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Armadale Road Duplication - Tapper Road to Anstey Road

Environmental Impact Assessment

Prepared for
Main Roads
by Strategen

May 2017

Armadale Road Duplication - Tapper Road to Anstey Road

Environmental Impact Assessment

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May 2017

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Client: Main Roads

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	Client review	A Welker / P Molinari / D Goundrey	Electronic	20/04/2017
Final Report	B	For submission	C Courtauld / D Goundrey	Electronic	31/05/2017

Filename: EIA MRO16249_01 R003 Rev_B - 31 May 2017

Executive Summary

Main Roads Western Australia (Main Roads) is proposing to duplicate approximately 7 km of Armadale Road, between Tapper Road in Atwell and Anstey Road in Forrestdale (the Project). The Project will involve the duplication of Armadale Road between Tapper Road and Anstey Road, improvement/upgrade of various intersections, and associated works including lighting, service relocations and drainage. The Project construction is anticipated to commence in late 2017.

As part of the Project the following upgrades and/or improvements to a number of intersections along Armadale Road and within the Project area are proposed, including:

- Tapper Road/Verde Drive, Atwell
- Fraser Road, Banjup
- Liddelow Road, Banjup
- Wright Road, Piara Waters
- Rossiter Avenue, Piara Waters
- Nicholson Road, Forrestdale.

A summary of the outcomes of the EIA are presented in Table E 1.

Table E 1: Summary of environmental impacts and management

Aspect	Evaluation of potential impacts	Management commitments
Geology, landform and soils	There are no key impacts relating to geology, landform and soils associated with the Project.	No specific geology, landform and soils management is required.
Vegetation	<p>The Project will result in the clearing of approximately 13.2 ha of native vegetation, comprising:</p> <ul style="list-style-type: none"> • 4.85 ha of <i>Banksia</i> woodland comprising: <ul style="list-style-type: none"> * 1.14 ha in 'Good' condition * 3.71 ha in 'Degraded' condition • 2.01 ha of <i>Kunzea glabrescens</i> tall shrubland • 6.26 ha of <i>Melaleuca preissiana</i> • 0.08 ha <i>Beaufortia elegans</i> tall shrublands. <p>An additional area of approximately 7.0 ha of planted vegetation will also be cleared.</p> <p>None of the vegetation proposed to be cleared comprise wholly or partly within a Priority Ecological Community (PEC).</p>	<p>The following management commitments apply to vegetation:</p> <ul style="list-style-type: none"> • minimise vegetation clearing where possible • a Native Vegetation Clearing Permit (NVCP) is required and offsets may be required • Referral to Department of the Environment and Energy (DEE) (formally Department of the Environment [DotE]) for assessment under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) may be required.
	<p>The Threatened Ecological Community (TEC) to be cleared is generally contiguous with other remnant vegetation and not comprising isolated patches. FCT 23a is not listed as Threatened or Priority in Western Australia therefore is not a rare community type.</p> <p>Given that the known extent of the TEC within the proposed action area is highly fragmented, comprised of small areas adjacent to an existing road reserve and on the edge of larger areas of the TEC are protected in adjacent conservation areas, the proposed action is considered unlikely to significantly reduce the extent of the FCT 23a.</p> <p>Clearing of this area is not likely to significantly impact on the extent of the TEC.</p>	

Aspect	Evaluation of potential impacts	Management commitments
Biodiversity	<p>The Project will result in the removal of:</p> <ul style="list-style-type: none"> • two individuals of Priority flora species <i>Dodonaea hackettiana</i> (P4) • removal of 4.85 ha of 'moderate' quality Carnaby's black cockatoo foraging habitat. <p>The impacts of the Project on biodiversity values described above are unlikely to be significant due to the nature of the linear duplication, adjacent to the existing Armadale Road. Furthermore, the impacts to biodiversity values can be readily managed through implementation of management commitments described adjacent.</p>	<p>The following management commitments should be implemented:</p> <ul style="list-style-type: none"> • avoid clearing of P4 species if possible • implement fauna mitigation strategies during clearing, construction and operation • minimise the clearing footprint where possible • referral to DEE for assessment under the EPBC Act may be required.
Declared plants (weeds)	<p>A total of 27 road-side weeds were observed. Of these weeds, four are listed as Declared Pests under the <i>Biodiversity and Agriculture Management Act 2007</i> (BAM Act), including the following:</p> <ul style="list-style-type: none"> • *<i>Gomphocarpus fruticosus</i> (Narrow Leaf Cotton Bush) • *<i>Zantedeschia aethiopica</i> (Arum Lily) • *<i>Moraea flaccida</i> (One-Leaf Cape Tulip) • *<i>Rubus</i> sp. (Blackberry). <p>The presence of these weeds within the Project area is not considered significant, ensuring weed and hygiene measures are implemented for the Project.</p>	<p>The following management commitments for hygiene should be implemented:</p> <ul style="list-style-type: none"> • implement a site hygiene management plan, including post-construction management of the Project area • conduct dieback assessment and implement appropriate hygiene management actions.
Dieback and other diseases or pathogens	<p>The Project area was not surveyed for dieback. Dieback could potentially be brought onto site as a result of ground disturbance.</p> <p>Impacts to the Project area from dieback are not known, however impacts can be managed through the implementation of hygiene measures.</p>	
Surface water and drainage	<p>The Project area is located in close proximity to the Forrestdale Main Drain and Bailey's Branch Drain, located approximately 1.7 km and 700 m respectively, however these areas will not be directly impacted by the Project. The Project area intersects James Drain which originates from the Taylor Road wetlands and Banjup Swamp. James Drain may be impacted as a result of the Project.</p> <p>Surface water flows resulting from stormwater can be readily managed through the installation of stormwater and drainage infrastructure. Given the minor intersections to environmental values and the engineering mitigation proposed impacts to surface water and drainage are not likely to be significant.</p>	<p>Drainage design to maintain existing hydrological regime.</p>

Aspect	Evaluation of potential impacts	Management commitments
Wetlands	<p>The Project area intersects 1.09 ha of the following mapped boundaries of Conservation category Geomorphic wetlands:</p> <ul style="list-style-type: none"> • 0.48 ha of the mapped wetland extent and of Conservation Management Category wetland (UFI 7143), 0.34 ha of which contains vegetation to be cleared • 0.52 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14874), 0.39 ha of which contains vegetation to be cleared • 0.93 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14893), all of which contains vegetation to be cleared. <p>Potential hydrological impacts to wetlands will be managed through the installation of drainage structures meeting Australian Standard. The Project will be designed to minimise the clearing footprint and further manage impacts to surrounding wetlands.</p> <p>Through implementation of the above, and given proposal improves the function of the existing road impact, impacts to wetlands are not likely to be significant.</p>	<p>Impacts to wetlands will be managed through construction of additional drainage structures as required.</p> <p>Clearing within wetlands and buffers will be minimised where possible.</p> <p>Where construction is proposed within 200 m of the boundary of a "Conservation" or "Resource Enhancement" Management category, liaise with Parks and Wildlife regarding potential wetland impacts (WAPC 2017).</p>
Groundwater	<p>The Project area intersects:</p> <ul style="list-style-type: none"> • Priority 1 (Water Catchment Reservation) • Priority 2 (Rural Water Protection Zone) • Priority 3 areas, as defined in Draft SPP 2.3 - Jandakot Groundwater Protection Policy (Western Australian Planning Commission [WAPC] 2014). <p>The impacts associated with the Project on groundwater are expected to be negligible ensuring hydrological function is maintained through drainage design.</p>	<p>Construction and implementation of the Project should be undertaken in consideration of Department of Water (DoW) WQPNs and DoW advice.</p> <p>Consult with DoW regarding potential impacts to Public Drinking Water Source Areas (PDWSA).</p>
Reserves / Conservation areas	<p>Three 1.68 ha of Bush Forever sites intersect the Project area, including:</p> <ul style="list-style-type: none"> • 0.16 ha of Fraser Road Bushland, Banjup (Site 390) • 0.32 ha of Anstey/Keane Dampland and Adjacent Bushland (Site 342) • 1.20 ha of Gibbs Road Swamp Bushland, Banjup/Forrestdale (Site 344) <p>As the Project is located adjacent to the existing Armadale Road, the additional areas of disturbance proposed will not significantly impact on the integrity of the Bush Forever sites and will not result in fragmentation of these areas.</p>	<p>The following management is required for reserves/conservation areas:</p> <ul style="list-style-type: none"> • avoid clearing within the Bush Forever sites where possible • where this is unavoidable, the clearing footprint should be minimised where possible and consultation with WAPC prior to submission of the NVCP should be undertaken • development application for impacts on Bush Forever sites.
Acid sulfate soils	<p>The Project area comprises a portion of:</p> <ul style="list-style-type: none"> • 'High to Moderate' probability of occurrence of Acid Sulfate Soil (ASS) at depths greater than 3 m from the natural soil surface • 'Moderate to Low' probability of occurrence of ASS occurring at depths within 3 m from the natural soil surface. <p>Impacts on the surrounding environment as a result of ASS are expected to be minimal, ensuring excavation is restricted to above 1-3 m.</p>	<p>The following measures should be implemented for ASS:</p> <ul style="list-style-type: none"> • where excavation is proposed below groundwater level (1-3 m), conduct ASS investigation. An ASS management plan should be developed and implemented during construction.
Air quality	<p>The impacts of the Project on air quality are not expected to significantly change from those associated with the current Armadale Road.</p>	<p>No specific air quality assessment or management is required.</p>

Aspect	Evaluation of potential impacts	Management commitments
Contamination	No contaminated sites occur within the Project area. It is unlikely that contamination will be encountered during construction.	No specific contaminated sites management is required. Environmental Management Plan (EMP) to contain contingency actions for encountering contamination.
Dust	Dust resulting from construction may impact on surrounding sensitive receivers, such as: <ul style="list-style-type: none"> residential. The impacts of dust on sensitive receptors are not likely to be significant with the implementation of dust mitigation during construction and operation.	The following measures should be implemented for dust: <ul style="list-style-type: none"> a dust management plan will be developed for construction activities.
Noise and vibration	The Project may result in minor noise and vibration impacts to nearby sensitive receptors as a result of construction activities; however these impacts are not expected to be significant. Road traffic noise may increase as a result of the Project.	The following measures should be implemented for the management of noise and vibration: <ul style="list-style-type: none"> develop a noise and vibration management plan in accordance with noise regulations to the satisfaction of the Local Government Authority to manage impacts associated with construction activities undertake a traffic noise assessment in accordance with State Planning Policy 5.4.
Visual amenity	The Project is unlikely to impact visual amenity on nearby sensitive receptors, however given the presence of the existing Armadale Road in the current view-shed as the impacts will be similar to those already resulting from the road.	No management commitments are required.
Aboriginal heritage / Native Title	Three 'other heritage places' that intersects the Project area, including: <ul style="list-style-type: none"> Readymix sandpit 2(Site No. 3300), including artefacts, scatters and a camp; the site has been 'lodged', however is not 'registered' Readymix sandpit 1 (Site No. 4108), including artefacts/scatter; the site has been 'lodged', however is not 'registered' Banjup: Calsil (Site No. 3301), including artefacts, scatters and a camp; the site is listed as 'stored data'. Main Roads has consulted with Whadjuk WC2011/009 Native Title Claim group who have confirmed no sites of significance will be impacted by the Project.	<ul style="list-style-type: none"> Main Roads to obtain Section 18 consent for impact to Lodged sites During induction, all personnel are to be made aware of their obligations under the AH Act If any human skeletal material is uncovered, work will cease on the site and it will be reported to the Police and DAA.
Heritage (non-indigenous)	The Banjup Memorial Park is located directly adjacent to the Project area; however will not be impacted by the Project. The Project may potentially impact remnants of the Armadale to Fremantle Railway Line at James Drain.	Attempts should be made to retain the remnants of the bridge at James Drain. If retention is not possible then interpretation utilising remnants of the bridge should be explored.
Hazardous substances	Hazardous substances (including refuelling, chemical storage, bitumen and asphalt).	Hazardous substances stored on site will be managed to avoid any potential contamination impacts.

The following approval processes are considered appropriate in order to undertake the Project:

1. Refer to the Department of Energy and Environment (DEE) under the EPBC Act for clearing impacts on black cockatoo and the *Banksia woodlands of the Swan Coastal Plain* TEC.
2. Part V EP Act approval to clear 13.2 ha native vegetation.

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Appendix 1 Armadale Road Duplication Biological Assessment (Astron 2015)
Appendix 2 Supplementary vegetation survey – targeted <i>Drakaea elastica</i> survey and black cockatoo assessment (Strategen 2016)
Appendix 3 Aboriginal and European Heritage survey reports
Appendix 4 Armadale Road Duplication Environmental Management Plan
Appendix 5 EPBC protected matters search

1. Introduction

This report is an Environmental Impact Assessment (EIA) of the proposed Armadale Road duplication - Tapper Road to Anstey Road, including an assessment of potential impacts and likely management requirements for the Project.

1.1 Project purpose, background and location

Main Roads Western Australia (Main Roads) is proposing to duplicate approximately 7 km of Armadale Road, between Tapper Road in Atwell and Anstey Road in Forrestdale (the Project). The Project will involve the duplication of Armadale Road between Tapper Road and Anstey Road, improvement/upgrade of various intersections, and associated works including lighting, service relocations and drainage. The Project construction is anticipated to commence in late 2017.

As part of the Project the following upgrades and/or improvements to a number of intersections along Armadale Road and within the Project area are proposed, including:

- Tapper Road/Verde Drive, Atwell
- Fraser Road, Banjup
- Liddelow Road, Banjup
- Wright Road, Piara Waters
- Rossiter Avenue, Piara Waters
- Nicholson Road, Forrestdale.

The Project construction is anticipated to commence in late 2017. The Project is located within the suburbs of Atwell and Banjup in the CoC and Piara Waters and Forrestdale in the CoA. The location of the Project in relation to the Perth Metropolitan region and surrounds is presented in Figure 1. Figure 2 identifies the Project area. The Project area is the area is applied as the study area. The proposed road alignment is wholly contained within the Project area. For the purposes of this assessment the impact area is assumed as the Project area.

A Preliminary Environmental Impact Assessment (PEIA) was completed for an initial concept design and associated Project area (Strategen 2016). The PEIA involved a desktop analysis of environmental aspects and impacts, investigation of a Level 2 vegetation and flora survey (Astron, 2015), investigation of a Level 1 fauna survey (Astron, 2015), targeted *Drakaea elastica* survey and a Black Cockatoo habitat assessment (Strategen, 2016).

The concept design was subsequently modified and due to these modifications, further environmental assessment was required, particularly in relation to matters of National Environmental Significance (NES) namely *Banksia woodlands of the Swan Coastal Plain Threatened Ecological Community* (TEC) and protected Black Cockatoo species.

The PEIA and amended concept design and additional gap site survey's inform this EIA.

1.2 Document purpose and scope

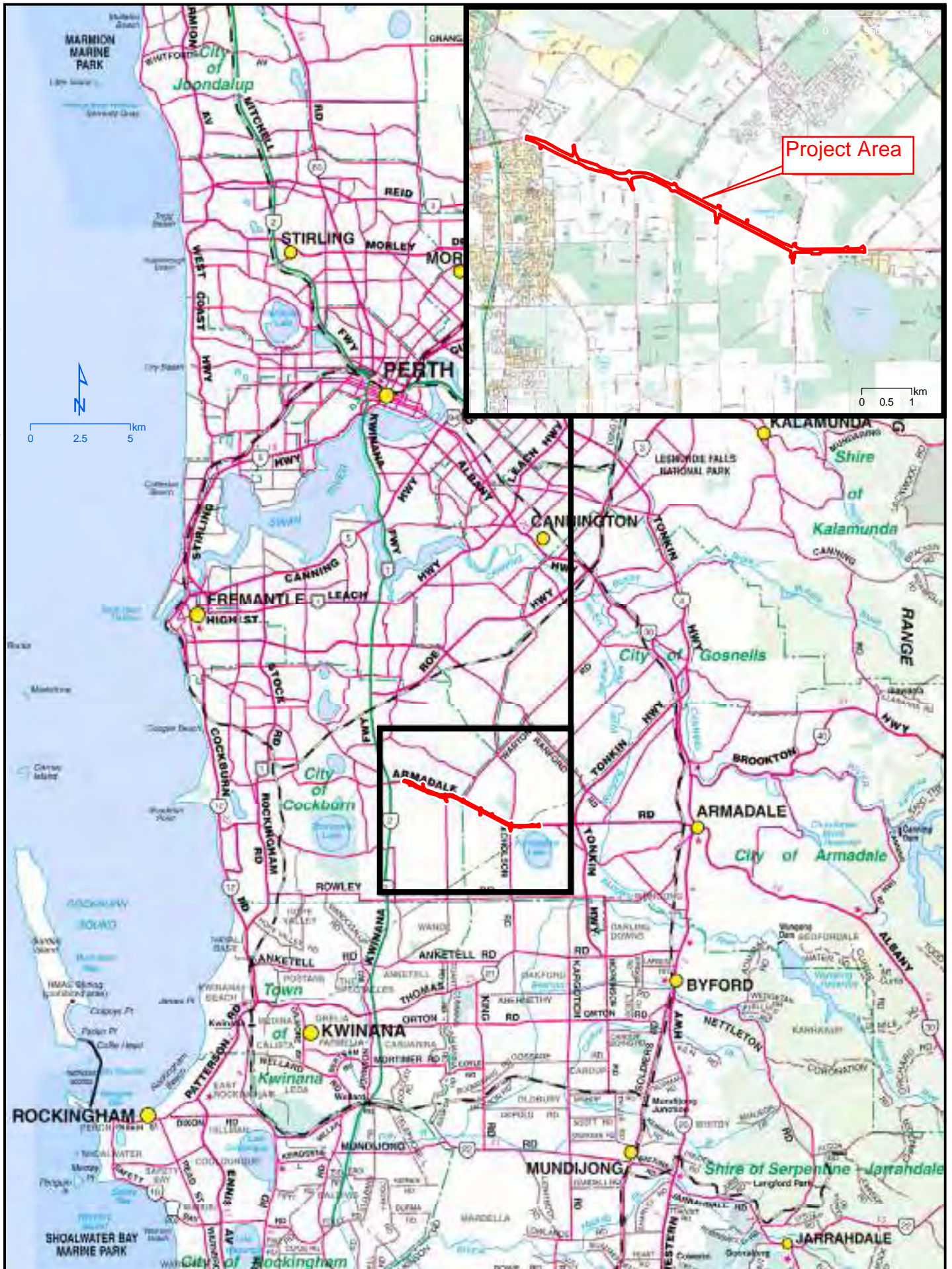
Strategen has engaged by Main Roads to conduct an EIA for the Project to assist Main Roads in determining environmental and heritage impacts, regulatory approvals, permits and licences required to facilitate the construction of the Project. In addition, the EIA has been prepared to support environmental and heritage approvals. The EIA will also identify management measures for key environmental and heritage aspects and impacts.

The scope of this EIA includes:

- description of the Project
- summary of existing environmental reports
- summary of the existing biological and social environment
- environmental assessment to identify key environmental aspects and impacts
- identification of environmental approvals required under the Australian Government and Western Australian environmental and heritage legislation
- further studies and recommendations.

This EIA has been prepared in accordance with the Main Roads *Consultant Brief: Armadale Road Duplication - Environmental Impact Assessment and Environmental Management Plan* and key Australian government and State government guidance material, including but not limited to:

- *Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) Referral Guidelines for three Threatened black cockatoo species: Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed black cockatoo* (Department of Sustainability Environment Water Population and Communities [DSEWPaC] 2012)
- *Survey Guidelines for Australia's Threatened Orchids* (Department of the Environment [DotE] 2013a)
- *Matters of National Environmental Significance, Significant Impact Guidelines 1.1* (DotE 2013b)
- *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* (Department of Environment and Energy 2016)
- *Statement of Environmental Principles, Factors and Objectives* (Environmental Protection Act [EPA] 2016a)
- *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016* (EPA 2016b)
- *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual 2016* (EPA 2016c)
- *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER 2014)
- *Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) (s266B) Approved conservation advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community.*



Armadale Road Duplication
Tapper Road to Anstey Road
Project Location

Figure
1

2. Project description

The Project involves the duplication of Armadale Road from Tapper Road in Atwell, to Anstey Road in Forrestdale, involving the duplication of approximately 7 km of road (Figure 2). Duplication works will involve construction of two new lanes adjacent to the existing road, from east of Tapper Road in Atwell and continuing for approximately 5.5 km to the intersection with Nicholson Road, then extending approximately 1.4 km east to the intersection with Anstey Road. As part of the road duplication, upgrades and/or improvements to a number of intersections along Armadale Road are proposed, as presented in Figure 2 and summarised below:

- Tapper Road/Verde Drive, Atwell
- Fraser Road, Banjup
- Liddelow Road, Banjup
- Wright Road, Piara Waters
- Rossiter Avenue, Piara Waters
- Nicholson Road, Forrestdale.

Existing lighting and drainage will also be upgraded and services relocated.

The modified Project design as detailed in Figure 2 is included within a larger Project area that forms the basis of this EIA. The Project area comprises a total area of approximately 63.90 ha, including 43.70 ha of cleared areas or existing road infrastructure and 20.19 ha of vegetation, including 6.99 ha of planted vegetation.

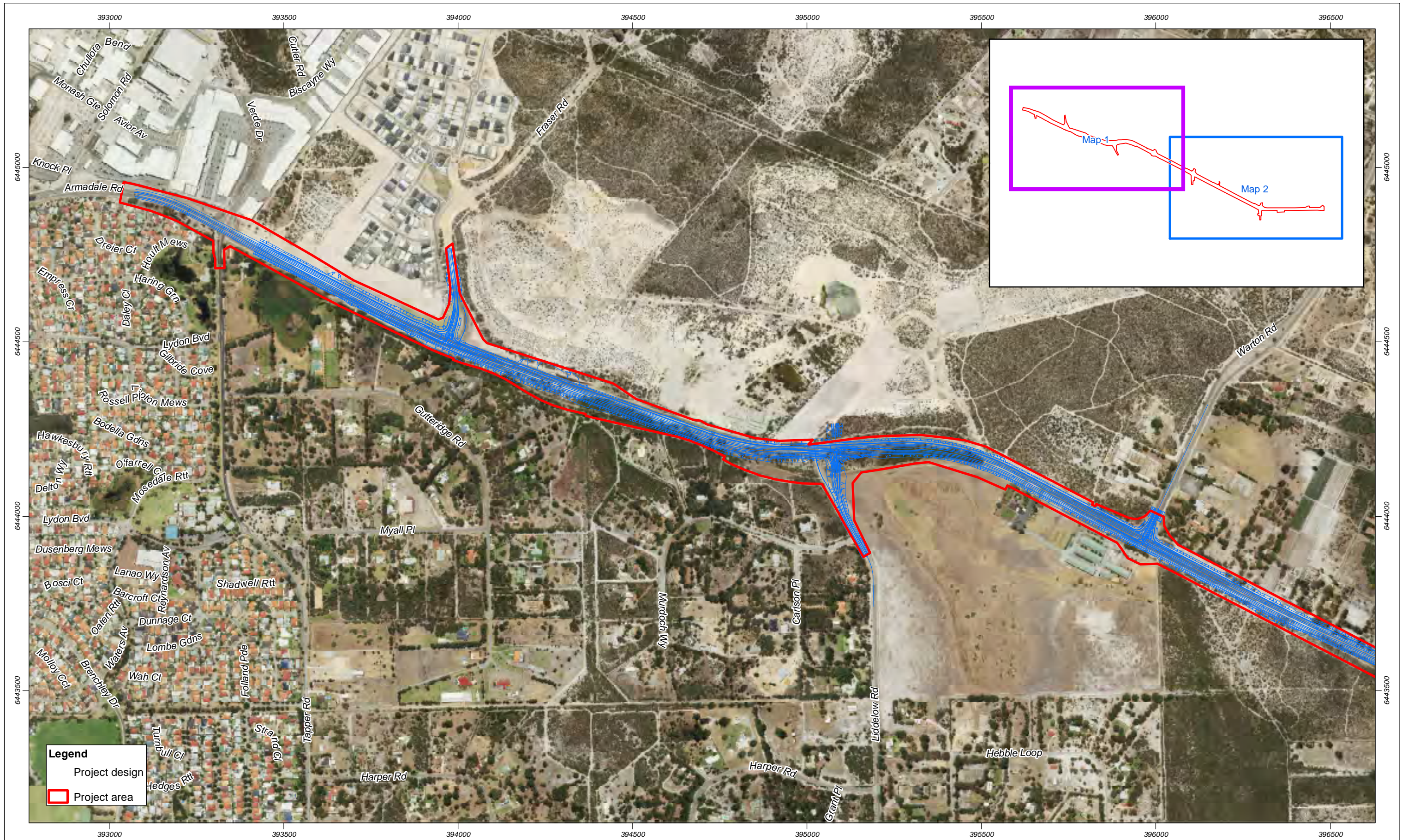


Figure 2: Project design and Project area

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/05/2017

Author: DWhite

Source: Aerial image and design: Client 06/2016.

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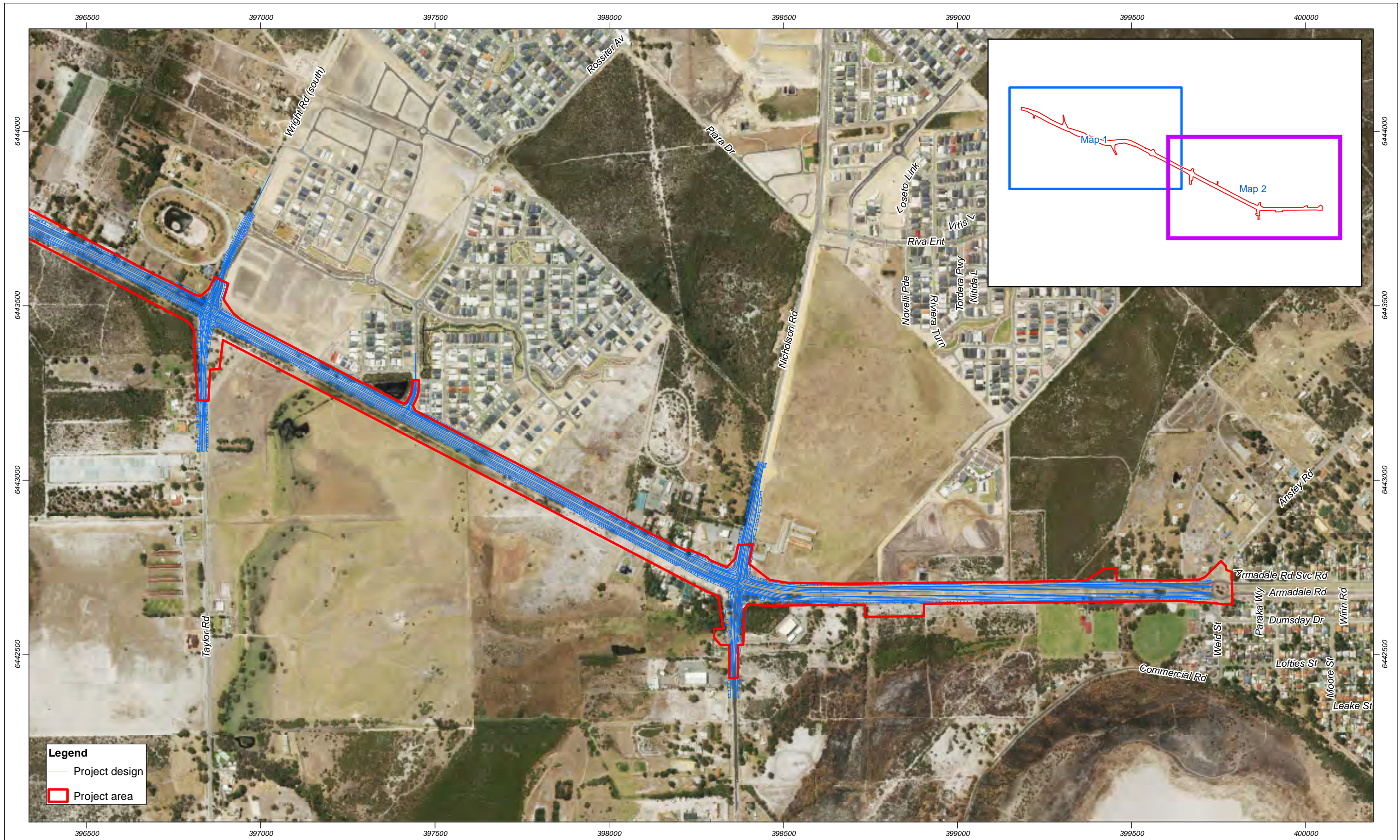


Figure 2: Project design and Project area

Scale 1:10,000 at A3



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas

Date: 19/05/2017

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Source: Aerial image and design: Client 06/2016.

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3. Existing surveys and reports

The reports undertaken to date have identified the existing environment within the Project area and were reviewed to assist in the preparation of this report. The existing surveys and reports are summarised below.

Armadale Road Duplication Biological Assessment (Astron, 2015)

A biological assessment of key flora, fauna, soil, groundwater and surface water values and potential sensitivity to impact, was conducted within a 50 metre buffer of the existing road and along a 400 metre length of all side roads. The investigation included a desktop assessment, Level 2 vegetation and flora survey and a Level 1 fauna survey.

Key findings include:

- three vegetation associations identified within the Project area
- twenty-seven introduced (weed) species identified within the Project area
- one conservation significant fauna species identified in the Project area; Forest Red-tailed Black Cockatoo
- limited foraging habitat present for black cockatoo species
- no potential breeding or roosting trees for black cockatoo species identified within the Project area.

The report concluded that targeted flora surveys are required for select flora species, several wetlands within and adjacent to the Project area should be surveyed and an ASS investigation is required pending the amount of excavation and dewatering required for the construction works.

Supplementary vegetation survey – targeted *Drakaea elastica* survey and black cockatoo assessment (Strategen 2016)

This report detailed the results of a Level 1 flora and vegetation survey (to supplement the Level 2 survey undertaken by Astron), a targeted survey for *Drakaea elastica* and a black cockatoo habitat assessment.

Key outcomes of the survey include:

- four vegetation associations were identified within the additional Project area (including the reclassified Astron vegetation); however, the majority of the Project area is cleared or planted with exotic species
- no individuals of the rare orchid species *Drakaea elastica* were located within the *Kunzea glabrescens* tall shrublands targeted as part of this survey
- approximately 4.85 ha of moderate quality foraging habitat for Carnaby's Black Cockatoo was identified within the additional Project area. No significant trees for black cockatoos were recorded during the survey, although potentially significant trees may be present within private property.

Additional areas – Level 1 vegetation survey (Strategen 2017)

Strategen undertook an additional Level 1 vegetation survey on 5 April 2017 to assess the vegetation associations present in areas within the updated Project concept design. The vegetation survey also validated the findings of a number of areas identified by Astron (2015) as Banksia Woodland. The findings of this survey have been included in this report.

4. Existing environment

A summary of the existing environment of the Project area is detailed in this section, which has been informed by the following investigations:

1. Desktop assessments; completed by Astron (2015) as part of the Armadale Road Duplication Biological Assessment and Strategen (2016).
2. Level 2 vegetation and flora survey (Astron 2015).
3. Level 1 fauna survey (Astron 2015).
4. Targeted *Drakaea elastica* survey and supplementary vegetation and black cockatoo habitat assessment (Strategen 2016).
5. Additional areas – Level 1 vegetation survey (Strategen 2017).

4.1 Geology, landform and soils

The Project area is located within the Swan Coastal Plain, comprising a low-lying coastal plain with swamps and sand hills scattered throughout (Astron 2015). The Swan Coastal Plain is bound by the Gingin and Darling Fault Scarps which represent the eastern boundary of Tertiary and Quaternary marine erosion (McPherson and Jones 2005).

The Project area occurs within the Bassendean Dune System, comprising a gently undulating aeolian sand plain. The dunes likely accumulated as shoreline deposits and coastal dunes during the interglacial periods of high sea level, originally consisting of calcareous sand with quartz sand and minor fine-grained, black, heavy-mineral concentrations (McPherson and Jones 2005). Soils of the Bassendean system are pale grey to white, including fine to coarse grained sand (McPherson and Jones 2005).

4.2 Vegetation and flora

4.2.1 Broad-scale vegetation mapping

Interim Biogeographic Regionalisation of Australia regions

A total of 89 recognised Interim Biogeographic Regionalisation of Australia (IBRA) regions occur within Australia, defined on the basis of climate, geology, soils, landform, vegetation and fauna characteristics (DSEWPac 2012a). There are 53 IBRA subregions in Western Australia, of which, the Project area occurs within the Swan Coastal Plain IBRA region, comprising an area of approximately 1,501,221 ha (Mitchell et al, 2002); of pre-European vegetation, of which approximately 579,161 ha is currently remaining, comprising 38.6% (as presented in Table 1).

The Swan Coastal Plain IBRA region is dominated largely by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark in swampy areas (Mitchell et al, 2002). The Swan Coastal Plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland in the east (Mitchell et al, 2002). Vegetation and soil associations typically include, heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes, Marri on colluvial and alluvial soils (Mitchell et al, 2002). The sub-region exhibits a Mediterranean climate with rainfall ranging between 600 and 1000 mm annually (Mitchell et al, 2002).

The City of Cockburn and the City of Armadale have a total of 28.02% and 77.05% of the pre-European vegetation remaining, comprising approximately 4,138 ha and 43,002 ha respectively.

Hedde and Beard vegetation complexes

The Project area occurs within the South-west Botanical Province which has been subject to extensive biological survey at both the regional and local scale (Beard 1981; Hedde 1980). Key Western Australian regional mapping undertaken includes Beard (1981) and Hedde *et al* (1980).

Table 1 includes a summary of broad-scale vegetation mapping and current percentage remaining of each association.

Table 1: Broad-scale vegetation mapping within Project Area (Government of Western Australia 2015)

Broad-scale mapping	Association	Pre-European (ha)	Current extent (ha)	% remaining	% remaining in Department of Parks and Wildlife (DPAW) reserves
IBRA Region	Swan Coastal Plain	1 501 221.93	579 161.92	38.58	10.19
Local Government Authority ¹	City of Cockburn	14 765	4 138.40	28.02	13.06
	City of Armadale	55 812	43 002.54	77.05	10.44
Hedde Vegetation Complex (2013 extent)	Bassendean complex – Central and South	87 392.73	24 206.24	27.70	0.79
	Southern River Complex	57 171.55	11 254.99	19.69	1.31
Beard vegetation mapping (1981)	Medium very sparse woodland; jarrah, with low woodland; <i>Banksia</i> and <i>Casuarina</i> (1001)	57 410.23	12 879.81	22.43	2.80
	Medium woodland; jarrah, marri and wandoo (968)	296 715.07	95 731.63	32.26	1.17

4.2.2 Vegetation associations and condition

The following vegetation and flora surveys have been undertaken within the Project area:

- Level 2 flora and vegetation assessment, including targeted *Caladenia huegelii* survey, completed on 27, 29 and 30 October 2015 (Astron 2015; Appendix 1)
- Targeted *Drakaea elastica* and vegetation assessment, completed on 28 July 2016 (Strategen 2016; Appendix 2)
- *Additional areas – flora and vegetation survey* April 2017 reported in *Armadale road Duplication Tapper road to Anstey Road, Environmental Impact Assessment* (Strategen 2017).

The vegetation surveys identified four native vegetation associations within the Project area, comprising an area of approximately 13.2 ha, as presented in Figure 3, including:

1. *Banksia* woodland (4.85 ha).
2. *Melaleuca* damplands (6.26 ha).
3. *Kunzea glabrescens* tall shrublands (2.01 ha).
4. *Beaufortia elegans* tall shrublands (0.08 ha).

In addition, the Project area also comprises:

- 6.99 ha of planted vegetation
- 43.7 ha of areas that are completely cleared, associated with existing road infrastructure.

Total vegetation (native and planted) within the Project area comprises approximately 20.19 ha.

Vegetation recorded in the Project area ranges from Completely Degraded to Excellent vegetation condition, in accordance with the Keighery (1994) vegetation scale. Approximately 10% of the Project area was in Good to Excellent condition, with the remaining areas being cleared and in Degraded and Completely Degraded condition (Figure 3).

Table 2 presents vegetation associations, habitat and condition recorded within the Project area, as determined in the vegetation and flora surveys.

¹ Values calculated as part of the Perth Biodiversity Project (2010).

Table 2: Vegetation associations and condition recorded within the Project area

Vegetation association and code	Habitat	Vegetation condition	Total area (ha)
<p>BaBm: <i>Banksia</i> woodland</p> <p><i>Banksia attenuata</i>, <i>B. menziesii</i> and <i>B. ilicifolia</i> low woodland (with <i>Eucalyptus marginata</i> scattered trees) over <i>Xanthorrhoea preissii</i> (<i>Macrozamia riedlei</i>) open shrubland over <i>Dasypogon bromeliifolius</i> and <i>Phlebocarya ciliata</i> or <i>Desmocladius flexuosus</i> open herbland to closed herbland.</p> <p>Associated species: <i>Allocasuarina fraseriana</i>, <i>*Avena barbata</i>, <i>Burchardia congesta</i>, <i>*Ehrharta calycina</i>, <i>*Euphorbia terracina</i>, <i>*Fumaria capreolata</i>, <i>Hypocalymma angustifolium</i>, <i>Lepidosperma</i> sp., <i>*Moraea flaccida</i>, <i>Patersonia occidentalis</i>.</p>	Mid to upper slopes on grey sand	Good (1.14 ha) Degraded (3.71 ha)	4.85
<p>Mp: <i>Melaleuca preissiana</i> damplands</p> <p><i>Melaleuca preissiana</i> low open Forest to low closed forest over <i>Lepidosperma</i> sp. or <i>Lepidosperma longitudinale</i> and <i>Dielsia stenostachya</i> closed sedgeland (over <i>Pteridium esculentum</i> herbland).</p> <p>Associated species: <i>Acacia ?longifolia</i>, <i>Hypocalymma angustifolium</i>, <i>Phlebocarya ciliata</i>, <i>Xanthorrhoea preissii</i>.</p>	Seasonally wet Damplands with dark loamy sand	Good to Excellent	6.26
<p>Kg: <i>Kunzea glabrescens</i> tall shrublands</p> <p><i>Kunzea glabrescens</i> tall open scrub to closed tall scrub over <i>Dasypogon bromeliifolius</i> or <i>Phlebocarya ciliata</i> low open shrubland.</p> <p>Associated species: <i>Corymbia calophylla</i>, <i>Jacksonia sternbergiana</i>, <i>Macrozamia riedlei</i>, <i>Regelia ciliata</i>, <i>Xanthorrhoea preissii</i>.</p>	Flat sandy palusplains	Good to Very Good	2.01
<p>Be: <i>Beaufortia elegans</i> tall shrublands</p> <p><i>Beaufortia elegans</i> tall open scrub to closed tall scrub over <i>Regelia ciliata</i> with occasional <i>Cassytha</i> spp.</p> <p>*Previously mapped by Astron as Kg.</p>	Seasonally wet Damplands with dark loamy sand	Good to Very Good	0.08
<p>Plantings</p> <p>Introduced and native species planting including (<i>Pinus</i> sp., <i>*Schinus terebinthifolius</i>, <i>*Ficus species'</i> [spp.]) over introduced grasses, often <i>*Avena barbata</i> and <i>*Ehrharta calycina</i> and <i>E. camaldulensis</i> and Eastern States Eucalypts).</p>			6.99
<p>Cleared</p> <p>Non-vegetated areas and areas associated with existing road infrastructure.</p>			43.71
TOTAL			63.90

NB - mapped extents of vegetation is subject to minor variation due to rounding.

Source: Astron 2015; Strategen 2016

Vegetation condition of the Project area was mapped using the Keighery (1994) vegetation scale (Figure 3; Astron 2015; Strategen 2016), including:

1. *Melaleuca preissiana* damplands vegetation association was in Good to Excellent condition.
2. *Kunzea glabrescens* tall shrubland were rated as being in Good Very Good condition, although rubbish was present.
3. *Banksia* woodlands were generally considered to be in Good to Degraded condition; however, weed species were present in the understorey.
4. *Beaufortia elegans* tall shrublands were rated as being in Good to Very Good condition.
5. Completely Degraded vegetation often consisted of cleared areas with planted or remnant native trees (*Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Eucalyptus marginata* and *E. rudis*), planted native trees (*E. camaldulensis* and Eastern States Eucalyptus species) or planted introduced species [Plantings] (**Pinus* sp., **Schinus terebinthifolius*, **Ficus species'* [spp.]) over introduced grasses, often **Avena barbata* and **Ehrharta calycina*. In addition, some drainage lines consist of **Typha ?orientalis* and *Melaleuca teretifolia*, or thick patches of *Pteridium esculentum*.

Table 3 includes the areas of each vegetation condition within the Project area. The total area of 64 ha in Table 3 is slightly higher than the total area of the Project area (63.9 ha) due to rounding.

Table 3: Vegetation condition of the Project area

Vegetation condition	Total mapped (ha)
Excellent	0.12
Excellent to good (including Very Good to Excellent and Good to Very Good)	0.34
Good	5.98
Good to degraded	0.02
Degraded	6.51
Completely Degraded (introduced species and cleared areas)	51.03
Total	64.0

NB - mapped extents of vegetation is subject to minor variation due to rounding.

Source: Astron 2015; Strategen 2016.

4.2.3 Threatened and Priority Ecological Communities

A search of the Australian Government EPBC Act Protected Matters Search Tool and Department of Parks and Wildlife (Parks and Wildlife) Threatened and Priority Ecological Communities Database was undertaken as part of the Astron (2015) biological assessment to identify potential Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) that may be present in the Project area.

A total of 10 TECs and 5 PECs have been previously recorded from within 10 km of the Project area. Of these TECs, the closest TEC to the Project area is *SCP08 - Herb rich shrublands in clay pans*. The buffer of this TEC occurs approximately 500 m from the Project area, and therefore will not be impacted by the Project. The two closest PECs to the Project area are *Banksia ilicifolia woodlands* and *Northern Spearwood shrublands and woodlands*, which are located within 3 km of the Project area (Figure 3).

Since undertaking the initial database searches and completion of the biological surveys, the *Banksia woodlands of the Swan Coastal Plain* TEC has been listed by the Commonwealth government as 'Endangered' under the EPBC Act. An assessment of the Banksia woodland within the Project area against the key diagnostic criteria was undertaken as displayed in Table 4.

