation complex as determined by vegetation and landform type Vegetation type and potential TEC/s Estimate of condition of vegetation using methods from Keighery (1994) Prediction of consistency of vegetation condition within the patch of vegetation Photographs 	5
General vegetation	<ul style="list-style-type: none"> Presence/absence of high quality foraging habitat for forest red-tailed black cockatoo and/or Carnaby's black cockatoo Characteristics of the land use transition/interface, including vegetation type and condition Likely Heddlé <i>et al.</i> (1980) vegetation complex as determined by vegetation and landform type Vegetation type and potential TEC/s Estimate of condition of vegetation using methods from Keighery (1994) Prediction of consistency of vegetation condition within the patch of vegetation Photographs 	40
Wetland	<ul style="list-style-type: none"> Presence of wetland landform and hydrology Vegetation type and condition Likely management category of wetland feature Photographs 	12
Land use interface	<ul style="list-style-type: none"> Photographs and notes of land use transition/interface 	14
TOTAL		71

[^] note that not all assessments were completed at each location, dependent on the relevant 'key considerations'.

Table 4: Number and type of site inspections completed at each PIA

Inspection type	Number of inspections completed		
	Wanneroo (Bebich Drive Precinct) PIA	Jandabup/ East Gangara PIA	East Gnarara PIA
Flora and vegetation (semi-formal)	4	1	0
General vegetation	17	14	9
Wetland	0	9	3
Land use interface	4	5	5
TOTAL	25	29	17

To enable determination of likely 'floristic community type' (FCT) for inspected areas of vegetation (and by extension, the potential for TEC occurrences), the flora lists collected at each of the 'flora and vegetation (semi-formal)' inspection locations were compared to the regional FCT dataset *A floristic survey of the southern Swan Coastal Plain* by Gibson *et al.* (1994) using the statistical analysis package PRIMER v6 (Clarke and Gorley 2006).

The current scientific names of recorded flora species were reconciled with those listed in Gibson *et al.* (1994), which was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into PRIMER v6. As data from a localised survey is often spatially correlated, data for each sample was compared to Gibson *et al.* (1994) separately. This removed the influence of spatial correlation when assigning a FCT. Classification was then undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure and further refined using a similarity probability measure (significance level of 0.05).

3.3 Assessment limitations

The aim of the site inspection was to further investigate environmental values within the PIAs, building on the results of the EAS and focusing on the 'key considerations' identified for each PIA. The site inspection represents a high level assessment and at most, was completed at a reconnaissance level.

Whilst many values were visible from public road reserves, and some public land was accessible, access restrictions limited data collected across the site. The survey does not meet the criteria for a 'detailed' survey (EPA 2016) and therefore the results, particularly in relation to defining likely FCTs and potential TECs (where detailed survey information is required), only provide an indication of potential values. In addition, further information is required for confirmation of other values, such as hydrology, geology and landform characteristics. The results of this survey are intended only to provide a high level overview of key environmental considerations across the PIAs.

3.4 Results and discussions

3.4.1 Wanneroo (Bebich Drive Precinct)

With a total area of approximately 90 ha, the Wanneroo (Bebich Drive Precinct) PIA is significantly smaller compared to the Jandabup/East Gnangara and East Gnangara PIAs (514 ha and 491 ha respectively). Given the Wanneroo (Bebich Drive Precinct) PIA is comprised of a large number of land parcels which were not accessible for the purpose of this assessment, the majority of inspections locations within this PIA were undertaken from public road reserves looking into private lots.

However, four flora and vegetation (semi-formal) inspection locations were completed within either small public reserves situated between rural residential lots (inspection locations FV-1 and FV-2) or within the public P&R MRS reserve to the east (inspection locations FV-3 and FV-4). These inspection locations allowed direct access to vegetation, resulting in more detailed observations and recording of species lists. The location of inspection locations within this PIA are shown in **Figure 2**.

3.4.1.1 Vegetation complexes

As outlined in **Table 2**, Hedde *et al.* (1980) mapping indicates the Wanneroo (Bebich Drive Precinct) PIA is situated within the Karrakatta – Central and South regional vegetation complex, which is described as an ‘open forest of *Eucalyptus gomphocephala* (tuart) - *Eucalyptus marginata* (jarrah) - *Corymbia calophylla* (marri)’.

Remnant native vegetation within the Wanneroo (Bebich Drive Precinct) PIA was observed to be generally consistent with this description, supporting *Eucalyptus marginata* and *Corymbia calophylla*. However, no *Eucalyptus gomphocephala* trees were observed. Multiple banksia species were also observed within this PIA. Overall, stands of intact native vegetation within the Wanneroo (Bebich Drive Precinct) PIA are considered to be generally representative of the Karrakatta – Central and South complex.



Plate 1: Example of vegetation within the Wanneroo (Bebich Drive Precinct) PIA representative of the Karrakatta – Central and South complex

3.4.1.2 Potential threatened ecological communities

The EAS (Emerge Associates 2018) included a preliminary assessment of potential TEC occurrences within the wider EWDSPP area, including the Wanneroo (Bebich Drive Precinct) PIA. However, the results of this assessment and associated potential TEC extent mapping were described as a likely overestimation of the actual extent of TECs, with additional finer-scale detailed flora and vegetation surveys recommended to be required to confirm the actual extent of TECs.

The EAS (Emerge Associates 2018) indicated that two TECs potentially occur within the Wanneroo (Bebich Drive Precinct) PIA, including:

- Banksia Woodlands of the SCP TEC, which is listed as ‘endangered’ under the EPBC Act.
- SCP 20a TEC, which is listed as ‘endangered’ in Western Australia.

Four 'flora and vegetation (semi-formal)' inspection locations were completed within public land within or directly adjacent to the Wanneroo (Bebich Drive Precinct) PIA, with the intent of gaining a preliminary understanding of the potential floristic community type (FCT) of vegetation and any associated potential TEC occurrence, the results of which are summarised as follows:

- Comparison of species observed at inspection location FV-1 against the Gibson *et al.* (1994) dataset was inconclusive, likely due to historical disturbance which has altered the structure and composition of the vegetation.
- Similarly, comparison of species observed at inspection location FV-2 was also inconclusive, clustering with a group of Gibson *et al.* (1994) sites representing multiple banksia woodland FCTs. This result may be due to the location of FV-2 on a slope near a wetland, where the vegetation may comprise a transition zone between different banksia woodland FCTs. Sample FV-2 would likely meet the condition threshold for the Banksia Woodlands of the SCP TEC.
- Species composition observed at inspection location FV-3 showed similarity to four Gibson *et al.* (1994) sites representing FCT 22 'Banksia *ilicifolia* woodlands' with 20-25% similarity. FCT 22 is one of the many FCTs associated with the Banksia Woodlands of the SCP TEC. The vegetation within FV-3 appeared likely to meet the condition criteria for the Banksia Woodlands of the SCP TEC, but to meet the minimum patch size it would likely be dependent on contiguity with adjacent banksia vegetation.
- Species composition observed at inspection location FV-4 showed high similarity to seven Gibson *et al.* (1994) sites representing FCT 20a 'Banksia *attenuata* woodlands over species rich dense shrublands' with 38-46% similarity. Sample FV-4 would meet the criteria to represent the Banksia Woodlands of the SCP TEC.

These results support the findings of the EAS and indicate that vegetation within and adjacent to the Wanneroo (Bebich Drive Precinct) PIA has the potential to represent one or both of the Banksia Woodlands of the SCP and SCP 20a TECs identified in the EAS. To confirm the presence (and extent) of the SCP 20a TEC within the PIA, access to private lots would be required to enable detailed flora and vegetation surveys and associated statistical floristic assessments to be completed.

The Banksia Woodlands of the SCP TEC is recorded by DBCA as occurring within this PIA and the results of the site inspection support this. However, due to the high level of vegetation fragmentation, an assessment against the TEC criteria and minimum thresholds, particularly patch size, would be required to confirm the extent of this TEC.

3.4.1.3 Potential black cockatoo foraging habitat

A variety of potential black cockatoo foraging habitat values were identified within the Wanneroo (Bebich Drive Precinct) PIA during the site inspection. High quality foraging habitat for Carnaby's black cockatoo and/or forest red-tailed black cockatoo was identified at the majority of inspection locations, with only two of the 21 inspection locations supporting lower quality foraging habitat (inspection locations GV-2 and GV-5).

High quality black cockatoo foraging habitat within the Wanneroo (Bebich Drive Precinct) PIA is primarily comprised of banksia woodland vegetation for Carnaby's black cockatoo and *Eucalyptus marginata* (jarrah) trees for forest red-tailed black cockatoo.