Table 4: Characteristics of the Banksia woodland within the Project area compared to the key diagnostic criteria as per Threatened Species Scientific Committee (TSSC) (2016)

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the Project area
<p><u>Location:</u> Occurs in the Swan Coastal Plain or Jarrah Forest IBRA bioregions.</p>	Yes. Banksia woodlands within the Project area occur on the Swan Coastal Plain.
<p><u>Soils and landform:</u> Occurs on:</p> <ul style="list-style-type: none"> well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands sandy colluviums and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau transitional substrates and sandflats. 	Yes. The Banksia woodlands within the Project area occur on Bassendean Dunes.
<p><u>Structure:</u> Low woodland to forest with:</p> <ul style="list-style-type: none"> a distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or co-dominated by one or more of the Banksia species identified below emergent trees of medium or tall (>10 m) height. <i>Eucalyptus</i> or <i>Allocasuarina</i> species may sometimes be present above the Banksia canopy an often highly species-rich understorey. 	Yes. The Banksia woodlands within the Project area represent a low woodland-woodland structure. Due to past disturbance such as clearing, the structure of much of the vegetation has been altered.

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the Project area
<p><u>Composition:</u> Contains at least one of the following species:</p> <ul style="list-style-type: none"> • <i>Banksia attenuata</i> • <i>Banksia menziesii</i> • <i>Banksia prionotes</i> • <i>Banksia ilicifolia</i>. <p>if present, the emergent tree layer often includes <i>Corymbia calophylla</i> (Marri), <i>Eucalyptus marginata</i> (Jarrah), or less commonly <i>E. gomphocephala</i> (Tuart).</p>	<p>Yes. The Banksia woodlands within the Project area contain <i>Banksia attenuata</i> and <i>B. menziesii</i>.</p>
<p><u>Condition (Keighery 1994):</u> 'Pristine': no minimum patch size 'Excellent': 0.5 ha 'Very Good': 1 ha 'Good': 2 ha.</p>	<p>Yes. A total of 4.85 ha of Banksia woodlands within the Project area were in Good (1.14 ha) to Degraded (3.71 ha) condition (Keighery 1994) as displayed in Figure 3. Vegetation condition is impacted by an immature structure as a result of historic clearing and moderate species diversity (Strategen 2016).</p>

Based on the key characteristics described in the DEE advice relating to the Banksia TEC, the *Banksia* vegetation association is consistent with the Endangered *Banksia* woodlands of the Swan Coastal Plain TEC; therefore up to 4.85 ha of the TEC will be cleared as a result of the Project as shown in Figure 3.

4.2.4 Floristic Community Type

As part of the biological assessment Astron (2015) identified three potential Floristic Community Types (FCTs) within the Project area, including:

1. FCT 4: *Melaleuca preissiana* swamplands.
2. FCT 5: Mixed shrub damplands.
3. FCT 23a: Central *Banksia attenuata*-*Banksia menziesii* woodlands.

A review of FCT 23a and the Banksia woodland vegetation association occurring within the Project area was undertaken against the Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (DEE 2016). Based on the key characteristics described in the DEE advice relating to the Banksia TEC, the Banksia vegetation association is consistent with the Endangered Banksia woodlands of the Swan Coastal Plain TEC; therefore 4.85 ha of the TEC in good condition is located within the Project area.

Of the remaining FCTs potentially occurring (FCT 4 and FCT 5), none of these correspond to the vegetation associations described as PECs or TECs.

4.2.5 Conservation significant flora

Desktop assessment

Astron (2015) conducted a search of the Parks and Wildlife Threatened and Priority Flora database, Threatened and Priority Flora List, WA Herbarium Flora database and NatureMap were undertaken to identify flora species with the potential to occur in the Project area. A total of 38 conservation significant flora species were identified during database searches as potentially occurring within 10 km from the Project area (Astron 2015). Of these species, the following have been recorded previously within 10 km of the Project area:

- 15 Threatened species, of which 14 are listed under the EPBC Act
- one Priority 1 (DPaW Priority Flora list)
- two Priority 2 (DPaW Priority Flora list)
- 11 Priority 3 (DPaW Priority Flora list)
- 9 Priority 4 (DPaW Priority Flora list).

The location of conservation significant species previously recorded from within 1 km of the Project area is presented in Figure 3.

Of these 38 conservation significant flora species identified during database searches, five were assessed by Astron (2015), as potentially occurring or likely to occur, including:

- Likely: *Caladenia huegelii* - EPBC Act Endangered; WC Act Threatened
- Potential: *Austrostipa jacobiana* - *Wildlife Conservation Act 1950* (WC Act) Threatened
- Potential: *Diuris purdiei* - EPBC Act Endangered; WC Act Threatened
- Potential: *Drakaea elastica* - EPBC Act Endangered; WC Act Threatened
- Potential: *Drakaea micrantha* - EPBC Act Vulnerable; WC Act Threatened.

Field survey

Of the species identified as potentially occurring, none of these were recorded during the survey by Astron, which was conducted on 27, 29 and 30 October 2015; considered by Parks and Wildlife to be the appropriate time to survey for flora species, including threatened orchid species (*Caladenia huegelii*, *Diuris purdiei* and *Drakaea micrantha*). The Astron survey did identify two individuals of the Priority flora species *Dodonaea hackettiana* (P4), which were recorded at the same location within the Project area in vegetation classed as 'Degraded' (Figure 3).

As the previous Astron survey (2015) was not completed during the optimal survey period for *Drakaea elastica*, an additional threatened orchid assessment was undertaken by Strategen in July 2016, targeting *Drakaea elastica* within the *Kunzea* shrublands. The assessment did not identify any individuals of *Drakaea elastica*.

4.2.6 Introduced species

A total of 27 road-side weeds were observed during the biological survey (Astron 2015). Of these weeds, four are listed as Declared Pests under the *Biodiversity and Agriculture Management Act 2007* (BAM Act), including the following:

- **Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush)
- **Zantedeschia aethiopica* (Arum Lily)
- **Moraea flaccida* (One-Leaf Cape Tulip)
- **Rubus* sp. (Blackberry).

4.2.7 Bush Forever

The Bush Forever policy, originally prepared in 2000, was developed with the aim of protecting and enhancing bushland within the Perth metropolitan region, ensuring bushland conservation is addressed and integrated with the broader land-use planning and decision-making. In 2010, the *State Planning Policy (SPP) 2.8: Bushland Policy for the Perth Metropolitan Region* was adopted to secure the long-term protection of biodiversity associated with environmental values of bushland areas (WAPC 2010).

A total of seven Bush Forever sites occur within a 2.3 km vicinity of the Project area. Three Bush Forever sites intersect the Project area (Figure 3). A total of 1.68 ha of vegetation within the following Bush Forever sites is proposed to be cleared:

- Fraser Road Bushland, Banjup (Site 390) – approximately 0.16 ha intersects the Project area
- Anstey/Keane Dampland and Adjacent Bushland (Site 342) – approximately 0.32 ha intersects the Project area
- Gibbs Road Swamp Bushland, Banjup/Forrestdale (Site 344) – approximately 1.20 ha intersects the Project area.

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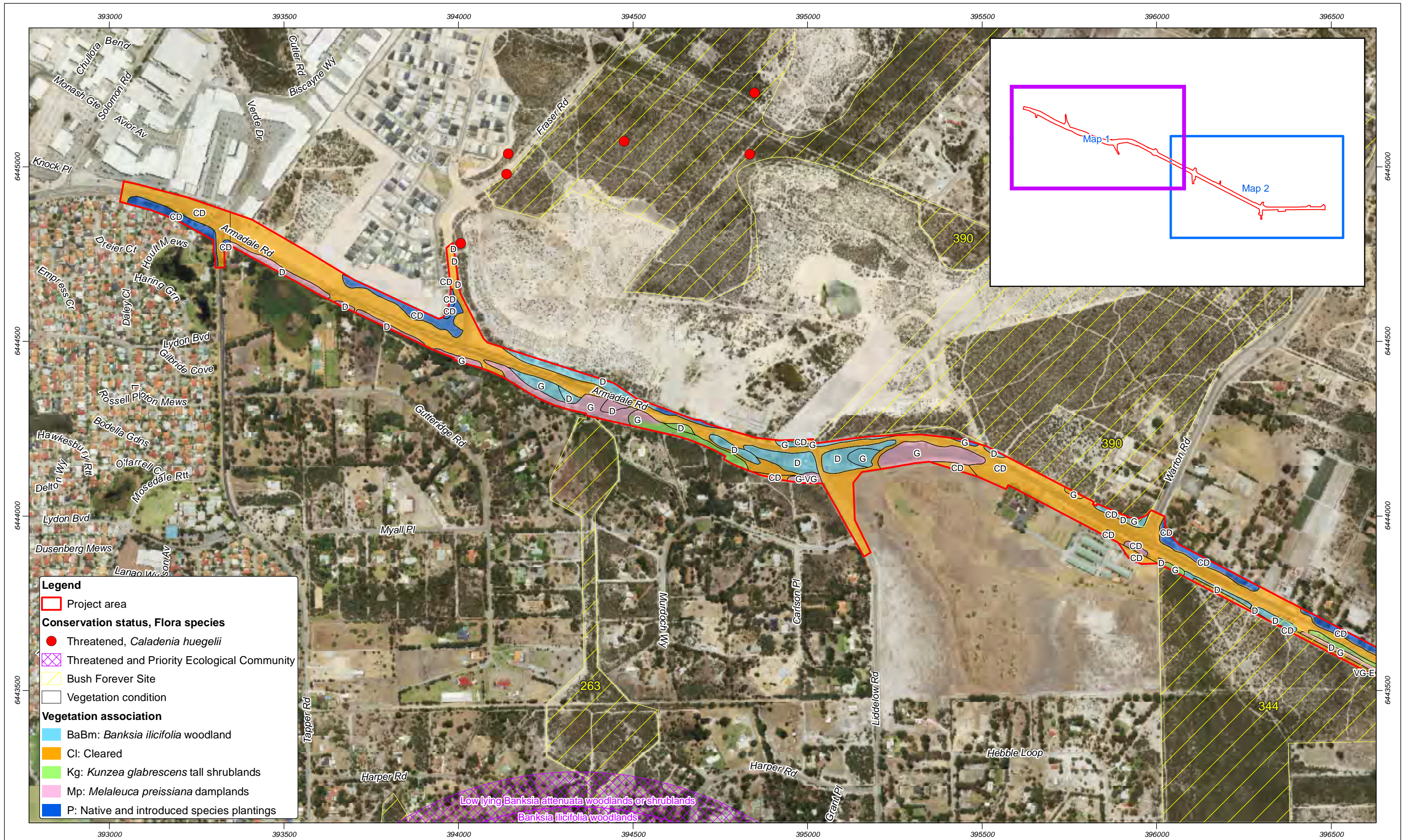


Figure 3: Flora and vegetation values

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/05/2017

Author: DWhite

Source: Aerial image and design: Client 06/2016.

Path: Q:\Consult\2016\MRO\MRO16249\ArcMap_documents\IR003\MRO16249_01_R003_RevB_F003.mxd

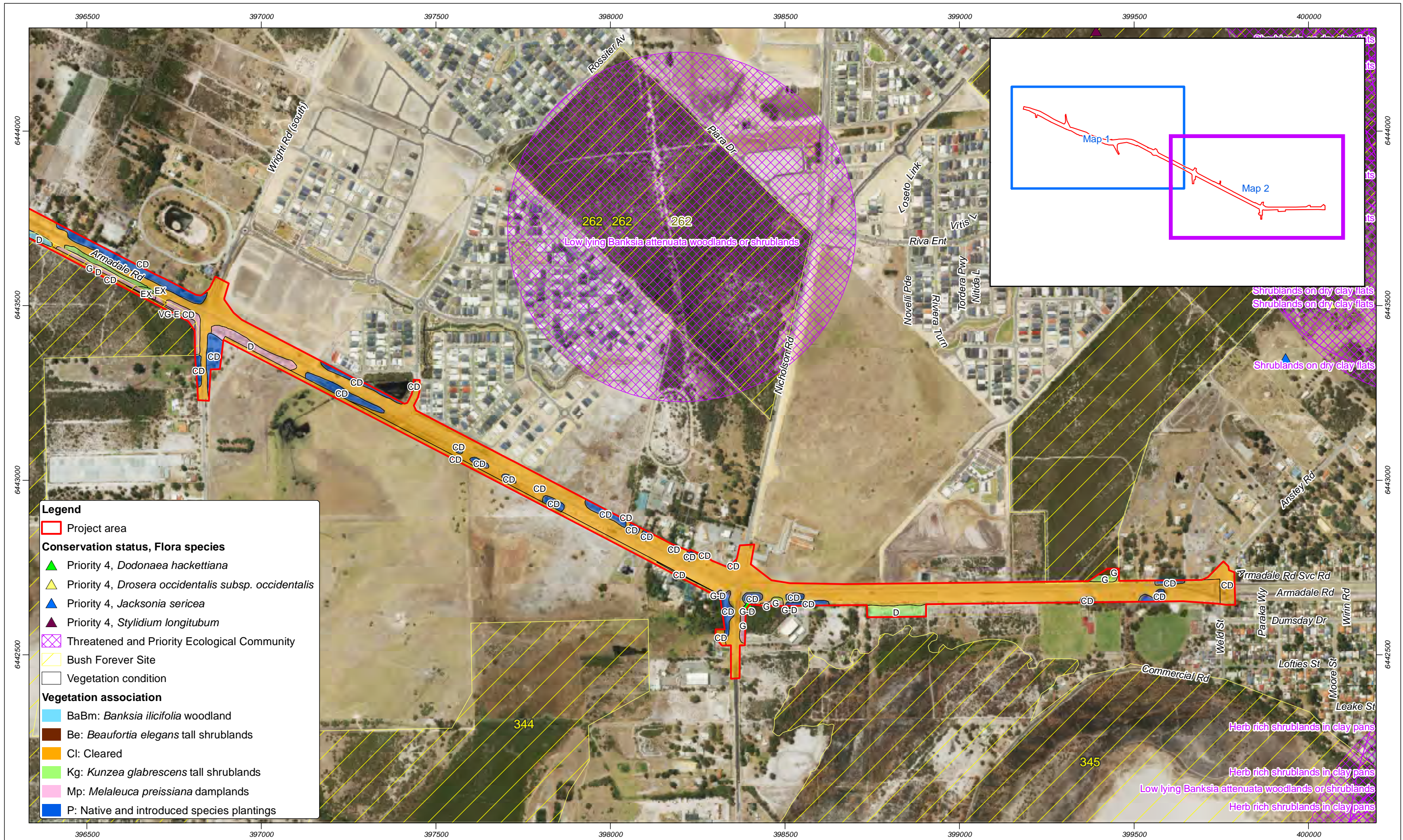


Figure 3: Flora and vegetation values

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

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4.3 Fauna

4.3.1 Fauna habitat

An assessment of the fauna habitat present within the Project area was undertaken as part of the assessments completed by Astron (2015) and Strategen (2016). Four vegetation types are identified providing habitat including:

- 4.85 ha of *Banksia* woodland
- 2.01 ha of *Kunzea glabrescens* tall shrubland
- 6.26 ha of *Melaleuca preissiana*.
- 0.08 ha *Beaufortia elegans* tall shrublands.

The remaining 50.78 ha is made up of cleared open areas or plantings as part of an existing road reserve.

The fauna habitat condition of intact vegetation communities was generally considered to be in Good condition, with these habitats retaining connectivity with other habitats, specifically areas connected to Bush Forever sites 342 and 390 (Bush Forever discussed further in section 4.2.7). Fauna habitat of good condition, did however, show some signs of degradation often associated with edge effects that are characteristic of road reserves (Astron 2015).

Fauna habitat condition within the remainder of the Project area was considered to be in Highly Degraded condition, being devoid of vegetation and therefore offer few micro-habitats for fauna species (Astron 2015).

4.3.2 Vertebrate fauna

To identify fauna species potentially impacted by the Project, a desktop review was undertaken using a wide range of databases (i.e. EPBC Act Protected Matters Search Tool, Parks and Wildlife Threatened Fauna and Black Cockatoo Database, NatureMap, BirdLife Australia) (Astron 2015; Strategen 2016). The desktop review identified 81 vertebrate fauna species of conservation significance previously recorded from within the vicinity of the Project area. Of these, 17 are listed as threatened under the EPBC Act and/or WC Act, with the remaining species listed as Migratory under the EPBC Act and/or as Priority species by Parks and Wildlife (Astron 2015).

A total of 21 fauna species were recorded during the biological assessment through direct observation or indirect evidence (calls or scats), including two reptile species, 17 bird species and two mammal species, both of which were introduced species (Astron 2015; Appendix 1), listed below:

- *Notechis scutatus* - Tiger Snake
- *Pseudonaja affinis* - Dugite
- *Phaps chalcoptera* - Common Bronzewing
- *Falco berigora* - Brown Falcon
- *Calyptorhynchus banksii naso* - Forest Red-tailed Black-cockatoo
- *Eolophus roseicapillus* - Galah
- *Purpureicephalus spurius* - Red-capped Parrot
- *Chalcites lucidus* - Shining Bronze-Cuckoo
- *Malurus splendens* - Splendid Fairy-wren
- *Lichenostomus virescens* - Singing Honeyeater
- *Anthochaera carunculata* - Red Wattlebird
- *Lichmera indistincta* - Brown Honeyeater
- *Phylidonyris novaehollandiae* - New Holland Honeyeater
- *Phylidonyris niger* - White-cheeked Honeyeater

- *Coracina novaehollandiae* - Black-faced Cuckoo-shrike
- *Artamus cinereus* - Black-faced Woodswallow
- *Cracticus tibicen* - Australian Magpie
- *Rhipidura leucophrys* - Willie Wagtail
- *Hirundo neoxena* - Welcome Swallow
- *Oryctolagus cuniculus* - Rabbit
- *Canis lupus familiaris* – Dog.

4.3.3 Conservation significant fauna

As database search request was submitted to the Threatened Communities Branch of Parks and Wildlife to identify any potential Threatened fauna within 5 km of the Project area. Figure 4 shows the Threatened and Priority fauna species that have been recorded within 5 km of the Project area (DPaW 2015), listed below:

Invertebrates:

- *Leioproctus contrarius* (Priority 3).

Vertebrates:

- *Ardea modesta* (Migratory)
- *Calidris ruficollis* (Migratory)
- *Merops ornatus* (Migratory)
- *Plegadis falcinellus* (Migratory)
- *Calyptorhynchus latirostris* (Threatened)
- *Calyptorhynchus banksii* subsp. *naso* (Threatened)
- *Isoodon obesulus* subsp. *Fusciventer*
- *Lerista lineata* (Priority 3)
- *Myrmecobius fasciatus* (Threatened).

Of these, the Quenda (*Isoodon obesulus* subsp. *fusciventer*) (Priority 4 – WC Act) and Numbat (*Myrmecobius fasciatus*) (Threatened – EPBC Act) were recorded as having the potential to occur within the Project area (Figure 4). These species were not observed during the site assessment.

Based on specific habitat requirements, the three species of black cockatoos listed as Threatened (EPBC Act) were considered to have the potential to occur within the Project area. One conservation significant fauna species, the Forest Red-tailed Black Cockatoo (EPBC Act Vulnerable and Schedule 3 WC Act) was recorded during the Astron (2015) survey.

A black cockatoo habitat assessment was undertaken by Astron in 2015, Strategen in 2016 and Strategen 2017 in accordance with the DEE Black Cockatoo Referral Guidelines (DSEWPac 2012b). A review of the DPaW Black Cockatoo database was undertaken as part of this assessment which identified one confirmed breeding site within 13.5 km of the Project area, and 23 confirmed roost records within 6 km of the Project area (Astron 2015). In addition, 448 foraging records were identified as part of the database search (Astron 2015).

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black-cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area. Table 5 summarises the value of each vegetation type in terms of the quality of foraging habitat provided for black cockatoos. Table 6 provides a justification for how foraging values were defined.

Evidence of foraging by the Forest Red-tailed Black Cockatoo was observed within the Project area, specifically chewed fruit of Marri located within *Kunzea glabrescens* tall shrubland (Astron 2015). Additional habitat for the Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo occurs within the Project area; however, is restricted to scattered foraging species primarily occurring within the *Banksia* woodland and *Kunzea glabrescens* tall shrubland habitat types (refer to Table 5). These potential foraging species for the Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo constitute less than 10% of total foliage cover within these vegetation types and consequently do not constitute as quality habitat for the Forest Red-tailed Black Cockatoo or Baudin's Cockatoo (Table 5, Table 6).

The proteaceous species present within the *Banksia* woodland habitat type (4.85 ha) were assessed by Astron as providing some level of foraging resources for Carnaby's Black Cockatoo species, however it was concluded that this fauna habitat is generally degraded, and therefore the habitat does not constitute 'quality' foraging habitat (Astron 2015).

Strategen undertook a review of the black cockatoo foraging habitat on site, in accordance with recent advice relating to reform of the DEE (formally DotE) black cockatoo referral guidelines (pers. comm DotE, 27 May 2016). Based on a review of this advice, it was determined that the *Banksia* woodland within the Project area does provide 'Moderate quality' Carnaby's black cockatoo foraging habitat given the presence of *Banksia* spp and the location of the Project area within the Swan Coastal Plain (Table 5; Figure 4).

Table 5: Vegetation types and black cockatoo foraging species and habitat quality within the Project area

Vegetation type	Foraging species potentially utilised by black cockatoos	Foraging quality	Area (ha)
BaBm	Carnaby's Black Cockatoo: <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>B. ilicifolia</i> , <i>Eucalyptus marginata</i> , <i>Xanthorrhoea preissii</i> , <i>Allocasuarina fraseriana</i> . Baudin's Black Cockatoo: <i>B. ilicifolia</i> , <i>E. marginata</i> , <i>X. preissii</i> , <i>A. fraseriana</i> . Forest Red-tailed Black Cockatoo: <i>E. marginata</i> , <i>A. fraseriana</i> .	Carnaby's Black Cockatoo: Moderate Baudin's Black Cockatoo: Very Poor Forest Red-tailed Black Cockatoo: Very Poor	4.85
Mp	Carnaby's Black Cockatoo: <i>X. preissii</i> . Baudin's Black Cockatoo: <i>X. preissii</i> . Forest Red-tailed Black Cockatoo: Nil.	Carnaby's Black Cockatoo: Very Poor Baudin's Black Cockatoo: Very Poor Forest Red-tailed Black Cockatoo: Nil	6.26
Kg	Carnaby's Black Cockatoo: <i>X. Preissii</i> , <i>Corymbia calophylla</i> . Baudin's Black Cockatoo: <i>X. Preissii</i> , <i>C. calophylla</i> . Forest Red-tailed Black Cockatoo: <i>C. calophylla</i> .	Carnaby's Black Cockatoo: Very Poor Baudin's Black Cockatoo: Very Poor Forest Red-tailed Black Cockatoo: Very Poor	2.01
Be	Nil.	Nil	0.08
Plantings	Carnaby's Black Cockatoo: <i>Pinus</i> sp., <i>Ficus</i> sp. Baudin's Black Cockatoo: <i>Pinus</i> sp. Forest Red-tailed Black Cockatoo: Nil.	Carnaby's Black Cockatoo: Very Poor Baudin's Black Cockatoo: Very Poor Forest Red-tailed Black Cockatoo: Nil	6.99
Cleared	Nil.	Nil	43.71

Table 6: Definition of black cockatoo foraging habitat within the Project area (Finn 2012; Groom 2011; Lee et al. 2013)

Foraging quality	Justification
Excellent	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (i.e. canopy and midstorey).
Moderate	Moderate foraging value density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 20-40%) and food sources only present at one or two strata (i.e. canopy and midstorey).
Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Very poor	Very low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species <10%) and presence of food sources at only one stratum (i.e. canopy).
Nil	Cleared areas - no suitable vegetation present.

The Project area does not provide potential breeding or roosting habitat for any species of black cockatoo, as no trees exhibit potential breeding hollows, no trees are considered to be future breeding habitat (diameter at breast height [DBH], greater than 50 cm or no breeding hollows) and no roosting habitat was identified during the survey (Astron 2015; Strategen 2016; Strategen 2017).

4.3.4 Introduced fauna

The Astron biological assessment (2015) did not identify any introduced species, however, it is likely that introduced species would be present in the Project area, due the presence of degraded vegetation and associated edge effects.

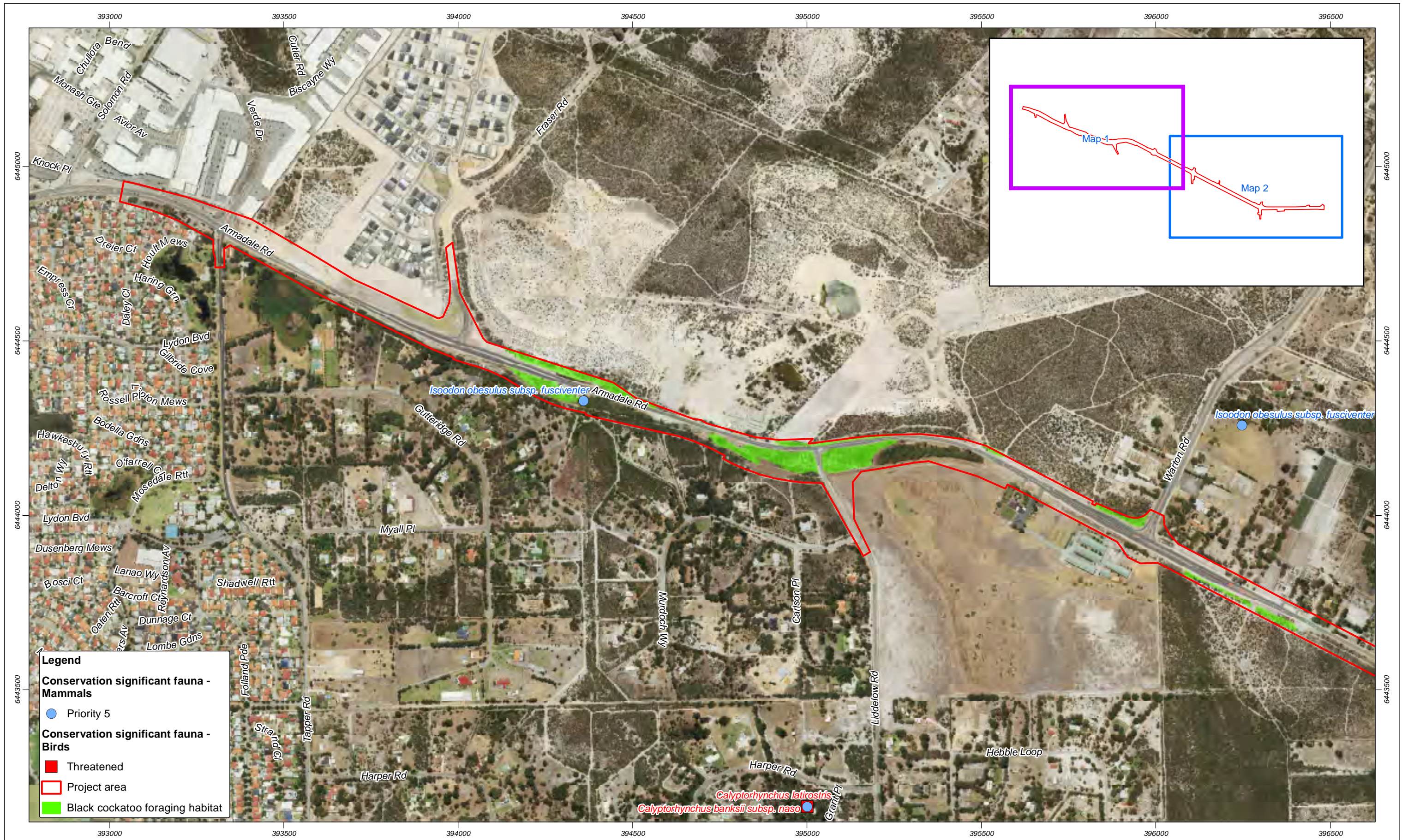


Figure 4: Fauna values

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/05/2017

Author: DWhite

Source: Aerial image and design: Client 06/2016.

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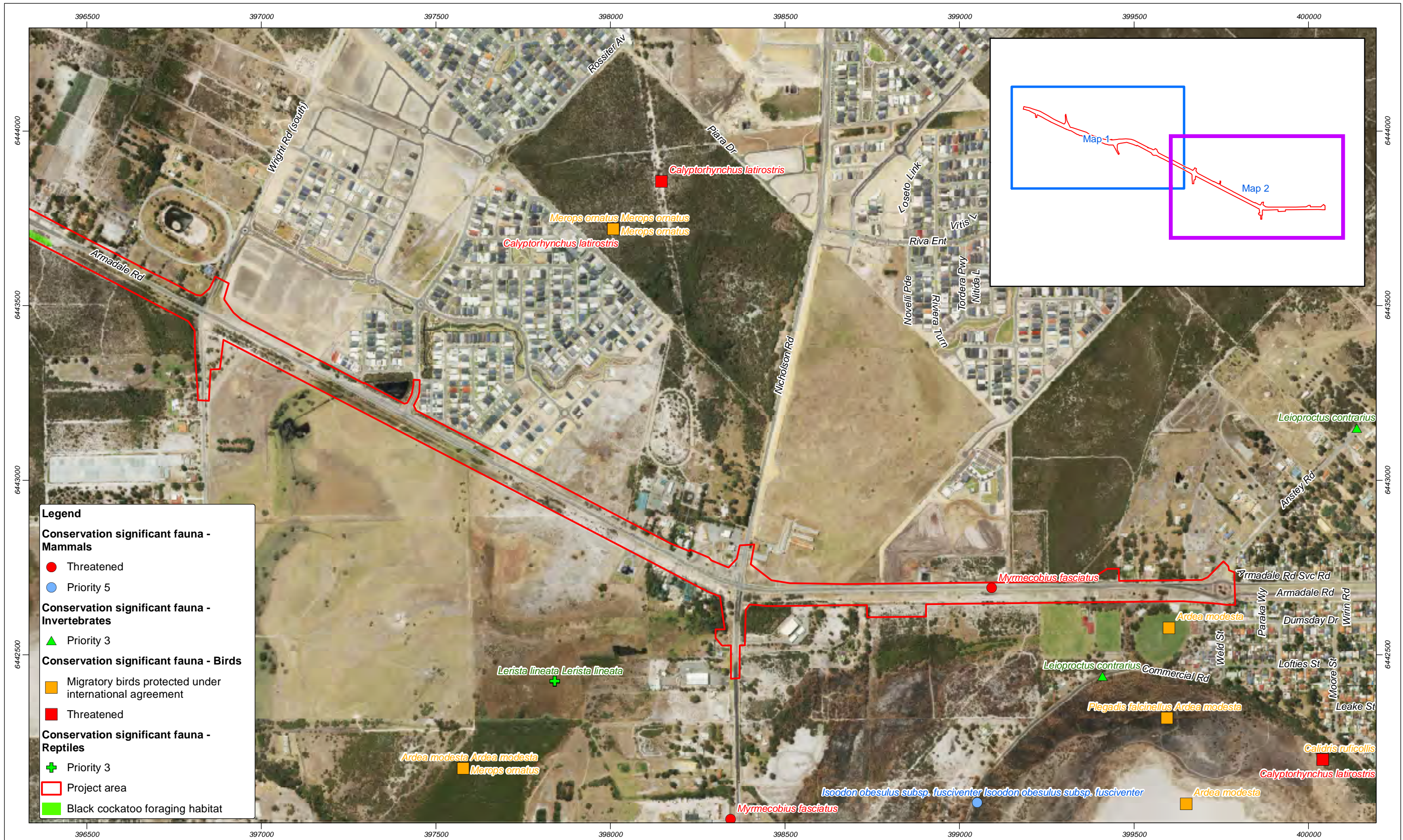


Figure 4: Fauna values

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

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Author: DWhite

Source: Aerial image and design: Client 06/2016.

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4.4 Wetlands and drainage

4.4.1 Wetlands

The Project area does not contain any rivers however contains a surface water drainage line (James Drain) (Astron 2015).

The Project area does not intersect any wetlands on the List of Wetlands of International Importance under the Convention on Wetlands (Ramsar). However, Forrestdale Lake, approximately 250 m south of the eastern end of the Project area, is listed as Ramsar site number 481 (Australian site number 35) (Astron 2015).

The Gibbs Road Swamp System includes Forrestdale Lake, which is a seasonal wetland on the List of Wetlands of International Importance under the Convention on Wetlands (Ramsar), and is located approximately 250 m south of the eastern end of the Project area (Astron 2015). Forrestdale Lake together with Thomsons Lake is listed as Ramsar site number 481 (Australian site number 35) (Astron 2015).

In addition, the Project area intersects the following Geomorphic Wetlands (including the 50m buffer) of the Swan Coastal Plain (DEC 2013):

- 4.71 ha of Conservation Category wetlands
- 19.55 ha of Resource Enhancement Category wetlands
- 6.90 ha of 7 Multiple Use Category wetlands.

Table 7 lists each conservation category and resource enhancement wetland and buffer located within the Project area based on available mapping information (DEC 2013).

Table 7: Mapped wetlands within the Project area

Wetland details	Total extent of wetland (ha)	Area within the Project area (ha)	General description of the wetland management category
		Wetland extent (ha)	
Conservation Management Category			
Conservation Management Category wetland (UFI 7143)	2.24	2.38	Wetlands which support a high level of attributes and functions.
Conservation Management Category wetland (UFI 14874)	34.70	1.27	
Conservation Management Category wetland (UFI 14893)	28.85	0.93	
Resource Enhancement Category			
Resource Enhancement Category wetland (UFI 7164)	1.83	1.39	Wetlands which may have been modified or degraded, but still support substantial attributes and functions.
Resource Enhancement Category wetland (UFI 7165)	43.86	2.22	
Resource Enhancement Category wetland (UFI 7210)	9.62	0.25	
Resource Enhancement Category wetland (UFI 7214)	0.33	0.93	
Resource Enhancement Category wetland (UFI 7215)	0.89	1.41	
Resource Enhancement Category wetland (UFI 13342)	26.70	2.97	
Resource Enhancement Category wetland (UFI 15297)	178.75	9.15	
Resource Enhancement Category wetland (UFI 15534)	0.36	0.84	
Resource Enhancement Category wetland (UFI 15539)	9.23	0.24	

As described in Table 7, the Project area will impact the mapped extent of a number of Conservation Category wetlands including:

- 0.48 ha of the mapped wetland extent and of Conservation Management Category wetland (UFI 7143), 0.34 ha of which contains vegetation to be cleared
- 0.52 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14874), 0.39 ha of which contains vegetation to be cleared
- 0.93 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14893), all of which contains vegetation to be cleared.

It is noted that the mapped extent of these wetlands does include areas that are already cleared and disturbed, including the existing road infrastructure as shown in Figure 5. Main Roads will install road drainage to minimise any potential impact from the road into wetlands, and ensure surface water flows are maintained as required. As the Project involves duplication of Armadale Road, involving construction along the current alignment, clearing will be restricted and will minimise encroachment of wetlands and buffers.

4.4.2 Drainage

A portion of the Project area is located within the South Jandakot Drainage Scheme (SJDS) catchment boundary. The SJDS was constructed to manage the adverse impacts of urban development within the catchment on the Jandakot Mound groundwater system water resource and to protect environmentally significant chains of wetlands including Thomsons Lake within the Beeliar Regional Park. Development within the SJDS is subject to environmental and ministerial requirements as outlined in the drainage management plan and environmental management programme developed for the scheme.

The Project area is located approximately 1.7 km and 700 m from the Forrestdale Main Drain and Bailey's Branch Drain respectively. The Forrestdale and Bailey's Branch Drains are important open Water Corporation drains facilitating drainage of stormwater; and therefore require consideration as part of the Project design and planning.

4.5 Groundwater

4.5.1 Groundwater assets

The Project area is underlain by the Superficial aquifer (Superficial formations), Osborne Formation and the Leederville aquifer. The Superficial and Leederville aquifers are major aquifers in the Perth region (Davidson 1995). The Superficial aquifer contains the Jandakot Mound beneath the Bassendean and Spearwood Dunes. The Superficial aquifer is in hydraulic connection with the Osborne Formation but not in hydraulic connection with the Leederville aquifer (Davidson 1995).

4.5.2 Public drinking water supply areas

The Jandakot Underground Water Pollution Control Area (UWPCA) occurs within approximately half of the Project area (Astron 2015). The Project area intersects the following priority areas within the Jandakot UWPCA, as defined in *Draft SPP 2.3 - Jandakot Groundwater Protection Policy* (Western Australian Planning Commission [WAPC] 2014):

- Priority 1 (Water Catchment Reservation)
- Priority 2 (Rural Water Protection Zone)
- Priority 3 (where water supply need co-exist with other land uses) areas.

Figure 7 illustrates the priority PDWSAs as described above. Areas identified as Priority 1 incorporate infrastructure and roads as an acceptable land use within the policy area; however, WAPC does note that there are potential risks to groundwater in both the construction and operation of infrastructure and roads that must be considered (WAPC 2017).

Within Priority 2 areas, the Project is subject to conditional approval, provided the road will not cause an increased risk to water resource values (DoW 2006). The conditions of approval are to be designed to minimise water contamination risks. Within Priority 3 areas, roads are compatible with the DoW's source protection strategy provided best industry design and construction practice is followed, as detailed in the DoW Water Protection Quality Notes listed below.

The following items require consideration for the Project:

- where water abstraction is required within the UWPCA, a licence to take water (26D Licence application) will be required to be sought from DoW in accordance with the *Rights in Water and Irrigation Act 1914* (RiWI)
- the policy supports retention and rehabilitation of existing vegetation to ensure the ecological integrity of the Jandakot UWPCA is maintained and associated wetlands (WAPC 2017)
- where developments are proposed within 200 m from the boundary of a Conservation or Resource Enhancement Management category, they should be referred to Parks and Wildlife (WAPC 2017).

The following Water Quality Protection Notes (WQPNs) should be utilised to guide Project planning and development:

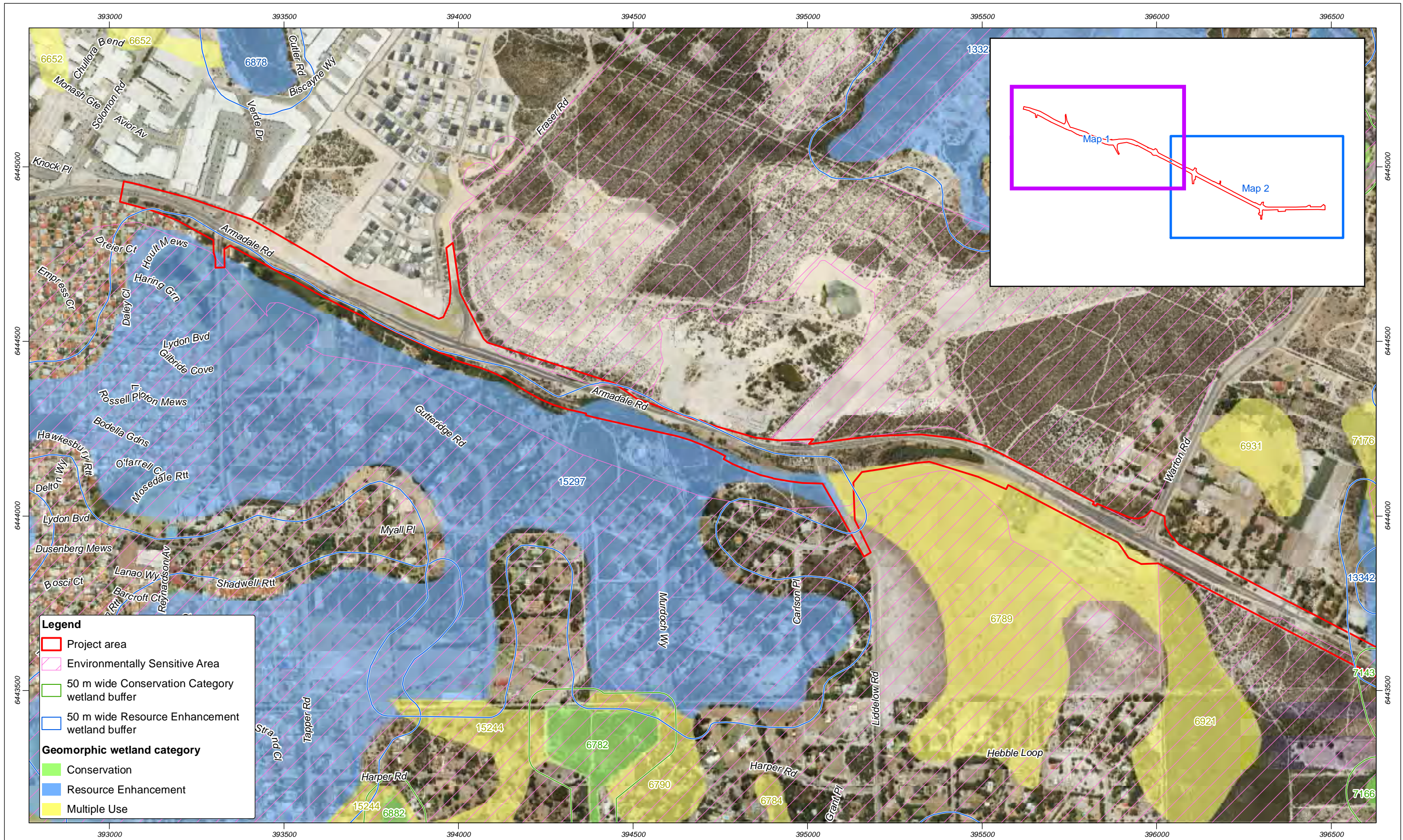
- WQPN 10: *Contaminant spills - emergency response*
- WQPN 25: *Land use compatibility tables for public drinking water source areas*
- WQPN 44: *Roads near sensitive water resources*
- WQPN 60: *Tanks for mobile fuel storage in PDWSAs*
- WQPN 83: *Infrastructure corridors near sensitive water resources*
- WQPN 84: *Rehabilitation of disturbed land in PDWSAs.*

4.6 Environmentally sensitive areas

Environmentally Sensitive Areas (ESAs) are areas of environmental importance, declared by the Western Australian Minister for the Environment, under section 51B of the *Environmental Protection Act 1986* (EP Act). The extent of ESAs within the Project area is summarised in Table 8 and discussed further in relevant sections of the PEIA (Strategen, 2016) as described in Table 8.