Although native understorey vegetation has been removed within a number of rural residential land parcels, many native overstorey species (such as banksia and jarrah trees) remain within cleared areas, providing foraging habitat for black cockatoos.

During the site inspection, a flock of approximately 60 white-tailed black cockatoos (assumed to be Carnaby's black cockatoo) were observed flying and foraging in the eastern portion of the Wanneroo (Bebich Drive Precinct) PIA.



Plate 2: Example of high quality foraging habitat (banksia, marri and jarrah) for both FRTBC and CBC in the Wanneroo (Bebich Drive Precinct) PIA (inspection location GV-1)

3.4.1.4 Land use interfaces

The primary land use transition and interface consideration for the Wanneroo (Bebich Drive Precinct) PIA occurs along its eastern boundary, between rural residential lots east of Benmuni Road and the adjacent MRS P&R reserve and Bush Forever Site 327. The location of this interface is shown in **Figure 5**.

The majority of lots on the eastern boundary of Wanneroo (Bebich Drive Precinct) contain patches of intact native vegetation. However, vegetation remains fragmented within and across lot boundaries due to clearing for firebreaks, gardens, driveways, dwellings and other structures. Prior to historical clearing to support rural residential land uses, vegetation within these lots would once have been contiguous with vegetation in the adjacent MRS P&R reserve.

Visual examples of this interface are provided in **Table 5**.

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Table 5: Wanneroo (Bebich Drive Precinct) PIA land use interface examples

location	Photo	Photo summary
LU1		<ul style="list-style-type: none"> • Left: turfed road reserve, followed by vegetated MRS P&R reserve • Right: Rural-residential land uses
LU2		<ul style="list-style-type: none"> • Left: Rural-residential property (beyond fenceline) • Right: MRS P&R reserve
LU3		<ul style="list-style-type: none"> • Left: turfed road reserve, followed by rural-residential land uses supporting native vegetation. • Right: road reserve followed by vegetated MRS P&R reserve (beyond fenceline)
LU4		<ul style="list-style-type: none"> • Left: MRS P&R reserve • Right: Rural-residential property (beyond fenceline)

3.4.2 Jandabup/East Gnangara

The majority of inspection locations within this PIA were undertaken from public road reserves looking into private lots, with the exception of four inspection locations undertaken within accessible public reserves and pine plantation areas (inspection locations FV-5, WT-7, LU-7 and WT-8). Inspection locations within the Jandabup/East Gnangara PIA are shown in **Figure 3**.

3.4.2.1 Vegetation complexes

As outlined in **Table 2**, the Jandabup/East Gnangara PIA is situated across a number of mapped regional vegetation complexes Heddle *et al.* (1980), including the Bassendean – North, Bassendean – North Transition, Bassendean – Central and South, and Pinjar complexes.

The majority of remnant vegetation within the Jandabup/East Gnangara PIA is within the mapped extent of the Bassendean – North Transition complex, which is described as a ‘low open forest and low woodland of *Banksia* spp. - *Eucalyptus totdtiana* on a series of high sand dunes’ (Heddle *et al.* 1980). The majority of remnant vegetation within the Jandabup/East Gnangara PIA was observed to comprise a woodland to open forest of multiple banksia species and *Eucalyptus totdtiana*, on elevated sand dunes. This vegetation structure aligns with the Bassendean – North Transition complex description and as such, this vegetation is considered representative of this complex.

Some lower-lying wetland vegetation that aligns with the Heddle *et al.* (1980) description of the Pinjar Complex was observed in the north western portion of the Jandabup/East Gnangara PIA, comprising *Eucalyptus rudis* and *Melaleuca preissiana* trees. However, the site inspection did observe discrepancies between the currently mapped boundary of the Pinjar complex and the Bassendean–North Transition complex. This was not unexpected considering the scale of the Heddle *et al.* (1980) mapping. Detailed surveys that take into consideration the vegetation type, landform and soil characteristics would be required to delineate the precise boundary between these two associations.

The portion of vegetation mapped as the Bassendean – Central and South complex within the south-western portion of the Jandabup/East Gnangara PIA aligned with the Heddle *et al.* (1980) description of this complex, comprising *Melaleuca preissiana* and *Xanthorrhoea preissii* near a wetland. The mapped boundary between this complex and the Bassendean – North Transition complex within the Jandabup/East Gnangara PIA appeared generally consistent with on-ground values.



Plate 3: Example of vegetation within the Jandabup/East Gnangara PIA representative of the Bassendean – North Transition complex



Plate 4: Example of vegetation within the Jandabup/East Gnangara PIA representative of the Pinjar Complex



Plate 5: Example of vegetation within the Jandabup/East Gnangara PIA representative of the Bassendean – Central and South complex (inspection location GV-27)

3.4.2.2 Potential threatened ecological communities

The EAS (Emerge Associates 2018) indicated that vegetation within the Jandabup/East Gnangara PIA is potentially representative of the Banksia Woodlands of the SCP TEC. The site inspection determined that the majority of remnant native vegetation within this PIA comprises a banksia woodland composition, which would meet the associated vegetation composition criteria for the Banksia Woodlands of the SCP TEC. The vegetation is considered likely to meet the remaining TEC criteria due to the large size and contiguity of patches, as well as the 'good' or better condition of the majority of observed vegetation. Notwithstanding this, detailed site-specific assessments would be required to confirm the exact extent of the Banksia Woodlands of the SCP TEC within the Jandabup/East Gnangara PIA, particularly for smaller isolated patches of banksia vegetation.

One semi-formal flora and vegetation assessment was undertaken in public land within the Jandabup/East Gnangara PIA during the site inspection. The recorded species composition at inspection location FV-5 showed similarity to seven Gibson *et al.* (1994) sites representing FCT/SCP 20a TEC with 39-44% similarity.

The EAS did not indicate the SCP 20a TEC as potentially occurring within the Jandabup/East Gnangara PIA, largely due to regional and contextual information, in addition to the vegetation types and species observed during previous field surveys. The closest confirmed occurrence of the SCP 20a TEC is mapped in the DBCA TEC database approximately 4.2 km to the south east of inspection location FV-5. Gibson *et al.* (1994) stated that FCT 20a is confined to the Karrakatta complex (part of the Spearwood dune system) and Southern River complex (part of the Bassendean dune system); neither of which occur within Jandabup/East Gnangara PIA.

The species list recorded at inspection location FV-5 was a rapid 'snapshot' assessment and does not meet the criteria for a 'detailed' assessment in accordance with the EPA's *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). Therefore, while comparison to the Gibson *et al.* (1994) dataset provides an indication of potential FCT (and subsequent TEC), it cannot be relied upon. Detailed sampling of over multiple visits would be required to make conclusions regarding the FCT of the vegetation in and around FV-5, as well as across the remainder of the Jandabup/East Gnangara PIA.

3.4.2.3 Potential black cockatoo foraging habitat

The Jandabup/East Gnangara PIA supports high quality **CBC** foraging habitat where areas of native banksia woodland vegetation occur, which is generally widespread across the western half of the site. In addition, stands of mature **Pinus radiata* (pine) trees, while exotic, also provide high quality CBC foraging habitat, which were observed within parts of remaining pine plantation, in addition to around some wetland areas.

High quality **FRTBC** foraging habitat was observed to be limited across the Jandabup/East Gnangara PIA, being observed at only one inspection location (GV-29). Although vegetation within the Jandabup/East Gnangara PIA does include some FRBC foraging species, they do not represent a high enough proportion for this vegetation to be considered a 'high quality' FRTBC foraging resource.



Plate 6: Example of high quality foraging habitat (banksia) for CBC in Jandabup/East Gnangara PIA

3.4.2.4 Wetlands

Six geomorphic wetlands are mapped by DBCA as occurring within the Jandabup/East Gnangara PIA. The site inspection included a high-level assessment of each wetland, the results of which are summarised in **Table 6**.

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Table 6: Wetland inspection results for Jandabup/East Gnangara PIA

UFI	Site inspection observations	Recommendations	Photo/s
8102 CCW	<ul style="list-style-type: none"> Landform confirmed to represent a wetland. Vegetation comprises native <i>Melaleuca preissiana</i> trees and non-native <i>*Pinus radiata</i>. Unable to determine whether understorey vegetation is native or non-native from viewing point due to access restrictions. 	<ul style="list-style-type: none"> May not have values consistent with a CCW due to signs of disturbance and occurrence of non-native species. May support values consistent with a REW. Further surveys required (with direct access to wetland) to determine appropriate management category. 	 <p>Inspection location WT-6</p>
8122 CCW	<ul style="list-style-type: none"> Landform confirmed to represent a wetland. Dominated by vegetation in 'good' or better condition. 	<ul style="list-style-type: none"> Appears to have values consistent with a CCW. No modifications likely to be appropriate. 	 <p>Inspection location WT-7</p>
8120 REW	<ul style="list-style-type: none"> Unable to be surveyed due to lack of access (located on private property, away from roads). 	<ul style="list-style-type: none"> Aerial imagery indicates native species likely to be present, as well as non-native <i>*Pinus radiata</i>. Likely to have values consistent with a REW, however further surveys required (with direct access to wetland) to determine appropriate management category. 	No photo as wetland was not accessible.