Table 8: Extent of ESAs within the Project area (includes wetlands buffer areas)

ESA	Area within Project area (ha)	Document section
Bush Forever site 390: Fraser Road Bushland, Banjup	0.16	Discussed further in section 4.2.7
Bush Forever site 342: Anstey/Keane Dampland and adjacent bushland	0.32	Discussed further in section 4.2.7
Bush Forever site 344: Gibbs Road Swamp Bushland, Banjup/Forrestdale	1.20	Discussed further in section 4.2.7
Conservation Management Category wetland (UFI 7143)	2.38	Discussed further in section 4.4.1
Conservation Management Category wetland (UFI 14874)	1.27	Discussed further in section 4.4.1
Conservation Management Category wetland (UFI 14893)	0.93	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 7164)	1.39	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 7165)	2.22	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 7210)	0.25	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 7214)	0.93	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 7215)	1.41	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 13342)	2.97	Discussed further in section 4.4.1
Resource Enhancement Category wetland (UFI 15297)	9.15	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 6789)	1.52	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 13927)	0.10	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 13948)	0.09	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 13949)	2.11	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 14897)	0.10	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 15425)	0.86	Discussed further in section 4.4.1
Multiple Use Category wetland (UFI 15529)	2.11	Discussed further in section 4.4.1



Legend

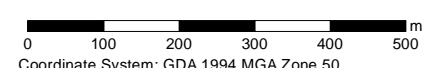
- Project area
- Environmentally Sensitive Area
- 50 m wide Conservation Category wetland buffer
- 50 m wide Resource Enhancement wetland buffer

Geomorphic wetland category

- Conservation
- Resource Enhancement
- Multiple Use

Figure 5: Wetlands and Environmentally Sensitive Areas

Scale 1:10,000 at A3



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas

Date: 19/05/2017
 Author: VDinh
 Source: Aerial image and design: Client 06/2016; Wetlands: DPaW 2012; ESA: DER 2012.
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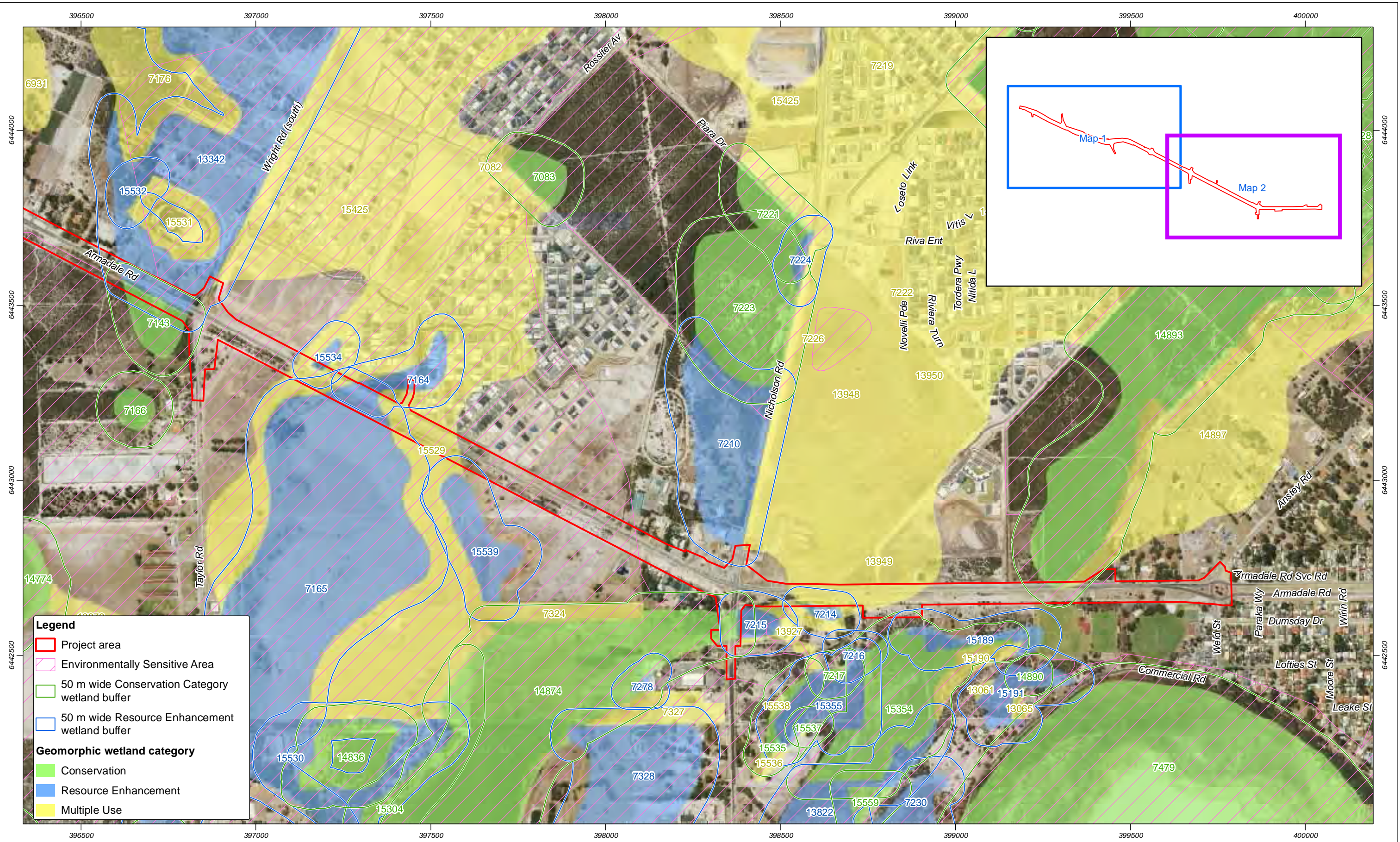


Figure 5: Wetlands and Environmentally Sensitive Areas

4.7 Acid Sulfate Soils

As part of the desktop assessment undertaken by Astron (2015) a review of the CSIRO Australian Soil Resource Information System Acid Sulfate Soil risk mapping was undertaken. A small portion of the Project area was identified as having a 'High to Moderate' probability of occurrence of ASS at depths greater than 3 m from the natural soil surface as shown in Figure 6. The majority of the Project area was identified as having a 'Moderate to Low' probability of occurrence of ASS occurring at depths within 3 m from the natural soil surface (Figure 6).

4.8 Contamination

A search of the Department of Environment and Regulation (DER) Contaminated Sites database was undertaken on 20 July 2016 (DER 2016). The search did not identify any sites registered as contaminated or potentially contaminated that intersect the Project area. One registered site, 843 Warton Road; Piara Waters is located approximately 590 m from the Warton Road/Armadale Road intersection (Figure 6). The site is a known contaminated site, due to the presence of asbestos and asbestos containing material, construction and demolition waste and household waste present as a result of illegal dumping.

It is possible that asbestos dumping has occurred with the Project area, therefore, where encountered asbestos should be managed in accordance with the *Contaminated Sites Act 2003* and Department of Health (2009) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*.

4.9 Land use

The Project area comprises predominantly of Main Roads road reserve, including reserved land. The Project area is surrounded by various land uses including:

- residential industrial (light and service industry)
- rural and rural residential
- parks and recreational areas
- Bush Forever sites.

All surrounding land uses require consideration as part of Project planning and management to ensure potential impacts of the Project do not significantly impact on surrounding land uses. There are a number of sensitive land uses present in proximity to the Project area that require consideration; including residential, rural residential, parks and recreation areas and Bush Forever sites due to the sensitivity of these areas to be impacted by road construction.

Residential areas occur adjacent to the Project area at a number of locations along Armadale Road. The closest house to the Project area occurs at the south-east corner of the intersection of Tapper Road and Armadale Road, less than 50 m from the boundary of the Project area (Figure 2). In addition, there are a number of existing residential and rural residential properties along the boundary of Armadale Road, also located less than 50 m from the boundary of the existing road (Figure 2).

4.10 Heritage

4.10.1 Aboriginal heritage

A search of the Department of Aboriginal Affairs (DAA) Heritage Inquiry System was undertaken by Strategen on 20 July 2016 and by Brad Goode and Associates (BGA) on 20 February 2017 to identify any Aboriginal heritage sites located within the Project area (DAA 2016, 2017; Appendix 3). The search did not identify any registered DAA ethnographic sites located within the Project area; however two registered sites, Lake Forrestdale, a mythological, camp and hunting place (Site No. 3713) and Neerigen Brook (Site No. 3714) are located approximately 370 m and 100 m, respectively, from the Project area (Figure 7). In addition, the Project area intersects three Other Heritage Places, including the following (DAA 2016, 2017):

- Readymix sandpit 2 (Site No. 3300), including artefacts, scatters and a camp; the site has been 'lodged', however is not 'registered'
- Readymix sandpit 1 (Site No. 4108), including artefacts/scatter; the site has been 'lodged', however is not 'registered'
- Banjup: Calsil (Site No. 3301), including artefacts, scatters and a camp; the site is listed as 'stored data'.

Additionally, anthropologists from BGA conducted an ethnographic Aboriginal heritage survey for the Project with several representatives from the Whadjuk WC2011/009 NTC group in February 2017 (BGA 2017). Main Roads has consulted with Whadjuk WC2011/009 Native Title Claim group who have confirmed no sites of significance will be impacted by the Project.

4.10.2 European heritage

A search of the City of Cockburn and City of Armadale Interactive Mapping databases was undertaken to identify any European heritage places located within the Project area or surrounds (City of Cockburn 2016; City of Armadale 2016). Additionally, a cultural heritage survey was undertaken in February 2017 to assess the cultural heritage significance within the Project area (AWA 2017; Appendix 3). The searches identified two sites of European heritage significance, the Banjup Memorial Park and the Armadale to Fremantle Railway Line and Bridge (James Drain Portion), located in the City of Cockburn.

The Banjup Memorial Park is located adjacent to the Project area and is listed as 'Category B - considerable significance' and has been entered into the Heritage List for the City. The Banjup Memorial Park comprises fourteen gum trees surrounded by a white post and rail fence, covering approximately 100 m², the site was established after World War I, including planted gum trees for men from the district who enlisted. The Project is not expected to impact the Banjup Memorial Park.

The Armadale to Fremantle Railway Line and Bridge is located adjacent to the Project area and is listed as 'Category A'. The construction of the existing Armadale Road along the railway reserve has eliminated much of the railway. However, there are remains of a bridge over the James Drain in Forrestdale between Nicholson and Taylor Road and a small culvert visible north of Taylor Road. Remains of the bridge could be affected due to the proposed improvement of the culvert under the bridge and the widening of the road.

4.11 Other factors

4.11.1 Air quality and dust

The impacts of the Project on air quality are not expected to significantly change from those associated with the current Armadale Road. Consequently, no specific air quality assessment or management is required.

Construction of the road may increase dust and potentially impact surrounding sensitive receivers, such as residential areas. A dust management plan shall be developed for construction activities and dust mitigation will occur during construction and operation of the Project; therefore the impacts of dust on sensitive receptors are not likely to be significant.

4.11.2 Noise and vibration

The Project may result in minor noise and vibration impacts to nearby sensitive receptors as a result of construction activities (i.e. road traffic noise may increase as a result of the Project); however these impacts are not expected to be significant. Management measures shall be set in accordance with noise regulations to the satisfaction of the Local Government Authority to manage potential noise and vibration associated with the Project. Management measures shall include the following (refer to Table 9):

- develop a noise and vibration management impacts associated with construction activities
- undertake a traffic noise assessment in accordance with State Planning Policy 5.4.

4.11.3 Visual amenity

The Project is unlikely to impact visual amenity on nearby sensitive receptors due to the existing Armadale Road in the current view. The impacts will be similar to those already resulting from the road therefore no management commitments are required.

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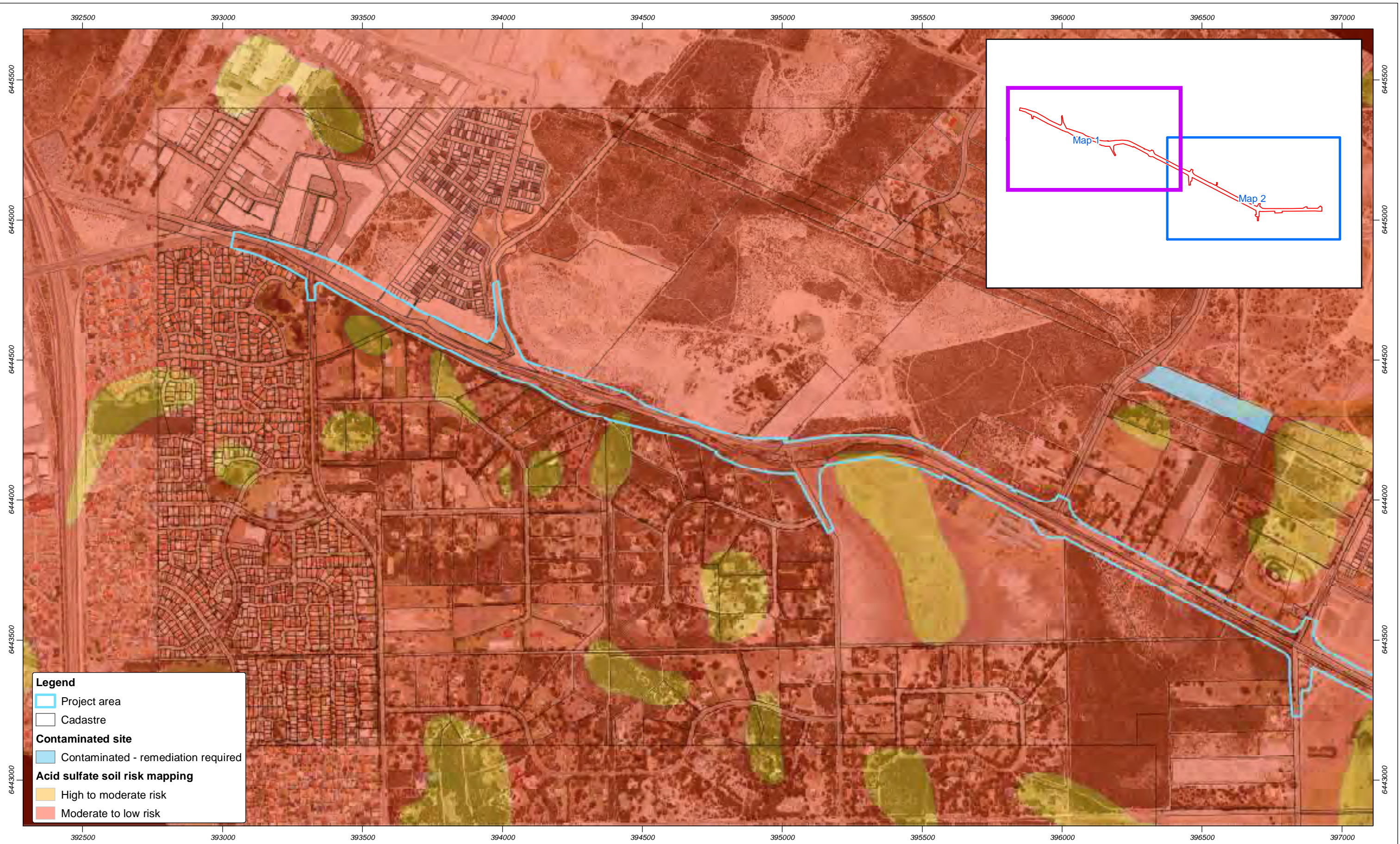
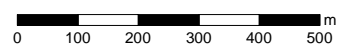


Figure 6: Acid Sulfate Soils and Contamination

Scale 1:12,500 at A3



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 19/05/2017

Author: VDinh
 Source: Aerial image and design: Client 06/2016.

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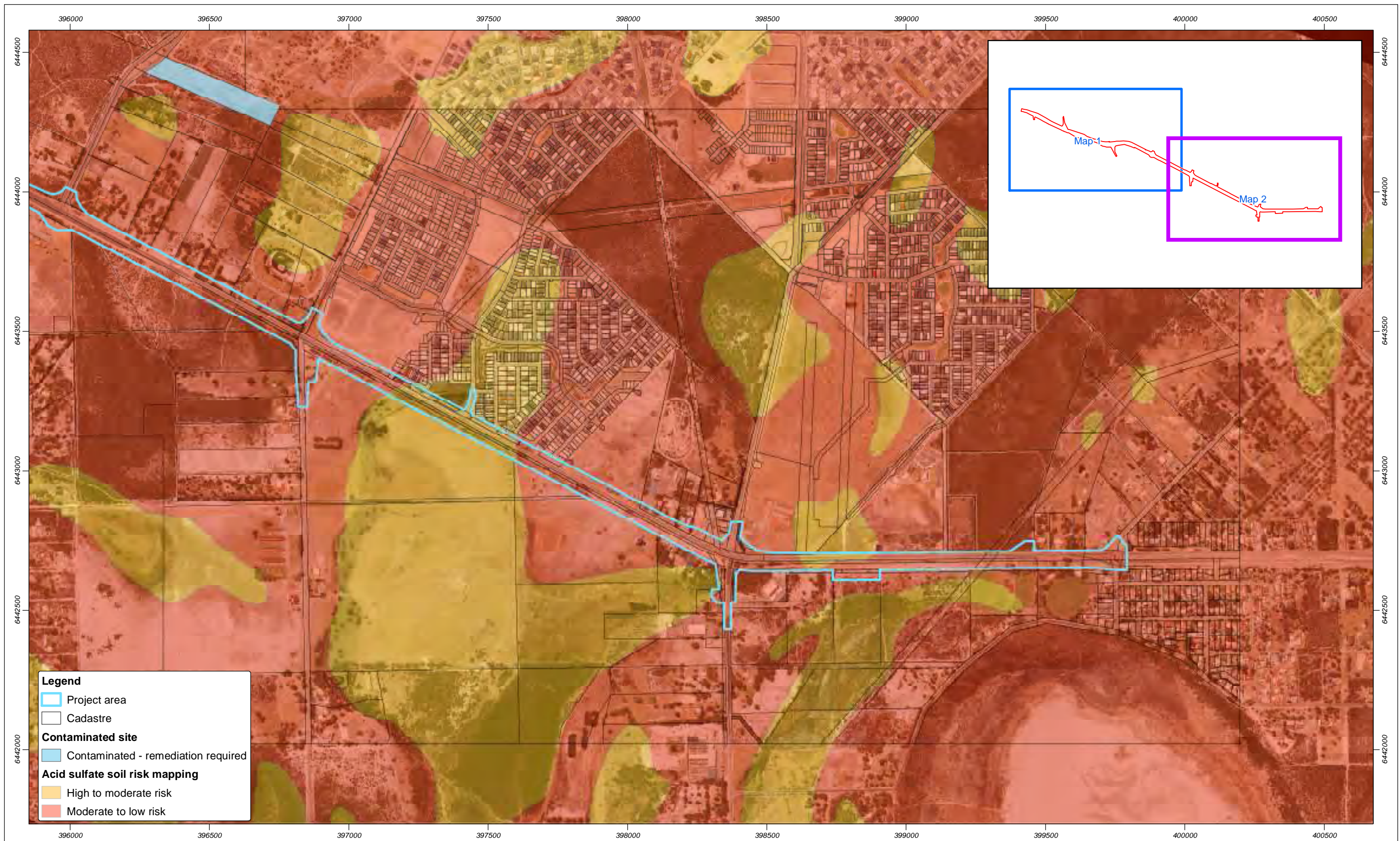
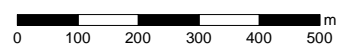


Figure 6: Acid Sulfate Soils and Contamination

Scale 1:12,500 at A3



Coordinate System: GDA 1994 MGA Zone 50
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 Date: 19/05/2017

Author: VDinh
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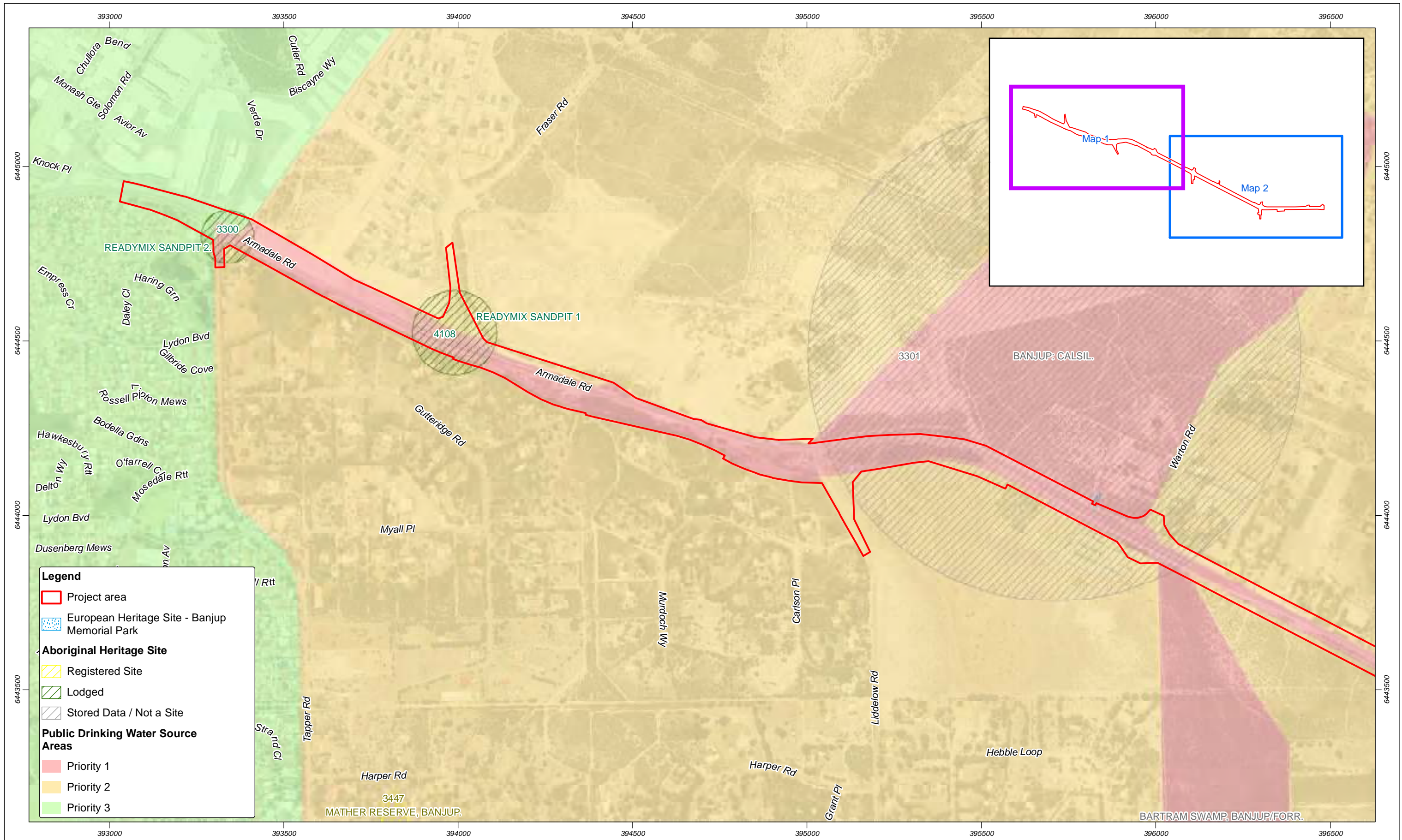


Figure 7: Heritage values and PDWSAs

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 22/05/2017

Author: DWhite

Source: Aerial image and design: Client 06/2016; Aboriginal Heritage Sites: DIA 2016; PDWSA: DoW 2016

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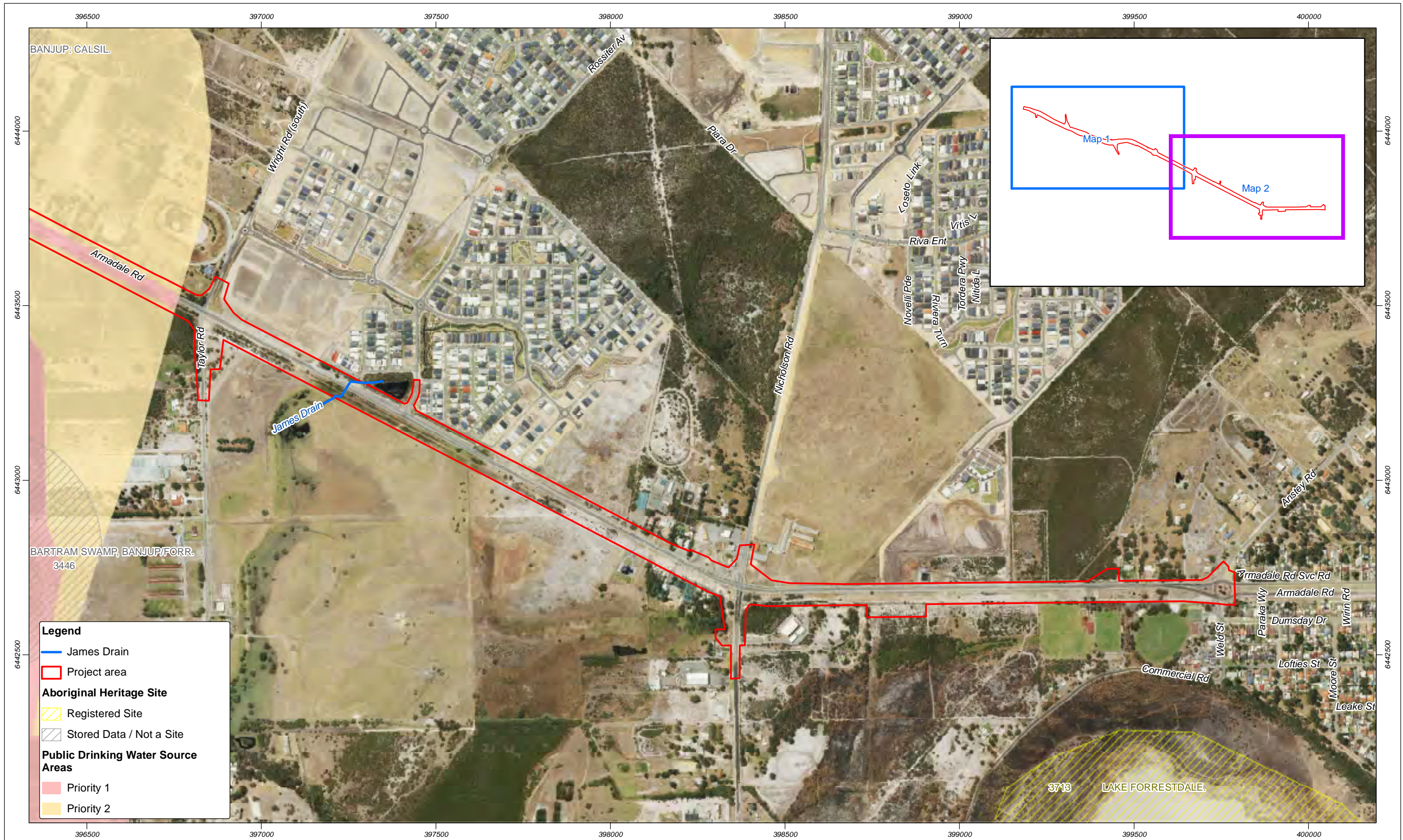


Figure 7: Heritage values and PDWSAs

Scale 1:10,000 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 22/05/2017

Author: DWhite

Source: Aerial image and design: Client 06/2016; Aboriginal Heritage Sites: DIA 2016; PDSWA: DoW 2016

Path: Q:\Consult\2016\MRO\MRO16249\ArcMap_documents\IR005\Rev AMRO16249_01_R003_RevB_F007.mxd

5. Environmental impact assessment

The key environmental and heritage aspects, impacts and proposed management commitments are summarised in Table 9 and are based on results of the desktop assessments and field surveys. Figure 8 includes key constraints located in the Project area. Management commitments have been developed to ensure all anticipated management of impacts are identified to inform the Project Environmental Management Plan, included in Appendix 3.

Table 9: Summary of environmental impacts and management

Aspect	Evaluation of potential impacts	Management commitments
Geology, landform and soils	There are no key impacts relating to geology, landform and soils associated with the Project.	No specific geology, landform and soils management is required.
Vegetation	<p>The Project will result in the clearing of approximately 13.2 ha of native vegetation, comprising:</p> <ul style="list-style-type: none"> • 4.85 ha of <i>Banksia</i> woodland • 2.01 ha of <i>Kunzea glabrescens</i> tall shrubland • 6.26 ha of <i>Melaleuca preissiana</i> • 0.08 ha <i>Beaufortia elegans</i> tall shrublands. <p>An additional area of approximately 6.99 ha of planted vegetation will also be cleared.</p> <p>The Banksia woodland located within the Project area is consistent with the recently Commonwealth listed Banksia woodlands TEC. A total of 4.85 ha of Banksia TEC in 'Good' (1.14 ha) to 'Degraded' (3.71 ha) condition will be impacted by the proposal. This assessment is based on the key characteristics described in the DEE advice relating to the Banksia TEC, the Banksia vegetation association is consistent with the Endangered Banksia woodlands of the Swan Coastal Plain TEC. FCT 23a has a known range of approximately 95 km from Pinjar to Keysbrook along the Bassendean system. FCT 23a is not listed as Threatened or Priority in Western Australia therefore is adequately represented in the Swan Coastal Plain.</p> <p>None of the vegetation proposed to be cleared is comprised wholly or partly within a Priority Ecological Community (PEC).</p> <p>The Banksia Woodland TEC (EPBC Act, WC Act) within the Armadale Road area has been historically cleared to make way for the existing roads and road reserves. The remaining Banksia woodland is therefore highly fragmented and not representative of the more intact Banksia TEC vested in conservation reserves. Therefore clearing Banksia woodland within the Project area is not expected to significantly impact on the conservation status and extent of this TEC.</p>	<p>The following management commitments apply to vegetation:</p> <ul style="list-style-type: none"> • minimise vegetation clearing where possible • a Native Vegetation Clearing Permit (NVCP) is required and offsets may be required • Referral to Department of the Environment and Energy (DEE) (formally Department of the Environment [DotE]) for assessment under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) may be required.
Biodiversity	<p>The Project will result in the removal of:</p> <ul style="list-style-type: none"> • two individuals of Priority flora species <i>Dodonaea hackettiana</i> (P4) • removal of 4.85 ha of Moderate quality Carnaby's black cockatoo foraging habitat. <p>The impacts of the Project on biodiversity values described above are unlikely to be significant due to the nature of the linear duplication, adjacent to the existing Armadale Road. Furthermore, the impacts to biodiversity values can be readily managed through implementation of management commitments described adjacent.</p>	<p>The following management commitments should be implemented:</p> <ul style="list-style-type: none"> • avoid clearing of P4 species if possible • implement fauna mitigation strategies during clearing, construction and operation • minimise the clearing footprint where possible • referral to DEE for assessment under the EPBC Act may be required.
Declared plants (weeds)	<p>A total of 27 road-side weeds were observed. Of these weeds, four are listed as Declared Pests under the <i>Biodiversity and Agriculture Management Act 2007</i> (BAM Act), including the following:</p> <ul style="list-style-type: none"> • *<i>Gomphocarpus fruticosus</i> (Narrow Leaf Cotton Bush) • *<i>Zantedeschia aethiopica</i> (Arum Lily) • *<i>Moraea flaccida</i> (One-Leaf Cape Tulip) • *<i>Rubus</i> sp. (Blackberry). <p>The presence of these weeds within the Project area is not considered significant, ensuring weed and hygiene measures are implemented for the Project.</p>	<p>The following management commitments for hygiene should be implemented:</p> <ul style="list-style-type: none"> • implement a site hygiene management plan, including post-construction management of the Project area • conduct dieback assessment and implement appropriate hygiene management actions.

Aspect	Evaluation of potential impacts	Management commitments
Dieback and other diseases or pathogens	<p>The Project area was not surveyed for dieback. Dieback could potentially be brought onto site as a result of ground disturbance.</p> <p>Impacts to the Project area from dieback are not known, however impacts can be managed through the implementation of hygiene measures.</p>	
Surface water and drainage	<p>The Project area is located in close proximity to the Forrestdale Main Drain and Bailey's Branch Drain, located approximately 1.7 km and 700 m respectively; however these areas will not be directly impacted by the Project. The Project area intersects James Drain therefore this drain may be impacted by the Project.</p> <p>Surface water flows resulting from stormwater can be readily managed through the installation of stormwater and drainage infrastructure, therefore are not expected to be significant.</p>	<p>Drainage design to maintain existing hydrological regime.</p>
Wetlands	<p>The Project area intersects 1.09 ha of the following mapped boundaries of Conservation category Geomorphic wetlands:</p> <ul style="list-style-type: none"> • 0.48 ha of the mapped wetland extent and of Conservation Management Category wetland (UFI 7143), 0.34 ha of which contains vegetation proposed to be cleared • 0.52 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14874), 0.39 ha of which contains vegetation proposed to be cleared • 0.93 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14893), all of which contains vegetation proposed to be cleared. <p>These wetlands have been subject to degradation from weeds and surrounding rural land use activities.</p> <p>Potential hydrological impacts to wetlands will be managed through the installation of drainage structures, complementing the existing Armadale Road alignment. Furthermore, the Project will be designed to minimise the clearing footprint and further manage impacts to surrounding wetlands.</p> <p>Through implementation of the above, impacts to wetlands are not expected to be significant.</p>	<p>Impacts to wetlands can be adequately managed through construction of additional drainage structures as required.</p> <p>Clearing within wetlands and buffers will be minimised where possible.</p> <p>Where construction is proposed within 200 m of the boundary of a "Conservation" or "Resource Enhancement" Management category, liaise with Parks and Wildlife regarding potential wetland impacts (WAPC 2017).</p>
Groundwater	<p>The Project area intersects:</p> <ul style="list-style-type: none"> • Priority 1 (Water Catchment Reservation) • Priority 2 (Rural Water Protection Zone) • Priority 3 areas, as defined in Draft SPP 2.3 - Jandakot Groundwater Protection Policy (Western Australian Planning Commission [WAPC] 2014). <p>The impacts associated with the Project on groundwater are expected to be negligible ensuring drainage structures are constructed and maintained and Project implementation is undertaken consistent with WQPNS.</p>	<ul style="list-style-type: none"> • construction and implementation of the Project should be undertaken in consideration of DoW WQPNS and DoW advice • consult with DoW regarding potential impacts to PDWSA.
Reserves / Conservation areas	<p>Three Bush Forever sites intersect the Project area, including:</p> <ul style="list-style-type: none"> • 0.16 ha of Fraser Road Bushland, Banjup (Site 390) • 0.32 ha of Anstey/Keane Dampland and Adjacent Bushland (Site 342) • 1.20 ha of Gibbs Road Swamp Bushland, Banjup/Forrestdale (Site 344). <p>As the Project is located adjacent to the existing Armadale Road, the additional areas of disturbance proposed will not significantly impact on the integrity of the Bush Forever sites and will not result in fragmentation of these areas.</p>	<p>The following management is required for reserves/conservation areas:</p> <ul style="list-style-type: none"> • avoid clearing within the Bush Forever sites where possible • where this is unavoidable, the clearing footprint should be minimised where possible and consultation with WAPC prior to submission of the NVCP should be undertaken • development application for impacts on Bush Forever sites.

Aspect	Evaluation of potential impacts	Management commitments
Acid sulfate soils	<p>The Project area comprises a portion of:</p> <ul style="list-style-type: none"> 'High to Moderate' probability of occurrence of ASS at depths greater than 3 m from the natural soil surface 'Moderate to Low' probability of occurrence of ASS occurring at depths within 3 m from the natural soil surface. <p>Impacts on the surrounding environment as a result of ASS, are expected to be minimal, ensuring excavation is restricted to above 1-3 m.</p>	<p>The following measures should be implemented for ASS:</p> <ul style="list-style-type: none"> where excavation is proposed below groundwater level (1-3 m), an ASS management plan should be developed and implemented during construction.
Air quality	<p>The impacts of the Project on air quality are not expected to significantly change from those associated with the current Armadale Road.</p>	<p>No specific air quality assessment or management is required.</p>
Contamination	<p>No contaminated sites occur within the Project area. It is unlikely that contamination will be encountered during construction.</p>	<p>No specific contaminated sites management is required. EMP to contain contingency actions for encountering contamination.</p>
Dust	<p>Dust resulting from construction may impact on surrounding sensitive land uses, such as:</p> <ul style="list-style-type: none"> residential (including the former Banjup Quarry) rural and rural residential parks and recreational areas Bush Forever sites. <p>The impacts of dust on sensitive receptors are not likely to be significant with the implementation of dust mitigation during construction and operation.</p>	<p>The following measures should be implemented for dust:</p> <ul style="list-style-type: none"> a dust management plan will be developed for construction activities.
Noise and vibration	<p>The Project may result in minor noise and vibration impacts to nearby sensitive receptors as a result of construction activities; however, these impacts are not expected to be significant. Road traffic noise may increase as a result of the Project.</p>	<p>The following measures should be implemented for the management of noise and vibration:</p> <ul style="list-style-type: none"> develop a noise and vibration management plan to manage impacts associated with construction activities undertake a traffic noise assessment.
Visual amenity	<p>The Project may result in an impact to visual amenity on nearby sensitive receptors, however given the presence of the existing Armadale Road in the current view-shed; the impacts will be similar to those already resulting from the road.</p>	<p>No management commitments are required.</p>
Aboriginal heritage / Native Title	<p>Three 'other heritage places' that intersects the Project area, including:</p> <ul style="list-style-type: none"> Readymix sandpit 2(Site No. 3300), including artefacts, scatters and a camp; the site has been 'lodged', however is not 'registered' Readymix sandpit 1 (Site No. 4108), including artefacts/scatter; the site has been 'lodged', however is not 'registered' Banjup: Calsil (Site No. 3301), including artefacts, scatters and a camp; the site is listed as 'stored data'. <p>Main Roads has consulted with Whadjuk WC2011/009 Native Title Claim group who have confirmed no sites of significance will be impacted by the Project.</p>	<ul style="list-style-type: none"> During induction, all personnel are to be made aware of their obligations under the AH Act. If any human skeletal material is uncovered, work will cease on the site and it will be reported to the Police and DAA
Heritage (non-indigenous)	<p>The Banjup Memorial Park is located directly adjacent to the Project area; however, will not be impacted by the Project. The Project may potentially impact remnants of the Armadale to Fremantle Railway Line at James Drain.</p>	<p>Attempts should be made to retain the remnants of the bridge at James Drain. If retention is not possible then interpretation utilising remnants of the bridge should be explored.</p>
Hazardous substances	<p>Hazardous substances (including refuelling, chemical storage, bitumen and asphalt).</p>	<p>Hazardous substances stored on site will be managed to avoid any potential contamination impacts.</p>

Aspect	Evaluation of potential impacts	Management commitments
Land vesting	The Project is predominantly located on land vested with Main Roads as road reserve, however for land located outside road reserves, Main Roads may be required to purchase land and consult with relevant land owners.	Initiate consultation with land owners where the Project design falls within land not currently vested with Main Roads.

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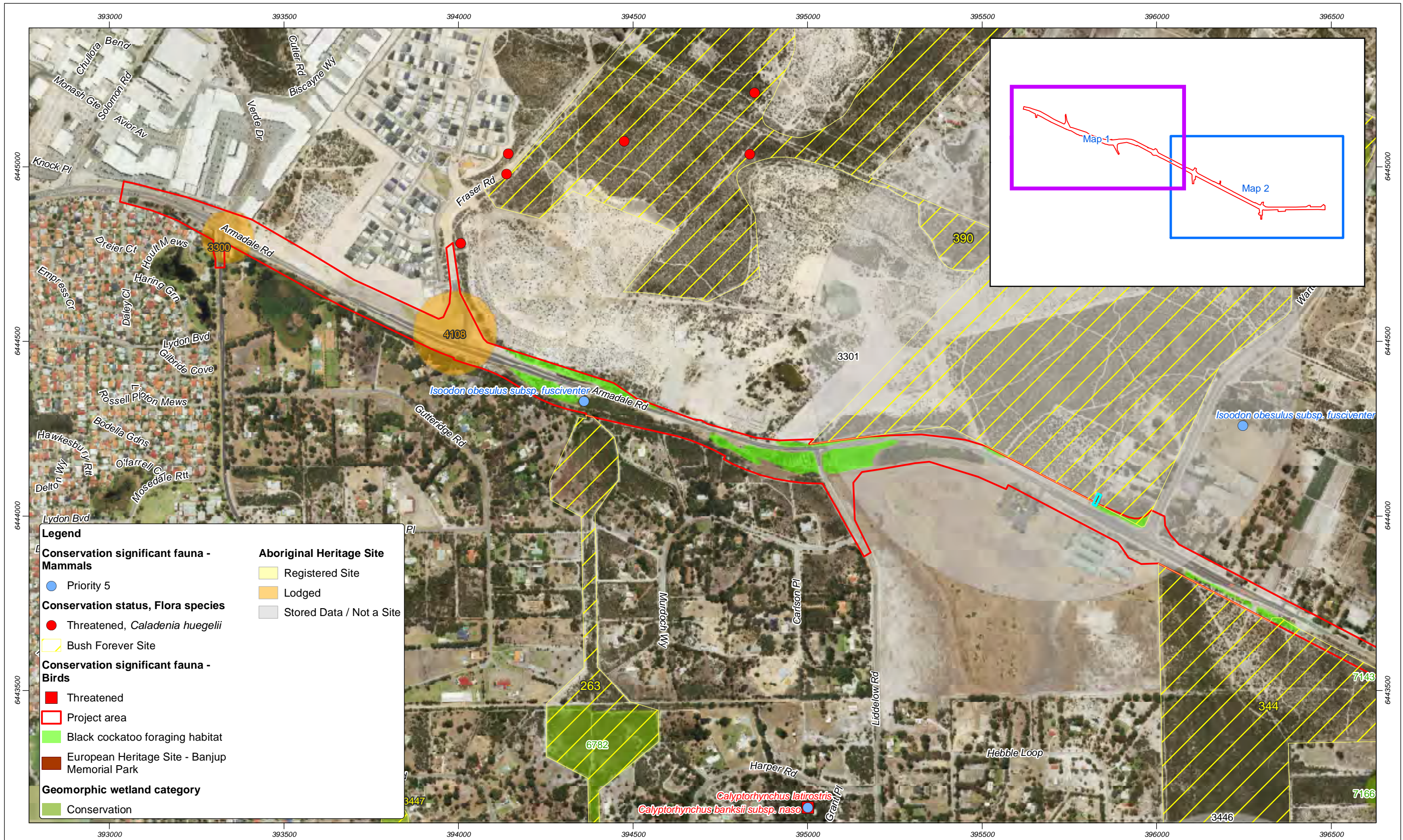


Figure 8: Key constraints

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 29/05/2017

Author: DWhite

Source: Aerial image and design: Client 06/2016.