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UFI	Site inspection observations	Recommendations	Photo/s
8123 (part) REW	<ul style="list-style-type: none"> • Landform likely to represent a wetland, but is not immediately obvious. • Native vegetation present but limited to small number of species such as native <i>Kunzea glabrescens</i> and non-native juvenile <i>*Pinus radiata</i>. • Ground layer mainly bare ground and non-native species. 	<ul style="list-style-type: none"> • May not have values consistent with a REW due to high disturbance, low cover of native species and observed lack of hydrological function. • May support values consistent with a MUW. • Further surveys required within the wetland to determine appropriate management category. 	 <p data-bbox="1256 791 1473 815">Inspection location WT-8</p>
8117 MUW	<ul style="list-style-type: none"> • Landform confirmed to represent a wetland. • Some native trees present (e.g. <i>Eucalyptus rudis</i>, <i>Melaleuca preissiana</i>). • Non-native <i>*Pinus radiata</i> present. • Unable to determine whether understorey vegetation is native or non-native from viewing point due to access restrictions. 	<ul style="list-style-type: none"> • Existing management category (MUW) may be understated, and wetland may support values consistent with an REW based on native species present. • Further surveys required (with direct access to wetland) to determine appropriate management category. 	 <p data-bbox="1256 1318 1473 1342">Inspection location WT-3</p>

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UFI	Site inspection observations	Recommendations	Photo/s
8116 MUW	<ul style="list-style-type: none"> • Landform confirmed to represent a wetland. • Vegetation composition and quality varies within the feature. • North eastern portion of feature supports dense native shrubland vegetation in 'good' or better condition • Central and western portion supports mainly non-native vegetation (e.g. pasture grasses and *<i>Pinus radiata</i> trees). 	<ul style="list-style-type: none"> • North eastern portion of feature likely to have values consistent with a CCW feature due to intact high quality native vegetation. • Remainder of wetland appears to have values consistent with a MUW. • Further surveys required within the wetland to determine appropriate management category and delineate boundary of different management categories, if determined to be appropriate. 	 <p data-bbox="1249 786 1944 810">Portion of wetland supporting non-native vegetation (inspection location WT-6)</p>  <p data-bbox="1249 1241 1906 1265">Portion of wetland supporting native vegetation (inspection location WT-5)</p>

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3.4.2.5 Land use interfaces

Examples of land use interfaces within the Jandabup/East Gnangara PIA are provided in **Table 7**. Descriptions of interfaces with between this PIA and various Bush Forever sites, MRS P&R reserves and CCWs are discussed below. The location of these interfaces are shown in **Figure 6**.

Bush Forever Site 326

Part of Bush Forever Site 326 extends across a large portion of the Jandabup/East Gnangara PIA. The interface between rural residential properties within and outside of Bush Forever Site 326 was observed to be distinct. Properties within Bush Forever Site 326 support large patches of intact remnant vegetation, compared to adjacent properties outside of Bush Forever Site 326 which are typically partly or wholly cleared of native vegetation.

To the east of Bush Forever Site 326, within the MRS State Forest reserve, there is a narrow interface that does not appear to have supported pine plantations and contains regenerating native vegetation. To the east of this strip of regenerating vegetation, a sand track provides a clear interface between native vegetation and historical pine plantation.

MRS P&R reserves

The site is bound by MRS P&R reserves to the north and south. With the exception of some roads and firebreaks, the interface with MRS P&R and rural-residential lots within Bush Forever Site 326 is generally well vegetated. In contrast, there is a distinct non-vegetated interface between the P&R reserve and rural-residential lots outside of Bush Forever 326, as these lots were observed to be typically partly or wholly cleared of vegetation.

Conservation category wetlands

Remnant native vegetation surrounds CCW UFI 8122 and as such there is no difference between land uses at the interface of this wetland feature. CCW UFI 8102 is surrounded by native vegetation that appears to have been disturbed and supports moderate to high cover of non-native species such as pasture grasses.

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Table 7: Jandabup/East Gnangara PIA land use interface examples

location	Photo	Photo summary
LU5		<ul style="list-style-type: none"> • Left: native vegetation (within MRS P&R reserve) • Right: fragmented native and non-native vegetation (rural-residential)
LU6		<ul style="list-style-type: none"> • Left: native vegetation within rural-residential lots (associated with Bush Forever Site 326) • Right: non-native planted vegetation within rural-residential lots outside of Bush Forever Site 326.
LU7		<ul style="list-style-type: none"> • Left: historical pine plantation • Right: disturbed regenerating native vegetation (reserve)
LU8		<ul style="list-style-type: none"> • Left: native vegetation (within MRS P&R reserve) • Right: native vegetation (rural-residential lots)
LU9		<ul style="list-style-type: none"> • Left: native vegetation (rural-residential lots) • Right: native vegetation (within MRS P&R reserve)

3.4.3 East Gngangara

The majority of inspection locations within the East Gngangara PIA were undertaken from public land within existing reserves and pine plantation areas, looking into private lots. Inspection locations within this PIA are shown in **Figure 4**.

3.4.3.1 Vegetation complexes

As outlined in **Table 2**, the majority of the East Gngangara PIA is cleared of native vegetation due to historical pine plantation land uses. Remnant native vegetation is generally limited to a small number of rural-residential lots along the southern PIA boundary. Based on Heddle *et al.* (1980) mapping, this vegetation is within the 'Bassendean– Central and South' regional vegetation complex.

Where native vegetation remains within the East Gngangara PIA, it most typically occurs in the rear of lots, with some patches being isolated and surrounded by non-native vegetation, and other patches being generally contiguous with adjacent vegetation within the adjacent MRS P&R reserve associated with Bush Forever Site 193.

Based on the observations recorded during the site inspection, remnant native vegetation within the southern portion of East Gngangara PIA generally aligned with the Heddle *et al.* (1980) description of the 'Bassendean – Central and South' complex, comprising a woodland with a canopy of multiple banksia species, *Eucalyptus marginata* and *Allocasuarina fraseriana*. Other canopy species such as *Corymbia calophylla* and *Eucalyptus todtiana* were also recorded in this area.



Plate 7: Example of vegetation within the East Gngangara PIA representative of the Bassendean – Central and South complex

3.4.3.2 Potential threatened ecological communities

The EAS (Emerge Associates 2018) only covered the south western portion of the East Gngangara PIA (given the remainder is outside of the EWDSF area), and indicated that this area has potential to support the Banksia Woodlands of the SCP TEC. Based on the site inspection, it is considered that this vegetation is likely to meet the criteria to represent the Banksia Woodlands of the SCP TEC, given:

- Vegetation within the south-west corner of this PIA is contiguous with similar vegetation within the adjacent MRS P&R reserve associated with Bush Forever Site 193.
- The majority of intact remnant vegetation was observed to be in 'good' or better condition.

Whilst the remainder of the East Gngangara PIA was not included in potential TEC extent mapping presented in the EAS, the majority of this area is devoid of remnant native vegetation and as such would not represent a TEC. However, the exception to this is two small patches of vegetation in the south-east of the site (inspection locations GV-32 and GV-33), which comprise a banksia woodland structure. Detailed flora and vegetation surveys would be required to confirm whether vegetation meets the various criteria to be considered representative of the Banksia Woodlands of the SCP TEC.

3.4.3.3 Potential black cockatoo foraging habitat

Quality foraging habitat for CBC and FRTBC was observed to be confined to the south-western portion of the East Gngangara PIA. Habitat for CBC in this area comprises banksia woodland vegetation, whilst habitat for FRTBC in this area comprises *Corymbia calophylla* (marri) trees.

Due to historical clearing, the remainder of the East Gngangara PIA either does not support any black cockatoo foraging habitat or supports lower quality foraging habitat (such as occasional pine trees within the historical pine plantation areas or planted eucalypt trees within rural-residential lots).