Path: Q:\Consult\2016\MRO\MRO16249\ArcMap_documents\IR003\MRO16249_01_R003_RevB_F008.mxd



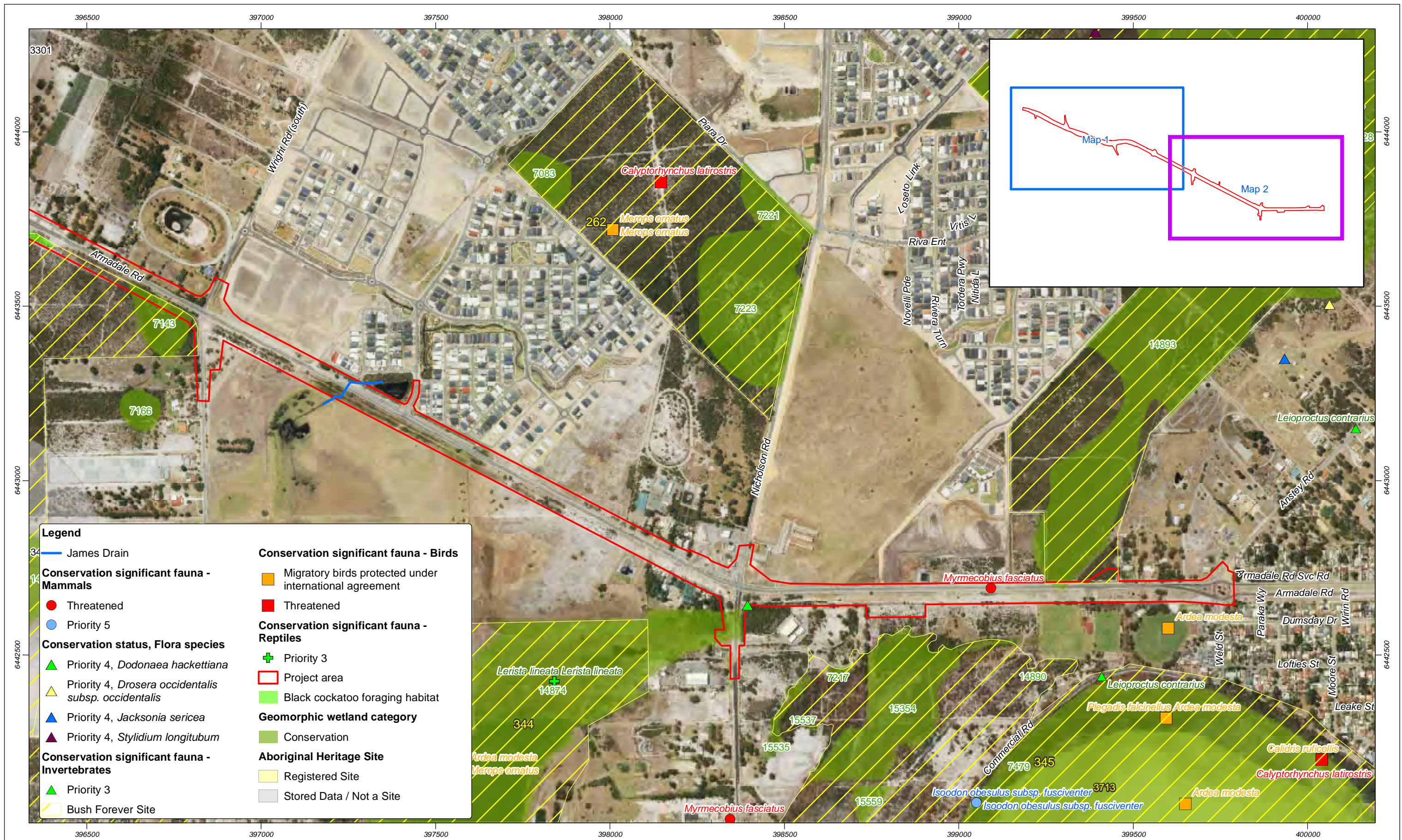


Figure 8: Key constraints

Scale 1:10,000 at A3

0 100 200 300 400 500 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 29/05/2017

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Source: Aerial image and design: Client 06/2016.

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6. Assessment of Matters of National Environmental Significance

A search of the EPBC Act Protected Matters Search Tool was undertaken by Astron (2015) and by Strategen (2017; Appendix 4) to inform the EIA. The search found a number of MNES with the potential to occur within 10 km of the Project area, including two Ramsar wetlands, two TECs, 30 Threatened species and 19 listed Migratory species, listed within Appendix 4;

An assessment of the likelihood of occurrence of each of these MNES within the Project area was undertaken as detailed in Table 10. A number of MNES including threatened species identified in the search are marine species, as the Project area does not comprise a marine area; these species have not been discussed further in the EIA.

Threatened species

Of the threatened species, the following were identified as potentially occurring or likely to occur:

- Forest Red-tailed Black Cockatoo (Vulnerable)
- Carnaby's Black Cockatoo (Endangered)
- Baudin's Black Cockatoo (Vulnerable)
- *Caladenia huegelii* (Endangered)
- *Diuris purdiei* (Endangered)
- *Drakaea elastica* (Endangered)
- *Drakaea micrantha* (Vulnerable).

Threatened Ecological Communities

In addition to the above, the *Banksia woodlands of the Swan Coastal Plain* TEC is likely to be impacted by the Project and has therefore been discussed in Table 10. The TEC was listed under the EPBC Act as 'Endangered' in September 2016.

As detailed in Table 8Table 10, MNES with the potential to be impacted by the Project have been assessed further in Table 9. Based on the findings of the assessment undertaken in and in consideration of the following documentation, the Project is unlikely to have a significant impact on any MNES:

1. DEE (2016) *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plan ecological community*.
2. DSEWPaC (2012) *EPBC Act 1999: Referral Guidelines for three threatened black cockatoo species*.
3. DotE (2013b) *Matters of National Environmental Significance, Significant Impact Guidelines 1.1*.

Referral to DEE for assessment under the EPBC Act will provide certainty to Main Roads regarding Australian Government approval requirements. Further details relating to the anticipated approval requirements are provided in section 9.

Table 10: MNES with the potential to occur in the Project area (within 10 km)

MNES	Conservation status	Suitable habitat	Likelihood of occurrence
Wetlands of international importance			
Forrestdale and Thomsons lakes	-	Forrestdale Lake is located 250 m south of the eastern edge of the Project area. The Project has the potential to impact on the Forrestdale and Thomsons Lakes systems however the Project will be managed to prevent impacts to the Forrestdale and Thomsons Lakes systems through the implementation of drainage measures to maintain existing hydrological regime.	
Peel-Yalgorup system	-	Peel-Yalgorup system is located approximately 30 – 40 km upstream from the Project area.	
Threatened Ecological Communities			
Claypans of the Swan Coastal Plain	Critically Endangered	The Claypans of the Swan Coastal Plain includes a number of TECs listed at the Western Australian level, including the <i>SCP08 - Herb rich shrublands in clay pans</i> . This TEC is located 500 m from the Project area and therefore will not be impacted by the Project.	
Banksia woodlands of the Swan Coastal Plain TEC	Endangered	The Project area comprises 4.85 ha of Banksia woodland consistent with the <i>Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community</i> (DEE 2016), therefore the TEC is likely to be impacted.	
Birds			
Australasian Bittern <i>Botaurus poiciloptilus</i>	Endangered	The species occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds or cutting grass (<i>Gahnia</i>) growing over muddy or peaty substrate (DEE 2017).	Unlikely Potential habitat for the species is present in areas surrounding the Project area in association with wetlands, however given that the majority of the Project area comprises road and associated infrastructure, the species is unlikely to occur.
Red Knot, Knot <i>Calidrus canutus</i>	Endangered	Known habitat for the species includes intertidal mudflats, sandflats and sandy beaches of sheltered coasts. This species is known to occur around the coast of Australia and has a broad distribution. The greatest threat to this species is indirect and direct habitat loss (DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Curlew Sandpiper <i>Calidris ferruginea</i>	Critically Endangered	Known habitat for the species includes intertidal mudflats in sheltered coastal areas, such as estuaries and non-tidal swamps and lakes near the coast (DEE 2017). The species has been recorded less often inland around lakes, dams and bore drains with bare edges of mud or sand (DEE 2017). The distribution of the species is limited by land clearing and disturbance at roost and feeding sites (DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Forest Red-tailed Black-Cockatoo <i>Calyptorhynchus banksii naso</i>	Vulnerable	Known habitat includes remnant <i>Eucalypt</i> woodlands, especially Jarrah, Marri and Karri forest. The species is also known from the Perth metropolitan area and in remnant patches of native vegetation on land cleared for development or agriculture (DEE 2017). The species utilises <i>Corymbia calophylla</i> , * <i>Corymbia citriodora</i> , <i>Allocasuarina fraseriana</i> , <i>Eucalyptus patens</i> and <i>Eucalyptus marginata</i> as a foraging plant and <i>C. calophylla</i> as breeding habitat (DEE 2017).	Known/unlikely to be significant The species was recorded in the Project area. Scattered suitable foraging habitat for the species occurs in the Project area.

MNES	Conservation status	Suitable habitat	Likelihood of occurrence
Baudin's Cockatoo <i>Calyptorhynchus baudinii</i>	Vulnerable	Baudin's Black-Cockatoo mainly occurs in <i>Eucalypt</i> forests, especially Jarrah (<i>E. marginata</i>), Marri (<i>Corymbia calophylla</i>), also Karri (<i>E. diversicolor</i>) forest, less frequently in woodlands of Wandoo (<i>E. wandoo</i>), Blackbutt (<i>Eucalyptus patens</i>), Flooded Gum (<i>Eucalyptus rudis</i>), Yate (<i>Eucalyptus cornuta</i>), partly cleared farmlands and urban areas including roadside trees and house gardens (Johnstone & Kirkby 2008). This cockatoo forages at all levels of the forest, from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially banksias, and in orchards (both in trees and on dropped or fallen fruit on the ground) (Johnstone & Kirkby 2008). Baudin's Black-Cockatoo breeds in the Jarrah, Marri and Karri forests of the far south-west in areas averaging more than 750 mm of rainfall annually. Breeding generally occurs in woodland or forest, but may also occur in former woodland or forest now present as isolated trees. Nesting occurs in hollows in live or dead trees of Karri, Marri, Wandoo and Tuart (DSEWPac 2012b). During the breeding season feeding primarily occurs in native vegetation, particularly Marri (DSEWPac 2012b).	Possible/unlikely to be significant Some scattered suitable habitat for the species occurs in the Project area.
Carnaby's Black-Cockatoo <i>Calyptorhynchus latirostris</i>	Endangered	Known habitat includes remnant <i>Eucalypt</i> woodlands, and shrubland or Kwongan heathland dominated by proteaceous species. The species is also known from the Perth metropolitan area and in remnant patches of native vegetation on land cleared for agriculture (DotE 2015b). The species is known to utilise <i>C. calophylla</i> , * <i>C. citriodora</i> , <i>E. patens</i> , <i>E. marginata</i> , <i>X. preissii</i> , <i>A. fraseriana</i> as a foraging plant, <i>C. calophylla</i> as breeding habitat and <i>C. calophylla</i> and <i>E. marginata</i> as roosting habitat (DEC 2011).	Likely/unlikely to be significant The species is likely to use the Project area in areas of <i>Banksia</i> woodland.
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	The Malleefowl occurs in semi-arid and arid zones of temperate Australia, where it occupies shrublands and low woodlands that are dominated by mallee vegetation. It also occurs in other habitat types including eucalypt or native pine <i>Callitris</i> woodlands, acacia shrublands, Broombush <i>Melaleuca uncinata</i> vegetation or coastal heathlands (DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Eastern Curlew, Far Eastern Curlew <i>Numenius madagascariensis</i>	Critically Endangered	During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes within the mangroves. The birds are also found in coastal saltworks and sewage farms (DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Fairy Prion (southern) <i>Pachyptila turtur subantarctica</i>	Vulnerable	Mostly accommodates temperate and sub-Antarctic seas. This species can sometimes forage over continental shelves and the continental slope but can be found inshore in rough weather. Breeding occurs on islands and rock stacks, burrowing in crevices or rock caves. It has also been known to nest in scrub, hermland, tussock or pasture (DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Australian Painted Snipe <i>Rostratula australia</i>	Endangered	Australian Painted Snipe generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or sapphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (<i>Melaleuca</i>) (DEE 2017).	Unlikely This species may occur in the Project area, however due to the lack of wetlands within the Project area it is unlikely the Australian Painted Snipe will occur.

Insects

MNES	Conservation status	Suitable habitat	Likelihood of occurrence
Short-tongued bee <i>Leioproctus douglasiellus</i>	Critically Endangered	The species is known to occur in Western Australia from Cannington to Forrestdale. Specimens of <i>Leioproctus douglasiellus</i> have been collected on two plant species <i>Goodenia filiformis</i> and <i>Anthotium junciforme</i> which are not located within the Project Area.	Unlikely The Project area does not contain habitat species, on this basis the species is not likely to occur in the Project area.
Native bee <i>Neopasiphae simplicior</i>	Critically Endangered	<i>Neopasiphae simplicior</i> is endemic to Western Australia and occurs as a single population in the Forrestdale Lake Nature Reserve (DEE 2017). The species has been collected only at flowers of Thread-leaved Goodenia (<i>Goodenia filiformis</i>), a perennial herb, Slender Lobelia (<i>Lobelia tenulor</i>), an annual herb, <i>Angianthus preissianus</i> (males only), an annual herb, and <i>Velleia</i> sp (Western Australian Herbarium 1998-, DEE 2017).	Unlikely The species is known to occur in a single population in the Forrestdale Lake Nature Reserve 250m from the Project area. The Project area does not contain habitat species. On the basis <i>Neopasiphae simplicior</i> is highly mobile and habitat is not contained within the Project area, this species is unlikely to occur in the Project area.
Mammals			
Brush-tailed Bettong, Woylie <i>Bettongia penicillata</i>	Endangered	Open forest and woodland with a low understorey of tussock grasses or woody scrub. Formerly occurred in a wider range of habitats including spinifex hummock grasslands (DPaW n.d.). The species has been reduced to 1% of its pre-European range and currently only exists in isolated pockets in uninhabited vegetation (DEE 2017).	Unlikely The Woylie may occur in the Project area, however it is considered unlikely due to the previous disturbance associated with road infrastructure.
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Current habitat largely restricted to the southwest forests. The distribution of the species is limited by land clearing and predation by feral cats and foxes (DEE 2017).	Unlikely The Chuditch may occur in the Project area, however it is considered unlikely due to the previous disturbance associated with road infrastructure and adjacent land uses.
Western Ringtail Possum <i>Pseudocheirus occidentalis</i>	Vulnerable	Habitat for this species is generally within areas of forest or woodland containing Peppermint trees; <i>Agonis flexuosa</i> (DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Quokka <i>Setonix brachyurus</i>	Vulnerable	The Quokka is a habitat specialist, preferring early seral (young) vegetation stages that have been burned within the previous ten years. The Quokka also has relatively high water requirements, which necessitates close proximity to fresh water throughout the year. Hence, the species is often present in riparian and swamp habitat DEE 2017).	Unlikely No suitable habitat for the species occurs in the Project area therefore the species is unlikely to occur.
Plants			
Slender Andersonia <i>Andersonia gracilis</i>	Endangered	Flowers are white to pink to purple from September to November. Habitat for this species occurs in white/grey sand, sandy clay, gravelly loam within winter-wet areas and near swamps (Western Australian Herbarium 1998-).	Unlikely No suitable habitat for the species occurs in the Project area; therefore the species is unlikely to occur.
King Spider-orchid <i>Caladenia huegelii</i>	Endangered	Habitat for this species occurs within well-drained, deep sandy soils in low mixed <i>Banksia</i> , <i>Allocasuarina</i> and Jarrah woodlands (Western Australian Herbarium 1998-, DEE 2017).	Possible/unlikely to be significant Potential suitable habitat for the species occurs in the Project area, therefore the species may occur.

MNES	Conservation status	Suitable habitat	Likelihood of occurrence
Dwarf Bee-orchid <i>Diuris micrantha</i>	Vulnerable	Flowers are yellow with reddish-brown markings and visible from September to October. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DEE 2017).	Possible/unlikely to be significant No suitable habitat for the species occurs in the Project area; therefore the species is unlikely to occur.
Purdie's Donkey-orchid <i>Diuris purdiei</i>	Endangered	Flowers are yellow and visible from September to October. Habitat for this species is grey-black sand substrates in winter-wet swamps which have high moisture (Western Australian Herbarium 1998-). <i>Diuris purdiei</i> occurs from Perth south to near the Whicher Range, within the Swan Region. It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent <i>Melaleuca preissiana</i> , <i>Eucalyptus calophylla</i> , <i>E. marginata</i> and <i>Nuytsia floribunda</i> (DEE 2017).	Possible/unlikely to be significant Potential suitable habitat for the species occurs in the Project area, therefore the species may occur.
Glossy-leafed Hammer-orchid <i>Drakaea elastica</i>	Endangered	<i>Drakaea elastica</i> is currently known only from the Swan Coastal Plain over a range of approximately 350 km between Cataby in the north and Busselton in the south. The species is known to grow on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps (DEE 2017). The species typically grows in <i>Banksia</i> (<i>Banksia menziesii</i> , <i>B. attenuata</i> and <i>B. ilicifolia</i>) woodland or Spearwood (<i>Kunzea glabrescens</i>) thicket vegetation.	Possible/unlikely to be significant Potential suitable habitat for the species occurs in the Project area, therefore the species may occur.
Dwarf Hammer-orchid <i>Drakaea micrantha</i>	Vulnerable	Flowering occurs from September to October. Habitat for this species occurs within cleared firebreaks or open sandy patches that have been disturbed, where competition from other plants has been removed (Western Australian Herbarium 1998-, DotE 2015b).	Possible/unlikely to be significant Potential suitable habitat for the species occurs in the Project area, therefore the species may occur.
Keighery's Eleocharis <i>Eleocharis keigheryi</i>	Vulnerable	This species grows in small clumps in a substrate of clay or sandy loam. This species is emergent in freshwater creeks, and transient waterbodies such as drainage lines and claypans in water to approximately 15 cm deep. Fringing woodland species and associated species include Swamp Sheoak (<i>Casuarina obesa</i>), Flooded Gum (<i>Eucalyptus rudis</i>), Red Robin Bush (<i>Melaleuca lateritia</i>), Swamp Paperbark (<i>M. raphiophylla</i>), Common Spike-sedge (<i>Eleocharis acuta</i>), Aponogeton hexatepalus, Veined Swamp Wallaby Grass (<i>Amphibromus nervosus</i>) and herbs such as Wurmbea, Tribonanthes and <i>Leptocarpus</i> spp. (Western Australian Herbarium 1998-, DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.
Cadda Road Mallee <i>Eucalyptus balanites</i>	Endangered	A mallee up to 500 cm tall with rough, flaky bark. Flowers are white, occurring from October to December or January to February. Habitat for this species occurs in sandy soils with lateritic gravel (Western Australian Herbarium 1998-).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.
Narrow curved-leaf Grevillea <i>Grevillea curviloba</i> subsp. <i>incurva</i>	Endangered	Habitat for this species is sand and sandy loam substrates in winter-wet heath (Western Australian Herbarium 1998-). Flowering occurs from September to October. This species is confined to an area between Muchea and Badgingarra and grows in open heath in winter-wet areas on sand over limestone, or over ironstone at sites with a high water table. It is associated with the 'shrublands and woodlands on Perth to Gingin Ironstone' ('Northern Ironstone') and the 'Shrublands and Woodlands on Muchea Limestone' communities. These are both threatened ecological communities (DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.
Beaked Lepidosperma <i>Lepidosperma rostratum</i>	Endangered	Flowers are brown and flowering occurs from May to June. Habitat for this species occurs in peaty sand or clay and within seasonally wet swamps (Western Australian Herbarium 1998-, DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.

MNES	Conservation status	Suitable habitat	Likelihood of occurrence
Selena's Synaphea <i>Synaphea sp. Fairbridge Farm</i>	Critically Endangered	Habitat for the species occurs on grey, clayey sand with lateritic pebbles in low woodland areas near winter-wet flats. Two subpopulations occur in seasonally wet Swamp Teatree (<i>Pericalymma ellipticum</i>) dominated shrubland, with Teatrees (<i>Leptospermum sp.</i>), Blue Lechenaultia (<i>Lechenaultia biloba</i>), Semaphore Sedge (<i>Mesomelaena tetragona</i>), <i>Adenanthos meisneri</i> , White Myrtle (<i>Hypocalymma angustifolium</i>) and Dwarf Sheoak (<i>Allocasuarina humilis</i>) (DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.
Dwellingup Synaphea <i>Synaphea stenoloba</i>	Endangered,	The Dwellingup Synaphea is a compact shrub that can grow to 50 cm high. The leaves are 5–40 cm long and tripinnate. The inflorescences are yellow and borne above the leaves to a height of 15 cm. Flowers can be seen in August but occur mainly from September to October (Western Australian Herbarium 2006). The Dwellingup Synaphea occurs on loamy soils in low lying areas that are occasionally inundated. Associated vegetation is generally swampy heath to 1 m high with scattered emergent Christmas Tree (<i>Nuytsia floribunda</i>). Field evidence suggests that the condition of the plants deteriorates following inundation of the habitat (DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.
Cinnamon Sun Orchid <i>Thelymitra dedmaniarum</i>	Endangered	Flowers are yellow and have a strong cinnamon odour, occurring from November to December or January. This species inhabits open wandoo woodland on red-brown sandy loam, associated with dolerite and granite outcropping (Western Australian Herbarium 1998-, DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.
Star Sun-orchid <i>Thelymitra stellata</i>	Endangered	Flowering occurs from October to November. A single, broad lily-like leaf, up to 9 cm long and 4 cm wide clasps the stem at the base. Habitat for this species is within sand, gravel, and lateritic loam on ridges, slopes, flats, riverbanks and breakaways (Western Australian Herbarium 1998-, DEE 2017).	Unlikely Suitable habitat does not occur in the Project area therefore this species is unlikely to occur.

Table 11 Assessment of Impacts on Banksia Woodlands of the Swan Coastal Plan ecological community

Impact Consideration	Impact Significance
Will the action reduce the extent of an ecological community?	<p>The proposed action will involve the clearing of up to 4.85 ha of Banksia Woodland TEC comprising 3.71 ha in Degraded and 1.14 ha in Good condition. Vegetation proposed to be cleared is fragmented comprising of small areas of vegetation associated with the existing road reserve and is intersected by cleared land and areas of planted vegetation.</p> <p>The Banksia Woodland TEC is well represented and protected within a number of conservation reserves located in close proximity to the proposed action area as shown in Figure 6a and Figure 6b, including:</p> <ul style="list-style-type: none"> • 35.87 ha of Fraser Road Bushland, Banjup (Bush Forever Site 390) • 26.59 ha of Anstey/Keane Dampland and Adjacent Bushland (Bush Forever Site 342) • 36.38 ha of Gibbs Road Swamp Bushland, Banjup/Forrestdale (Bush Forever Site 344) • 14.28 ha of Dennis De Young Reserve and Forrestdale Lake and Adjacent Bushland, Forrestdale (Bush Forever Site 345) • 41.26 ha of Piara Nature Reserve, Forrestdale (Bush Forever Site 262) • 5226.68 ha of Rosella Road Bushland, Bullsbrook (Bush Forever Site 380). <p>Given that the known extent of the TEC within the proposed action area is comprised of small areas adjacent to an existing road reserve and given that large areas of the TEC are protected in adjacent conservation areas, the proposed action is considered unlikely to significantly reduce the extent of the Banksia woodland TEC.</p>

<p>Will the action fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?</p>	<p>The proposed action will involve the clearing of up to 3.71 ha of Degraded and 1.14 ha of Good condition Banksia Woodland TEC to allow for the widening of an existing road. The vegetation proposed to be cleared is of a linear nature and is comprised of small fragmented areas of the TEC. Because of existing road and the demonstrated connectivity with the adjacent conservation areas, the clearing of the TEC areas will not affect the connectivity of the community, and the habitat it provides, with surrounding vegetation.</p> <p>Given the large areas of the TEC that are protected in the local area, the proposed action area will not specifically increase fragmentation of the ecological community.</p>
<p>Will the action adversely affect habitat critical to the survival of an ecological community?</p>	<p>The proposed action will involve the clearing of up to 3.71 ha of Degraded and 1.14 ha of Good condition Banksia Woodland TEC. Due to the fragmented nature of the vegetation and the extent of the TEC protected within close proximity to the proposed action, the proposed action is unlikely to adversely affect habitat critical to the survival of the ecological community as the proposed clearing only represents a small portion of the Banksia Woodland TEC located in the local area.</p> <p>Measures will also be undertaken during construction to ensure that retained areas and adjacent conservation reserves that are likely to contain the TEC are not adversely impact by the Project.</p>
<p>Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?</p>	<p>The impacts are confined to the clearing of 4.85 ha of the community. The proposed action does not represent a threat to the survival of patches of the ecological community that will be retained in adjacent areas.</p>
<p>Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?</p>	<p>While the proposed action will clear up to up 3.71 ha of Degraded and 1.14 ha of Good quality Banksia Woodland TEC, extensive areas of Banksia Woodland TEC are also available within large conservation reserves surrounding the Project area; therefore, it is unlikely that the proposed action will cause a substantial change to the ecological community.</p> <p>Vegetation proposed to be cleared is comprised of small, isolated areas of vegetation adjacent to existing road reserves and contains 27 road-side weeds (Astron 2015).</p> <p>Disturbance for the proposed action is therefore unlikely to cause a substantial change in the species composition of the ecological community.</p>
<p>Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <ul style="list-style-type: none"> – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community? 	<p>The clearing of this vegetation will not cause a substantial reduction on the quality or integrity of an occurrence of the ecological community. Main Roads will install road drainage to minimise any potential impact from stormwater or wastewater on adjacent land. A total of 27 road-side weeds were observed during the biological survey (Astron 2015). Removal of this vegetation will not affect the likelihood of establishment of weed species.</p>
<p>Will the action interfere with the recovery of an ecological community?</p>	<p>The proposed action is unlikely to interfere with the recovery of the ecological community, given the amount of Banksia Woodland TEC retained within local conservation areas.</p>

The Project will result in the clearing of 4.85 ha of black cockatoo foraging habitat but no removal of potentially significant trees. There are two relevant Commonwealth policy documents which provide guidance for the evaluation of significant impacts on black cockatoo species:

1. DSEWPaC (2012) EPBC Act 1999: *Referral Guidelines for three threatened black cockatoo species*.
2. DotE (2013b) *Matters of National Environmental Significance, Significant Impact Guidelines 1.1*.

An evaluation of the proposed action against each of these guidelines is provided below. Table 12 assesses the proposed action against referral triggers identified in the Referral Guidelines for black cockatoos.

Table 12: Assessment of the proposed action against the black cockatoo Referral Guidelines

Referral trigger	Assessment of proposed action against referral trigger
Clearing of any known nesting tree	The proposed action will not result in the clearing of any known nesting trees. No evidence that trees have been used or were currently being used by black cockatoos for nesting purposes was recorded within the proposed action area.
Clearing or degradation of any part of a vegetation community known to contain breeding habitat	No active nests were recorded within the proposed action area. All Tuart trees will be retained on the site.
Clearing or degradation of more than 1 ha of quality foraging habitat	Up to 4.85 ha of moderate to poor quality black cockatoo foraging habitat may be cleared as a result of the proposal.
Clearing or degradation of a known night roosting tree	The proposed action will not result in the clearing of any known roosting trees. No known night roosting trees have been recorded within the proposed action area.
Creating a gap of more than 4 km between patches of black cockatoo habitat	The proposed action area is located in close proximity to a number of existing reserves containing potential black cockatoo habitat including: <ul style="list-style-type: none"> • 35.87 ha of Fraser Road Bushland, Banjup (Bush Forever Site 390) • 26.59 ha of Anstey/Keane Dampland and Adjacent Bushland (Bush Forever Site 342) • 36.38 ha of Gibbs Road Swamp Bushland, Banjup/Forrestdale (Bush Forever Site 344) • 14.28 ha of Dennis De Young Reserve and Forrestdale Lake and Adjacent Bushland, Forrestdale (Bush Forever Site 345) • 41.26 ha of Piara Nature Reserve, Forrestdale (Bush Forever Site 262) • 5226.68 of Rosella Road Bushland, Bullsbrook (Bush Forever Site 380). As such, the proposal will not create a gap of more than 1 km between patches of habitat.

An assessment of the proposed action on Carnaby's Black Cockatoo is detailed in Table 13, with reference to the Significant Impact Guidelines (DotE 2013b).

Table 13: Assessment of potential impacts to black cockatoos against significant impact criteria

Will the action lead to a long-term decrease in the size of an important population of a species?	<p>The Project is located in close proximity to six Bush Forever sites and other conservation reserves, including the Thomsons Lake and Forrestdale Lake systems, that provide quality foraging habitat and known breeding and roosting trees. Additionally, a desktop review of the DPaW Black Cockatoo database shows that the Project area occurs within 13.5 km of a confirmed breeding site and contains 23 confirmed roost records within 6 km of the Project area (Astron 2015).</p> <p>The Proposed action comprises Moderate to Very Poor potential foraging and breeding habitat for Black Cockatoos. No potential breeding or roosting habitat was found in the Project area. Black cockatoos would potentially utilise the Bush Forever sites and surrounding vegetation in the wider area for foraging and potential breeding activities.</p> <p>Given that the habitat proposed to be cleared is of Moderate to Very Poor quality and small in size (4.85 ha) and does not comprise habitat important for survival of the species, the action is unlikely to result in a long-term decrease in the size of an important population for the species.</p>
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<p>Will the action reduce the area of occupancy of an important population?</p>	<p>The site's current habitat value is limited in both scale and value and is not considered to be important for Black Cockatoos. The proposed action will impact on a total of 4.85 ha Moderate to Very Poor quality potential foraging habitat. No potential breeding or roosting habitat was found in the Project area.</p> <p>Given the low quality and small size of habitat removal, absence of breeding or roosting trees, this habitat is not an important area of occupancy for the species. The habitat proposed to be removed is limited in comparison to the habitat available within conservation reserves in close proximity.</p>
<p>Will the action fragment an existing important population into two or more populations?</p>	<p>The site's current habitat value is limited in both scale and value and is not considered to be important for Black Cockatoos. The Proposed action will not result in fragmentation of an existing important population. The habitat to be cleared within the Proposal site is highly fragmented and surrounding reserves are located in close proximity to the proposed action. Black cockatoos are highly mobile and the area of the proposed clearing will not present a barrier to movement between these reserves and is therefore not likely to fragment populations.</p>
<p>Will the action adversely affect habitat critical to the survival of a species?</p>	<p>The site's current habitat value is limited in both scale and value and is not considered critical to the survival of Black Cockatoo species. The site is adjacent to extensive Black Cockatoo habitat associated with Bush Forever Sites and Conservation reserves.</p> <p>Potential impacts are not anticipated to affect the conservation status of black cockatoos. The proposed impact to 4.85 ha of Moderate to Very Poor Quality foraging habitat with no impacts to potential breeding or roosting habitat, limits the impact of the proposed clearing.</p>
<p>Will the action disrupt the breeding cycle of an important population?</p>	<p>No potential breeding or roosting habitat was found in the Project area as no trees exhibit potential breeding hollows, no trees are considered to be future breeding habitat (diameter at breast height [DBH], greater than 50 cm or no breeding hollows) and no roosting habitat was identified during the survey (Astron 2015; Strategen 2016; Strategen 2017).</p> <p>The action will not disrupt breeding due to the absence of breeding habitat.</p>
<p>Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?</p>	<p>The site's current habitat value is limited in both scale and value and is not considered to be important for Black Cockatoos. Given the proximity of the Proposed action (directly adjacent) to the reserved vegetation and surrounding conservation reserves, it is considered highly unlikely that removal of 4.85 ha Moderate to Very Poor quality black cockatoo foraging habitat will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
<p>Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?</p>	<p>The Proposal will not result in impacts by invasive species relative to the current land use. The Proposal site is currently largely cleared and degraded land supporting an existing road corridor. The Project will include treatment of invasive species around areas of adjacent vegetation to reduce the extent and ongoing threat of invasive species to the retained habitat values.</p>
<p>Will the action introduce disease that may cause the species to decline?</p>	<p>A dieback survey has not been undertaken; however, the area is highly disturbed. The Proposed action is therefore unlikely to introduce new plant diseases to the Proposal site or adjacent reserves. The Proposal site is primarily cleared therefore any risk of dieback is minimised.</p>
<p>Will the action interfere substantially with the recovery of the species?</p>	<p>The FRTBC (Baudin's Cockatoo <i>Calyptorhynchus baudinii</i> and Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i>) Recovery Plan (DEC; DotE 2008) includes the following success criteria:</p> <ul style="list-style-type: none"> * the extent of occurrence of Forest Black Cockatoos in Western Australia remains stable or increases in the next ten years * the number of breeding pairs of Forest Black Cockatoos in Western Australia remains stable or increases in the next ten years * the number of Forest Black Cockatoos in each roosting flock remains stable or increases in the next ten years * the proportion of juvenile Forest Black Cockatoos in each roosting flock remains stable or increases in the next ten years. <p>Removal of approximately 4.85 ha (comprising moderate to Very Poor quality) potential foraging habitat will not significantly impact on achieving the above success criteria, therefore will not interfere with the recovery of the species.</p>

Table 14: Summary assessment of MNES potentially occurring in the Project area

MNES	Name	Existing environment and likely impact	Justification of likely impact	Methodology
Nationally listed ecological communities	Banksia woodlands of the Swan Coastal Plain TEC	<p>Unlikely to be significant</p> <p>The Project area comprises 4.85 ha of Banksia woodland of 'Good' to 'Degraded' condition.</p>	<p>The <i>Banksia</i> woodland vegetation association is consistent with the Endangered <i>Banksia</i> woodlands of the Swan Coastal Plain TEC; therefore up to 4.85 ha of the TEC will be cleared as a result of the Project.</p> <p>Clearing of 4.85 ha Banksia Woodland TEC resembling FCT 23a (Central <i>Banksia attenuata</i> – <i>Banksia menziesii</i> woodlands) comprising of 1.14 ha in Good and 3.71 ha in Degraded condition. The environmental outcome is not likely to result in a significant impact given that the known extent of the TEC within the proposed action:</p> <ul style="list-style-type: none"> • is highly fragmented • is comprised of small areas adjacent to an existing road within an established road reserve • impacts on the edge of larger areas of the TEC • is in close proximity to the TEC protected in adjacent conservation areas • The FCT 23a is not rare as it is not listed as Threatened or Priority in Western Australia therefore is adequately represented in the Swan Coastal Plain. <p>The proposed action is therefore considered unlikely to significantly reduce the extent of the TEC.</p>	<p>A review of the Banksia woodland vegetation association occurring within the Project area was undertaken against the <i>Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community</i> (DEE 2016).</p> <p>Based on the key characteristics described in the DEE advice relating to the Banksia TEC, the Banksia vegetation association is consistent with the Endangered Banksia woodlands of the Swan Coastal Plain TEC; therefore up to 4.85 ha of the TEC will be cleared as a result of the Project.</p>
Nationally listed threatened species	<p>Forest Red-tailed Black Cockatoo Vulnerable: EPBC Act</p> <p>Carnaby's Black Cockatoo Endangered: EPBC Act</p>	<p>Possible/unlikely to be significant</p> <p>Evidence of foraging by the Forest Red-tailed Black Cockatoo was found in the Project area, specifically chewed fruit of Marri (Astron 2015).</p> <p>No evidence of Carnaby's Black Cockatoo or Baudin's Black Cockatoo using the Project area was found during the surveys. Despite this, it is highly likely that Carnaby's Black Cockatoo occur in the Project area.</p> <p>The Project area comprises 4.85 ha of <i>Banksia</i> woodland habitat, providing 'quality' foraging habitat for primarily Carnaby's Black</p>	<p>The Project will result in the following:</p> <ul style="list-style-type: none"> • clearance of approximately 4.85 ha of Moderate quality foraging habitat for the Carnaby's black cockatoo • the Project will not result in the removal of any known or future breeding or roosting trees. <p>The Project area provides 4.85 ha of Moderate quality foraging habitat for the Carnaby's Black-Cockatoo comprising: Banksia Woodland with <i>Banksia attenuata</i>, <i>B. menziesii</i>, <i>B. ilicifolia</i>, <i>Eucalyptus marginata</i>, <i>Xanthorrhoea preissii</i>, <i>Allocasuarina fraseriana</i>.</p> <p>No potential breeding or roosting habitat was found in the Project area as no trees exhibit potential breeding hollows, no trees are</p>	<p>An assessment of the likely impacts on black cockatoos was undertaken in consideration of following key documents:</p> <ul style="list-style-type: none"> • Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (DotE 2013b) • EPBC Act Referral Guidelines for three Threatened black cockatoo species: Carnaby's cockatoo, Baudin's cockatoo and Forest red-tailed black cockatoo (DSEWPac 2012; pers. Comm. DotE, 27 May 2016).

MNES	Name	Existing environment and likely impact	Justification of likely impact	Methodology
	<p>Baudin's Black Cockatoo</p> <p>Vulnerable: EPBC Act</p>	<p>Cockatoo, however does also provide some scattered habitat for Forest Red-tail and Baudin's Cockatoo in both Banksia and Kunzea vegetation associations.</p> <p>No potential breeding or roosting habitat was found in the Project area, as no trees exhibit potential breeding hollows, or are considered to be future breeding habitat (diameter at breast height, greater than 50 cm).</p>	<p>considered to be future breeding habitat (diameter at breast height [DBH], greater than 50 cm or no breeding hollows) and no roosting habitat was identified during the survey (Astron 2015; Strategen 2016; Strategen 2017).</p> <p>The Project is located in close proximity to six Bush Forever sites and other conservation reserves, including the Thomsons Lake and Forrestdale Lake systems, that provide quality foraging habitat and known breeding and roosting trees. Additionally, a desktop review of the DPaW Black Cockatoo database shows that the Project area occurs within 13.5 km of a confirmed breeding site and contains 23 confirmed roost records within 6 km of the Project area (Astron 2015).</p> <p>The Project will involve duplication of the existing Armadale Road therefore the removal of foraging habitat will not fragment existing foraging resources. Furthermore, the proposed clearing will not prevent a barrier to movement across the Bush Forever sites and the Thomsons Lake and Forrestdale Lake systems.</p> <p>Given that the habitat to be removed is not a large area of intact vegetation and there are no current or potential future breeding trees, it is unlikely that clearing of this habitat will result in a significant impact to Carnaby's Black Cockatoo.</p> <p>As the Project will involve duplication of the existing Armadale Road, any removal of foraging habitat will not fragment existing foraging resources, therefore not preventing a barrier to movement across surrounding Bush Forever sites and reserves. Based on the above, the Project is unlikely to significantly impact on the diversity, viability and ecological function of terrestrial fauna known to occur or potentially occurring in the Project area.</p>	
	<p><i>Caladenia huegelii</i></p> <p>Endangered EPBC Act</p>	<p>Possible/unlikely to be significant</p> <p>Suitable habitat for the species occurs in Banksia woodland, comprising 4.85 ha of the Project area.</p>	<p>The species was not recorded during the Astron (2015) survey, which was conducted on 27, 29 and 30 October 2015, the appropriate survey time for the species.</p>	<p>An assessment of the likely impacts on the species was undertaken as part of the following investigations:</p> <ol style="list-style-type: none"> 1. Desktop assessments; completed by Astron (2015) as part of the Armadale Road Duplication Biological Assessment and Strategen (2016). 2. Level 2 vegetation and flora survey (Astron 2015).

MNES	Name	Existing environment and likely impact	Justification of likely impact	Methodology
	<i>Diuris purdiei</i> Endangered EPBC Act	Possible/unlikely to be significant The species is known to occur in winter wet swamps comprising <i>Melaleuca preissiana</i> , <i>Eucalyptus calophylla</i> , <i>E. marginata</i> and <i>Nuytsia floribunda</i> .	The species was not recorded during the Astron (2015) survey, which was conducted on 27, 29 and 30 October 2015, the appropriate survey time for the species.	An assessment of the likely impacts on the species was undertaken as part of the following investigations: 1. Desktop assessments; completed by Astron (2015) as part of the Armadale Road Duplication Biological Assessment and Strategen (2016). 2. Level 2 vegetation and flora survey (Astron 2015).
	<i>Drakaea elastica</i> Endangered EPBC Act	Possible/unlikely to be significant The species is known to occur on <i>Kunzea</i> shrublands comprising 2.01 ha of the Project area.	The species was not recorded during the Astron (2015) survey, which was conducted on 27, 29 and 30 October 2015, the appropriate survey time for the species. An additional threatened orchid assessment was undertaken by Strategen in July 2016, targeting <i>Drakaea elastica</i> , specifically <i>Kunzea</i> shrublands as the previous Astron survey was not completed during the optimal survey period for the species. The assessment did not identify any individuals of <i>Drakaea elastica</i> .	An assessment of the likely impacts on the species was undertaken as part of the following investigations: 1. Desktop assessments; completed by Astron (2015) as part of the Armadale Road Duplication Biological Assessment and Strategen (2016). 2. Level 2 vegetation and flora survey (Astron 2015). 3. <i>Drakaea elastica</i> targeted survey (Strategen 2016).
	<i>Drakaea micrantha</i> Vulnerable EPBC Act	Possible/unlikely to be significant The species occurs in cleared areas and firebreaks, therefore has the potential to occur within cleared areas, comprising up to approximately 43.7 ha.	The species was not recorded during the Astron (2015) survey, which was conducted on 27, 29 and 30 October 2015, the appropriate survey time for the species.	An assessment of the likely impacts on the species was undertaken as part of the following investigations: 1. Desktop assessments; completed by Astron (2015) as part of the Armadale Road Duplication Biological Assessment and Strategen (2016). 2. Level 2 vegetation and flora survey (Astron 2015).
Migratory species	No migratory species will be impacted by the Project.			

MNES	Name	Existing environment and likely impact	Justification of likely impact	Methodology
Wetlands of international importance	Forrestdale and Thomsons Lakes	<p>Forrestdale Lake is a seasonal wetland (located 250 m south of the Project area) listed as a Wetland of International Importance under the Convention on Wetlands (Ramsar) and together with Thomsons Lake is listed as Ramsar site number 481.</p> <p>Indirect and off-site impacts to wetlands of International significance can include downstream impacts from runoff of chemicals and/or sediment washed in from the road. Downstream impacts are not anticipated due to the distance of the conservation significant wetlands from the Project area.</p> <p>On the basis of the separation and engineering design compliant with Australian Standards, no impact is likely as a result of the Project.</p>	<p>The SJDS was constructed to manage the adverse impacts of urban development within the catchment on the Jandakot Mound groundwater system as a water resource and to protect the environmentally significant chain of wetlands including Thomsons Lake within the Beeliar Regional Park.</p> <p>Development within the SJDS is subject to environmental and ministerial requirements as outlined in the drainage management plan and environmental management programme developed for the scheme.</p> <p>Furthermore, drainage management structures will be constructed as part of the duplication to ensure no impacts to the lakes system occurs.</p> <p>The Project design shall be compliant with the relevant Australian Standards to ensure that there are no indirect impacts (i.e. via runoff) as a result of the Project.</p>	An assessment of the likely impact on the Forrestdale and Thomsons Lakes was undertaken utilising available literature and desktop information.
World heritage properties	No World Heritage Properties species will be impacted by the Project.			
National Heritage Places	No National Heritage Places will be impacted by the Project.			
Commonwealth Land or Marine Areas	No Commonwealth Land or Marine areas will be impacted by the Project.			
Nuclear Actions	No Nuclear Actions occur in proximity to the Project area.			
Water resource	Water resources with the potential to be impacted by the Project have been discussed in preceding sections.			