Plate 8: Example of high quality CBC foraging habitat (banksia) within the East Gngangara PIA



Plate 9: Example of high quality FRBC foraging habitat (marri trees) within the East Gngangara PIA

3.4.3.4 Wetlands

Six geomorphic wetlands are mapped by DBCA as occurring within the Jandabup/East Gnangara PIA. The site inspection included a high-level assessment of each wetland, the results of which are summarised in **Table 8**.

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Table 8: Wetland inspection results for East Gnangara PIA

UFI	Site inspection observations	Recommendations	Photo
8258 REW	<ul style="list-style-type: none"> Landform likely to represent a wetland, but is not immediately obvious. Native vegetation present as scattered trees (such as <i>Melaleuca preissiana</i>) and shrubs (such as <i>Hypocalymma robustum</i>). Ground layer mainly bare ground and non-native grassy species. Limited differentiation evident between wetland and surrounding historical pine plantation area. 	<ul style="list-style-type: none"> May support values consistent with a REW or a MUW. Further surveys required within the wetland to determine presence of hydrological function and appropriate management category. 	 <p>Inspection location WT-10</p>
8259 MUW	<ul style="list-style-type: none"> Landform may represent a wetland, but is not immediately obvious. Native vegetation present as scattered trees (such as <i>Melaleuca preissiana</i>) and shrubs (such as <i>Hypocalymma robustum</i>). Ground layer mainly bare ground and non-native grassy species. Limited differentiation evident between wetland and surrounding historical pine plantation area. 	<ul style="list-style-type: none"> Overall wetland values are minimal, potentially consistent with a MUW classification. Further surveys required within the wetland to determine presence of hydrological function and appropriate management category. 	 <p>Inspection location WT-12</p>

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UFI	Site inspection observations	Recommendations	Photo
8269 MUW	<ul style="list-style-type: none"> • Landform may represent a wetland, but is not immediately obvious. • Native vegetation present as scattered trees (such as <i>Melaleuca preissiana</i>) and shrubs (such as <i>Hypocalymma robustum</i>). • Ground layer mainly bare ground and non-native grassy species. • Limited differentiation evident between wetland and surrounding historical pine plantation area. 	<ul style="list-style-type: none"> • Overall wetland values are minimal, potentially consistent with a MUW classification. • Further surveys required within the wetland to determine presence of hydrological function and appropriate management category. 	

Inspection location WT-11

3.4.3.5 Land use interfaces

There is a distinct interface between areas of historical pine plantation (incorporating the majority of the East Gngangara PIA) and the adjacent MRS P&R Reserve to the west. The historical pine plantation supports primarily non-native grasses, with some scattered native and exotic trees and shrubs, in contrast to areas of intact remnant native vegetation within the adjacent MRS P&R reserve.

Remnant native vegetation within rural-residential lots in the south western portion of the East Gngangara PIA is also generally contiguous with native vegetation within the adjacent MRS P&R reserve, with the exception of fence-lines and firebreaks. Visual examples of the existing interface are provided in **Table 9**. The location of these interfaces are shown in **Figure 7**.

Table 9: East Gngangara PIA land use interface examples

location	Photo	Photo summary
LU11		<ul style="list-style-type: none"> • Left: native vegetation within rural-residential lot • Right: non-native vegetation (horticulture) within private lot
LU12		<ul style="list-style-type: none"> • Left: native vegetation (within MRS P&R reserve) • Centre/right: cleared areas and scattered non-native vegetation (historical pine plantation)
LU13		<ul style="list-style-type: none"> • Left: Rural residential lot supporting native vegetation (beyond fence line) • Right: MRS P&R reserve
LU14		<ul style="list-style-type: none"> • Left: native vegetation within rural-residential lot • Right: native vegetation within MRS P&R reserve

4 Conclusions and Recommendations for Planning Investigation Areas

4.1 General

- This preliminary environmental assessment documents the existing environmental values within each of the three PIAs, based on the results of high-level environmental investigations. This assessment has specifically considered the environmental ‘key considerations’ identified by DPLH for each PIA in the Frameworks.
- This preliminary environmental assessment identifies whether any of the assessed PIAs contain environmental values (either known or potential) that are of a level of significance such that they require consideration as part of district structure planning and/or the wider regional planning process.

4.2 Wanneroo (Bebich Drive Precinct)

4.2.1 Conclusions

Key environmental values within the Wanneroo (Bebich Drive Precinct) PIA include:

- Patches of intact vegetation within rural residential lots which are potentially representative of the SCP 20a TEC and Banksia Woodlands of the SCP TEC. However, vegetation across this PIA is highly fragmented due to historical clearing along property boundaries, which has resulted in individual patches of vegetation not exceeding 1 ha in area. Detailed flora and vegetation surveys would be required to confirm whether vegetation is representative of the SCP 20a TEC.
- Vegetation across this PIA is representative of the Karrakatta – Central and South regional vegetation complex, of which of which 23% of its original extent across the SCP remains and 16.8% of its original extent across the Perth and Peel regions remains (EPA 2015).
- Vegetation across this PIA represents high quality CBC and FRTBC foraging habitat.
- The transition of land uses between this PIA and the adjacent MRS P&R reserve and Bush Forever Site 327 (associated with Badgerup Lake) is characterised by rural-residential lots which contain fragmented patches of retained native vegetation amongst cleared areas associated with existing dwellings, driveways, gardens and firebreaks.
- Patches of vegetation within some rural-residential lots located directly adjacent to the Badgerup Lake MRS P&R reserve were identified as ‘priority areas for future investigation’ in the EAS, on the basis that this vegetation was determined to be potentially representative of the SCP 20a TEC and formed an extension (i.e. part of a larger patch) of similar vegetation within the MRS P&R reserve.

4.2.2 Recommendations

4.2.2.1 West of Benmuni Drive

- Based on the completed investigations, the portion of the Wanneroo (Bebich Drive Precinct) PIA west of Benmuni Drive is not considered to contain environmental values which are of a level of significance such that they would require protection at a regional planning level.
- Whilst the composition of remnant native vegetation within this portion of the PIA is potentially significant due to the potential this vegetation to be representative of the SCP 20a TEC, the small size and highly fragmented nature of vegetation patches reduces their overall environmental significance below that which would require protection at the regional planning stage. In contrast, a number of larger and more contiguous patches of intact native vegetation across the wider EWDSP area (which were also determined to be potentially representative of the SCP 20a TEC) were identified as 'priority areas for further investigation' in the EAS. These areas were recommended to be prioritised for retention through the district structure planning process, should detailed investigations confirm their environmental values. The vegetation values within this portion of the PIA were not identified as 'priority areas for further investigation' in the EAS.
- Similarly, whilst vegetation within the PIA is also representative of the Karrakatta – Central and South complex, high quality CBC foraging habitat and high quality FRBC foraging habitat, these values are not present in a large enough magnitude and contiguity such that they would require protection at the regional planning level.

4.2.2.2 East of Benmuni Road

- Patches of vegetation within this PIA and east of Benmuni Road were identified in the EAS as 'priority areas for further investigation'. The EAS recommended that, subject to confirmation of their environmental values through detailed investigations, these areas should be prioritised for protection through the district structure planning process.
- Notwithstanding the above, the proportion of vegetation within the site compared to the proportion within the adjacent MRS P&R reserve (which collectively form a single patch), is low. As such, it is considered unlikely that where this vegetation occurs within the PIA that it warrants protection through the regional planning process, even if it was determined to be representative of the SCP 20a TEC as a result of further detailed investigations. Alternative mechanisms to facilitate its protection, if determined to be required, could be applied through future planning stages given it does not comprise a large spatial area.

4.3 Jandabup/East Gnangara

4.3.1 Conclusions

Key environmental values within the Jandabup/East Gnangara PIA include:

- The extent and condition of remnant vegetation within this PIA is varied. The portion of this PIA comprising Bush Forever Site 193 is largely vegetated, with the exception of cleared areas associated with lot boundary firebreaks, roads and isolated building footprints. In contrast, the portion of this PIA outside of Bush Forever Site 193 is generally highly disturbed and mostly cleared.

- The majority of upland vegetation across this PIA is recorded by DBCA as being representative of the Banksia Woodlands of the SCP TEC.
- Select areas of vegetation within this PIA are representative of Bassendean – Central and South regional vegetation complex (26% of its original extent across the SCP remains and 21% of its original extent across the Perth and Peel regions remains) and the Pinjar Complex (30% of its original extent across the SCP remains and 30% of its original extent across the Perth and Peel region remains). Some discrepancies in the regional vegetation complex mapping within the site were observed during the site inspection.
- Vegetation within this PIA represents high quality CBC foraging habitat, including remaining areas of pine plantation. High quality FRTBC foraging habitat is limited across this PIA.
- With regard to the transition of land uses within and adjacent to this PIA;
 - The interface between rural-residential lots within and outside of Bush Forever Site 326 is distinct, with lots within Bush Forever Site 326 supporting a high proportion of retained native vegetation, compared to the largely cleared adjacent lots.
 - The interface between the PIA and adjacent MRS P&R reserves is generally well vegetated, where it aligns with rural-residential lots within Bush Forever Site 326. In contrast, there is a distinct interface between the P&R reserve and rural-residential lots outside of Bush Forever 326, as these lots were observed to be typically partly or wholly cleared of vegetation.
 - The interface with CCW UFI 8102 is characterised by disturbed native vegetation that supports moderate to high cover of non-native species such as pasture grasses. In contrast, the interface with CCW UFI 8122 is completely vegetated and relatively undisturbed.
- Detailed assessments would be required to confirm the appropriate management category of each mapped wetland within this PIA. Notwithstanding this, the results of the high-level wetland inspection completed as part of this work are summarised as follows:
 - CCW 8102 is disturbed and may be representative of an REW
 - CCW 8122 is likely to represent a CCW
 - REW 8120 is likely to represent a REW
 - REW 8123 is disturbed and may be representative of an MUW
 - MUW 8117 supports some native species and vegetation values, and may be representative of a REW.
 - MUW 8116 can likely be split into two wetland categories, the western (cleared) area represents an MUW and the eastern (vegetated) area may be representative of a CCW.

4.3.2 Recommendations

- The portion of the MRS State Forest reserve associated with Bush Forever Site 326 (approximately 56 ha) supports a large patch of mostly intact native vegetation (with the exception of some access tracks and cleared openings) representative of the Banksia Woodlands of the SCP TEC. The environmental values of this area are considered to be of a level of environmental significance such that they warrant protection at the regional planning stage.
- The remaining area of the MRS State Forest reserve outside of Bush Forever Site 326 is not considered to contain environmental values that would require protection at the regional planning stage.

- The portion of this PIA comprising rural-residential lots associated within Bush Forever Site 326 is considered to support environmental values which may warrant protection at the regional planning stage, given this area contains vegetation representative of the Banksia Woodlands of the SCP TEC as well high quality foraging habitat for CBC, in large patch sizes. If protection of existing vegetation is proposed, the targeting and consolidation of specific areas is recommended. For example, targeting vegetation within rural-residential lots around Paini Way provides an opportunity for consolidating large patches of remnant vegetation for protection, which also provide ecological connectivity between large reserved areas of remnant vegetation to the north and south. There is generally a low level of clearing across these lots, likely due to the designation of Bush Forever Site 326, with the large average patch size and high number of adjacent patches being unique to this part of the EWDSP area.
- In contrast, existing rural residential areas outside of Bush Forever Site 326 are generally characterised by a high level of disturbance and historical clearing, and are not considered to contain environmental values which would require protection at the regional planning stage.
- Further detailed wetland investigations are required to determine the appropriate management category of the three wetlands occurring within the site.

4.4 East Gngangara

4.4.1 Conclusions

Key environmental values within the East Gngangara PIA include:

- Where intact remnant vegetation remains within the southern extent of the PIA, it considered to be representative of the Bassendean – Central and South complex. This vegetation is also representative of the Banksia Woodlands of the SCP TEC, high quality CBC foraging habitat and high quality FRBC foraging habitat.
- All mapped wetland features within the East Gngangara PIA are indistinct and appear to have been subject to repeated historical disturbances. Whilst detailed assessments would be required to confirm the appropriate management category of each wetland, the results of the high-level wetland inspection completed as part of this work are summarised as follows:
 - MUW 8259 and MUW 8269 are unlikely to support any significant wetland values.
 - REW 8258 supported some wetland values and is likely to represent either an MUW or REW.
- The transition of land uses between this PIA and the adjacent MRS P&R reserve and Bush Forever Site 327 (associated with Badgerup Lake) is characterised by patches of intact vegetation within rural residential lots east of Benmuni Road.

4.4.2 Recommendations

- This PIA is not considered to contain environmental values which are of a level of significance such that they would warrant protection at the regional planning stage. The majority of the PIA is cleared and supports scattered remnants of historical pine plantations, with only small patches of remnant vegetation occurring in a small area in the south-west of the PIA.
- Further detailed wetland investigations are required to determine the appropriate management category of the three wetlands occurring within the site.

5 References

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Figures



Figure 1: Location of Planning Investigation Areas

Figure 2: Environmental Values – Wanneroo (Bebich Drive Precinct)

Figure 3: Environmental Values – Jandabup/East Gnangara

Figure 4: Environmental Values – East Gnangara

Figure 5: Land Use Interface – Wanneroo (Bebich Drive Precinct)

Figure 6: Land Use Interface – Jandabup/East Gnangara

Figure 7: Land Use Interface – East Gnangara

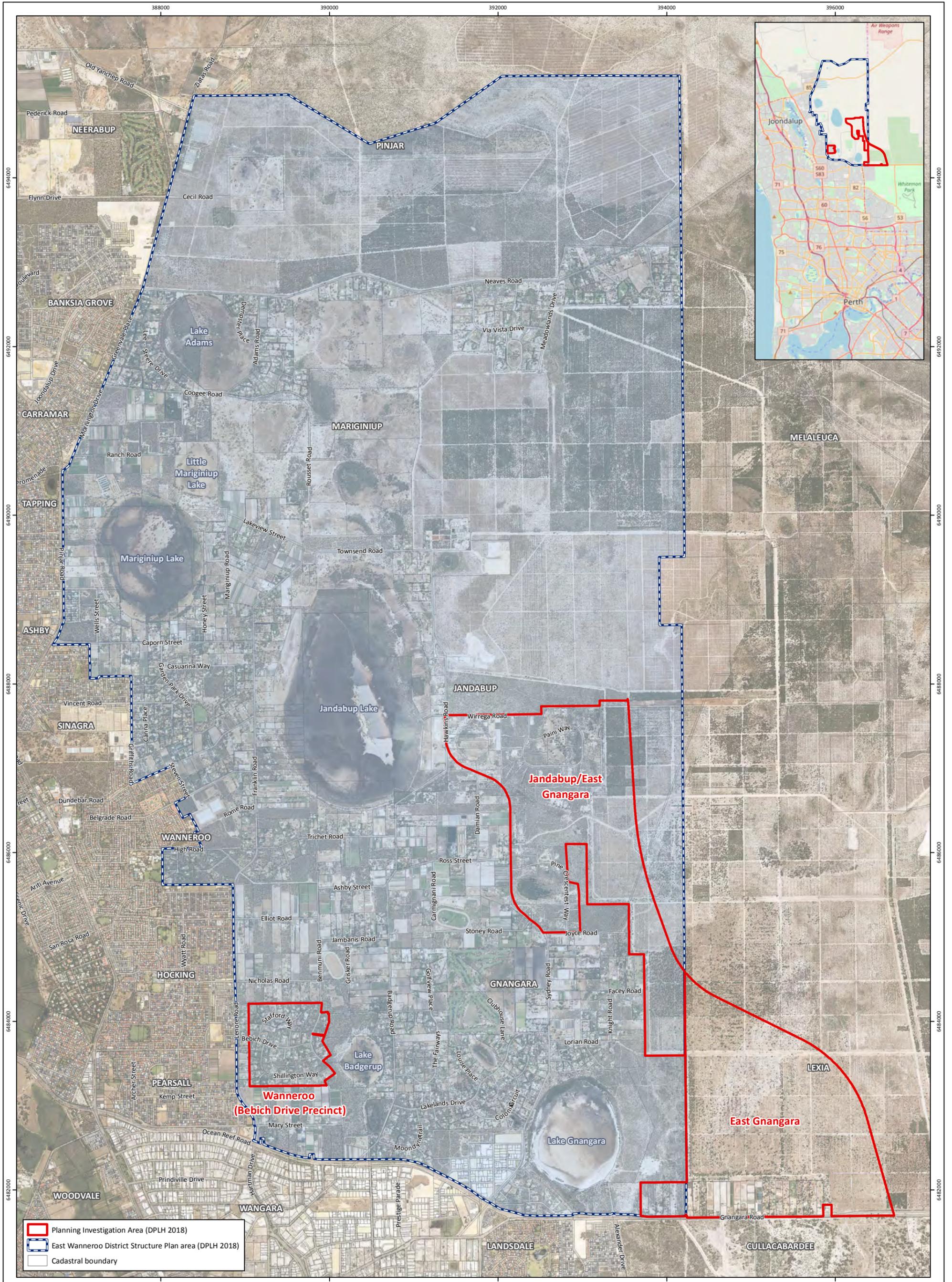


Figure 1: Location of Planning Investigation Areas

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number: EP17-106(05)-F70
Drawn: ADB
Date: 03/09/2018
Checked: ADB
Approved: JDH
Date: 08/10/2018