7. Environmental Protection Authority Significance framework

An assessment of the Project impacts has been undertaken in accordance with the Environmental Protection Authority (EPA) *Environmental Assessment Guideline (EAG) 8: Environmental factors and objectives* (EPA 2016a) and *EAG 9: Application of a significance framework in the environmental impact assessment process, focusing on the key environmental factors* (EPA 2015) to determine the significance of the Project and referral requirements, as presented in Table 15

Table 15: EPA Significance framework

Theme	Factor	Objective	Significance
Land	Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	<p>The Project will involve the clearing of approximately 13.2 ha of native vegetation, comprising the following vegetation associations:</p> <ul style="list-style-type: none"> • <i>Banksia</i> woodland. • <i>Melaleuca</i> damplands. • <i>Kunzea glabrescens</i> tall shrublands • <i>Beaufortia elegans</i> tall shrublands. <p>Approximately 6.99 ha of planted vegetation will also be cleared within the Project area.</p> <p>Vegetation within the Project area is highly disturbed, with over half of the Project area (approximately 70%) cleared of native vegetation.</p> <p>Vegetation condition ranges from completely degraded to excellent, with the majority of the Project area classed as Completely degraded, associated with edge effects of surrounding cleared areas.</p> <p>The <i>Banksia</i> woodland located within the Project area is consistent with the recently Commonwealth listed <i>Banksia</i> woodlands TEC. Therefore 4.85 ha of the TEC will be cleared as a result of the Project.</p> <p>As the proposed clearing will follow the existing Armadale Road alignment, clearing will not result in additional fragmentation of large tracts of vegetation and subsequent impacts to the viability and function of vegetation associations.</p> <p>The Project will result in the removal of two individuals of Priority 4 species <i>Dodonaea hackettiana</i>. The removal of two individuals of this species will not result in a significant impact to the overall population of the species as populations are well represented on the Swan Coastal Plain.</p> <p>Based on the findings above, the Project will not significantly impact on flora and vegetation to result in a reduction in the diversity, viability and ecological function at the species, population and community level.</p>
	Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	The Project will involve earthworks, including minor excavation of soil material within the Project area. The Project will not significantly alter landforms.
	Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	The Project will involve earthworks, including minor excavation of soil material within the Project area.
	Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Evidence of foraging by the Forest Red-tailed Black Cockatoo was found in the Project area, specifically chewed fruit of Marri (Astron 2015). No other significant fauna species were confirmed during the survey, however Carnaby's Black Cockatoo and Baudin's Cockatoo are likely to utilise the Project area.

Theme	Factor	Objective	Significance
			<p>The Project area comprises 4.85 ha of Banksia woodland habitat, which provides 'moderate quality' foraging resource for Carnaby's black cockatoos.</p> <p>No potential breeding or roosting habitat was found in the Project area, as no trees exhibit potential breeding hollows, or are considered to be future breeding habitat (diameter at breast height, less than 50 cm).</p> <p>As the Project will involve duplication of the existing Armadale Road, any removal of foraging habitat will not fragment existing foraging resources, therefore not preventing a barrier to movement across surrounding Bush Forever sites and reserves.</p> <p>Based on the above, the Project is unlikely to significantly impact on the diversity, viability and ecological function of terrestrial fauna known to occur or potentially occurring in the Project area.</p>
Water	Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	<p>The Project will not result in any excavation activities below groundwater level, therefore no direct impacts to hydrogeological regimes will result.</p> <p>The Project area intersects the following Conservation Category Geomorphic wetlands and buffers:</p> <ul style="list-style-type: none"> • 0.48 ha of the mapped wetland extent and of Conservation Management Category wetland (UFI 7143), 0.34 ha of which contains vegetation proposed to be cleared • 0.52 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14874), 0.39 ha of which contains vegetation proposed to be cleared • 0.93 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14893), all of which contains vegetation proposed to be cleared. <p>In addition, the Project area intersects the Gibbs Road Swamp System for approximately 1.4 km.</p> <p>The Project area is located in close proximity to the Forrestdale Main Drain and Bailey's Branch Drain, located approximately 1.7 km and 700 m respectively, however these areas will not be directly impacted by the Project.</p> <p>As the Project is associated with the existing Armadale Road, duplication activities will not significantly alter the existing wetlands and associated buffers as the construction will remain predominately along the existing alignment, therefore minimising disturbance to surrounding wetlands. Furthermore, drainage structures will be installed to prevent drainage into these areas and to protect the wetland values of the Project area and surrounds.</p> <p>Based on the summary described above, potential impacts to surface water and groundwater are unlikely to significantly impact the existing hydrological regimes.</p>
	Inland Waters Environmental Quality	To maintain the quality of groundwater and surface water so that environmental values are protected.	<p>The Project will involve earthworks, including excavation within the Project area. As part of earthworks and construction activities, soils and surface water have the potential to be contaminated through the miss-handling of hydrocarbons and other chemicals. In addition, sediment may contaminant surface water, which could result in downstream impacts to the surrounding drainage scheme areas. With the application of surface water management measures, including construction of drainage systems to minimise potential impacts to water quality, impacts to inland water environmental quality are expected to be minimal. Furthermore, the quality of water sources will be maintained to ensure that environmental values, both ecological and social are protected.</p>

Theme	Factor	Objective	Significance
People	Social Surroundings	To protect social surroundings from significant harm.	Impacts to amenity resulting from construction noise and vibration will be managed through the implementation of dust, noise and vibration management measures.
	Human Health	To protect human health from significant harm.	Impacts to human health resulting from construction noise and vibration will be managed through the implementation of dust, noise and vibration management measures.

8. Assessment of native vegetation clearing

The Project was assessed against the 10 clearing principles as per Schedule 5 of the EP Act, in accordance with the DER guideline 'A Guide to the Assessment of Applications to Clear Native Vegetation' (DER, 2014) and summarised in Table 16.

Table 16: Assessment of native vegetation clearing in accordance with the 10 Clearing Principles

Clearing principle	Rationale	Likelihood of variance
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	<p>The Project is not at variance with this clearing principle as:</p> <ul style="list-style-type: none"> vegetation within the Project area is highly disturbed, with over half of the Project area (approximately 70%) cleared of native vegetation approximately 103 native vascular plant taxa were recorded from vegetation within the Project area a total of 38 conservation significant flora species were identified during database searches as potentially occurring within 10 km from the Project area; of these species, only two individuals of <i>Dodonaea hackettiana</i> (P4) were recorded in the Project area within vegetation classed as 'Degraded' the proximity of public roads (including the existing Armadale Road), infrastructure, industries and previous clearing for land development has had an impact on the vegetation condition within the proposed Project area, particularly evident by the number of weeds recorded (27 taxa), including four listed under the BAM Act. <p>Based on the above, the Project area does not constitute a site with a high level of biological diversity.</p>	May be at variance.
b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<p>The Project is not at variance with this clearing principle as:</p> <ul style="list-style-type: none"> the Project area comprises 4.85 ha of Moderate Quality Carnaby's Black Cockatoo foraging habitat and scattered Very Poor Quality habitat for Forest Red-tail Black Cockatoo and Baudin's Cockatoo foraging habitat the Forest Red-tailed Black Cockatoo was recorded during the Astron (2015) survey, including evidence of foraging; however no potential breeding trees (exhibiting a DBH greater than 50 cm) were recorded the removal of approximately 4.85 ha of Moderate to Very Poor quality black cockatoo foraging habitat is unlikely to result in a significant impact to black cockatoo species as the proposed clearing is adjacent to the existing Armadale Road, therefore clearing will not fragment existing habitat as clearing is proposed adjacent to the existing Armadale Road in a linear footprint, no significant portions of potential fauna habitat will be cleared areas that are temporarily cleared will be progressively revegetated with native species once construction is completed. 	Likely to be at variance.
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	<p>The Project is not at variance with this clearing principle as no threatened flora species were identified during surveys of the Project area; therefore, no vegetation is necessary for the continued existence of rare flora.</p>	Not at variance.
d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	<p>The Banksia woodland located within the Project area is consistent with the recently Commonwealth listed Banksia woodlands TEC <i>Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plan ecological community</i> (DEE 2016), whereby the vegetation type includes similar structure, diagnostic species, patch size and canopy characteristics. Therefore 4.85 ha of the TEC will be cleared as a result of the Project.</p>	Likely to be at variance.

Clearing principle	Rationale	Likelihood of variance
<p>e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.</p>	<p>The Project is not at variance with this clearing principle as:</p> <ul style="list-style-type: none"> • a total of 13.2 ha of native vegetation is proposed to be cleared within the Project area, which occurs adjacent to the existing Armadale Road, infrastructure, industries and previous clearing for land development. Approximately 6.99 ha of planted species within the Project area will also be cleared • vegetation to be cleared within the Project area, comprises the Swan Coastal Plain IBRA region of which 38.58% is remaining and is well represented and the Heddle vegetation complexes Bassendean complex – Central and South, and Southern River Complex have 27.7% and 19.69% respectively remaining within the IBRA region. Vegetation remaining is greater than the 30% required as per EPA Position Statement No.2 indicating the complexes are well represented outside the Project area • removal of vegetation within the Project area is not considered to be at variance with this principle as it will not result in the removal of a significant remnant of vegetation; rather, the Project area represents a small amount of disturbed vegetation adjacent to existing infrastructure. 	<p>Not at variance.</p>
<p>f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.</p>	<p>The Project is not likely to be at variance to this clearing principle:</p> <p>The Project area intersects the following Geomorphic Conservation Category wetland and buffers, identified by the Geomorphic Wetlands of the Swan Coastal Plain, including the following:</p> <ul style="list-style-type: none"> • 0.48 ha of the mapped wetland extent and of Conservation Management Category wetland (UFI 7143), 0.34 ha of which contains vegetation to be cleared • 0.52 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14874), 0.39 ha of which contains vegetation to be cleared • 0.93 ha of the mapped wetland extent of Conservation Management Category wetland (UFI 14893), all of which contains vegetation to be cleared. <p>Due to the presence of the existing Armadale Road, disturbance of linear zones along the current road alignment is unlikely to significantly impact on any of the mapped wetlands, and any minor impacts that may occur will be managed through the construction of additional drainage structures.</p>	<p>Likely to be at variance.</p>
<p>g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.</p>	<p>The Project is not at variance with this clearing principle as:</p> <ul style="list-style-type: none"> • vegetation within the Project area is highly disturbed, with over half of the Project area (approximately 70%) cleared of native vegetation • the proximity of public roads (including the existing Armadale Road), infrastructure, industries and previous clearing for land development has had an impact on the vegetation condition within the proposed Project area, particularly evident by the number of weeds recorded (27 taxa), including four listed under the BAM Act • as a result, the proposed clearing along Armadale Road is unlikely to cause appreciable land degradation and any impacts associated with the Project can be readily managed. 	<p>Not at variance.</p>
<p>h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.</p>	<p>The Project is not likely to be at variance to this clearing principle:</p> <ul style="list-style-type: none"> • three Bush Forever sites intersect the Project area, including: <ul style="list-style-type: none"> * 1.02 ha of Fraser Road Bushland, Banjup (Site 390) * 0.32 ha of Anstey/Keane Dampland and Adjacent Bushland (Site 342) * 1.20 ha of Gibbs Road Swamp Bushland, Banjup/Forrestdale (Site 344). <p>Given the location of the proposed clearing, adjacent to Armadale Road and associated road reserve, including cleared areas, the impact of clearing within any of these Bush Forever sites is unlikely to result in a significant impact to the environmental values of the Bush Forever sites. The Project is therefore unlikely to be at variance with this principle.</p>	<p>May be at variance.</p>

Clearing principle	Rationale	Likelihood of variance
<p>i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.</p>	<p>The Project is not at variance with this clearing principle as:</p> <ul style="list-style-type: none"> • the proposed clearing within the identified 4.71 ha Conservation Category, 19.55 ha of Resource Enhancement Category and 6.90 ha of Multiple Use Category Geomorphic wetlands will not impact on any water bodies associated with the wetlands and will largely be restricted to buffer zones • given the presence of the existing Armadale Road and the duplication activities including linear clearance areas adjacent to the existing road, any impacts to wetlands are not expected to be significant • the Project area is located 1.7 km and 700 m from the Forrestdale Main Drain and Bailey's Branch Drain respectively • the Project area intersects the Jandakot UWPCA, including Priority 1, Priority 2 and Priority 3 areas defined in Draft SPP 2.3 - Jandakot Groundwater Protection Policy (WAPC 2017) • through the implementation of drainage infrastructure, any potential impacts to surface water and groundwater will be mitigated consistent with requirements of WQPNs and SPP 2.3; therefore the Project is unlikely to result in deterioration of the surface water or groundwater quality of the Project area and surrounds. 	<p>Not likely to be at variance.</p>
<p>j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.</p>	<p>The Project is not at variance with this clearing principle as:</p> <ul style="list-style-type: none"> • clearing proposed adjacent to the already cleared Armadale Road and road reserve boundary is unlikely to impact on surface water flows such that flooding will occur • the Project will be constructed in accordance with engineering requirements including drainage and stormwater management consistent with detailed design; furthermore, Main Roads will implement a drainage and stormwater management plan. 	<p>Not at variance.</p>

9. Environmental approvals

9.1 Australian government

Referral under the EPBC Act is required due to the presence of Threatened black cockatoo habitat and the Banksia Woodland TEC.

Any proposal that has the potential to have a significant impact on MNES is required to be referred to DEE under the EPBC Act. Based on the results of the environmental assessments, two MNES have the potential to be impacted by the Project including:

- *Banksia* woodland TEC
- Carnaby's Black Cockatoo.

In consideration of the above policy documents, the Project triggers the requirement for referral for assessment by DEE due to the potential impacts on black cockatoo foraging habitat and the impacts to the Banksia woodland TEC, as summarised in Table 17.

Table 17: Environmental values and approvals pathways

Legislation	Trigger value	Value within Project area	Approvals pathway
EPBC Act	Clearing >1 ha of quality foraging habitat (DSEWPaC 2012)	4.85 ha of Moderate quality foraging habitat for Carnaby's black cockatoos	Referral to DEE under the EPBC Act.
	Clearing of >2 ha of good quality Banksia woodland TEC	4.85 ha of good quality Banksia woodland	Referral to DEE under the EPBC Act.

The Project is unlikely to result in a significant impact to black cockatoo species. The determination of this referral as a "Not a Controlled Action" by DEE will be dependent on the consideration of the proposals impact on fragmentation and the surrounding values.

9.2 Western Australian government

9.2.1 Referral under Part IV the Environmental Protection Act

The Project will be able to meet the EPA's objectives for the relevant environmental factors through the application of the EP Act Part V management measures and other delegated regulatory approval processes, as detailed in Table 15.

Table 18 lists the biological values within the Project area that are protected by the Part V of the EP Act triggering an approval requirement.

Table 18: Environmental values and approvals pathways

Legislation	Trigger value	Value within Project area	Approvals pathway
Part V of the EP Act	Clearing any native vegetation (<i>Environmental Protection [Clearing of Native Vegetation] Regulations 2004</i>)	13.2 ha of native vegetation	Referral to the Department of Environment Regulation (DER) under Part V of the EP Act (i.e. NVCP)

9.2.2 Other approvals

Aboriginal heritage

The AH Act allows for the protection of Aboriginal heritage sites, including both sites that are registered and those that are not. Consent from the Minister for Aboriginal Affairs is required for any activity which will negatively impact Aboriginal heritage sites.

Three 'other heritage places' intersect the Project area, including the following:

- Readymix sandpit 2(Site No. 3300), including artefacts, scatters and a camp; the site has been 'lodged', however is not 'registered'
- Readymix sandpit 1 (Site No. 4108), including artefacts/scatter; the site has been 'lodged', however is not 'registered'
- Banjup: Calsil (Site No. 3301), including artefacts, scatters and a camp; the site is listed as 'stored data'.

Main Roads has consulted with Whadjuk WC2011/009 Native Title Claim group who have confirmed no sites of significance will be impacted by the Project.

Water licensing

If groundwater is required to be abstracted for the Project, a licence under the RiWI Act is required. If required, licenses will be sought from DoW.

9.2.3 Environmental management actions

The environmental values within the Project area (e.g. native vegetation and habitat for black cockatoos); will be managed in accordance with the EMP developed to support the Project, as detailed in Appendix 3.

10. Further studies

The EIA has identified a number of further studies required in order to complete the environmental assessment and approvals process for the Project. The following further studies are recommended:

1. Undertake an assessment of traffic noise associated with the duplication
2. Consultation with DAA to determine the significance of the 'other heritage places' identified as occurring within the Project area, in order to determine approval requirements under the AH Act.
3. If construction is proposed outside the Project area ensure all flora and fauna assessments, including threatened orchid and black cockatoo habitat assessments have been undertaken.
4. Consult with DoW regarding potential impacts on PDWSA.
5. Conduct dieback assessment and develop management plan.

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Appendix 1
Armada Road Duplication Biological
Assessment (Astron 2015)

Armadale Road Duplication Biological Assessment

November 2015

Prepared for
Main Roads Western Australia



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Armadale Road Duplication Biological Assessment

Prepared for
Main Roads Western Australia





Job Number: 8206-15

Reference: 8206-15-BISR-1Rev0_160418

Revision Status

Rev	Date	Description	Author(s)	Reviewer
A	04/12/2015	Draft Issued for Client Review	M. Love C. Harding J. Oates	R. Archibald
B	01/02/2016	Revised Draft Issued for Client Review	J. Oates	R. Archibald
C	12/04/2016	Revised Draft Issued for Client Review	J. Oates	R. Archibald
0	18/04/2016	Final Issued for Information	J. Oates	R. Archibald

Approval

Rev	Date	Issued to	Authorised by	
			Name	Signature
A	08/12/2015	V. Clarke	S. Pearse	
B	01/02/2016	V. Clarke	S. Pearse	
C	12/04/2016	V. Clarke	S. Pearse	
0	18/04/2016	V. Clarke	S. Pearse	



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Abbreviations

Abbreviation	Definition
ASS	Acid Sulfate Soils
cm	Centimetres
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBH	Diameter Breast Height
EPA	Environmental Protection Authority (State)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
FCT	Floristic Community Type
GPS	Global Positioning System
ha	Hectares
km	Kilometres
m	Metres
mm	Millimetres
Parks and Wildlife	Department of Parks and Wildlife
P	Priority
PEC	Priority Ecological Community
sp.	Species singular
spp.	Species plural
T	Threatened
TEC	Threatened Ecological Community
WC Act	<i>Wildlife Conservation Act 1950</i> (State)
WoNS	Weed of National Significance
°C	Degrees Celsius

Executive Summary

Main Roads Western Australia is planning to extend the duplication of Armadale Road between Anstey and Tapper Roads in Banjup. A biological assessment of key flora, fauna, soil, groundwater and surface water values and potential sensitivity to impact, was conducted within a 50 metre buffer of the existing road and along a 400 metre length of all side roads. The outcomes of the survey will be used in the environmental assessment and approvals process; specifically, they will assist in the preparation of Clearing Impact Assessment and Vegetation Management Plan and may be used in State or Commonwealth referral documentation.

Three vegetation associations were described and mapped for the survey area: *Banksia* woodland, *Melaleuca preissiana* damplands, and *Kunzea glabrescens* tall shrublands. None of these represent a Commonwealth or State-listed Threatened or Priority Ecological Community. Much of the survey area comprised of cleared and degraded area and vegetation along the survey area was rated as Poor to Very Good condition.

One hundred and three vascular flora species were recorded within the survey area. No Commonwealth or State-listed threatened flora species were recorded. One State-listed Priority flora species was recorded, *Dodonaea hackettiana* (Priority 4), which was recorded in vegetation rated as in Degraded condition.

Twenty-seven introduced (weed) species were both recorded in unmarked quadrats and opportunistically within the survey area. Four of these, *Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush), *Zantedeschia aethiopica* (Arum Lily), *Moraea flaccida* (One-Leaf Cape Tulip) and *Rubus* species (Blackberry) are listed as declared pest plants in Western Australia (Department of Agriculture and Food 2015), but not listed as Weeds of National Significance (Australian Weeds Committee 2012).

A large number of conservation significant fauna species have been previously recorded within the vicinity of the survey area and were identified in the desktop review. These include 17 species that are listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or the State *Wildlife Conservation Act 1950*. However, given the degraded and disconnected nature of the fauna habitat found in the survey area, it is unlikely that these species would be expected to occur. The remaining 66 species are listed as Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or as Priority species by the Department of Parks and Wildlife and were also rated as having a low likelihood of occurring.

One conservation significant species was recorded in the survey area, the Forest Red-tailed Black-cockatoo. This species is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and Scheduled 3 under the *Wildlife Conservation Act 1950*. Recent evidence of foraging on marri fruit by this species was recorded at one location.

The *Banksia* woodland fauna habitat type within the survey area would provide some foraging opportunities for black cockatoo species due to the presence of Proteaceous plants such as *Banksia* and *Hakea* species, which when flowering, are a high priority food for this species. However, this habitat was generally degraded and does not constitute as 'quality' foraging habitat and therefore would not be significant for the black cockatoos in the local vicinity. In addition, neither breeding habitat nor potential future breeding trees were recorded and hence referral under the guidelines by the Commonwealth (Department of Sustainability Environment Water Population and Communities 2012) is not required. Referral to the State Environmental Protection Authority is

unlikely to be required given the low impacts to biodiversity values within the Project area. However, a number of recommendations for further field investigations were identified:

- A targeted winter survey for *Drakaea elastica* (T) should be considered within the areas of *Kunzea glabrescens* tall shrubland in good or better condition to confirm the presence or absence of this species.
- Clarification and possible re-evaluation of some boundaries and management categories for wetlands intersecting the survey area.
- Several wetland areas immediately adjacent to the survey area may also require further survey if they have the potential to be impacted from the proposed works.
- For any potential works undertaken in the survey area that require dewatering, drainage works or excavation of more than 100 cubic metres, an Acid Sulfate Soils investigation should be carried out. If Acid Sulfate Soils are found to be present, then an appropriate Acid Sulfate Soil Management Plan would be required.

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1 Introduction

1.1 Project Background

Main Roads Western Australia is planning to extend the duplication of Armadale Road between Anstey Road and Tapper Road in Banjup. A biological assessment of key flora, fauna, soil, groundwater and surface water values and potential sensitivity to impact, was conducted within the 'survey area'. The survey area consists of a 50 metre (m) buffer on either side of the existing road and includes 400 m length along all side roads to ensure intersections can be upgraded and/ or widened where required (Figure 1). The outcomes of the survey will be used in the environmental assessment and approvals process; they will assist in the preparation of a Clearing Impact Assessment and Vegetation Management Plan and may be used in State or Commonwealth referral documentation.

1.2 Scope and Objectives

Astron was commissioned by Main Roads Western Australia to undertake the following scope of works:

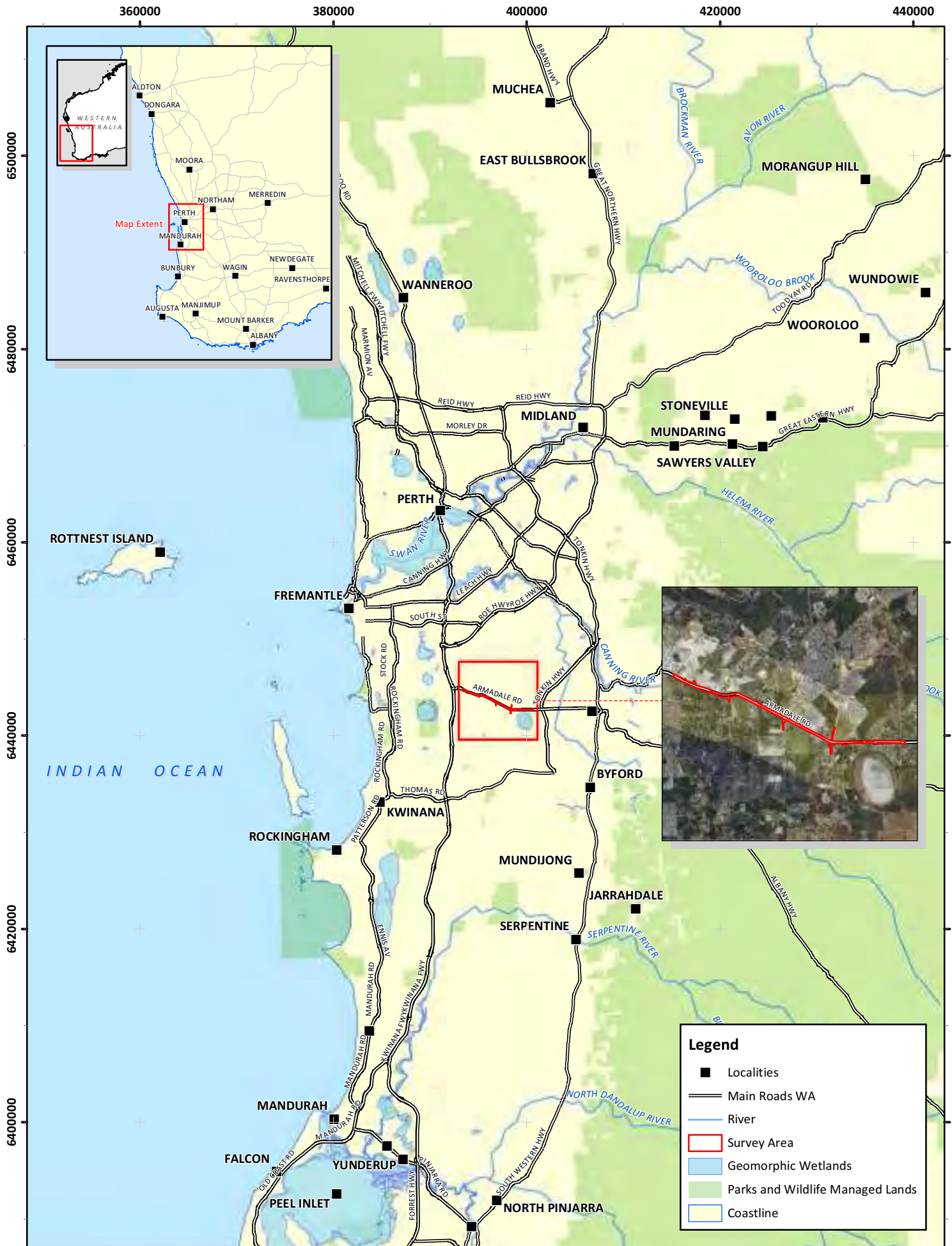
- A biological assessment in accordance with Main Roads Statewide Purpose Clearing Permit, CPS818/12 and compliant with the Environmental Protection Authority (EPA) Guidance Statement 51 (Environmental Protection Authority 2004b) and Guidance Statement 56 (Environmental Protection Authority 2004a).

More specifically, the requirements of the biological assessment include:

- A desktop assessment of the study area to;
 - identify significant flora, fauna, soil, groundwater and surface water values and potential sensitivity to impact
 - identify broad vegetation types using State datasets
 - identify conservation significant species likely to be present, including an assessment of the likelihood of occurrence for potential conservation significant species.
- A field survey to;
 - verify the desktop assessment
 - undertake vegetation association and condition mapping
 - record the presence of all Threatened (Declared Rare) and Priority flora, Weeds of National Significance or Declared Pests encountered, and map the extent of populations (if encountered)
 - assess the flora species diversity, density, composition, structure and weed cover in nominated quadrats
 - identify and map the presence of any Threatened Ecological Communities and/or Priority Ecological Communities
 - map any suitable roosting habitat, feeding habitat, and breeding trees and hollows for Carnaby's Cockatoo
 - assess all biological aspects (including Matters of National Environmental Significance) likely to require referral of the project to the Environmental Protection

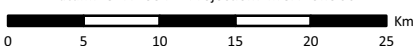

Authority/Commonwealth Department of the Environment, and determine the legislative context of the aspects.

- A concise report on the findings of the biological survey
- Advice on the need for and scope of further field investigations and more detailed environmental impact assessment, if required.



Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure 1: Armadale Road Duplication survey area location



Author: J. Oates	Date: 15-04-2016	Datum: GDA 1994 - Projection: MGA Zone 50  
Drawn: W. An	Figure Ref: 8206-15-BIDR-2Rev0_160415_Fig01_ArmadaleRd	

2 Environmental Context

2.1 Climate

The survey area is located in the Southwest Region of Western Australia. The climate in this area is described as warm Mediterranean. Weather data from Jandakot airport weather station (station 9172), the nearest long-term weather station (located within four kilometres (km) of the survey area), indicate the mean rainfall from 1972 to 2015 is 821.8 millimetres (mm). Maximum mean daily temperatures range between 29.1 degrees Celsius (°C) and 31.7°C in the summer months and between 17.9°C and 19.0°C in the winter months (Bureau of Meteorology 2015) (Figure 2).

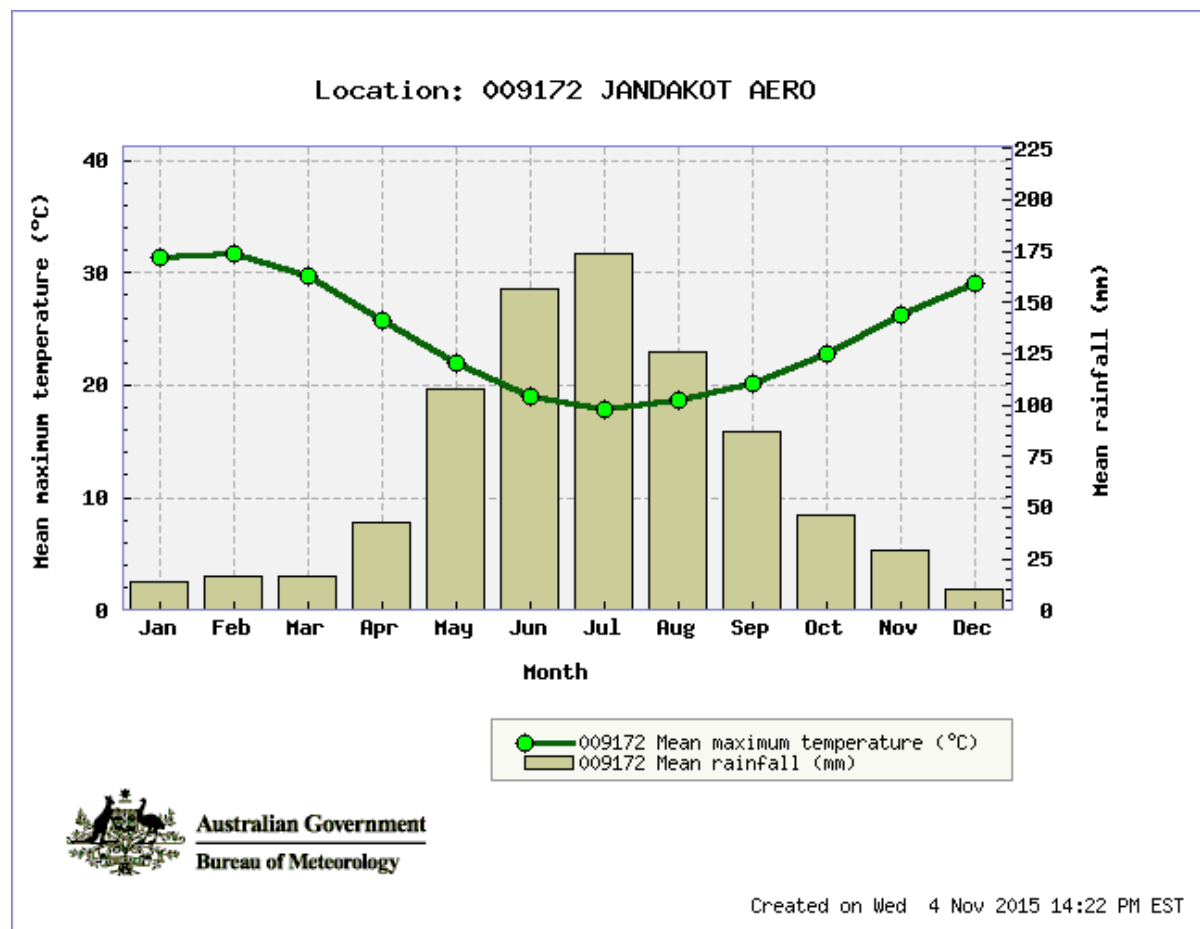


Figure 2: Climate data from Jandakot Airport weather station (9172) including mean annual rainfall (mm) and mean maximum temperature (°C) (1972 to 2015) (Bureau of Meteorology 2015).

2.2 Geology, Landforms and Soils

The survey area occurs on the Swan Coastal Plain, a low-lying coastal plain with swamps and sand hills scattered throughout (Beard 1990). The survey area occurs on the Bassendean Dune System, characterised by sand dunes and sandplains with pale deep sand, with damplands and wetlands often occurring in interdunal areas. The surface geology consists of Bassendean sand which is aeolian, coastal sediment (Stewart et al. 2008).

2.2.1 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are formed naturally, under waterlogged iron and sulfate rich conditions, being typical of lowlands where the land has been subject to inundation by water. These soils contain iron sulfite minerals (most commonly pyrite) or their oxidation products. These soils remain stable under anaerobic conditions but exposure to air can lead to their oxidation with the result being the formation of sulfuric acid and the release of iron, aluminium and other trace metals and nutrients from soils into groundwater and surface water bodies (Department of Environment Regulation 2015b).

Disturbance of land containing ASS introduces a risk of environmental harm and as such requires management in order to minimize the associated risk. Prior to disturbing land containing ASS, an ASS Management Plan must be prepared in accordance with the *Department of Environment Regulation Treatment and management of soil and water in acid sulfate soil landscapes* (Department of Environment Regulation 2015c).

2.3 Surface Water and Hydrology

No rivers or drainage lines occur within the survey area. The buffer for the Gibbs Road Swamp System intersects the survey area for approximately 1.4 km. The Gibbs Road Swamp System includes a chain of wetlands to the north and south of the survey area and is listed on the Directory of Important Wetlands in Australia (site WA078) (Department of the Environment 2015c). This includes Forrestdale Lake, located approximately 250 m south of the eastern end of the survey area. Forrestdale Lake is a seasonal wetland on the List of Wetlands of International Importance under the Convention on Wetlands (Ramsar) and together with Thomsons Lake is listed as Ramsar site number 481 (Australian site number 35) (Ramsar 2015). Forrestdale Lake satisfies criteria 1, 3, 5 and 6 for Ramsar nomination:

- Criterion 1: Forrestdale and Thomsons Lakes are the best remaining examples of wetlands of their type on the Swan Coastal Plain
- Criterion 3: Thomsons Lake is one of the last remaining refuges within the Swan Coastal Plain for the Western Australian-listed threatened Australasian Bittern
- Criterion 5: More than 20,000 waterbirds have been recorded on Forrestdale Lake
- Criterion 6: Regularly supports more than 1% of the national population of five shorebirds: Red-capped Plover, Black-winged Stilt, Red-necked Avocet, Long-toed Stint and Curlew Sandpiper (Ramsar 2015)

A number of Geomorphic Wetlands (Department of Environment and Conservation 2013) also intersect the survey area. These are discussed in more detail in Section 4.2.3 and shown in the vegetation association mapping (Figure E.1, Appendix E). Approximately half of the survey area occurs within the Jandakot Underground Water Pollution Control Area (Department of Water 2008).

2.4 Vegetation

The survey area occurs within the Swan Coastal Plain Biogeographic Region of the South-west Botanical Province (Thackway and Cresswell 1995). A number of botanical surveys have previously been undertaken on a regional and local scale, which has quantified the type of vegetation in the south-west region of Western Australia (Gibson et al. 1994; Heddle, Loneragan, and Havell 1980).

Beard (1981) undertook mapping of the Swan Coastal Plain and defined two broad vegetation types within the survey area (Table 1). Mapping of vegetation complexes was undertaken by Heddle,

Loneragan and Havell (1980) across the Swan Coastal Plain, mapping two vegetation complexes within the survey area (Table 1).

Table 1: Vegetation associations within the survey area.

Association	Description	Original area on the Swan Coastal Plain (SCP) (ha)	Area remaining on SCP (ha)	Proportion remaining (%)
Beard (1981) mapping				
1001	Medium very sparse woodland; jarrah, with low woodland; banksia and casuarina	57,410.23	12,240.22	23.1
968	Medium woodland; jarrah, marri and wandoo	136,188.20	9,143.12	6.7
Heddl, Loneragan and Havell (1980) mapping				
Bassendean complex – Central and South	Vegetation ranges from woodland of <i>Eucalyptus marginata</i> – <i>Allocasuarina fraseriana</i> – <i>Banksia</i> species to low woodland of <i>Melaleuca</i> species, and sedgeland on moister sites	87,477	23,624	27
Southern River complex	Open woodland of <i>Eucalyptus calophylla</i> – <i>E. marginata</i> – <i>Banksia</i> species with fringing woodland of <i>E. rudis</i> – <i>Melaleuca raphiophylla</i> along creek beds	57,979	11,501	20

3 Methodology

3.1 Desktop Assessment

Searches of the Department of Parks and Wildlife (Parks and Wildlife) *FloraBase*, Western Australian Herbarium and Threatened and Priority Ecological Communities Database were conducted in order to identify listed conservation significant flora, fauna and ecological communities within, or in close proximity to, the survey area. Additionally a targeted black cockatoo fauna database search request was made of key black cockatoo ecological activities within the vicinity of the survey area. A Protected Matters Database search (for Matters of National Environmental Significance), Birdlife Birdata, *NatureMap* database search were also conducted. The details of the searches requested are summarised in Table 2.

Table 2: Details of database searches conducted.

Database	Date search results received	Search focus	Search area (MGA50, GDA94)
Protected Matters Search Tool (Department of the Environment 2015d)	05/10/2015	Matters of National Significance	10 km buffer around a point defined by the coordinate 32°08'02"S, 115°53'17"E
Threatened And Priority Ecological Communities Database (Department of Parks and Wildlife 2015b)	15/10/2015	Listed Threatened Ecological Communities and Priority Ecological Communities	10 km buffer around a polygon defined by coordinates 32°07'40"S, 115°51'30"E and 32°08'53"S, 115°56'13"E
Threatened and Priority Flora database (Department of Parks and Wildlife 2015c)	22/10/2015	Threatened and Priority flora species	10 km buffer around a polygon defined by coordinates 32°07'40"S, 115°51'30"E and 32°08'53"S, 115°56'13"E
Threatened and Priority Flora List (Department of Parks and Wildlife 2015d)			
Western Australia Herbarium Flora database (Department of Parks and Wildlife 2015f)			
<i>NatureMap</i> - Flora (Department of Parks and Wildlife 2015a)	22/10/2015	Flora of conservation significance; general species records	5 km buffer defined by the coordinates 32°08'02"S, 115°53'21"E
<i>NatureMap</i> – Fauna (Department of Parks and Wildlife 2015a)	05/10/2015	Fauna of conservation significance; general species records	20 km buffer defined by the coordinates 32°08'16"S, 115°54'42"E
BirdLife Australia (Birdlife Australia 2015)	05/10/2015	All avian species	1 degree radius from a centre point of interest defined by the 32°08'00"S, 115°53'37"E
Threatened Fauna Database and Black Cockatoo (Department of Parks and Wildlife 2015e)	12/10/2015	Threatened Species and Black Cockatoo Key Criteria Search Request	1.5 km buffer for threatened species defined by the alignment coordinates 32°07'40"S, 115°51'30"E and 32°08'53"S, 115°56'13"E

3.2 Field Survey

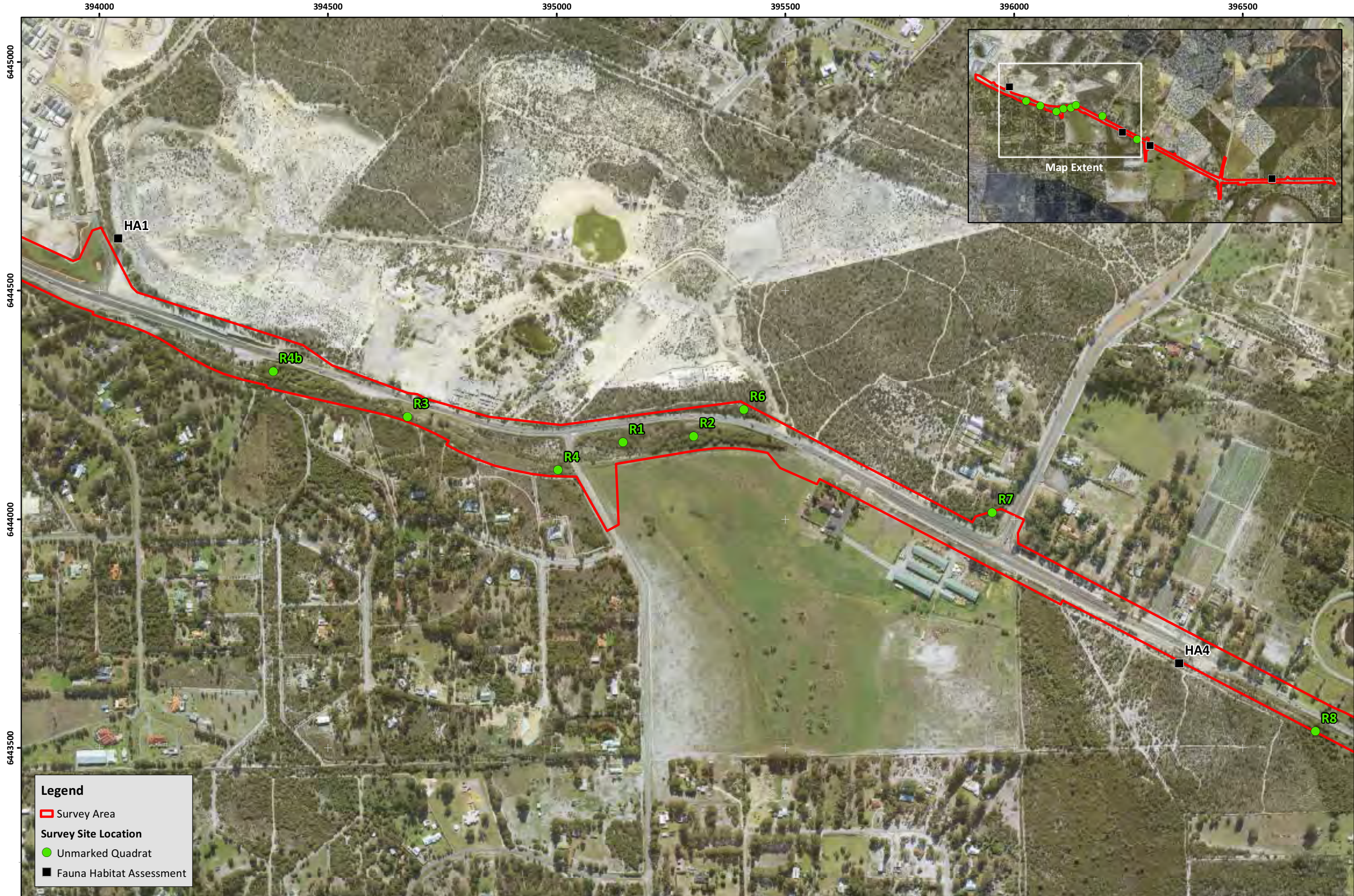
3.2.1 Vegetation and Flora Survey

The vegetation and flora survey was undertaken by Carolyn Harding, Botanist (flora collection licence SL011576), on 27, 29 and 30 October 2015 in accordance with the requirements of a Level 2 vegetation and flora survey (Environmental Protection Authority 2004b). Nine unmarked quadrats (10 m x 10 m) were surveyed to be consistent with regulatory expectations for the Swan Coastal Plain floristic sample sites (Figure 3). The following information was recorded from each unmarked quadrat:

- Location – coordinates measured using a handheld Global Position Systems (GPS) (MGA50, GDA94). One set of coordinates was taken from the northwest corner.
- Recorder and date – personnel involved in sampling that location and survey date.
- Species – all vascular plant species present, including weed species. Species that were not confidently identified during the field survey were collected for later identification by Carolyn Harding.
- Per cent foliar cover – the estimated percentage cover for each dominant species in each stratum.
- Vegetation description – vegetation units were described according to Keighery's (1994) modification of the vegetation classification system of Muir (1977) and Aplin (1979), and the National Vegetation Information System level 5 (Department of the Environment 2015b) (Appendix A). At this level, vegetation is described to 'association' where up to three dominant genera for each of the upper, mid and ground strata are categorised based on dominant growth form, cover and height.
- Vegetation condition – assessed according to the vegetation condition classification adapted by Keighery (1994) (Appendix A).
- Habitat – a broad description of the surrounding landscape based on landform, topography and soil.
- Disturbance – records of any obvious disturbances such as fire, tracks, weed infestation, or grazing.
- Photographs – a photograph was taken of each quadrat and vegetation unit.