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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

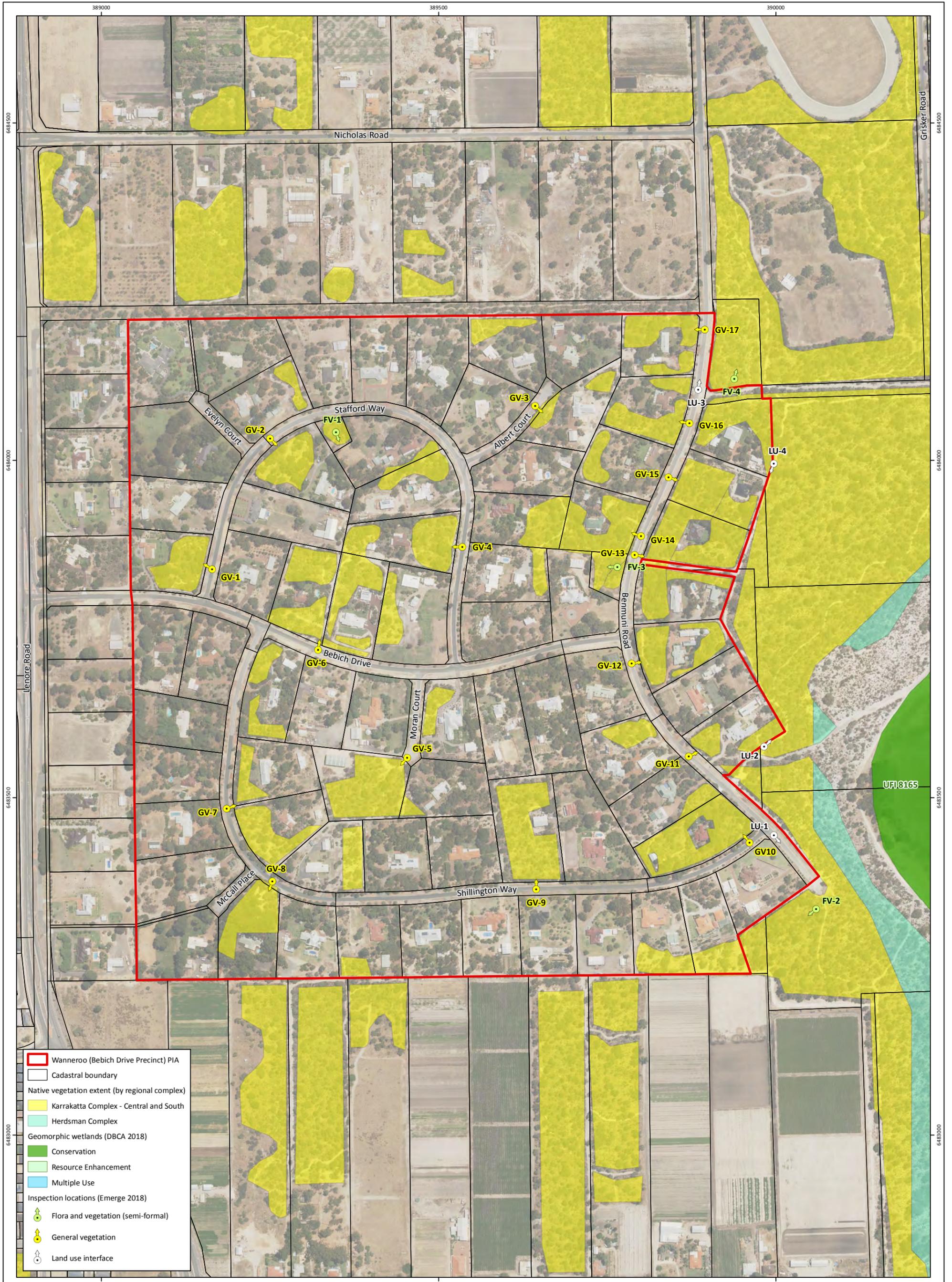


Figure 2: Environmental Values – Wanneroo (Bebich Drive Precinct) PIA

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number: EP17-106(05)-F71
Drawn: ADB
Date: 03/09/2018
Checked: ADB
Approved: JDH
Date: 08/10/2018



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GDA 1994 MGA Zone 50



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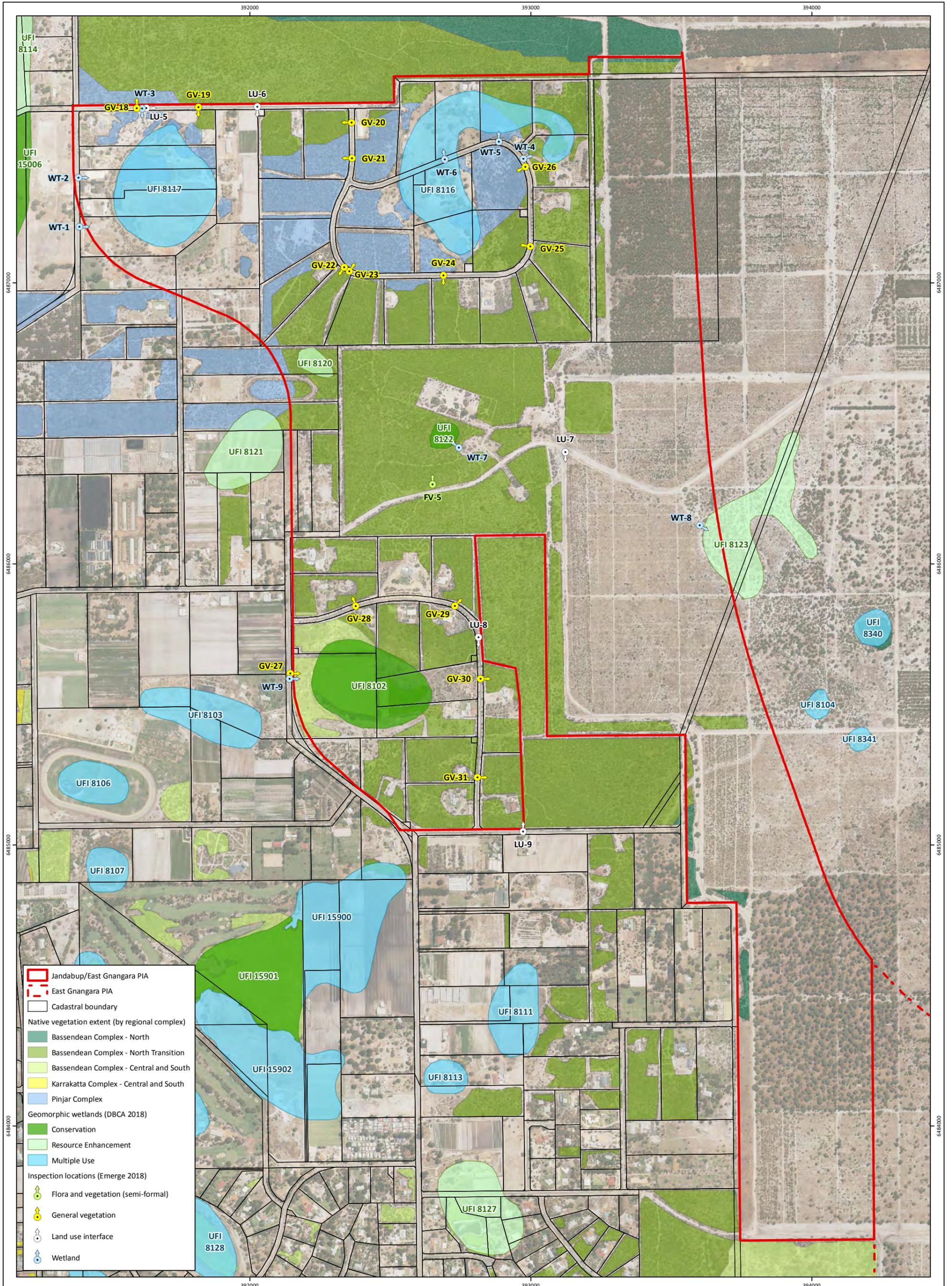
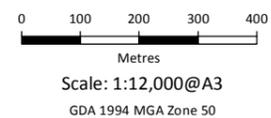