A hard copy of colour aerial photography on an A3 colour maps at a scale of 1:6,000 was used to locate the survey area and to assist in navigation as well as delineating vegetation communities and vegetation condition boundaries.

Targeted searches were undertaken for Threatened and Priority flora potentially occurring in the survey area as determined by the database search. The entire survey area was traversed on foot and all species found within the survey area, including introduced species, were listed opportunistically if they did not occur in an unmarked quadrat.



Legend

- ▬ Survey Area
- Survey Site Location**
- Unmarked Quadrat
- Fauna Habitat Assessment

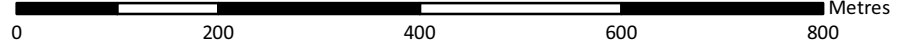
Main Roads Western Australia
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Figure 3A: Survey site locations

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_Fig03A_SurveySite



Legend

- ▭ Survey Area
- Survey Site Location**
- Unmarked Quadrat
- Fauna Habitat Assessment

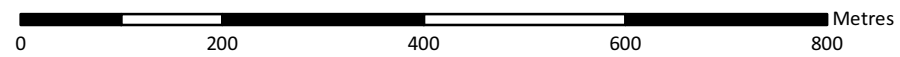
Main Roads Western Australia
 Armadale Road Duplication Biological Assessment

Figure 3B: Survey site locations

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_Fig03B_SurveySite

3.2.2 Fauna Survey

The fauna survey was undertaken by Matthew Love (Senior Zoologist) on 15 October 2015 in accordance with the requirements of a Level 1 fauna survey (Environmental Protection Authority 2004a). In the context of a Level 1 survey, the guidance statement advises field observers to describe the fauna habitats of the survey area, which give a comprehensive list of fauna that can reasonably be expected to occur. Therefore the aim of the fauna component of the survey included descriptions of fauna habitats in the survey area and a compilation of fauna species recorded opportunistically as the survey area was traversed. Four fauna habitat assessments were conducted (Figure 3) and detailed the following:

- Location – coordinates measured using a handheld GPS (MGA50, GDA94).
- Recorder and date – personnel involved in undertaking the fauna habitat assessment and the survey date.
- Habitat/landform – position in the landscape - major fauna habitat types were described based on the landform and vegetation.
- Vegetation type – a broad description of vegetation type and structure.
- Soils – a brief description of soil type.
- Microhabitat – presence of specific microhabitat features, e.g. leaf litter, logs, burrows, rocky outcrops, rock crevices, hollows, permanent or semi-permanent water.
- Condition – habitat condition was assessed based on the presence of anthropogenic (human-induced) disturbances, and using the condition ratings suggested by Thompson and Thompson (2010) (Appendix A).
- Disturbance – any disturbance such as clearing, fire, weeds, flooding, vehicular, machinery, tracks or grazing.
- Photographs – a representative photograph was taken at each habitat assessment site.

3.2.2.1 Black Cockatoo Assessment

The black cockatoo assessment was undertaken in accordance with the Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2012). Targeted searches were undertaken within the survey area for black cockatoo foraging, breeding and roosting habitat.

To determine if the survey area was foraging habitat for black cockatoos, potential foraging plants were identified and recorded, and the ground was searched for any evidence of black cockatoo foraging, for example, severed flower heads and seed cones of proteaceous plants found in the *Banksia*, *Hakea* and *Dryandra* genera.

An assessment was undertaken to determine the breeding habitat classification of the site in accordance with the Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2012). In addition the site was searched systematically and any native trees greater than 50 centimetres (cm) Diameter Breast Height (DBH) were recorded in accordance with the Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2012), including the species, height of tree, GPS coordinate and number of potential hollows.

To determine if trees had potential breeding hollows, the following criteria were assessed for each mature tree where possible (Gibbons and Lindenmayer 2002):

- height of the potential hollow in the tree
- minimum entrance width of a potential hollow
- diameter of the branch on which the potential hollow occurred
- whether the branch was living, part dead or dead
- whether the tree has multiple potential hollows.

The Commonwealth referral guidelines regard roosting habitat for black cockatoos as any tall tree in the Perth Metropolitan Area. Also, these roost sites are generally found in or near riparian environments or natural and artificial water sources for Baudin’s and Carnaby’s Cockatoos and tall Jarrah and Marri trees within or on the edge of forests for Forest Red-tailed Black-cockatoo (Department of Sustainability Environment Water Population and Communities 2012). The details of any trees that matched this definition were noted, and their location (GPS coordinates), species and height (in metres) were recorded. A search under the canopy of each of these trees was undertaken for evidence of recent use as a roost site (indicated by the presence of feathers and droppings).

3.3 Taxonomy and Nomenclature

Plant specimens that were not identified in the field were confirmed in Perth by Carolyn Harding. The assigned nomenclature is consistent with the current listing of scientific names recognised by the Western Australian Herbarium and was used for the species list and associated species information collected. Data were entered into a customised Access database.

Nomenclature and sequence for invertebrates, amphibians, reptiles, birds and mammals within this report is as per Western Australian Museum checklist for vertebrate fauna species (Western Australian Museum 2015). Field guides and accepted scientific peer review references were also used for fauna identification.

For species identified in the desktop assessment where there was doubt as to their true taxonomy (through subsequent name changes or taxonomic reviews), every effort was made to determine the current scientific name for each taxon. In addition, some taxon names may be followed by ‘sp.’, meaning that the species name was not given in the data source or the identification is in doubt.

3.4 Limitations of the Survey

The limitations of the vegetation, flora and fauna survey in accordance with EPA Guidance Statements 51 and 56 (Environmental Protection Authority 2004b) are detailed in Table 3.

Table 3: Statement of limitations for the surveys.

Potential limitation	Statement regarding potential limitations
(i) Competency/experience	The botanist and zoologist responsible for conducting the survey has extensive experience in conducting Level 2 flora and vegetation and Level 1 fauna surveys in the region.
(ii) Scope	There was adequate time to complete the Level 2 flora and vegetation and Level 1 fauna surveys; complete vegetation and fauna mapping and conduct opportunistic searches for threatened and Priority flora and fauna throughout the survey area. Time was not considered a limiting factor.

Potential limitation	Statement regarding potential limitations
(iii) Proportion of flora and fauna identified, recorded and/or collected	Average seasonal conditions preceded the field survey, where taxonomic groups recorded within the survey area represented a suite of species, but with limited annual and ephemeral species due to below average rainfall two months preceding the survey and the condition of the vegetation. The fauna observed and identified was likely to only represent a small proportion of the suite of species that utilises the survey area; however, fauna habitats were able to be adequately described and a list of species likely to be present was prepared.
(iv) Sources of information. Availability of contextual information.	Database searches and previous vegetation, flora and fauna surveys in the vicinity of the survey area provided contextual information. Adequate information was available from database searches and previous surveys in the region.
(v) Proportion of task achieved	The task was achieved in its entirety.
(vi) Mapping reliability	Colour aerial photography at a scale of 1:6,000 was used to assist in navigation and delineation of vegetation association boundaries. The aerial photographs were dated 2015 and were considered recent.
(vii) Timing/weather/season/cycle	The survey was conducted in spring, following recent rainfall, thereby providing good conditions for flora, vegetation and fauna. The plant families that most contain the Swan Coastal Plain flora (Fabaceae, Myrtaceae, and Proteaceae) were the dominant species, but a full suite of species wasn't recorded due to below average rainfall and the condition of the vegetation. A number of collections could only be identified to genus or species level. Windy conditions on the day resulted in sub-optimal conditions for recording birds
(viii) Disturbances (e.g. fire, flood, accidental human intervention) which affected results of survey	The survey area is essentially road reserve of Armadale Road and the majority of it showed minimal ecological characteristics for naturally existing fauna habitat and is not considered to be in a natural state. <i>Banksia</i> woodland of the bush forever sites were shown to be good fauna habitat. Three intact vegetation communities (<i>Banksia</i> woodland, <i>Melaleuca preissiana</i> damplands and <i>Kunzea glabrescens</i> tall shrublands) were observed; however, the survey area contained cleared and degraded areas with the presence of heavy rubbish dumping in some of these areas.
(ix) Intensity	The intensity of the survey was considered adequate.
(x) Completeness	The survey area was considered adequately surveyed for a Level 2 flora and vegetation survey and Level 1 fauna assessment.
(xi) Resources	Resources were adequate to complete the field survey.
(xii) Remoteness and/or access problems	There were no access problems.

4 Results

4.1 Seasonal Conditions

The vegetation and flora field survey was conducted on 27, 29 and 30 October 2015, and the fauna field survey was conducted 15 October 2015. In the 12 months preceding the fauna survey, 612 mm of rainfall was received, with a further 6 mm recorded prior to the flora survey. This is approximately 204 mm below the long-term mean of 821.8 mm (Bureau of Meteorology 2015). Rainfall in the two months prior to the field surveys was generally below average, with 63.8 mm less rainfall (Figure 4).

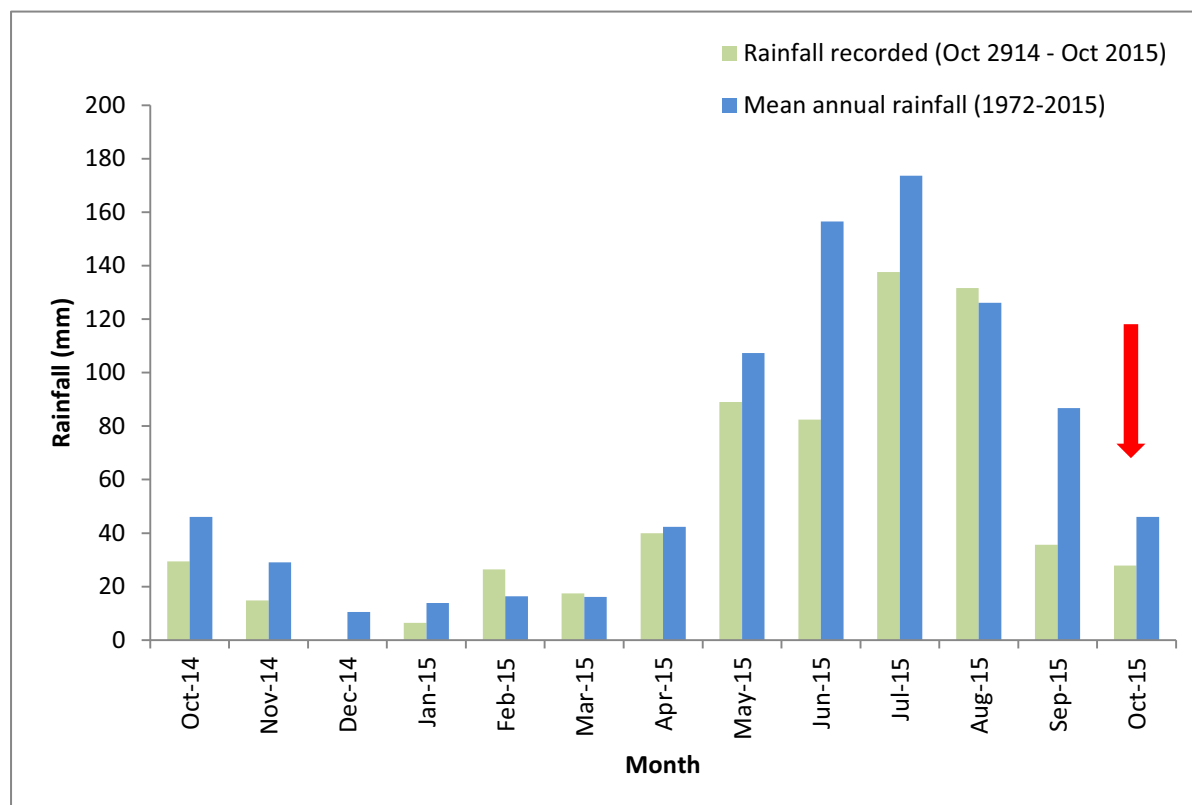


Figure 4: Mean (1972 to 2015) monthly rainfall (mm) and actual rainfall (mm) preceding the October 2015 surveys recorded at Jandakot Airport weather station (9172) (Bureau of Meteorology 2015). Red arrows depict timing of the surveys.

4.2 Desktop Assessment

4.2.1 Environmentally Sensitive Areas

There are two Environmentally Sensitive Areas that lie immediately adjacent to the survey area: 3667, which is the Gibbs Road Swamp System and buffer, and 3620, which is due to the presence of a threatened flora species, *Caladenia huegelli* (Figure 5) (Department of the Environment 2015a; Department of Environment Regulation 2015a).

Four Bush Forever Sites intersect the survey area:

- Fraser Road Bushland, Banjup (Site 390)
- Anstey/Keane Dampland and Adjacent Bushland (Site 342)
- Gibbs Road Swamp Bushland, Banjup/Forrestdale (Site 344)

- Dennis De Young Reserve and Forrestdale Lake and Adjacent Bushland, Forrestdale (Site 345) (Figure 5) (Government of Western Australia 2000a, 2000b).

Furthermore, another three Bush Forever Sites occur within close proximity to the survey area:

- Thomsons Lake Nature Reserve and Thomsons Lake Nature Reserve and Adjacent Bushland, Beeliar (Site 391) is located approximately 2.2 km to the west
- Banjup Bushland, Banjup (Site 263) is located less than 1 km south
- Piarra Nature Reserve, Forrestdale (Site 262) is located less than 1 km north of the survey area (Government of Western Australia 2000a, 2000b).

4.2.2 Acid Sulfate Soils

According to the ASS risk mapping sourced from the CSIRO Australian Soil Resource Information System database, part of the survey area was identified as having a 'High to Moderate Probability of Occurrence' of ASS at depths greater than 3 m from the natural soil surface. The remainder of the survey area was identified as having a 'Moderate to Low Probability of Occurrence' of ASS occurring at depths within 3 m from the natural soil surface (CSIRO Land and Water 2015).

4.2.3 Wetlands

The locations of wetlands have been determined using the Geomorphic Wetlands of the Swan Coastal Plain dataset adapted from Hill et al. (1996). A number of Geomorphic Wetlands intersect the survey area (Table 4) (Department of Environment and Conservation 2013). One Ramsar wetland (Ramsar site 481) is located 250 m to the south of the survey area (Ramsar 2015; Department of the Environment 2015c).

Table 4: Mapped wetlands within the survey area (Hill et al. 1996, Department of Environment and Conservation 2013).

Wetland details	Total mapped area (ha)	Area within survey area (ha)	General description of the geomorphic classification*	Objectives of the management category*
Conservation Management Category wetland (UFI 7143)	2.24	0.28	Wetlands which support a high level of attributes and functions.	To preserve and protect their existing conservation values through various mechanisms including: <ul style="list-style-type: none"> • reservation in national parks, Crown reserves and state owned land • protection under Environmental Protection Policies • wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Conservation Management Category wetland (UFI 14874)	34.70	0.52		
Conservation Management Category wetland (UFI 14893)	28.85	0.09		
Resource Enhancement Category wetland (UFI 7164)	1.83	0.15	Wetlands which may have been	To manage, restore and protect towards improving their conservation value. These wetlands have the

Wetland details	Total mapped area (ha)	Area within survey area (ha)	General description of the geomorphic classification*	Objectives of the management category*
Resource Enhancement Category wetland (UFI 7165)	43.86	0.70	modified or degraded, but still support substantial attributes and functions.	potential to be restored or rehabilitated to Conservation Management Category focusing on wetland functions, structure and biodiversity value.
Resource Enhancement Category wetland (UFI 7210)	9.62	0.65		
Resource Enhancement Category wetland (UFI 7214)	0.33	0.01		
Resource Enhancement Category wetland (UFI 7215)	0.89	0.09		
Resource Enhancement Category wetland (UFI 13342)	26.70	1.26		
Resource Enhancement Category wetland (UFI 15297)	178.75	2.20		
Resource Enhancement Category wetland (UFI 15534)	0.36	0.07		
Multiple Use Category wetland (UFI 6789)	41.40	1.20	Wetlands with few remaining important attributes and functions.	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.
Multiple Use Category wetland (UFI 13927)	1.82	0.10		
Multiple Use Category wetland (UFI 13948)	31.24	0.60		
Multiple Use Category wetland (UFI 13949)	9.47	2.11		
Multiple Use Category wetland (UFI 14897)	33.23	0.10		
Multiple Use Category wetland (UFI 15425)	190.31	0.71		
Multiple Use Category wetland (UFI 15529)	44.02	1.85		

4.2.4 Vegetation and Flora

Nine Threatened Ecological Communities (TECs) and five Priority Ecological Communities (PECs) have been previously recorded within 10 km of the survey area (Table 5). The buffer of one TEC: 'SCP08 – Herb rich shrublands in clay pans' intersects the eastern extent of the survey area. The nearest PECs to the survey area are: 'Banksia ilicifolia woodlands' and 'Northern Spearwood shrublands and woodlands', both located within 3 km of the survey area (Department of the Environment 2015d; Department of Parks and Wildlife 2015b; Species and Communities Branch 2015).

Table 5: Threatened and priority ecological communities recorded within 10 km of the survey area.

Supergroup-landform element	Floristic community type	Conservation status (State/Commonwealth)
Subtropical and Temperate Coastal Saltmarsh	Coastal saltmarsh; Subtropical and Temperate Coastal Saltmarsh; Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: <ul style="list-style-type: none"> • succulent shrubs (e.g. <i>Tecticornia</i>) • grasses (e.g. <i>Sporobolus virginicus</i>) • sedges and grasses (e.g. <i>Juncus kraussii</i>, <i>Gahnia trifida</i>) • herbs (e.g. low-growing creeping plants such as <i>Wilsonia backhousei</i>, <i>Samolus repens</i>, <i>Schoenus nitens</i>). Note: Coastal Saltmarsh currently is not included on Western Australia's list of threatened ecological communities endorsed by the Western Australia Minister for the Environment.	NA/Vu
Muceha limestone	Muceha Limestone; Shrublands and woodlands on Muceha Limestone	En B) ii)/En
<i>Casuarina obsesa</i> association	<i>Casuarina obsesa</i> Association	Priority 1/NA
Flooded gum, Marri and Peppermint Forest	<i>Eucalyptus rudis</i> , <i>Corymbia calophylla</i> , <i>Agonis flexosa</i> Closed Low Forest (near Busselton)	Priority 1/NA
Supergroup 1 – Foothills/Pinjarra Plain	SCP3a - <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain	Cr B) ii)/En
	SCP3b – <i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> woodlands on sandy clay soils of the southern Swan Coastal Plain	Vu B)/NA
Claypans of the Swan Coastal Plain	Herb rich shrublands in clay pans; SCP08 – Swan Coastal Plain Community type 8	Vu B)/Cr
	Shrublands on dry clay flats; SCP10a – Swan Coastal Plain Community type 10a	En B) ii)/Cr
Supergroup 3 – Uplands centered on Bassendean Dunes and Dandaragan Plateau	SCP20b - <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain	En B) i)/NA
	SCP21c - Low lying <i>Banksia attenuata</i> woodlands or shrublands	Priority 3(i)/NA
	SCP22 - <i>Banksia ilicifolia</i> woodlands	Priority 2/NA
Supergroup 4 – Uplands Centered on Spearwood and Quindalup Dunes	SCP24 - Northern Spearwood shrublands and woodlands	Priority 3(i)/NA
	SCP30a – <i>Callitris preisii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands, Swan Coastal Plain	Vu B)/NA
Limestone ridges	SCP26a – <i>Melaleuca huegelii</i> – <i>Melaleuca acerosa</i> (currently <i>M. systema</i>) shrublands on limestone ridges	En B) iii)/NA

SCP = Swan Coastal Plain, Cr = Critically Endangered, En = Endangered, NA = Not applicable, Vu = Vulnerable

Database search results identified 38 conservation significant flora species within a 10 km radius of the survey area. This includes 15 Threatened species, of which 14 are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Table 6). One Priority (P) 1, two P2, 11 P3 and nine P4 species have also been previously recorded in the vicinity of the survey area. Conservation categories for conservation significant flora are presented in Appendix B and the results of the database searches are provided in full in Appendix C.

One Threatened (T) species, *Caladenia huegelii* (T), has been previously recorded within or immediately adjacent to the survey area (Table 6 and Appendix D).

Table 6: Threatened flora recorded within 10 km of the survey area (Department of the Environment 2015d; Department of Parks and Wildlife 2015a, 2015c, 2015d, 2015f) listed according to potential to occur.

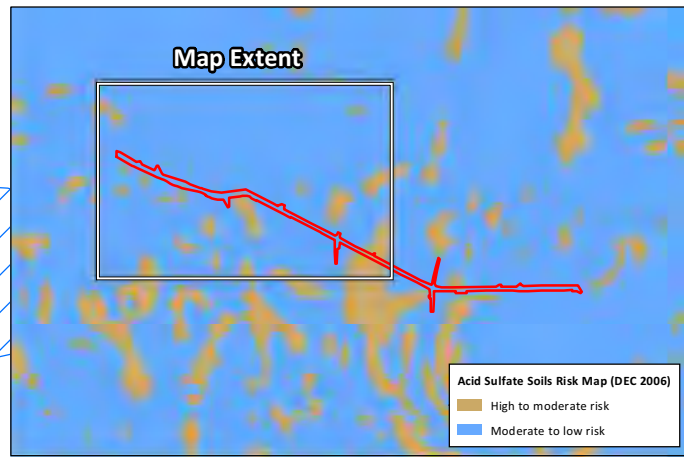
Taxon	Conservation status (Commonwealth/State)	Life form	Flowering	Potential to occur in survey area
<i>Andersonia gracilis</i>	Endangered/Threatened (T)	Shrub	Sep to Nov	Unlikely
<i>Austrostipa jacobiana</i>	Not listed /T	Grass	Sep to Nov	Potential
<i>Caladenia huegelii</i>	Endangered/T	Geophyte	Sep to Oct	Likely
<i>Darwinia foetida</i>	Critically Endangered/T	Low shrub	Sep to Oct	Unlikely
<i>Diuris micrantha</i>	Endangered/T	Geophyte	Sep to Oct	Unlikely
<i>Diuris purdiei</i>	Endangered/T	Geophyte	Sep to Oct	Potential
<i>Drakaea elastica</i>	Endangered/T	Geophyte	Oct to Nov	Potential
<i>Drakaea micrantha</i>	Vulnerable/T	Geophyte	Sep to Oct	Potential
<i>Eucalyptus x balanites</i>	Endangered/T	Mallee	Oct to Dec; Jan to Feb	Unlikely
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Endangered/T	Shrub	Aug to Sep	Unlikely
<i>Lepidosperma rostratum</i>	Endangered/T	Sedge	Jun to Jul	Unlikely
<i>Synaphea</i> sp. Fairbridge Farm (D.Papenfus 696)	Critically Endangered/T	Low shrub	Oct	Unlikely
<i>Synaphea stenoloba</i>	Endangered/T	Low shrub	Aug to Oct	Unlikely
<i>Thelymitra dedmaniarum</i>	Endangered/T	Geophyte	Nov to Dec or Jan	Unlikely
<i>Thelymitra stellata</i>	Endangered/T	Geophyte	Oct to Nov	Unlikely

394000

395000

396000

397000



- Conservation Significant Flora**
- *Aurolastipa jacobsoniana*
 - *Byblis gigantea*
 - *Caladenia huegelii*
 - *Cyathochaeta teretifolia*
 - *Diuris purdiei*
 - *Drakea elastica*
 - *Drakea micrantha*
 - *Drosera occidentalis* subsp. *occidentalis*
 - *Jacksonia gracillima*
 - *Jacksonia sericea*
 - *Lepidosperma rostratum*
 - *Meeboldina decipiens* subsp. *decipiens*
 - *Ornduffia submersa*
 - *Schoenus pennisetis*
 - *Stylidium aceratum*
 - *Stylidium longitubum*
 - *Thysanotus glaucus*
 - *Tripterococcus* sp. *Brachylobus* (A.S. George 14234)
 - *Verticordia lindleyi* subsp. *lindleyi*
- Conservation Significant Fauna**
- ▲ *Ardea modesta* (Eastern Great Egret)
 - ▲ *Calidris ruficollis* (Red-necked Stint)
 - ▲ *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo)
 - ▲ *Calyptorhynchus latirostris* (Carnaby's Cockatoo)
 - ▲ *Isoodon obesulus fusciventer* (Quenda)
 - ▲ *Leioproctus contrarius* (Bee)
 - ▲ *Lerista lineata* (Lined Skink)
 - ▲ *Merops ornatus* (Rainbow Bee-eater)
 - ▲ *Myrmecobius fasciatus* (Numbat)
 - ▲ *Oxyura australis* (Blue-billed Duck)
 - ▲ *Plegadis falcinellus* (Glossy Ibis)
 - ▲ *Tringa nebularia* (Common Greenshank)

6445000

6444000

6443000

- Legend**
- Main Roads WA
 - ▭ Survey Area
 - ▭ Bush Forever
 - ▭ Environmentally Sensitive Areas
 - ▭ Parks and Wildlife Managed Lands
 - ▭ Swan Coastal Plain Geomorphic Wetland
- TEC/PECs**
- ▭ Muchea Limestone - Shrublands and woodlands on Muchea Limestone
 - ▭ SCP08 - Herb rich shrublands in clay pans
 - ▭ SCP10a - Shrublands on dry clay flats
 - ▭ SCP21c - Low lying *Banksia attenuata* woodlands or shrublands
 - ▭ SCP22 - *Banksia ilicifolia* woodlands

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment

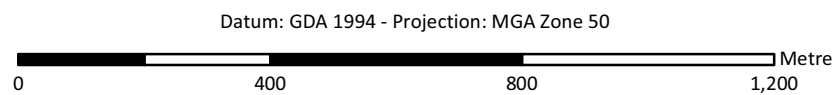
Figure 5A: Environmental constraints known from within and adjacent to the survey area

Author: J. Oates

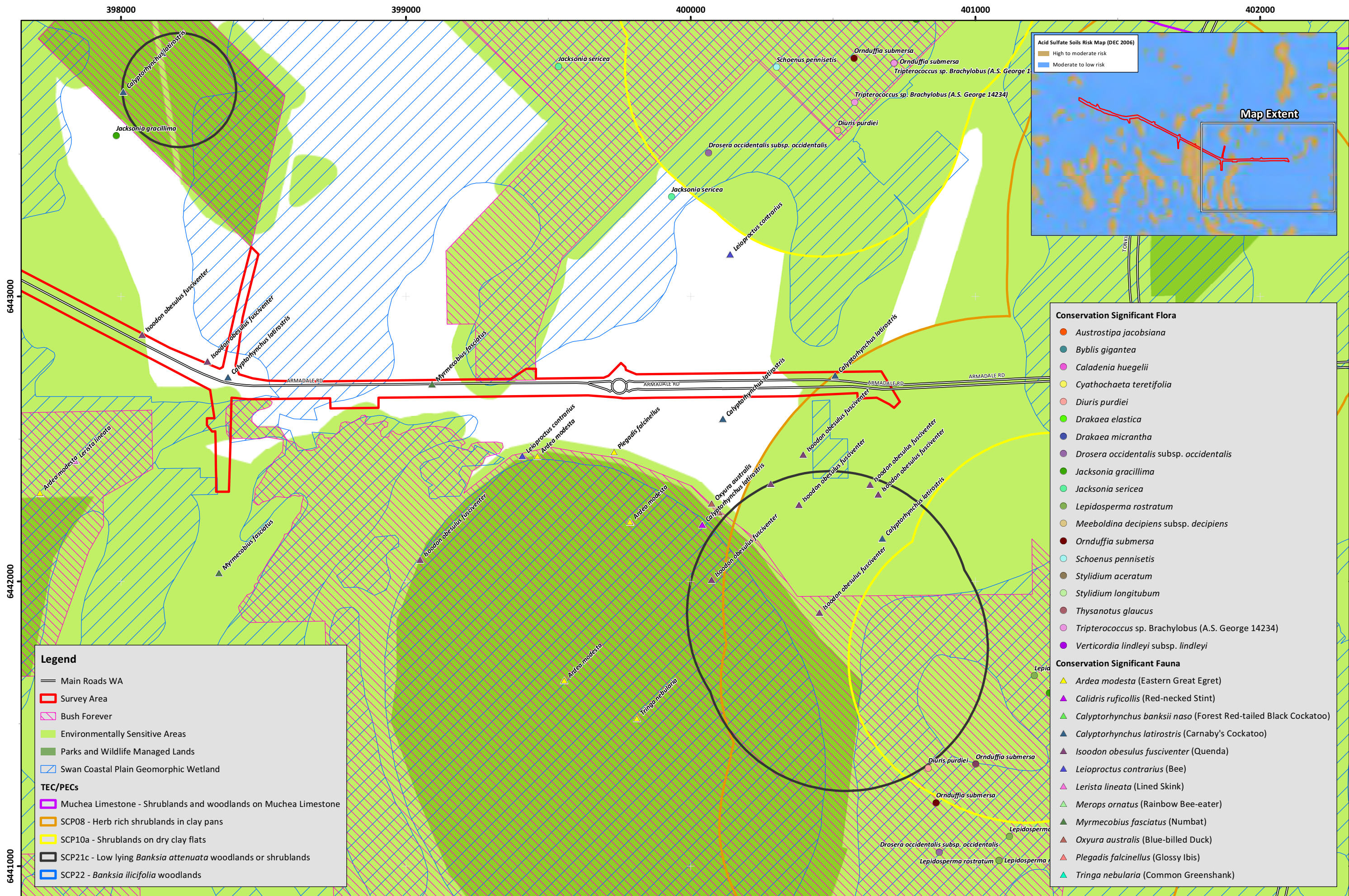
Drawn: W. An

Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_Fig05B_ConSigSpecies



Datum: GDA 1994 - Projection: MGA Zone 50



Legend

- Main Roads WA
- Survey Area
- Bush Forever
- Environmentally Sensitive Areas
- Parks and Wildlife Managed Lands
- Swan Coastal Plain Geomorphic Wetland
- TEC/PECs**
- Muecha Limestone - Shrublands and woodlands on Muecha Limestone
- SCP08 - Herb rich shrublands in clay pans
- SCP10a - Shrublands on dry clay flats
- SCP21c - Low lying *Banksia attenuata* woodlands or shrublands
- SCP22 - *Banksia ilicifolia* woodlands

Conservation Significant Flora

- Austrostipa jacobsoniana*
- Byblis gigantea*
- Caladenia huegelii*
- Cyathochaeta teretifolia*
- Diuris purdiei*
- Drakaea elastica*
- Drakaea micrantha*
- Drosera occidentalis subsp. occidentalis*
- Jacksonia gracillima*
- Jacksonia sericea*
- Lepidosperma rostratum*
- Meeboldina decipiens subsp. decipiens*
- Ornduffia submersa*
- Schoenus pennisetis*
- Stylidium aceratum*
- Stylidium longitubum*
- Thysanotus glaucus*
- Tripterococcus sp. Brachylobus (A.S. George 14234)*
- Verticordia lindleyi subsp. lindleyi*

Conservation Significant Fauna

- Ardea modesta* (Eastern Great Egret)
- Calidris ruficollis* (Red-necked Stint)
- Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo)
- Calyptorhynchus latirostris* (Carnaby's Cockatoo)
- Isodon obesulus fusciventer* (Quenda)
- Leioproctus contrarius* (Bee)
- Lerista lineata* (Lined Skink)
- Merops ornatus* (Rainbow Bee-eater)
- Myrmecobius fasciatus* (Numbat)
- Oxyura australis* (Blue-billed Duck)
- Plegadis falcinellus* (Glossy Ibis)
- Tringa nebularia* (Common Greenshank)

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment

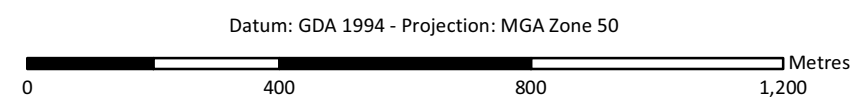
Figure 5B: Environmental constraints known from within and adjacent to the survey area

Author: J. Oates

Drawn: W. An

Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_Fig05B_ConSigSpecies



4.2.5 Vertebrate Fauna

The desktop fauna literature review identified 81 vertebrate fauna species of conservation significance previously recorded within the vicinity of the survey area, comprising of seven reptile species, 63 bird species and 11 mammal species (Appendix C). Of these, 17 species were listed as threatened under the Commonwealth EPBC Act and/or State *Wildlife Conservation Act 1950* (WC Act) (Table 7). The remaining 66 species are listed as Migratory under the EPBC Act and/or as Priority species by Parks and Wildlife (Appendix D). Conservation categories for conservation significant fauna are presented in Appendix B.

Table 7: Threatened fauna species occurring within the vicinity of the survey area identified from the desktop review (Department of the Environment 2015d; Department of Parks and Wildlife 2015a).

Scientific name	Common name	EPBC Act	WC Act	Likelihood of occurrence
<i>Pseudemydura umbrina</i>	Western Swamp Turtle	CR	S1	Low
<i>Leipoa ocellata</i>	Malleefowl	VU	S3	Low
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	S2	Low
<i>Charadrius mongolus</i>	Lesser Sand Plover	MI	S5	Low
<i>Rostratula australis</i>	Australian Painted Snipe	EN	S2	Low
<i>Numenius madagascariensis</i>	Eastern Curlew	MI	S5	Low
<i>Calidris tenuirostris</i>	Great Knot	MI	S5	Low
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR (MI)	S5	Low
<i>Anous tenuirostris melanops</i>	Lesser Noddy	VU	S2	Low
<i>Sternula nereis nereis</i>	Fairy Tern	VU	S3	Low
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-cockatoo	VU	S3	Low
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	EN	S2	Low
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	VU	S2	Low
<i>Cacatua pastinator pastinator</i>	Muir's Corella	VU	S6	Low
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch	VU	S3	Low
<i>Phascogale tapoatafa tapoatafa</i>	Wambenger, Brush-tailed Phascogale	NA	S3	Low
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	VU	S2	Low
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	VU	S3	Low
<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong, Woylie	EN	S2	Low
<i>Setonix brachyurus</i>	Quokka	VU	S3	Low

CR = Critically Endangered, EN = Endangered, MI = Migratory, NA = Not applicable, S = Schedule, VU = Vulnerable

Of the 81 conservation significant species previously recorded in the vicinity of the survey area, one species (Forest Red-tailed Black-cockatoo) was recorded during the survey and the remaining species were rated as low (Appendix D).

Marine species and species rated as extinct (Schedule 4) have been excluded from the desktop database assessment as they are highly unlikely to occur within the survey area. Five conservation significant species were identified through *NatureMap* (Department of Parks and Wildlife 2015a) but clearly outside their nominal distribution and hence deleted from the assessment: the Dwarf Bearded Dragon (Houtman Abrolhos Island race) (*Pogona minor* subsp. *minima*), Western Barred

Bandicoot (Shark Bay subsp.) (*Perameles bougainville* subsp. *bougainville*), Gilbert's Potoroo (*Potorous gilberti*), the Shark Bay Boodie (*Bentongia lesueur* subsp. *lesueur*) and the Shark Bay Keelless Legless Lizard (*Pletholax gracilis* subsp. *edelensis*).

4.2.5.1 Black Cockatoos

A Parks and Wildlife database search for foraging, breeding and roosting resources for black cockatoos overlapping the survey area, revealed that the search area is within 13.5 km of a confirmed breeding site and contains 23 confirmed roost records within 6 km of the survey area (Department of Parks and Wildlife 2015e). In addition, this search area consisted of 448 incidences of foraging evidence.

4.3 Field Survey

4.3.1 Vegetation



Three vegetation associations were recorded within the survey area (Table 8). Vegetation association mapping is provided in Figure E.1 (Appendix E) and the data collected from each unmarked quadrat is provided in Appendix F. There were also areas of planted species (6.7 hectares (ha)) and areas that were completely cleared (47.6 ha) (Appendix E, Figure E.1).

4.3.2 Vegetation Condition

Vegetation in the survey area ranged from Completely Degraded to Excellent condition (Keighery 1994) (Table 9; Appendix E, Figure E.2). Approximately 10% of the survey area was in Good to Excellent condition, with the remaining areas being cleared and in Degraded and Completely Degraded condition (Appendix E, Figure E.2).

The vegetation in both unmarked quadrats 4b and 8, the *Melaleuca preissiana* damplands, were in Excellent condition (Plate 2). Sites in the *Kunzea glabrescens* tall shrubland were rated as being in Good condition, although rubbish was present. Heavy rubbish dumping was also observed in some other areas. Sites in the *Banksia* woodland were in overall Good condition with the presence of weed species in the understorey. Vegetation mapped as being in Completely Degraded condition often consisted of predominantly cleared areas with planted or remnant native trees (*Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Eucalyptus marginata* and *E. rudis*), planted native trees (*E. camaldulensis* and Eastern States Eucalypts), or planted introduced trees (**Pinus* sp., **Schinus terebinthifolius*, **Ficus* species' (spp.)) over introduced grasses, often **Avena barbata* and **Ehrharta calycina*. Some areas also included drainage lines with **Typha ?orientalis* and *Melaleuca teretifolia*, or thick patches of *Pteridium esculentum*.

Table 8: Vegetation associations recorded within the survey area.

Vegetation association and code	Habitat	Site(s)	Vegetation condition	Total area (ha)	Representative photograph
<p>BaBm Banksia woodland</p> <p><i>Banksia attenuata</i>, <i>B. menziesii</i> and <i>B. ilicifolia</i> low woodland (with <i>Eucalyptus marginata</i> scattered trees) over <i>Xanthorrhoea preissii</i> (<i>Macrozamia riedlei</i>) open shrubland over <i>Dasypogon bromeliifolius</i> and <i>Phlebocarya ciliata</i> or <i>Desmocladius flexuosus</i> open herbland to closed herbland.</p> <p>Associated species: <i>Allocasuarina fraseriana</i>, *<i>Avena barbata</i>, <i>Burchardia congesta</i>, *<i>Ehrharta calycina</i>, *<i>Euphorbia terracina</i>, *<i>Fumaria capreolata</i>, <i>Hypocalymma angustifolium</i>, <i>Lepidosperma</i> sp., *<i>Moraea flaccida</i>, <i>Patersonia occidentalis</i></p>	Mid to upper slopes on grey sand	1, 6, 7	Good	7.0	 <p>Plate 1: Vegetation representing BaBm – <i>Banksia</i> woodland.</p>
<p>Mp Melaleuca preissiana damplands</p> <p><i>Melaleuca preissiana</i> low open Forest to low closed forest over <i>Lepidosperma</i> sp. or <i>Lepidosperma longitudinale</i> and <i>Dielsia stenostachya</i> closed sedgeland (over <i>Pteridium esculentum</i> herbland).</p> <p>Associated species: <i>Acacia ?longifolia</i>, <i>Hypocalymma angustifolium</i>, <i>Phlebocarya ciliata</i>, <i>Xanthorrhoea preissii</i></p>	Seasonally wet damplands with dark loamy sand	2, 4, 4b, 8	Good to Excellent	4.3	 <p>Plate 2: Vegetation representing Mp – <i>Melaleuca preissiana</i> damplands.</p>


Vegetation association and code	Habitat	Site(s)	Vegetation condition	Total area (ha)	Representative photograph
<p>Kg <i>Kunzea glabrescens</i> tall shrublands</p> <p><i>Kunzea glabrescens</i> tall open scrub to closed tall scrub over <i>Dasypogon bromeliifolius</i> or <i>Phlebocarya ciliata</i> low open shrubland.</p> <p>Associated species: <i>Jacksonia sternbergiana</i>, <i>Macrozamia riedlei</i>, <i>Regelia ciliata</i>, <i>Xanthorrhoea preissii</i></p>	<p>Flat sandy palusplains</p>	<p>3, 5</p>	<p>Good to Very Good</p>	<p>2.5</p>	 <p>Plate 3: Vegetation representing Kg – <i>Kunzea glabrescens</i> tall shrublands on palusplains.</p>

Table 9: Vegetation condition recorded for the survey area.

Vegetation condition	Total mapped area (ha)
Excellent	0.1
Good to Very Good	0.2
Good	6.3
Degraded	6.4
Completely Degraded	55.1

4.3.3 Conservation Significance of Vegetation

Several wetland areas were observed on the edge of roads intersecting the survey area, which although they were degraded at edges would require further examination as to their potential to be impacted, including the wetland area to the south of 393537.95mE 6444670mN, *Melaleuca preissiana* dampland adjacent to 398376.361mE 6442613.373mN, an area of Jandakot Regional Park near 398456.27mE 6443226.54mN and a dense shrubland adjacent to 400715mE 6442600.85mN.

Preliminary assessments of intact vegetation communities show that Floristic Community Types (FCTs) 4 (*Melaleuca preissiana* swamplands), 5 (Mixed shrub damplands) and 23a (Central *Banksia attenuata*-*Banksia menziesii* woodlands) are the likely FCTs occurring in the area. None of the FCTs that match the vegetation associations described are PECs or TECs. Hence, no TECs (State or Commonwealth listed) or PECs were recorded within the survey area.

The buffer of a Commonwealth listed TEC 'SCP08 – Herb rich shrublands in clay pans' intersects the eastern end of the survey area, however the area is comprised of housing and road infrastructure, planted trees and no natural vegetation (Department of Parks and Wildlife 2015b).

4.3.4 Flora

One hundred and three vascular flora species, representing 80 genera and 42 families were recorded within the survey area. The dominant plant family was Fabaceae, with 15 taxa recorded, and *Acacia* was the most frequently recorded genus (Table 10). A species list for the survey area is provided in Appendix G.

Table 10: Plant families and genera most frequently recorded in the survey area.

Family	Number of taxa
Fabaceae	15
Myrtaceae	14
Poaceae	7
Proteaceae	7
Genus	Number of taxa
<i>Acacia</i>	5
<i>Melaleuca</i>	3
<i>Banksia</i>	3

4.3.5 Conservation Significance of Flora

Two plants of *Dodonaea hackettiana* (P4) were located within the survey area in vegetation rated as in Degraded condition (Table 10; Appendix H, Figure H.1).

Table 11: Location of conservation significant flora species recorded within the survey area.

Species	Estimated abundance	Easting (MGA50, GDA94)	Northing (MGA50, GDA94)
<i>Dodonaea hackettiana</i> P4	2	398394	6442642

4.3.6 Introduced Flora (Weeds)




Twenty-seven roadside environmental weeds were observed throughout the survey area (Appendix I, Table I.1.). Of these weeds, four are listed as a Declared Pest plant in Western Australia under the *Biodiversity and Agriculture Management Act 2007*: **Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush), **Zantedeschia aethiopica* (Arum Lily), **Moraea flaccida* (One-Leaf Cape Tulip) and **Rubus* sp. (Blackberry) (**Rubus* sp. could only be identified to species level, however most *Rubus* likely to occur in the area are Declared Pests) (Appendix I, Figure I.1 and Table I.1) (Department of Agriculture and Food 2015). None of the species are listed as a Weed of National Significance (WoNS) (Australian Weeds Committee 2012).

4.3.7 Fauna Habitat

Three fauna habitat types based on vegetation mapping were identified during the field survey: *Banksia* woodland (7.0 ha, 10%), *Kunzea glabrescens* tall shrubland (2.5 ha, 4%) and *Melaleuca preissiana* dampland (4.3 ha, 6%) (Table 12). The remaining 54.3 ha (80%) was essentially cleared open areas or plantings and part of an existing road reserve. These habitat types correspond to the vegetation types (Appendix E, Figure E.1) due to the differing micro-habitats that each provides.

The fauna habitat condition within the intact vegetation communities generally were in ‘good’ condition (Thompson and Thompson 2010). These habitats still retained some connectivity with other habitats, specifically the areas connected to Bush Forever sites 342 and 390, but did show signs of degradation often associated with edge effects that are characteristic of road reserves. Fauna habitat condition within the remainder of the survey area was considered to be in ‘highly degraded’ condition (Thompson and Thompson 2010). These cleared areas were devoid of vegetation and therefore offered few micro-habitats to fauna species.

Table 12: Fauna habitats recorded within the survey area.

Habitat and description	Area within survey area (ha)	Representative photograph
<p><i>Banksia</i> woodland Mainly consisted of <i>Banksia</i> species such as <i>Banksia attenuata</i>, <i>B. menziesii</i>, <i>B. ilicifolia</i>, providing foraging opportunities to avian species that target fruiting Proteaceous plants, specifically conservation significant black cockatoos. The soils were mainly grey sand suitable for burrowing specialists that forage and/or burrow within soft soils, such as the conservation significant Southern Brown Bandicoot.</p>	7.0 (10%)	 <p>Plate 4: <i>Banksia</i> woodland fauna habitat type.</p>
<p><i>Kunzea glabrescens</i> tall shrubland Mainly consisted of the myrtaceous <i>Kunzea glabrescens</i> was generally closed tall scrub vegetation with a significantly greater level of leaf litter offering foraging and shelter opportunities to a suite of fauna species. This habitat lacks large trees thereby providing no nesting or roosting opportunities for avian species, particularly species of conservation significance.</p>	2.5 (4%)	 <p>Plate 5: <i>Kunzea glabrescens</i> tall shrubland fauna habitat type.</p>
<p><i>Melaleuca preissiana</i> dampland Consisted of an overstorey of <i>Melaleuca</i> with ground cover of sedges species such as <i>Lepidosperma longitudinale</i> and <i>Dielsia stenostachya</i>. These areas are often low lying and will become inundated during peak rain events and provide habitat for burrowing specialists, particularly frog species.</p>	4.3 (6%)	 <p>Plate 6: <i>Melaleuca preissiana</i> dampland fauna habitat type.</p>

4.3.8 Vertebrate Fauna

Twenty-one fauna species were recorded during the survey through direct observation or indirect evidence (calls or scats), including two reptile species, 17 bird species (including one conservation significant species) and two mammal species both of which were introduced species (Table 13). One conservation significant species was recorded in the survey area, the Forest Red-tailed Black-cockatoo. This species is listed as Vulnerable under the EPBC Act and Scheduled 3 under the WC Act.

Table 13: Vertebrate fauna species recorded during the survey.

Scientific name	Common name	Observation type
REPTILES		
<i>Notechis scutatus</i>	Tiger Snake	Individuals
<i>Pseudonaja affinis</i>	Dugite	Individuals
BIRDS		
<i>Phaps chalcoptera</i>	Common Bronzewing	Individuals
<i>Falco berigora</i>	Brown Falcon	Individuals (active nest)
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-cockatoo	Foraging evidence
<i>Eolophus roseicapillus</i>	Galah	Individuals
<i>Purpureicephalus spurius</i>	Red-capped Parrot	Individuals
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo	Calls
<i>Malurus splendens</i>	Splendid Fairy-wren	Individuals
<i>Lichenostomus virescens</i>	Singing Honeyeater	Calls
<i>Anthochaera carunculata</i>	Red Wattlebird	Individuals
<i>Lichmera indistincta</i>	Brown Honeyeater	Calls
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Individuals
<i>Phylidonyris niger</i>	White-cheeked Honeyeater	Individuals
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Individuals
<i>Artamus cinereus</i>	Black-faced Woodswallow	Scats
<i>Cracticus tibicen</i>	Australian Magpie	Individuals
<i>Rhipidura leucophrys</i>	Willie Wagtail	Individuals
<i>Hirundo neoxena</i>	Welcome Swallow	Individuals
MAMMALS		
<i>Oryctolagus cuniculus</i>	Rabbit	Scats
<i>Canis lupus familiaris</i>	Dog	Scats

4.3.8.1 Black Cockatoo Assessment

Astron has consulted the Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2012), particularly the distribution maps for black cockatoos and assumes all of the three species of black cockatoos endemic to the southwest of Western Australia could be expected to occur within the vicinity of the survey area at intermittent times.

Foraging Resources

Foraging evidence of the Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*), listed as Vulnerable under the federal EPBC Act and Schedule 3 under the WC Act, was recorded in the survey area. This species was recorded through the presence of recent foraging evidence (Plate 7 and Plate 8), specifically chewed fruit of Marri (*Corymbia calophylla*) (Table 14; Appendix H, Figure H.1).

Foraging habitat for this species includes the vegetation associations containing *Banksia* and *Hakea* species, which when flowering, is a high priority food for this species (Department of Environment

and Conservation 2011). The proteaceous species present within the *Banksia* woodland (7.0 ha) fauna habitat type within the survey area would provide some level of foraging opportunities for black cockatoo species. However, as this fauna habitat was generally degraded, it does not constitute as 'quality' foraging habitat.

Table 14: Location of conservation significant fauna species recorded within the survey area.

Species	Observation	Easting (MGA50, GDA94)	Northing (MGA50, GDA94)
<i>Calyptorhynchus banksii naso</i> (Schedule 3, Vulnerable)	Foraging evidence	399359	6442713



Plate 7: Chewed Marri fruit as foraging evidence of the Forest red-tailed Black-cockatoo at GPS co-ordinate 399359mE and 6442713mN (MGA Zone 50).



Plate 8: Chewed Marri fruit from the Forest red-tailed Black-cockatoo at GPS co-ordinate 399359mE and 6442713mN (MGA Zone 50).

Breeding Resources

The vegetation within the survey area is unsuitable for breeding habitat for black cockatoos as no trees with potential breeding hollow were present. In addition, no trees deemed as future habitat trees (DBH greater than 50 cm) under the referral guidelines (Department of Sustainability Environment Water Population and Communities 2012), were recorded in the survey area.

Roosting Resources

No trees suitable as roost trees for black cockatoos were recorded in the survey area.

5 Discussion and Recommendations

5.1 Vegetation and Flora

The survey area comprised seasonal wetland, winter wet dampland and gently undulating plain habitat with varying degree of tree and shrub cover over tussock grassland or sedgeland. The majority of the survey area was cleared. Of the vegetation remaining most was degraded due to the presence of weed invasion and rubbish dumping, but the remainder was in Good to Excellent condition. The vegetation observed within the survey area is typical of what might be expected in these areas on the Swan Coastal Plain. None of the vegetation associations represent a Commonwealth or State listed TEC or PEC, although the buffer of the Commonwealth listed TEC 'SCPO8 – Herb rich shrublands in clay pans' intersects the eastern end of the survey area. This area contains no natural vegetation besides some plant trees.

Seasonal conditions were average and rainfall recorded two months prior to the survey area was below the average annual rainfall. One hundred and three vascular flora species were recorded during the field survey, which represented a suite of species with few annual and ephemeral species. No threatened flora species were recorded, but one State-listed Priority flora species was recorded: *Dodonaea hackettiana* (P4). This species has been previously recorded in the vicinity of the survey area and it is unlikely that the proposed duplication work will have a significant impact on the conservation status of this species as only one individual was recorded. Three of the Priority flora species listed from database searches are likely to occur and a further 16 have the potential to occur within the survey area but were not recorded in the survey area. All of these species are perennial, except for two (*Stylidium aceratum* and *Stylidium longitubum*) and given the average seasonal conditions and thorough search conducted, it is considered likely that they would have been observed if present. The exception to this is *Drakaea elastica* (T), where surveys are best undertaken by the end of August when the orchid leaf is still green and more easily sighted given that the plant can be difficult to see during its flowering period (Parks and Wildlife advice 2015). The majority of the mapped wetland areas within the survey area were degraded and lacked understorey; however where *Kunzea glabrescens* tall shrubland is present in good or better condition there may be suitable habitat for *D. elastica*.

Twenty-seven weeds were recorded in the survey area. Four of these, **Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush), **Zantedeschia aethiopica* (Arum Lily), **Moraea flaccida* (One-Leaf Cape Tulip) and **Rubus* spp. (Blackberry), are a Declared pest in Western Australia (Department of Agriculture and Food 2015), but are not a WoNS (Australian Weeds Committee 2012).

5.2 Vertebrate Fauna

A large number of conservation significant fauna species are known from the vicinity surrounding the survey area. These include 17 species that are listed as threatened under the Commonwealth EPBC Act and/or State WC Act. However given the degraded and disconnected nature of the fauna habitat found in the survey area, it is unlikely that these species would be expected to occur, or occur on a regular basis; hence, they were generally all rated as having a low likelihood of occurrence. The habitats within the survey area are not unique and generally are degraded or cleared areas offering few micro-habitats for fauna species to exploit. There are no habitats in the survey area that are important to species of conservation significance.

The *Banksia* woodland habitat present within the survey area is consistent with the definition of foraging habitat for black cockatoos, particularly Carnaby's Cockatoo, in accordance Commonwealth referral guidelines (Department of Sustainability Environment Water Population and Communities 2012). Recent feeding evidence of the Forest Red-tailed Black-cockatoo of Marri (*Corymbia*

calophylla) fruit was also found within the survey area. However, it is deemed not to be ‘quality’ foraging habitat under these guidelines due to this fauna habitat being highly degraded and therefore unlikely to be significant for local populations of these birds. The *Banksia* trees are isolated and disconnected within existing vegetation and some are planted. The survey area is also more than 12 km from any known confirmed breeding site, which is significant as individuals generally do not travel greater than this distance from a nest site to forage (Department of Sustainability Environment Water Population and Communities 2012). Therefore the survey area is not considered important foraging habitat to sustain breeding pairs.

5.3 Recommendations

5.3.1 Further Field Investigations

A targeted winter survey for *Drakaea elastica* (T) should be considered within the areas of *Kunzea glabrescens* tall shrubland in good or better condition to confirm the presence or absence of this species.

A number of Conservation and Resource Enhancement category wetlands were identified during the desktop assessment. Based on the vegetation association and condition mapping from the current survey, it is recommended that clarification and possibly re-evaluation of some wetland boundaries and management categories is undertaken. Several wetland areas immediately adjacent to the survey area may also require further survey if they have the potential to be impacted from the proposed works.

For any potential works undertaken in the survey area that require dewatering, drainage works or excavation of more than 100 cubic metres, an ASS investigation should be carried out. It is likely that ASS will be present as some parts of the survey area have been mapped as a ‘High to Moderate Probability of Occurrence’.

5.3.2 Management Measures

Where practicable, disturbance to Priority flora recorded should be avoided. To minimise impacts to vegetation, vehicles and plant machinery should remain within areas designated for clearing such as tracks. Weed and soil measures in accordance with Main Roads Statewide Purpose Clearing Permit, CPS818/12 should be implemented during clearing and construction to prevent further spread of weeds. This is of particular relevance for the Declared pests recorded in the survey area.

The survey area provides minimal foraging resources for black cockatoos and breeding habitat was not recorded, hence referral under the Commonwealth guidelines (Department of Sustainability Environment Water Population and Communities 2012) is not required.

If ASSs are found to be present then an appropriate ASS Management Plan would be required in accordance with the Department of Environment Regulation guidelines:

- Department of Environment Regulation 2015, *Identification and investigation of acid sulfate soils and acidic landscapes, June 2015* (Department of Environment Regulation 2015b)
- Department of Environment Regulation 2015, *Treatment and management of soils and water in acid sulfate soil landscapes, June 2015* (Department of Environment Regulation 2015c)

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Appendix A: Vegetation Classification and Condition Scales, and Fauna Habitat Condition Scale

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Table A.1: Vegetation Classification System Specht (1970) as modified by Aplin (1979).

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
Trees >30 m	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees <10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs >2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs <1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, sedges, herbs	Closed tussock grassland/ sedgeland/ herbland	Tussock grassland/ sedgeland/ herbland	Open tussock grassland/ sedgeland/ herbland	Very open tussock grassland/ sedgeland/ herbland	Scattered tussock grasses/sedges/herbs

Table A.2: Summary of adapted vegetation condition scale (Keighery 1994).

Vegetation condition	Condition description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. Disturbance to vegetation structure covers repeated fire, aggressive weeds, dieback, logging, grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure covers frequent fires, aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure includes frequent fires, presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs.

Table A.3. Fauna habitat condition scale (Thompson and Thompson 2010).

Habitat condition	Condition description
High Quality Fauna Habitat	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any human induced disturbance. The habitat has connectivity with other habitats and is likely to support the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat	These areas show minimal signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) and retain almost all of the characteristics of the habitat had it not been disturbed. The habitat has connectivity with other habitats, and fauna assemblages in these areas are likely to be minimally effected by disturbance.
Good Fauna Habitat	These areas show signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat had it not been disturbed. The habitat still retains some connectivity with other habitats but fauna assemblages in these areas are likely to be affected by disturbance. Fauna assemblages in these areas are likely to be similar to what might be expected in this habitat.
Disturbed Fauna Habitat	These areas show signs of human induced significant disturbance (e.g. mining, clearing, tracks and roads). Many of the trees, shrubs and undergrowth have died or have been cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain an abundance of weeds or have been damaged by vehicles or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat	These areas often have a significant human induced loss of vegetation, and / or a large number of vehicle tracks and / or have been completely cleared, and / or areas have been heavily grazed or farmed. There is limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to differ significantly from what existed prior to the disturbance, and are often depleted compared to what existed prior to the disturbance.

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**Appendix B: Conservation Categories for Flora, Fauna and
Ecological Communities, and Categories for Introduced Flora
and Fauna**

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Table B.1: Categories of threatened ecological communities (Parks and Wildlife 2015b).

PD: Presumed Totally Destroyed
<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
CR : Critically Endangered
<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

En: Endangered

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU: Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Table B.2: Definitions and criteria for priority ecological communities (Parks and Wildlife 2015b).

P1: Priority One – Poorly-known ecological communities
Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-Known ecological communities
Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-Known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table B.3: Definitions and criteria for threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999*.

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table B.4: Conservation codes for Western Australian flora and fauna under the *Wildlife Conservation Act 1950*.

Code	Conservation category	Definition
S1	Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice and Wildlife Conservation (Rare Flora) Notice under the Wildlife Conservation Act 1950.	Taxa that is rare or likely to become extinct, as critically endangered taxa.
S2	Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice and Wildlife Conservation (Rare Flora) Notice under the Wildlife Conservation Act 1950.	Taxa that is rare or likely to become extinct, as endangered taxa.
S3	Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice and Wildlife Conservation (Rare Flora) Notice under the Wildlife Conservation Act 1950.	Taxa that is rare or likely to become extinct, as vulnerable taxa.
S4	Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice and Wildlife Conservation (Rare Flora) Notice under the Wildlife Conservation Act 1950.	Taxa that is presumed to be extinct.
S5	Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Birds that are subject to international agreements relating to the protection of migratory birds.
S6	Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Fauna that are of special conservation need being species dependent on ongoing conservation intervention.
S7	Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice under the Wildlife Conservation Act 1950.	Declared to be fauna that is in need of special protection, otherwise than for the reasons mentioned.

Note: Schedules 5, 6, and 7 are only related to conservation significant fauna.

Threatened fauna and flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

- **CR: Critically Endangered** - considered to be facing an extremely high risk of extinction in the wild.
- **EN: Endangered** - considered to be facing a very high risk of extinction in the wild.
- **VU: Vulnerable** - considered to be facing a high risk of extinction in the wild.

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring. Conservation Dependent species are placed in Priority 5.

Table B.5: Priority species under the Western Australian Wildlife Conservation Act 1950.

<p>P1: Priority One – Poorly known taxa</p> <p>Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.</p>
<p>P2: Priority Two – Poorly known taxa</p> <p>Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.</p>
<p>P3: Priority Three – Poorly known taxa</p> <p>Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.</p>
<p>P4: Priority Four: Rare, near threatened and other taxa in need of monitoring</p> <p>(a) Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<p>P5: Priority Five: Conservation dependent taxa</p> <p>Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.</p>

Table B.6: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalized population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	<p>Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied:</p> <ul style="list-style-type: none"> i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; iv) Cessation of the management plan would adversely affect the conservation status of the taxa <p>Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.</p>

The management of introduced flora species in Western Australia is now regulated through the Biosecurity and Agriculture Management Act 2007 (BAM Act). A list of declared pests, including ‘pest’ plants is provided under the BAM Act, which has been updated to incorporate a number of other Acts that are administered by Department of Agriculture and Food Western Australia. Declared pests can fall into two categories: one that relates to the prevention of introducing the species or eradicating it; and the other relates to managing the species and whether it can be kept (i.e. for scientific purposes, education or other purpose).

The threat and risk posed to site-specific biodiversity values, influences to rehabilitation success, primary production, infrastructure assets or human health will differ depending on the unique characteristics of each site and the associated land management practice or operation. Therefore site or project specific weed assessments and priorities should be reviewed for each project.

As per introduced flora species, the BAM Act seeks to establish a modern biosecurity regulatory scheme to prevent serious animal pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State. Declared animal pests fall into three categories as Gazetted under the BAM Act.

Table B.7: Declared pests categories as gazetted under the *Biosecurity and Agriculture Management Act 2007*.

Category	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table B.8: Fauna habitat condition scale (Thompson and Thompson 2010).

Habitat condition	Condition description
High Quality Fauna Habitat (1.0)	These areas closely approximate the vegetation mix and quality that would have been in the area prior to any human induced disturbance. The habitat has connectivity with other habitats and is likely to support the most natural vertebrate fauna assemblage.
Very Good Fauna Habitat (0.8)	These areas show minimal signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) and retain almost all of the characteristics of the habitat had it not been disturbed. The habitat has connectivity with other habitats, and fauna assemblages in these areas are likely to be minimally effected by disturbance.
Good Fauna Habitat (0.6)	These areas show signs of human induced disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat had it not been disturbed. The habitat still retains some connectivity with other habitats but fauna assemblages in these areas are likely to be affected by disturbance. Fauna assemblages in these areas are likely to be similar to what might be expected in this habitat.
Disturbed Fauna Habitat (0.4)	These areas show signs of human induced significant disturbance (e.g. mining, clearing, tracks and roads). Many of the trees, shrubs and undergrowth have died or have been cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, contain an abundance of weeds or have been damaged by vehicles or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.
Highly Degraded Fauna Habitat (<0.2)	These areas often have a significant human induced loss of vegetation, and/or a large number of vehicle tracks and / or have been completely cleared, and/or areas have been heavily grazed or farmed. There is limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to differ significantly from what existed prior to the disturbance, and are often depleted compared to what existed prior to the disturbance.

Appendix C: Database Search Results

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Table C.1: Amphibian species recorded within 40 km of the survey area.

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Hylidae										
<i>Litoria adelaidensis</i>	Slender Tree Frog					X				
<i>Litoria moorei</i>	Motorbike Frog					X				
Limnodynastidae										
<i>Heleioporus barycragus</i>	Hooting Frog					X				
<i>Heleioporus eyrei</i>	Moaning Frog					X				
<i>Heleioporus psammophilus</i>	Sand Frog					X				
<i>Limnodynastes dorsalis</i>	Western Banjo Frog					X				
<i>Neobatrachus pelobatoides</i>	Humming Frog					X				
Myobatrachidae										
<i>Crinia georgiana</i>	Quacking Frog					X				
<i>Crinia glauerti</i>	Clicking Frog					X				
<i>Crinia insignifera</i>	Squelching Froglet					X				
<i>Crinia pseudinsignifera</i>	Bleating Froglet					X				
<i>Geocrinia leai</i>	Ticking Frog					X				
<i>Myobatrachus gouldii</i>	Turtle Frog					X				
<i>Pseudophryne guentheri</i>	Crawling Toadlet					X				

Table C.2: Reptile species recorded within 40 km of the survey area.

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Cheluidae										
<i>Chelodina colliei</i>	Oblong Turtle					X				
<i>Pseudemys umbrina</i>	Western Swamp Turtle		CR	S1		X				
Carphodactylidae										
<i>Underwoodisaurus milii</i>	Southern Barking Gecko					X				
Diplodactylidae										
<i>Crenadactylus ocellatus</i>	Clawless Gecko					X				
<i>Diplodactylus granariensis</i>						X				
<i>Diplodactylus polyophthalmus</i>	Spotted Sandplain Gecko					X				
<i>Diplodactylus pulcher</i>						X				
<i>Lucasium alboguttatum</i>						X				
<i>Strophurus spinigerus</i>						X				
Gekkonidae										
<i>Christinus marmoratus</i>	Marbled Gecko					X				
<i>Gehyra variegata</i>						X				
<i>Hemidactylus frenatus</i>	Asian House Gecko	*				X				
<i>Heteronotia binoei</i>	Bynoe's Gecko					X				
Pygopodidae										
<i>Aprasia pulchella</i>						X				
<i>Aprasia repens</i>						X				
<i>Delma fraseri</i>						X				
<i>Delma grayii</i>						X				
<i>Lialis burtonis</i>						X				
<i>Pletholax gracilis</i>	Keeled Legless Lizard					X				
<i>Pygopus lepidopodus</i>	Common Scaly Foot					X				
<i>Pygopus nigriceps</i>						X				
Agamidae										

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Calotes versicolor versicolor</i>	Oriental Garden Lizard	*				X				
<i>Ctenophorus adalaidensis</i>	Western Heath Dragon					X				
<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon					X				
<i>Pogona minor</i>						X				
<i>Pogona nullarbor</i>	Nullabor Bearded Dragon					X				
Egerniidae										
<i>Cyclodomorphus celatus</i>						X				
<i>Egernia kingii</i>	King's Skink					X				
<i>Egernia napoleonis</i>						X				
<i>Tiliqua multifasciata</i>	Central Blue-tongue					X				
<i>Tiliqua occipitalis</i>	Western Bluetongue					X				
<i>Tiliqua rugosa</i>						X				
Eugongylidae										
<i>Acritoscincus trilineatus</i>						X				
<i>Cryptoblepharus buechananii</i>						X				
<i>Cryptoblepharus plagiocephalus</i>						X				
<i>Menetia greyii</i>						X				
<i>Menetia maini</i>						X				
<i>Menetia surda</i>						X				
<i>Morethia adalaidensis</i>						X				
<i>Morethia boulengeri</i>						X				
<i>Morethia butleri</i>						X				
<i>Morethia lineoocellata</i>						X				
<i>Morethia obscura</i>						X				
<i>Morethia ruficauda</i>						X				
<i>Morethia storri</i>						X				
<i>Proablepharus reginae</i>						X				
<i>Proablepharus tenuis</i>						X				

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Pseudemoia baudini</i>						X				
Sphenomorphidae										
<i>Ctenotus australis</i>						X				
<i>Ctenotus delli</i>	Darling Range Heath Ctenotus				P4	X				
<i>Ctenotus fallens</i>						X				
<i>Ctenotus gemmula</i>	Jewelled Southwest Ctenotus				P3	X				
<i>Ctenotus impar</i>						X				
<i>Ctenotus ora</i>	Coastal Plains Skink				P3	X				
<i>Hemiergis initialis</i>						X				
<i>Hemiergis quadrilineata</i>						X				
<i>Lerista christinae</i>						X				
<i>Lerista distinguenda</i>						X				
<i>Lerista elegans</i>						X				
<i>Lerista lineata</i>					P3	X				
<i>Lerista lineopunctulata</i>						X				
<i>Lerista praepedita</i>						X				
<i>Notoscincus ornatus</i>						X				
Varanidae										
<i>Varanus gouldii</i>	Bungarra or Sand Goanna					X				
<i>Varanus rosenbergi</i>	Heath Goanna					X				
<i>Varanus tristis</i>	Racehorse Goanna					X				
Boidae										
<i>Antaresia stimsoni</i>	Stimson's Python					X				
<i>Morelia spilota imbricata</i>	Carpet Python					X				
Colubridae										
<i>Dendrelaphis punctulata</i>	Green Tree Snake					X				
Elapidae										

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Acanthophis antarcticus</i>	Southern Death Adder				P3	X				
<i>Brachyuropis fasciolatus</i>						X				
<i>Brachyuropis semifasciatus</i>						X				
<i>Demansia psammophis</i>	Yellow-faced Whipsnake					X				
<i>Echiopsis curta</i>	Bardick					X				
<i>Elapognathus coronatus</i>	Crowned Snake					X				
<i>Neelaps bimaculatus</i>	Black-naped Snake				P3	X				
<i>Neelaps calonotos</i>	Black-striped Snake					X				
<i>Notechis scutatus</i>	Tiger Snake					X				
<i>Parasuta gouldii</i>						X				
<i>Parasuta nigriceps</i>						X				
<i>Pseudechis australis</i>	Mulga Snake					X				
<i>Pseudonaja affinis</i>	Dugite					X				
<i>Pseudonaja mengdeni</i>	Western Brown Snake					X				
<i>Pseudonaja modesta</i>	Ringed Brown Snake					X				
<i>Simoselaps bertholdi</i>	Jan's Banded Snake					X				
<i>Simoselaps littoralis</i>	West Coast Banded Snake					X				

Table C.3: Bird species recorded within 40 km of the survey area.

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Casuariidae										
<i>Dromaius novaehollandiae</i>	Emu					X		X		
Megapodiidae										
<i>Leipoa ocellata</i>	Malleefowl		VU	S3		X	X			
Phasianidae										
<i>Coturnix pectoralis</i>	Stubble Quail					X		X		
<i>Coturnix ypsilophora</i>	Brown Quail					X		X		
<i>Pavo cristatus</i>	Indian Peafowl	*				X		X		
<i>Phasianus colchicus</i>	Common Pheasant	*						X		
Anatidae										
<i>Biziura lobata</i>	Musk Duck					X		X		
<i>Stictonetta naevosa</i>	Freckled Duck					X		X		
<i>Cygnus atratus</i>	Black Swan					X		X		
<i>Tadorna radjah</i>	Radjah Shelduck					X				
<i>Tadorna tadornoides</i>	Australian Shelduck					X		X		
<i>Chenonetta jubata</i>	Australian Wood Duck					X		X		
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck					X		X		
<i>Anas rhynchotis</i>	Australasian Shoveler					X		X		
<i>Anas gracilis</i>	Grey Teal					X		X		
<i>Anas castanea</i>	Chestnut Teal					X		X		
<i>Anas platyrhynchos</i>	Northern Mallard					X	X	X		
<i>Anas superciliosa</i>	Pacific Black Duck					X		X		
<i>Aythya australis</i>	Hardhead					X		X		
<i>Oxyura australis</i>	Blue-billed Duck				P4	X		X		
Podicipedidae										
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe					X		X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Polyocephalus polyocephalus</i>	Hoary-headed Grebe					X		X		
<i>Podiceps cristatus</i>	Great Crested Grebe					X		X		
Columbidae										
<i>Columba livia</i>	Rock Dove	*				X	X	X		
<i>Gallicolumba jobiensis</i>	White-breasted Ground Dove	*				X				
<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	*				X				
<i>Streptopelia senegalensis</i>	Laughing Dove	*				X	X	X		
<i>Streptopelia chinensis</i>	Spotted Dove	*				X	X	X		
<i>Phaps chalcoptera</i>	Common Bronzewing					X		X		
<i>Phaps elegans</i>	Brush Bronzewing					X		X		
<i>Ocyphaps lophotes</i>	Crested Pigeon					X		X		
Podargidae										
<i>Podargus strigoides</i>	Tawny Frogmouth					X		X		
Eurostopodidae										
<i>Eurostopodus argus</i>	Spotted Nightjar					X		X		
Aegothelidae										
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar					X		X		
Apodidae										
<i>Apus pacificus</i>	Fork-tailed Swift		MI	S5		X	X	X		
Anhingidae										
<i>Anhinga novaehollandiae</i>	Australasian Darter					X		X		
Phalacrocoracidae										
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant					X		X		
<i>Phalacrocorax carbo</i>	Great Cormorant					X		X		
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant					X		X		
<i>Phalacrocorax varius</i>	Pied Cormorant					X		X		
<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant					X		X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Pelecanidae										
<i>Pelecanus conspicillatus</i>	Australian Pelican					X		X		
Ardeidae										
<i>Botaurus poiciloptilus</i>	Australasian Bittern		EN	S2		X	X	X		
<i>Ixobrychus dubius</i>	Australian Little Bittern				P4	X		X		
<i>Ardea pacifica</i>	White-necked Heron					X		X		
<i>Ardea modesta</i>	Eastern Great Egret		MI	S5		X	X	X		
<i>Ardea intermedia</i>	Intermediate Egret					X				
<i>Ardea ibis</i>	Cattle Egret		MI	S5		X	X	X		
<i>Egretta novaehollandiae</i>	White-faced Heron					X		X		
<i>Egretta garzetta</i>	Little Egret					X		X		
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron					X		X		
Threskiornithidae										
<i>Plegadis falcinellus</i>	Glossy Ibis		MI	S5		X		X		
<i>Threskiornis molucca</i>	Australian White Ibis					X		X		
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					X		X		
<i>Platalea regia</i>	Royal Spoonbill					X		X		
<i>Platalea flavipes</i>	Yellow-billed Spoonbill					X		X		
Accipitridae										
<i>Pandion cristatus</i>	Eastern Osprey		MI	S5		X	X	X		
<i>Elanus axillaris</i>	Black-shouldered Kite					X		X		
<i>Lophoictinia isura</i>	Square-tailed Kite					X				
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		MI	S5		X		X		
<i>Haliastur sphenurus</i>	Whistling Kite					X		X		
<i>Haliastur indus</i>	Brahminy Kite					X				
<i>Milvus migrans</i>	Black Kite					X		X		
<i>Accipiter fasciatus</i>	Brown Goshawk					X		X		
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					X		X		
<i>Circus assimilis</i>	Spotted Harrier					X		X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Circus approximans</i>	Swamp Harrier					X		X		
<i>Aquila audax</i>	Wedge-tailed Eagle					X		X		
<i>Hieraetus morphnoides</i>	Little Eagle					X		X		
Falconidae										
<i>Falco cenchroides</i>	Nankeen Kestrel					X		X		
<i>Falco berigora</i>	Brown Falcon					X		X		
<i>Falco longipennis</i>	Australian Hobby					X		X		
<i>Falco subniger</i>	Black Falcon					X				
<i>Falco peregrinus</i>	Peregrine Falcon			S7		X		X		
Rallidae										
<i>Porphyrio porphyrio</i>	Purple Swamphen					X		X		
<i>Gallirallus philippensis</i>	Buff-banded Rail					X		X		
<i>Porzana pusilla</i>	Baillon's Crake					X		X		
<i>Porzana fluminea</i>	Australian Spotted Crake					X		X		
<i>Porzana tabuensis</i>	Spotless Crake					X		X		
<i>Tribonyx ventralis</i>	Black-tailed Native-hen					X		X		
<i>Gallinula tenebrosa</i>	Dusky Moorhen					X		X		
<i>Fulica atra</i>	Eurasian Coot					X		X		
Otididae										
<i>Ardeotis australis</i>	Australian Bustard					X				
Burhinidae										
<i>Burhinus grallarius</i>	Bush Stone-curlew					X		X		
Haematopodidae										
<i>Haematopus longirostris</i>	Australian Pied Oystercatcher					X		X		
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher							X		
Recurvirostridae										
<i>Himantopus himantopus</i>	Black-winged Stilt					X		X		
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet					X		X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Cladorhynchus leucocephalus</i>	Banded Stilt					X		X		
Charadriidae										
<i>Pluvialis fulva</i>	Pacific Golden Plover		MI	S5		X		X		
<i>Pluvialis squatarola</i>	Grey Plover		MI	S5		X		X		
<i>Charadrius dubius</i>	Little Ringed Plover		MI	S5		X	X	X		
<i>Charadrius ruficapillus</i>	Red-capped Plover					X		X		
<i>Charadrius bicinctus</i>	Double-banded Plover							X		
<i>Charadrius mongolus</i>	Lesser Sand Plover		MI	S2 (S5)		X		X		
<i>Charadrius leschenaultii</i>	Greater Sand Plover		MI	S5		X		X		
<i>Euseyonis melanops</i>	Black-fronted Dotterel					X		X		
<i>Thinornis rubricollis</i>	Hooded Plover				P4	X		X		
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel					X		X		
<i>Vanellus tricolor</i>	Banded Lapwing					X		X		
<i>Vanellus miles</i>	Masked Lapwing					X		X		
Rostratulidae										
<i>Rostratula australis</i>	Australian Painted Snipe		EN	S2			X			
Scolopacidae										
<i>Gallinago hardwickii</i>	Latham's Snipe		MI	S5				X		
<i>Gallinago stenura</i>	Pin-tailed Snipe		MI	S5			X			
<i>Gallinago megala</i>	Swinhoe's Snipe		MI	S5			X			
<i>Limosa limosa</i>	Black-tailed Godwit		MI	S5		X	X	X		
<i>Limosa lapponica</i>	Bar-tailed Godwit		MI	S5		X		X		
<i>Numenius phaeopus</i>	Whimbrel		MI	S5		X		X		
<i>Numenius madagascariensis</i>	Eastern Curlew		MI	S3(S5)		X		X		
<i>Numenius minutus</i>	Little Curlew		MI	S5			X			
<i>Xenus cinereus</i>	Terek Sandpiper		MI	S5				X		
<i>Actitis hypoleucos</i>	Common Sandpiper		MI	S5		X		X		
<i>Tringa brevipes</i>	Grey-tailed Tattler		MI	S5	P4			X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Tringa nebularia</i>	Common Greenshank		MI	S5		X		X		
<i>Tringa stagnatilis</i>	Marsh Sandpiper		MI	S5			X	X		
<i>Tringa glareola</i>	Wood Sandpiper		MI	S5		X	X	X		
<i>Arenaria interpres</i>	Ruddy Turnstone		MI	S5		X		X		
<i>Calidris tenuirostris</i>	Great Knot		MI	S3(S5)		X		X		
<i>Calidris canutus</i>	Red Knot		MI	S5		X	X	X		
<i>Calidris alba</i>	Sanderling		MI	S5		X		X		
<i>Calidris minuta</i>	Little Stint		MI	S5				X		
<i>Calidris ruficollis</i>	Red-necked Stint		MI	S5		X	X	X		
<i>Calidris subminuta</i>	Long-toed Stint		MI	S5		X	X			
<i>Calidris melanotos</i>	Pectoral Sandpiper		MI	S5		X	X	X		
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		MI	S5		X	X	X		
<i>Calidris ferruginea</i>	Curlew Sandpiper		CR (MI)	S3(S5)		X	X	X		
<i>Limicola falcinellus</i>	Broad-billed Sandpiper		MI	S5				X		
<i>Philomachus pugnax</i>	Ruff		MI	S5			X	X		
<i>Phalaropus lobatus</i>	Red-necked Phalarope		MI	S5				X		
Turnicidae										
<i>Turnix varius</i>	Painted Button-quail					X		X		
<i>Turnix velox</i>	Little Button-quail					X				
Glareolidae										
<i>Glareola maldivarum</i>	Oriental Pratincole		MI	S5		X		X		
Laridae										
<i>Anous stolidus</i>	Common Noddy		MI	S5		X		X		
<i>Anous tenuirostris melanops</i>	Lesser Noddy		VU	S2		X				
<i>Onychoprion anaethetus</i>	Bridled Tern		MI	S5		X		X		
<i>Sternula albifrons</i>	Little Tern							X		
<i>Sternula nereis nereis</i>	Fairy Tern		VU	S3		X		X		
<i>Gelochelidon nilotica</i>	Gull-billed Tern		MI	S5				X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Hydroprogne caspia</i>	Caspian Tern		MI	S5		X		X		
<i>Chlidonias hybrida</i>	Whiskered Tern					X		X		
<i>Chlidonias leucopterus</i>	White-winged Black Tern		MI	S5		X		X		
<i>Sterna dougallii</i>	Roseate Tern		MI	S5		X		X		
<i>Sterna striata</i>	White-fronted Tern							X		
<i>Sterna hirundo</i>	Common Tern		MI	S5		X		X		
<i>Sterna paradisaea</i>	Arctic Tern		MI			X		X		
<i>Thalasseus bergii</i>	Crested Tern					X		X		
<i>Larus pacificus</i>	Pacific Gull					X		X		
<i>Chroicocephalus novaehollandiae</i>	Silver Gull					X		X		
Cacatuidae										
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo		VU	S3		X	X	X		
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo		EN	S2		X	X	X		
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo		VU	S2		X	X	X		
<i>Eolophus roseicapillus</i>	Galah					X		X		X
<i>Cacatua tenuirostris</i>	Long-billed Corella	*				X		X		
<i>Cacatua pastinator</i>	Western Corella					X		X		
<i>Cacatua pastinator pastinator</i>	Muir's Corella		VU	S6		X				
<i>Cacatua sanguinea</i>	Little Corella					X		X		
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo					X		X		
<i>Nymphicus hollandicus</i>	Cockatiel					X		X		
Psittacidae										
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	*				X		X		
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet					X		X		
<i>Polytelis anthopeplus</i>	Regent Parrot					X		X		
<i>Platycercus icterotis</i>	Western Rosella					X		X		
<i>Barnardius zonarius</i>	Australian Ringneck							X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Purpureicephalus spurius</i>	Red-capped Parrot					X		X		
<i>Melopsittacus undulatus</i>	Budgerigar					X				
<i>Neophema elegans</i>	Elegant Parrot					X				
<i>Neophema petrophila</i>	Rock Parrot					X		X		
Cuculidae										
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo					X		X		
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo					X		X		
<i>Cacomantis pallidus</i>	Pallid Cuckoo					X		X		
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo					X		X		
Strigidae										
<i>Ninox connivens</i>	Barking Owl					X				
<i>Ninox novaeseelandiae</i>	Southern Boobook					X		X		
Tytonidae										
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl				P3	X		X		
<i>Tyto javanica</i>	Eastern Barn Owl					X		X		
Halcyonidae										
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	*				X		X		
<i>Todiramphus sanctus</i>	Sacred Kingfisher					X		X		
Meropidae										
<i>Merops ornatus</i>	Rainbow Bee-eater		MI	S5		X		X		
Atrichornithidae										
<i>Climacteris rufa</i>	Rufous Treecreeper					X		X		
Maluridae										
<i>Malurus splendens</i>	Splendid Fairy-wren					X		X		
<i>Malurus leucopterus</i>	White-winged Fairy-wren					X				
<i>Malurus lamberti</i>	Variiegated Fairy-wren					X		X		
<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren					X				

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Malurus elegans</i>	Red-winged Fairy-wren					X		X		
<i>Stipiturus malachurus</i>	Southern Emu-wren					X		X		
Acanthizidae										
<i>Sericornis frontalis</i>	White-browed Scrubwren					X		X		
<i>Smicronis brevirostris</i>	Weebill					X		X		
<i>Gerygone fusca</i>	Western Gerygone					X		X		
<i>Acanthiza nana</i>	Yellow Thornbill							X		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill					X		X		
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					X				
<i>Acanthiza inornata</i>	Western Thornbill					X				
<i>Acanthiza apicalis</i>	Inland Thornbill					X		X		
Pardalotidae										
<i>Pardalotus punctatus</i>	Spotted Pardalote					X		X		
<i>Pardalotus striatus</i>	Striated Pardalote					X		X		
Meliphagidae										
<i>Acanthorhynchus superciliosus</i>	Western Spinebill					X		X		
<i>Lichenostomus virescens</i>	Singing Honeyeater					X		X		X
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater					X		X		
<i>Purnella albifrons</i>	White-fronted Honeyeater					X		X		
<i>Manorina flavigula</i>	Yellow-throated Miner					X		X		
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					X				
<i>Anthochaera lunulata</i>	Western Wattlebird					X		X		
<i>Anthochaera carunculata</i>	Red Wattlebird					X		X		
<i>Epthianura albifrons</i>	White-fronted Chat					X		X		
<i>Sugomel niger</i>	Black Honeyeater					X		X		
<i>Glyciphila melanops</i>	Tawny-crowned Honeyeater					X		X		

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Lichmera indistincta</i>	Brown Honeyeater					X		X		X
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater					X		X		X
<i>Phylidonyris niger</i>	White-cheeked Honeyeater					X		X		
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater					X		X		
<i>Melithreptus lunatus</i>	White-naped Honeyeater					X		X		
Pomatostomidae										
<i>Pomatostomus superciliosus</i>	White-browed Babbler					X				
Neosittidae										
<i>Daphoenositta chrysoptera</i>	Varied Sittella					X		X		
Campephagidae										
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					X		X		
<i>Lalage sueurii</i>	White-winged Triller					X		X		
Pachycephalidae										
<i>Pachycephala pectoralis</i>	Golden Whistler					X		X		
<i>Pachycephala rufiventris</i>	Rufous Whistler					X		X		
<i>Colluricincla megarhyncha</i>	Little Shrike-thrush							X		
<i>Colluricincla harmonica</i>	Grey Shrike-thrush					X		X		
Artamidae										
<i>Artamus cinereus</i>	Black-faced Woodswallow					X		X		
<i>Artamus cyanopterus</i>	Dusky Woodswallow					X		X		
<i>Cracticus torquatus</i>	Grey Butcherbird					X		X		
<i>Cracticus nigrogularis</i>	Pied Butcherbird					X		X		
<i>Cracticus tibicen</i>	Australian Magpie					X		X		X
<i>Strepera versicolor</i>	Grey Currawong					X		X		
Rhipiduridae										
<i>Rhipidura albiscapa</i>	Grey Fantail					X		X		
<i>Rhipidura leucophrys</i>	Willie Wagtail					X		X		X

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Laniidae										
<i>Lanius tigrinus</i>	Tiger Shrike	*				X				
Corvidae										
<i>Corvus coronoides</i>	Australian Raven					X		X		X
<i>Corvus bennetti</i>	Little Crow					X		X		
<i>Corvus orru</i>	Torresian Crow					X				
<i>Corvus splendens</i>	House Crow	*				X				
Monarchidae										
<i>Myiagra inquieta</i>	Restless Flycatcher					X		X		
<i>Grallina cyanoleuca</i>	Magpie-lark					X		X		
Petroicidae										
<i>Microeca fascians</i>	Jacky Winter					X		X		
<i>Petroica boodang</i>	Scarlet Robin					X		X		
<i>Petroica goodenovii</i>	Red-capped Robin					X		X		
<i>Melanodryas cucullata</i>	Hooded Robin					X		X		
<i>Eopsaltria griseogularis</i>	Western Yellow Robin					X		X		
<i>Eopsaltria georgiana</i>	White-breasted Robin					X		X		
Acrocephalidae										
<i>Acrocephalus australis</i>	Australian Reed-Warbler					X		X		
Megaluridae										
<i>Megalurus gramineus</i>	Little Grassbird					X		X		
<i>Cincloramphus mathewsi</i>	Rufous Songlark					X		X		
<i>Cincloramphus cruralis</i>	Brown Songlark					X		X		
Timaliidae										
<i>Zosterops lateralis</i>	Silvereeye					X		X		
Hirundinidae										
<i>Cheramoeca leucosterna</i>	White-backed Swallow					X		X		
<i>Hirundo neoxena</i>	Welcome Swallow					X		X		X

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Petrochelidon ariel</i>	Fairy Martin					X		X		
<i>Petrochelidon nigricans</i>	Tree Martin					X		X		
Turdidae										
<i>Turdus merula</i>	Common Blackbird	*					X			
Sturnidae										
<i>Sturnus vulgaris</i>	Common Starling	*					X			
<i>Sturnus tristis</i>	Common Myna	*					X			
Nectariniidae										
<i>Dicaeum hirundinaceam</i>	Mistletoebird					X		X		
Estrildidae										
<i>Taeniopygia guttata</i>	Zebra Finch					X				
<i>Neochmia temporalis</i>	Red-browed Finch	*				X				
<i>Stagonopleura oculata</i>	Red-eared Firetail					X		X		
<i>Lonchura castaneothorax</i>	Chestnut-breasted Mannikin	*				X		X		
Passeridae										
<i>Passer domesticus</i>	House Sparrow	*				X	X	X		
<i>Passer montanus</i>	Eurasian Tree Sparrow	*				X	X			
Motacillidae										
<i>Anthus novaeseelandiae</i>	Australasian Pipit					X		X		
<i>Motacilla cinerea</i>	Grey Wagtail		MI	S5			X			
Fringillidae										
<i>Carduelis carduelis</i>	European Goldfinch	*				X	X	X		
<i>Carduelis chloris</i>	European Greenfinch	*				X				

Table C.4: Mammal species recorded within 40 km of the survey area.