Figure 3: Environmental Values – Jandabup/East Gngangara PIA

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number: EP17-106(05)-F72
Drawn: ADB
Date: 03/09/2018
Checked: ADB
Approved: JDH
Date: 08/10/2018



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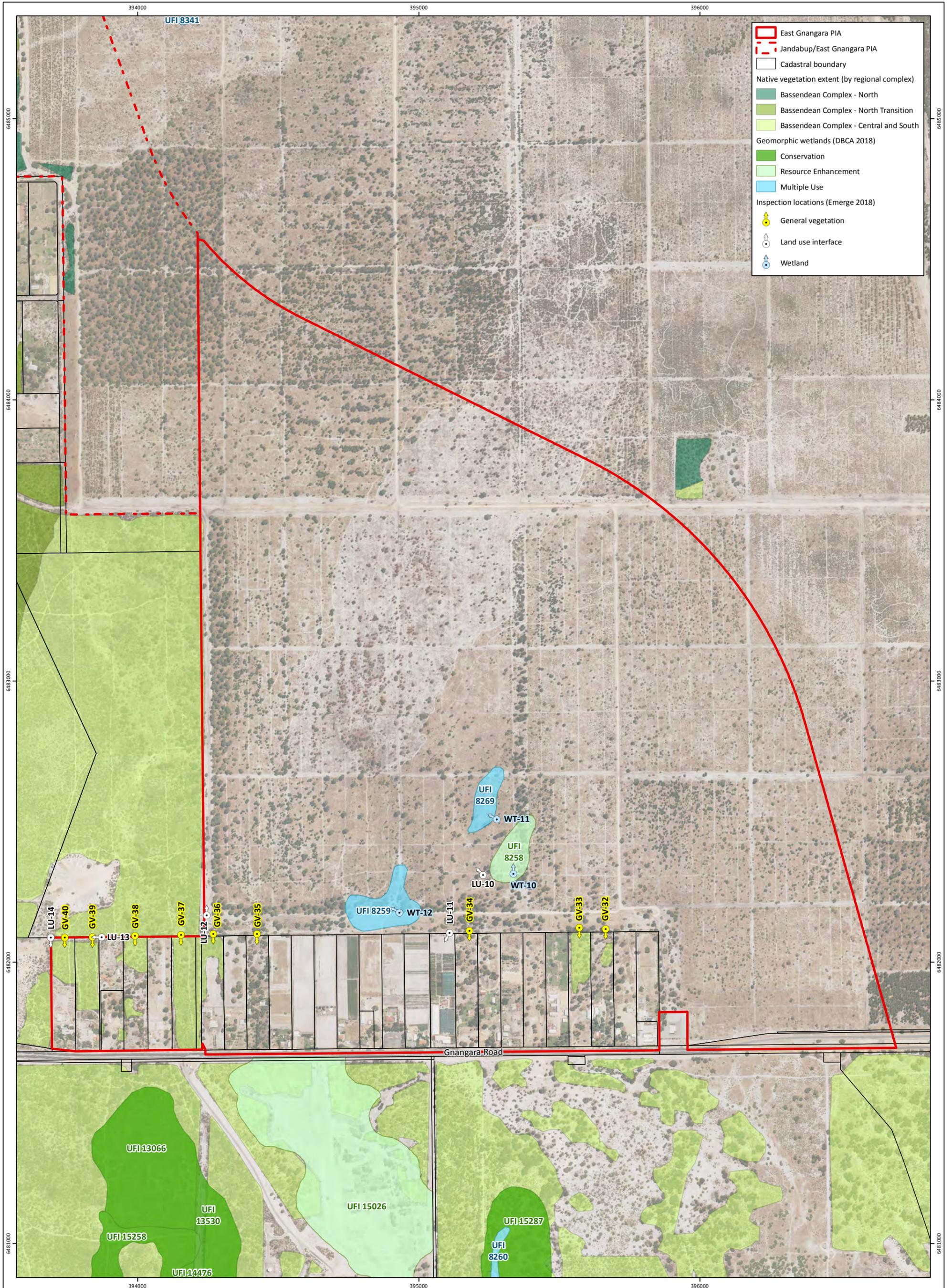


Figure 4: Environmental Values – East Gngangara PIA

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number: EP17-106(05)-F73
Drawn: ADB
Date: 03/09/2018
Checked: ADB
Approved: JDH
Date: 08/10/2018



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Scale: 1:12,000@A3
GDA 1994 MGA Zone 50



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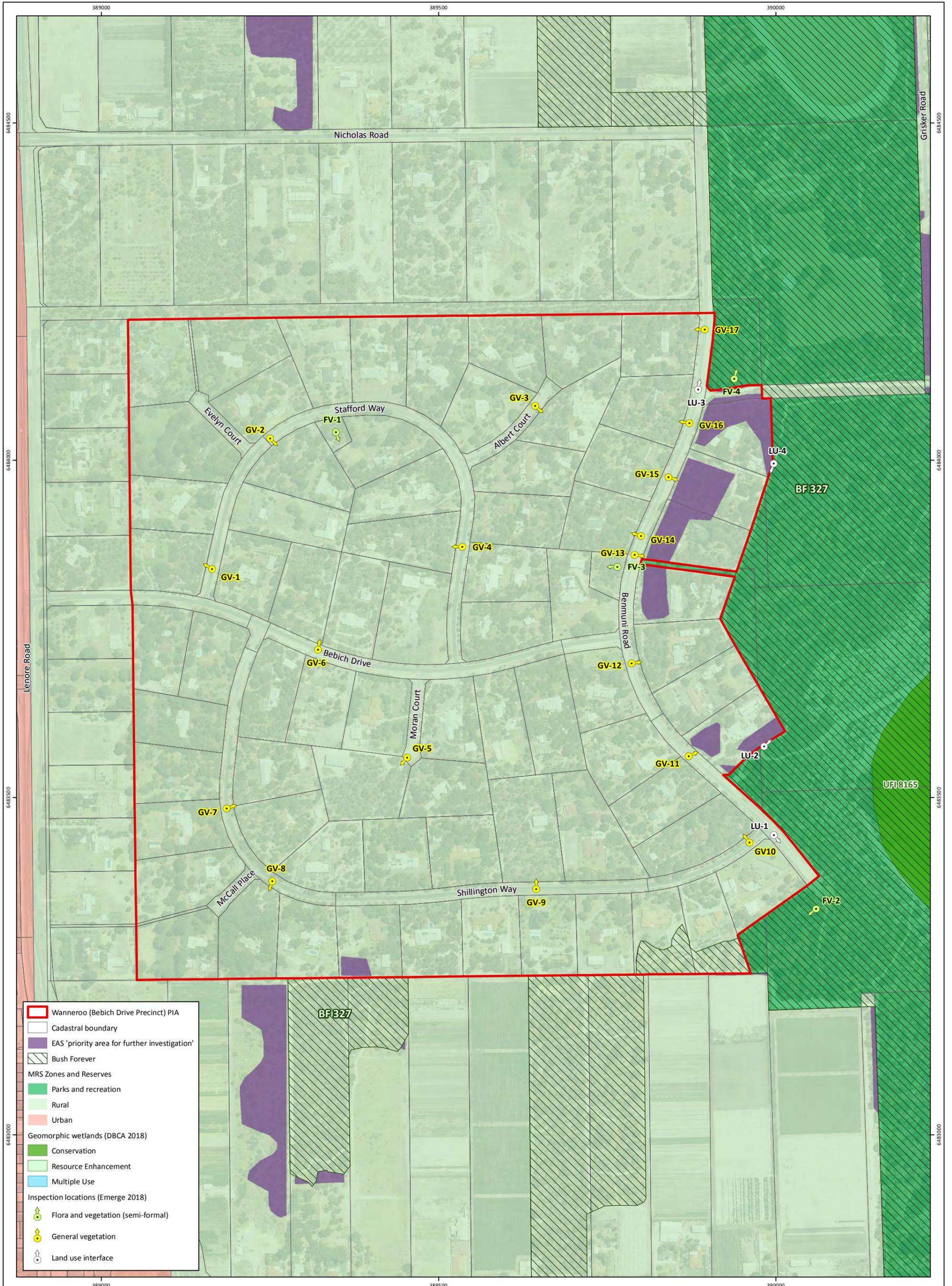


Figure 5: Land Use Interface – Wanneroo (Bebich Drive Precinct) PIA

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number: EP17-106(05)-F74
Drawn: ADB
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Checked: ADB
Approved: JDH
Date: 08/10/2018



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Scale: 1:5,000@A3
GDA 1994 MGA Zone 50



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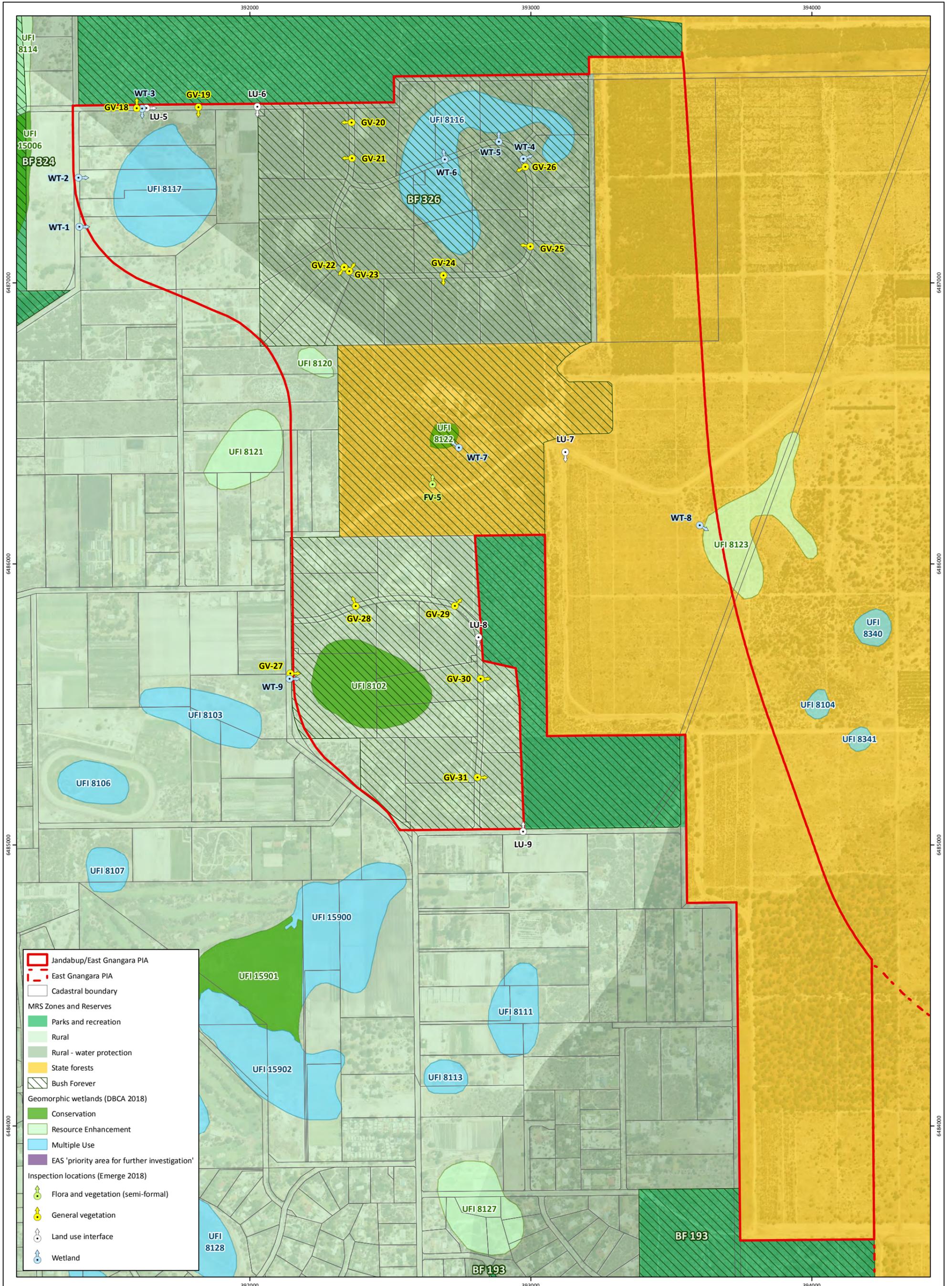
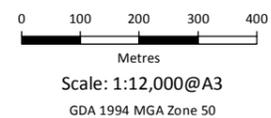


Figure 6: Land Use Interface – Jandabup/East Gngangara PIA

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number: EP17-106(05)-F75
Drawn: ADB
Date: 07/09/2018
Checked: ADB
Approved: JDH
Date: 08/10/2018



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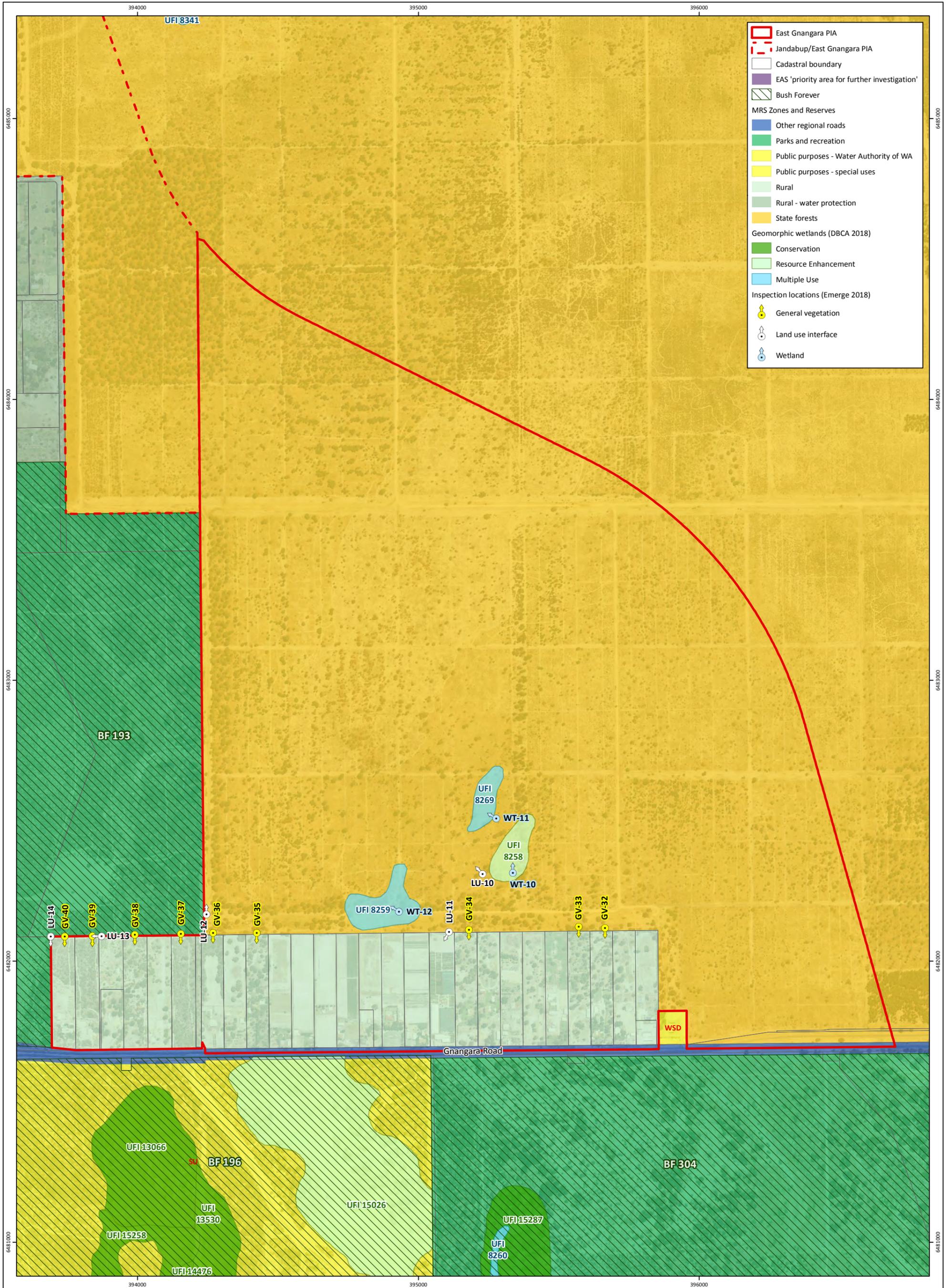
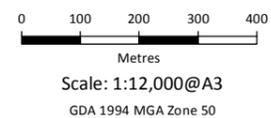


Figure 7: Land Use Interface – East Gngangara PIA

Project: Assessment of Planning Investigation Areas
East Wanneroo District Structure Plan
Client: Department of Planning, Lands and Heritage

Plan Number:
EP17-106(05)-F76
Drawn: ADB
Date: 07/09/2018
Checked: ADB
Approved: JDH
Date: 08/10/2018



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