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Tachyglossidae										
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna					X				
Dasyuridae										
<i>Antechinus flavipes</i>	Yellow-footed Antechinus, Mardo					X				
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch		VU	S3		X	X			
<i>Phascogale tapoatafa tapoatafa</i>	Wambenger Brush-tailed Phascogale			S3		X				
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart					X				
Myrmecobiidae										
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti		VU	S2		X				
Peramelidae										
<i>Isodon obesulus fusciventer</i>	Southern Brown Bandicoot, Quenda				P5	X				X
Burramyidae										
<i>Cercartetus concinnus</i>	Western Pygmy-possum, Mundarda					X				
Petauridae										
<i>Petaurus breviceps</i>	Sugar Glider					X				
Pseudocheiridae										
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum		VU	S2		X	X			
Tarsipedidae										
<i>Tarsipes rostratus</i>	Honey Possum, Noolbenger					X				
Phalangeridae										
<i>Trichosurus vulpecula vulpecula</i>	Common Brushtail Possum					X				

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
Potoroidae										
<i>Bettongia lesueur</i>	Burrowing Bettong, Boodie					X				
<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong, Woylie		EN	S1		X	X			
Macropodidae										
<i>Macropus fuliginosus</i>	Western Grey Kangaroo					X				
<i>Notamacropus eugenii derbianus</i>	Tammar				P5	X				
<i>Notamacropus irma</i>	Western Brush Wallaby				P4	X				
<i>Setonix brachyurus</i>	Quokka		VU	S3		X	X			
Muridae										
<i>Hydromys chrysogaster</i>	Water-rat				P4	X				
<i>Mus musculus</i>	House Mouse	*				X	X			
<i>Pseudomys delicatulus</i>	Delicate Mouse					X				
<i>Rattus fuscipes</i>	Western Bush Rat					X				
<i>Rattus norvegicus</i>	Brown Rat	*				X				
<i>Rattus rattus</i>	Black Rat	*				X	X			
Sciuridae										
<i>Funambulus pennanti</i>	Indian Palm Squirrel	*				X	X			
Leporidae										
<i>Oryctolagus cuniculus</i>	Rabbit	*				X	X			
Pteropodidae										
<i>Pteropus scapulatus</i>	Little Red Flying-fox					X				
Molossidae										
<i>Austronomus australis</i>	White-striped Free-tailed Bat					X				
Vespertilionidae										
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat					X				

Scientific name	Common name	Introduced	Conservation codes			Nature Map	EPBC Protected Matters Search	Birdlife	Previous Surveys	Current Survey
			EPBC Act	WC Act	Parks and Wildlife					
<i>Chalinolobus morio</i>	Chocolate Wattled Bat					X				
<i>Falsistrellus mackenziei</i>	Western Falsistrelle				P4	X				
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat					X				
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat					X				
<i>Nyctophilus major</i>	Greater Long-eared Bat					X				
<i>Vespadelus regulus</i>	Southern Forest-bat					X				
Canidae										
<i>Canis lupus familiaris</i>	Dog	*				X	X			
<i>Vulpes vulpes</i>	Red Fox	*				X	X			
Mustelidae										
<i>Mustela putorius</i>	European Polecat, Ferret	*				X				
Felidae										
<i>Felis catus</i>	Cat	*				X	X			
Suidae										
<i>Sus scrofa</i>	Pig	*				X				
Bovidae										
<i>Bos taurus</i>	European Cattle	*				X	X			

NatureMap_5km

Created By Megan Stalker on 22/10/2015

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°53' 21" E,32°08' 02" S
Buffer 5km
Group By Kingdom

Kingdom	Species	Records
Animalia	200	7563
Chromista	1	22
Fungi	3	3
Plantae	344	557
Protozoa	57	78
TOTAL	605	8223

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Animalia				
1.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
2.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
3.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
4.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
5.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
6.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
7.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
8.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
9.	<i>Aname mainae</i>			
10.	<i>Aname tepperi</i>			
11.	24312 <i>Anas gracilis</i> (Grey Teal)			
12.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
13.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
14.	25553 <i>Anhinga melanogaster</i> (Darter)			
15.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
16.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
17.	<i>Antichiropus variabilis</i>			
18.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
19.	25558 <i>Ardea ibis</i> (Cattle Egret)		IA	
20.	41324 <i>Ardea modesta</i> (Eastern Great Egret)		IA	
21.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
22.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
23.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
24.	24352 <i>Artamus cinereus subsp. melanops</i> (Black-faced Woodswallow)			
25.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
26.	<i>Artoria flavimana</i>			
27.	<i>Artoria linnaei</i>			
28.	<i>Artoria taeniifera</i>			
29.	24318 <i>Aythya australis</i> (Hardhead)			
30.	<i>Ballarra longipalpus</i>			
31.	24319 <i>Biziura lobata</i> (Musk Duck)			
32.	42381 <i>Brachyurophis semifasciatus</i> (Southern Shovel-nosed Snake)			
33.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
34.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
35.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
36.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
37.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
38.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
39.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
40.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
41.	24731 <i>Calyptorhynchus banksii subsp. naso</i> (Forest Red-tailed Black-Cockatoo)		T	
42.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo),			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
	<i>Carnaby's Cockatoo</i>		T	
43.	24373 <i>Charadrius melanops</i> (<i>Black-fronted Dotterel</i>)			
44.	24377 <i>Charadrius ruficapillus</i> (<i>Red-capped Plover</i>)			
45.	43380 <i>Chelodina colliei</i> (<i>Oblong Turtle</i>)			
46.	24321 <i>Chenonetta jubata</i> (<i>Australian Wood Duck, Wood Duck</i>)			
47.	24980 <i>Christinus marmoratus</i> (<i>Marbled Gecko</i>)			
48.	24834 <i>Cincloramphus mathewsi</i> (<i>Rufous Songlark</i>)			
49.	24288 <i>Circus approximans</i> (<i>Swamp Harrier</i>)			
50.	24774 <i>Cladorhynchus leucocephalus</i> (<i>Banded Stilt</i>)			
51.	25675 <i>Colluricincla harmonica</i> (<i>Grey Shrike-thrush</i>)			
52.	24399 <i>Columba livia</i> (<i>Domestic Pigeon</i>)	Y		
53.	25568 <i>Coracina novaehollandiae</i> (<i>Black-faced Cuckoo-shrike</i>)			
54.	<i>Cormocephalus aurantipes</i>			
55.	<i>Cormocephalus rubriceps</i>			
56.	25592 <i>Corvus coronoides</i> (<i>Australian Raven</i>)			
57.	24673 <i>Coturnix ypsilophora</i> subsp. <i>australis</i> (<i>Brown Quail</i>)			
58.	25595 <i>Cracticus tibicen</i> (<i>Australian Magpie</i>)			
59.	25596 <i>Cracticus torquatus</i> (<i>Grey Butcherbird</i>)			
60.	25398 <i>Crinia georgiana</i> (<i>Quacking Frog</i>)			
61.	25399 <i>Crinia glauerti</i> (<i>Clicking Frog</i>)			
62.	25400 <i>Crinia insignifera</i> (<i>Squelching Froglet</i>)			
63.	30893 <i>Cryptoblepharus buchananii</i>			
64.	<i>Cryptoerithus quobba</i>			
65.	30899 <i>Ctenophorus adelaidensis</i> (<i>Southern Heath Dragon, Western Heath Dragon</i>)			
66.	25027 <i>Ctenotus australis</i>			
67.	25040 <i>Ctenotus gemmula</i> (<i>Jewelled South-west Ctenotus (Swan Coastal Plain pop P3), skink</i>)			
68.	24322 <i>Cygnus atratus</i> (<i>Black Swan</i>)			
69.	30901 <i>Dacelo novaeguineae</i> (<i>Laughing Kookaburra</i>)	Y		
70.	25673 <i>Daphoenositta chrysoptera</i> (<i>Varied Sittella</i>)			
71.	24999 <i>Delma grayii</i>			
72.	25296 <i>Demansia psammophis</i> subsp. <i>reticulata</i> (<i>Yellow-faced Whipsnake</i>)			
73.	25607 <i>Dicaeum hirundinaceum</i> (<i>Mistletoebird</i>)			
74.	<i>Dingosa serrata</i>			
75.	25250 <i>Elapognathus coronatus</i> (<i>Crowned Snake</i>)			
76.	<i>Eodelena convexa</i>			
77.	24567 <i>Epthianura albifrons</i> (<i>White-fronted Chat</i>)			
78.	<i>Erythracarus decoris</i>			
79.	24379 <i>Erythronyctis cinctus</i> (<i>Red-kneed Dotterel</i>)			
80.	24368 <i>Eurostopodus argus</i> (<i>Spotted Nightjar</i>)			
81.	25621 <i>Falco berigora</i> (<i>Brown Falcon</i>)			
82.	25622 <i>Falco cenchroides</i> (<i>Australian Kestrel</i>)			
83.	25623 <i>Falco longipennis</i> (<i>Australian Hobby</i>)			
84.	25624 <i>Falco peregrinus</i> (<i>Peregrine Falcon</i>)		S	
85.	25727 <i>Fulica atra</i> (<i>Eurasian Coot</i>)			
86.	24761 <i>Fulica atra</i> subsp. <i>australis</i> (<i>Eurasian Coot</i>)			
87.	25729 <i>Gallinula tenebrosa</i> (<i>Dusky Moorhen</i>)			
88.	24763 <i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (<i>Dusky Moorhen</i>)			
89.	24764 <i>Gallinula ventralis</i> (<i>Black-tailed Native-hen</i>)			
90.	25730 <i>Gallirallus philippensis</i> (<i>Buff-banded Rail</i>)			
91.	25530 <i>Gerygone fusca</i> (<i>Western Gerygone</i>)			
92.	24735 <i>Glossopsitta porphyrocephala</i> (<i>Purple-crowned Lorikeet</i>)			
93.	24443 <i>Grallina cyanoleuca</i> (<i>Magpie-lark</i>)			
94.	24293 <i>Haliaeetus leucogaster</i> (<i>White-bellied Sea-Eagle</i>)		IA	
95.	24295 <i>Haliastur sphenurus</i> (<i>Whistling Kite</i>)			
96.	25410 <i>Heleioporus eyrei</i> (<i>Moaning Frog</i>)			
97.	25119 <i>Hemiergis quadrilineata</i>			
98.	25734 <i>Himantopus himantopus</i> (<i>Black-winged Stilt</i>)			
99.	24491 <i>Hirundo neoxena</i> (<i>Welcome Swallow</i>)			
100.	<i>Idiosoma sigillatum</i>			
101.	25478 <i>Isoodon obesulus</i> (<i>Southern Brown Bandicoot</i>)		P5	
102.	24153 <i>Isoodon obesulus</i> subsp. <i>fusciventer</i> (<i>Quenda, Southern Brown Bandicoot</i>)		P5	
103.	<i>Isopeida leishmanni</i>			
104.	<i>Lampona cylindrata</i>			
105.	<i>Latrodectus hasseltii</i>			
106.	33982 <i>Leioproctus contrarius</i> (<i>bee</i>)		P3	
107.	25131 <i>Lerista distinguenda</i>			
108.	25147 <i>Lerista lineata</i> (<i>Perth Slider, Lined Skink</i>)		P3	
109.	25005 <i>Lialis burtonis</i>			
110.	25661 <i>Lichmera indistincta</i> (<i>Brown Honeyeater</i>)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
111.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
112.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
113.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
114.	<i>Longepi woodman</i>			
115.	<i>Lycosa gilberta</i>			
116.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
117.	24133 <i>Macropus irma</i> (Western Brush Wallaby)		P4	
118.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
119.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
120.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
121.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			
122.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
123.	24587 <i>Melithreptus chloropsis</i> (Western White-naped Honeyeater)			
124.	25184 <i>Menetia greyii</i>			
125.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
126.	<i>Mituliodon tarantulinus</i>			
127.	<i>Mitzoruga insularis</i>			
128.	25610 <i>Myiagra inquieta</i> (Restless Flycatcher)			
129.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
130.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
131.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
132.	25748 <i>Ninox novaeseelandiae</i> (Boobook Owl)			
133.	24820 <i>Ninox novaeseelandiae</i> subsp. <i>boobook</i> (Boobook Owl)			
134.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
135.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
136.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
137.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
138.	25679 <i>Pachycephala pectoralis</i> (Golden Whistler)			
139.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
140.	25253 <i>Parasuta gouldii</i>			
141.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
142.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
143.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
144.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
145.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
146.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
147.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
148.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
149.	<i>Phenasteron longiconductor</i>			
150.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
151.	<i>Pinkfloydia harveii</i>			
152.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
153.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
154.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
155.	25007 <i>Pletholax gracilis</i> subsp. <i>gracilis</i> (Keeled Legless Lizard)			
156.	24383 <i>Pluvialis squatarola</i> (Grey Plover)		IA	
157.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
158.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
159.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
160.	24681 <i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
161.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
162.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
163.	24767 <i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
164.	24769 <i>Porzana fluminea</i> (Australian Spotted Crane)			
165.	25732 <i>Porzana pusilla</i> (Baillon's Crane)			
166.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
167.	<i>Prionosternum scutatatum</i>			
168.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
169.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
170.	<i>Raveniella cirrata</i>			
171.	<i>Raveniella peckorum</i>			
172.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
173.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
174.	30948 <i>Smicrornis brevirostris</i> (Weebill)			
175.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
176.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
177.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
178.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
179.	30950 <i>Streptopelia senegalensis</i> subsp. <i>senegalensis</i> (Laughing Turtle-Dove)	Y		
180.	<i>Supunna funerea</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
181.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		P4	
182.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
183.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
184.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
185.	24844 <i>Threskiornis molucca</i> (Australian White Ibis)			
186.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
187.	33994 <i>Throscodectes xiphos</i> (cricket)		P1	Y
188.	25519 <i>Tiliqua rugosa</i>			
189.	25204 <i>Tiliqua rugosa</i> subsp. <i>aspera</i>			
190.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
191.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
192.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
193.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
194.	24808 <i>Tringa nebularia</i> (Common Greenshank)		IA	
195.	<i>Urodacus novaehollandiae</i>			
196.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
197.	<i>Venator immansueta</i>			
198.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
199.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

Chromista

200. *Phytophthora cinnamomi*

Fungi

201. 38776 *Cortinarius phalarus*

202. 38795 *Hygrocybe conica*

203. 31280 *Lichenomphalia chromacea*

Plantae

204. 3374 *Acacia huegelii*

205. 30032 *Acacia saligna* subsp. *saligna*

206. 1775 *Adenanthos cygnorum* (Common Woollybush)

207. 1791 *Adenanthos obovatus* (Basket Flower)

208. 1728 *Allocasuarina fraseriana* (Sheoak, Kondil)

209. 1732 *Allocasuarina humilis* (Dwarf Sheoak)

210. 20184 *Amphipogon laguroides* subsp. *laguroides*

211. 199 *Amphipogon strictus* (Greybeard Grass)

212. 200 *Amphipogon turbinatus*

213. 7833 *Angianthus preissianus*

214. 1411 *Anigozanthos manglesii* (Mangles Kangaroo Paw, Kurulbrang)

215. 3686 *Aotus cordifolia*

216. 3692 *Aotus procumbens*

217. 207 *Aristida contorta* (Bunched Kerosene Grass)

218. 1264 *Arnocrinum preissii*

219. 8779 *Asparagus asparagoides* (Bridal Creeper)

220. 20350 *Astartea affinis*

221. 20283 *Astartea scoparia*

222. 7851 *Asteridea pulverulenta* (Common Bristle Daisy)

223. 6334 *Astroloma pallidum* (Kick Bush)

224. 6339 *Astroloma xerophyllum*

225. 2471 *Atriplex prostrata* (Hastate Orache)

226. 17234 *Austrostipa compressa*

227. 17245 *Austrostipa mollis*

228. 17737 *Azolla pinnata*

229. 42902 *Azolla rubra*

230. 1800 *Banksia attenuata* (Slender Banksia, Piara)

231. 32580 *Banksia dallanneyi* var. *dallanneyi*

232. 1822 *Banksia ilicifolia* (Holly-leaved Banksia)

233. 1834 *Banksia menziesii* (Firewood Banksia)

234. 1852 *Banksia telmatiaea* (Swamp Fox Banksia)

235. 741 *Baumea articulata* (Jointed Rush)

236. 744 *Baumea laxa*

237. 5393 *Beaufortia squarrosa* (Sand Bottlebrush, Puno)

238. 749 *Bolboschoenus caldwellii* (Marsh Club-rush)

239. 16636 *Boronia crenulata* subsp. *viminea*

240. 4417 *Boronia dichotoma*

241. 11381 *Boronia ramosa* subsp. *anethifolia*

242. 3710 *Bossiaea eriocarpa* (Common Brown Pea)

243. 30142 *Brachyloma preissii* subsp. *obtusifolium*

244. 30136 *Brachyloma preissii* subsp. *preissii*

245. 7867 *Brachyscome bellidioides*

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246.	7878 <i>Brachyscome iberidifolia</i>			
247.	244 <i>Briza maxima</i> (Blowfly Grass)	Y		
248.	245 <i>Briza minor</i> (Shivery Grass)	Y		
249.	249 <i>Bromus diandrus</i> (Great Brome)	Y		
250.	12770 <i>Burchardia congesta</i>			
251.	3178 <i>Byblis gigantea</i> (Rainbow Plant)		P3	
252.	1277 <i>Caesia occidentalis</i>			
253.	15348 <i>Caladenia flava</i> subsp. <i>flava</i>			
254.	1596 <i>Caladenia huegelii</i> (Grand Spider Orchid)		T	
255.	1599 <i>Caladenia latifolia</i> (Pink Fairy Orchid)			
256.	15361 <i>Caladenia longicauda</i> subsp. <i>calcigena</i>			
257.	13859 <i>Caladenia longicauda</i> subsp. <i>clivicola</i>			
258.	15503 <i>Caladenia paludosa</i>			
259.	15398 <i>Caladenia xantha</i>			
260.	16365 <i>Calandrinia</i> sp. Kenwick (G.J. Keighery 10905)			
261.	19309 <i>Calectasia narragara</i>			
262.	36600 <i>Callitris pyramidalis</i> (Swamp Cypress)			
263.	5411 <i>Calothamnus hirsutus</i>			
264.	5415 <i>Calothamnus lateralis</i>			
265.	5439 <i>Calytrix angulata</i> (Yellow Starflower)			
266.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
267.	5460 <i>Calytrix fraseri</i> (Pink Summer Calytrix)			
268.	2794 <i>Carpobrotus aequilaterus</i> (Angular Pigface)	Y		
269.	2795 <i>Carpobrotus edulis</i> (Hottentot Fig)	Y		
270.	1162 <i>Cartonema phylloides</i>			
271.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
272.	6542 <i>Centaurium tenuiflorum</i>	Y		
273.	6214 <i>Centella asiatica</i>			
274.	1125 <i>Centrolepis drummondiana</i>			
275.	1134 <i>Centrolepis polygyna</i> (Wiry Centrolepis)			
276.	2889 <i>Cerastium glomeratum</i> (Mouse Ear Chickweed)	Y		
277.	17685 <i>Chaetanthus aristatus</i>			
278.	18156 <i>Chamaecytisus palmensis</i> (Tagasaste)	Y		
279.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
280.	2483 <i>Chenopodium album</i> (Fat Hen)	Y		
281.	2490 <i>Chenopodium glaucum</i> (Glaucous Goosefoot)	Y		
282.	7937 <i>Cirsium vulgare</i> (Spear Thistle)	Y		
283.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
284.	4554 <i>Comesperma flavum</i>			
285.	1858 <i>Conospermum amoenum</i> (Blue Smokebush)			
286.	6348 <i>Conostephium pendulum</i> (Pearl Flower)			
287.	6349 <i>Conostephium preissii</i>			
288.	1418 <i>Conostylis aculeata</i> (Prickly Conostylis)			
289.	11826 <i>Conostylis aculeata</i> subsp. <i>aculeata</i>			
290.	11695 <i>Conostylis festucacea</i> subsp. <i>festucacea</i>			
291.	1436 <i>Conostylis juncea</i>			
292.	7939 <i>Conyza bonariensis</i> (Flaxleaf Fleabane)	Y		
293.	7941 <i>Conyza parva</i>	Y		
294.	20074 <i>Conyza sumatrensis</i>	Y		
295.	1285 <i>Corynotheca micrantha</i> (Sand Lily)			
296.	7945 <i>Cotula coronopifolia</i> (Waterbuttons)	Y		
297.	3137 <i>Crassula colorata</i> (Dense Stonecrop)			
298.	3139 <i>Crassula exserta</i>			
299.	13527 <i>Croninia kingiana</i>			
300.	16245 <i>Cyathochaeta teretifolia</i>		P3	
301.	40660 <i>Cycnogeton huegelii</i>			
302.	783 <i>Cyperus congestus</i> (Dense Flat-sedge)	Y		
303.	10916 <i>Cyrtostylis huegelii</i>			
304.	10942 <i>Cyrtostylis tenuissima</i>			
305.	17692 <i>Cytogonidium leptocarpoides</i>			
306.	7451 <i>Dampiera lavandulacea</i>			
307.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
308.	5508 <i>Darwinia citriodora</i> (Lemon-scented Darwinia)			
309.	1218 <i>Dasypogon bromeliifolius</i> (Pineapple Bush)			
310.	3845 <i>Daviesia triflora</i>			
311.	16595 <i>Desmocladius flexuosus</i>			
312.	1259 <i>Dianella revoluta</i> (Blueberry Lily)			
313.	1287 <i>Dichopogon capillipes</i>			
314.	17838 <i>Dielsia stenostachya</i>			
315.	13635 <i>Drakaea micrantha</i>		T	

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316.	13217 <i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>			
317.	3106 <i>Drosera macrantha</i> (Bridal Rainbow)			
318.	13216 <i>Drosera menziesii</i> subsp. <i>penicillaris</i>			
319.	13191 <i>Drosera occidentalis</i> subsp. <i>occidentalis</i>		P4	
320.	13188 <i>Drosera paleacea</i> subsp. <i>paleacea</i>			
321.	8911 <i>Drosera rosulata</i>			
322.	3131 <i>Drosera stolonifera</i> (Leafy Sundew)			
323.	33500 <i>Dysphania ambrosioides</i> (Mexican Tea)	Y		
324.	2501 <i>Dysphania glomulifera</i>			
325.	11368 <i>Dysphania glomulifera</i> subsp. <i>glomulifera</i>			
326.	11105 <i>Echinochloa crus-galli</i>	Y		
327.	347 <i>Ehrharta calycina</i> (Perennial Veldt Grass)	Y		
328.	349 <i>Ehrharta longiflora</i> (Annual Veldt Grass)	Y		
329.	5187 <i>Elatine gratioloides</i> (Waterwort)			
330.	822 <i>Eleocharis acuta</i> (Common Spikerush)			
331.	1645 <i>Epiblema grandiflorum</i> (Babe-in-a-cradle)			
332.	6133 <i>Epilobium hirtigerum</i> (Hairy Willow Herb)			
333.	13950 <i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>			
334.	15412 <i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i>			
335.	15414 <i>Eriochilus helonomus</i>			
336.	15415 <i>Eriochilus scaber</i> subsp. <i>scaber</i>			
337.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
338.	5790 <i>Eucalyptus todtiana</i> (Coastal Blackbutt)			
339.	3872 <i>Euchilopsis linearis</i> (Swamp Pea)			
340.	4648 <i>Euphorbia terracina</i> (Geraldton Carnation Weed)	Y		
341.	3880 <i>Eutaxia virgata</i>			
342.	835 <i>Evandra pauciflora</i>			
343.	1747 <i>Ficus carica</i> (Common Fig)	Y		
344.	20483 <i>Gastrolobium linearifolium</i>			
345.	1520 <i>Gladiolus caryophyllaceus</i> (Wild Gladiolus)	Y		
346.	17043 <i>Glyceria declinata</i>	Y		
347.	12624 <i>Gnephosis angianthoides</i>			
348.	6587 <i>Gomphocarpus fruticosus</i> (Narrowleaf Cottonbush)	Y		
349.	10909 <i>Gompholobium confertum</i>			
350.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
351.	6160 <i>Gonocarpus paniculatus</i>			
352.	6161 <i>Gonocarpus pithyoides</i>			
353.	19286 <i>Goodenia pulchella</i> subsp. <i>Coastal Plain A (M. Hislop 634)</i>			
354.	19628 <i>Grevillea bipinnatifida</i> subsp. <i>bipinnatifida</i>			
355.	2032 <i>Grevillea leucopteris</i> (White Plume Grevillea)			
356.	1475 <i>Haemodorum spicatum</i> (Mardja)			
357.	2197 <i>Hakea prostrata</i> (Harsh Hakea)			
358.	2216 <i>Hakea varia</i> (Variable-leaved Hakea)			
359.	3961 <i>Hardenbergia comptoniana</i> (Native Wisteria)			
360.	29594 <i>Helichrysum luteoalbum</i> (Jersey Cudweed)			
361.	6710 <i>Heliotropium europaeum</i> (Common Heliotrope)	Y		
362.	6839 <i>Hemiandra pungens</i> (Snakebush)			
363.	1293 <i>Hensmania turbinata</i>			
364.	19778 <i>Hibbertia glomerata</i> subsp. <i>darlingensis</i>			
365.	5134 <i>Hibbertia huegelii</i>			
366.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
367.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
368.	43280 <i>Hibbertia sericosepala</i>			
369.	5173 <i>Hibbertia subvaginata</i>			
370.	5176 <i>Hibbertia vaginata</i>			
371.	444 <i>Holcus lanatus</i> (Yorkshire Fog)	Y		
372.	6222 <i>Homalosciadium homalocarpum</i>			
373.	3968 <i>Hovea trisperma</i> (Common Hovea)			
374.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
375.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
376.	8086 <i>Hypochoeris glabra</i> (Smooth Catsear)	Y		
377.	9352 <i>Hypochoeris radicata</i> (Flat Weed)	Y		
378.	17841 <i>Hypolaena pubescens</i>			
379.	20200 <i>Isolepis cernua</i> var. <i>setiformis</i>			
380.	917 <i>Isolepis marginata</i> (Coarse Club-rush)			
381.	921 <i>Isolepis producta</i>			
382.	4012 <i>Jacksonia furcellata</i> (Grey Stinkwood)			
383.	20462 <i>Jacksonia gracillima</i>		P3	
384.	4027 <i>Jacksonia sericea</i> (Waldjumi)		P4	
385.	4029 <i>Jacksonia sternbergiana</i> (Stinkwood, Kapur)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
386.	1178 <i>Juncus bufonius</i> (Toad Rush)	Y		
387.	1186 <i>Juncus microcephalus</i>	Y		
388.	1188 <i>Juncus pallidus</i> (Pale Rush)			
389.	1190 <i>Juncus planifolius</i> (Broadleaf Rush)			
390.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
391.	15498 <i>Kunzea glabrescens</i> (Spearwood)			
392.	5835 <i>Kunzea micrantha</i>			
393.	20019 <i>Lachnagrostis filiformis</i>			
394.	19955 <i>Lachnagrostis plebeia</i>			
395.	6777 <i>Lachnostachys albicans</i>			
396.	8095 <i>Lactuca saligna</i> (Wild Lettuce)	Y		
397.	18585 <i>Lagenophora huegelii</i>			
398.	4052 <i>Latrobea tenella</i>			
399.	1307 <i>Laxmannia ramosa</i> (Branching Lily)			
400.	11911 <i>Laxmannia ramosa</i> subsp. <i>ramosa</i>			
401.	11464 <i>Laxmannia sessiliflora</i> subsp. <i>australis</i>			
402.	1309 <i>Laxmannia squarrosa</i>			
403.	7574 <i>Lechenaultia floribunda</i> (Free-flowering Leschenaultia)			
404.	44490 <i>Leontodon rhagadioloides</i>	Y		
405.	8099 <i>Leontodon saxatilis</i> (Hairy Hawkbit)	Y		
406.	925 <i>Lepidosperma angustatum</i>			
407.	937 <i>Lepidosperma longitudinale</i> (Pithy Sword-sedge)			
408.	940 <i>Lepidosperma pubisquamum</i>			
409.	41649 <i>Lepidosperma rigidulum</i>			
410.	19833 <i>Leptocarpus laxus</i>			
411.	2344 <i>Leptomeria empetriformis</i>			
412.	2350 <i>Leptomeria pauciflora</i> (Sparse-flowered Currant Bush)			
413.	6360 <i>Leucopogon australis</i> (Spiked Beard-heath)			
414.	6374 <i>Leucopogon conostephioides</i>			
415.	6425 <i>Leucopogon oxycedrus</i>			
416.	6434 <i>Leucopogon polymorphus</i>			
417.	40803 <i>Leucopogon squarrosus</i> subsp. <i>squarrosus</i>			
418.	6451 <i>Leucopogon tenuis</i>			
419.	9289 <i>Lobelia anceps</i> (Angled Lobelia)			
420.	7408 <i>Lobelia tenuior</i> (Slender Lobelia)			
421.	478 <i>Lolium rigidum</i> (Wimmera Ryegrass)	Y		
422.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
423.	1228 <i>Lomandra hermaphrodita</i>			
424.	1239 <i>Lomandra preissii</i>			
425.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
426.	4059 <i>Lotus angustissimus</i> (Narrowleaf Trefoil)	Y		
427.	8564 <i>Lotus subbiflorus</i>	Y		
428.	4065 <i>Lupinus angustifolius</i> (Narrowleaf Lupin)	Y		
429.	1097 <i>Lyginia barbata</i>			
430.	18049 <i>Lyginia imberbis</i>			
431.	6456 <i>Lysinema ciliatum</i> (Curry Flower)			
432.	6458 <i>Lysinema elegans</i>			
433.	5281 <i>Lythrum hyssopifolia</i> (Lesser Loosestrife)	Y		
434.	2838 <i>Macarthuria apetala</i>			
435.	2839 <i>Macarthuria australis</i>			
436.	85 <i>Macrozamia riedlei</i> (Zamia, Djiridji)			
437.	4079 <i>Medicago polymorpha</i> (Burr Medic)	Y		
438.	17683 <i>Meeboldina cana</i>			
439.	34676 <i>Meionectes brownii</i> (Swamp Raspwort)			
440.	37580 <i>Melaleuca acutifolia</i>			
441.	5900 <i>Melaleuca cuticularis</i> (Saltwater Paperbark)			
442.	13273 <i>Melaleuca incana</i> subsp. <i>incana</i>			
443.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
444.	5959 <i>Melaleuca raphiophylla</i> (Swamp Paperbark)			
445.	5964 <i>Melaleuca seriata</i>			
446.	5978 <i>Melaleuca teretifolia</i> (Banbar)			
447.	5980 <i>Melaleuca thymoides</i>			
448.	5987 <i>Melaleuca viminea</i> (Mohan)			
449.	4085 <i>Melilotus indicus</i>	Y		
450.	953 <i>Mesomelaena graciliceps</i>			
451.	15419 <i>Microtis media</i> subsp. <i>media</i>			
452.	16693 <i>Minuartia mediterranea</i>	Y		
453.	4666 <i>Monotaxis occidentalis</i>			
454.	14293 <i>Oenothera indecora</i> subsp. <i>bonariensis</i>	Y		
455.	16347 <i>Oenothera laciniata</i>	Y		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
456.	6140 <i>Oenothera mollissima</i>	Y		
457.	7090 <i>Parentucella viscosa</i> (Sticky Bartsia)	Y		
458.	527 <i>Paspalum dilatatum</i>	Y		
459.	1550 <i>Patersonia occidentalis</i> (Purple Flag, Koma)			
460.	4343 <i>Pelargonium capitatum</i> (Rose Pelargonium)	Y		
461.	6006 <i>Pericalymma ellipticum</i> (Swamp Teatree)			
462.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
463.	11052 <i>Pescicaria prostrata</i>			
464.	2273 <i>Persoonia saccata</i> (Snottygobble)			
465.	20391 <i>Petrophile juncifolia</i>			
466.	2299 <i>Petrophile linearis</i> (Pixie Mops)			
467.	1478 <i>Phlebocarya ciliata</i>			
468.	1479 <i>Phlebocarya filifolia</i>			
469.	11557 <i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>		P3	
470.	4141 <i>Phyllota gracilis</i>			
471.	2793 <i>Phytolacca octandra</i> (Red Ink Plant)	Y		
472.	5252 <i>Pimelea lanata</i>			
473.	4524 <i>Platytheca galioides</i>			
474.	8184 <i>Podotheca gnaphalioides</i> (Golden Long-heads)			
475.	582 <i>Polypogon monspeliensis</i> (Annual Beardgrass)	Y		
476.	1670 <i>Prasophyllum drummondii</i> (Swamp Leek Orchid)			
477.	1673 <i>Prasophyllum gibbosum</i> (Humped Leek Orchid)			
478.	1674 <i>Prasophyllum giganteum</i> (Bronze Leek Orchid)			
479.	1676 <i>Prasophyllum hians</i> (Yawning Leek Orchid)			
480.	1681 <i>Prasophyllum regium</i> (King Leek Orchid)			
481.	17267 <i>Pterostylis brevisepala</i>			
482.	44723 <i>Pterostylis glebosa</i>			
483.	12217 <i>Pterostylis sanguinea</i>			
484.	18648 <i>Pterostylis</i> sp. <i>cauline leaves</i> (N. Gibson & M.N. Lyons 1490)			
485.	18655 <i>Pterostylis</i> sp. <i>crinkled leaf</i> (G.J. Keighery 13426)			
486.	2718 <i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)			
487.	4177 <i>Pultenaea ochreatea</i>			
488.	4181 <i>Pultenaea reticulata</i>			
489.	6012 <i>Regelia ciliata</i>			
490.	4822 <i>Rhamnus alaternus</i> (Buckthorn)	Y		
491.	14485 <i>Romulea flava</i> var. <i>minor</i>	Y		
492.	14924 <i>Romulea rosea</i> var. <i>communis</i>	Y		
493.	6263 <i>Schoenolaena juncea</i>			
494.	973 <i>Schoenus asperocarpus</i> (Poison Sedge)			
495.	979 <i>Schoenus caespititius</i>			
496.	984 <i>Schoenus curvifolius</i>			
497.	986 <i>Schoenus efoliatus</i>			
498.	992 <i>Schoenus grandiflorus</i> (Large Flowered Bogrush)			
499.	1008 <i>Schoenus pennisetis</i>		P3	
500.	1011 <i>Schoenus rigens</i>			
501.	1017 <i>Schoenus subbulbosus</i>			
502.	1018 <i>Schoenus subfascicularis</i>			
503.	6033 <i>Scholtzia involucrata</i> (Spiked Scholtzia)			
504.	8203 <i>Senecio diaschides</i>			
505.	7020 <i>Solanum linnaeanum</i> (Apple of Sodom)	Y		
506.	8228 <i>Solidago canadensis</i> (Goldenrod)	Y		
507.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
508.	2316 <i>Stirlingia latifolia</i> (Blueboy)			
509.	25831 <i>Stylidium araeophyllum</i>			
510.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
511.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
512.	7717 <i>Stylidium divaricatum</i> (Daddy-long-legs)			
513.	7734 <i>Stylidium guttatum</i> (Dotted Triggerplant)			
514.	7756 <i>Stylidium longitubum</i> (Jumping Jacks)		P3	
515.	25829 <i>Stylidium neurophyllum</i>			
516.	25800 <i>Stylidium paludicola</i>		P3	
517.	7774 <i>Stylidium piliferum</i> (Common Butterfly Triggerplant)			
518.	7777 <i>Stylidium preissii</i> (Lizard Triggerplant)			
519.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
520.	7790 <i>Stylidium roseoalatum</i> (Pink-wing Triggerplant)			
521.	25806 <i>Stylidium scarosum</i>			
522.	7806 <i>Stylidium utricularioides</i> (Pink Fan Triggerplant)			
523.	1260 <i>Stypantra glauca</i> (Blind Grass)			
524.	37360 <i>Tamarix ramosissima</i>	Y		
525.	1716 <i>Thelymitra tigrina</i> (Tiger Orchid)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
526.	1318 <i>Thysanotus arbuscula</i>			
527.	1338 <i>Thysanotus manglesianus</i> (Fringed Lily)			
528.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
529.	1343 <i>Thysanotus patersonii</i>			
530.	1358 <i>Thysanotus triandrus</i>			
531.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
532.	4383 <i>Tribulus terrestris</i> (Caltrop)	Y		
533.	1363 <i>Tricoryne tenella</i>			
534.	1038 <i>Tricostularia neesii</i>			
535.	17145 <i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Y		
536.	14738 <i>Trifolium resupinatum</i> var. <i>resupinatum</i>	Y		
537.	16998 <i>Tripterococcus paniculatus</i>		P4	
538.	4360 <i>Tropaeolum majus</i> (Garden Nasturtium)	Y		
539.	98 <i>Typha domingensis</i> (Bulrush, Djandjid)			
540.	8255 <i>Ursinia anthemoides</i> (Ursinia)	Y		
541.	38388 <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	Y		
542.	15432 <i>Verticordia densiflora</i> var. <i>densiflora</i>			
543.	14714 <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		P4	
544.	11474 <i>Vicia sativa</i> subsp. <i>nigra</i>	Y		
545.	7384 <i>Wahlenbergia capensis</i> (Cape Bluebell)	Y		
546.	7389 <i>Wahlenbergia preissii</i>			
547.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
Protozoa				
548.	38963 <i>Arcyria affinis</i>			Y
549.	38964 <i>Arcyria cinerea</i>			
550.	38965 <i>Arcyria denudata</i>			
551.	38966 <i>Arcyria ferruginea</i>			
552.	38967 <i>Arcyria incarnata</i>			
553.	44709 <i>Arcyria major</i>			Y
554.	38970 <i>Arcyria obvelata</i>			
555.	38973 <i>Arcyria pomiformis</i>			
556.	38974 <i>Arcyria stipata</i>			
557.	38975 <i>Badhamia capsulifera</i>			Y
558.	38981 <i>Calomyxa metallica</i>			Y
559.	38982 <i>Ceratiomyxa fruticulosa</i>			
560.	38983 <i>Clastoderma debaryanum</i>			
561.	38984 <i>Collaria arcyrionema</i>			
562.	38988 <i>Comatricha laxa</i>			
563.	38990 <i>Comatricha nigra</i>			
564.	38991 <i>Comatricha pulchella</i>			
565.	38997 <i>Craterium leucocephalum</i>			
566.	38998 <i>Craterium minutum</i>			
567.	39001 <i>Cribraria cancellata</i>			
568.	39002 <i>Cribraria microcarpa</i>			
569.	39003 <i>Cribraria minutissima</i>			
570.	39011 <i>Diderma asteroides</i>			
571.	39023 <i>Didymium perforatum</i>			Y
572.	39024 <i>Didymium serpula</i>			
573.	39025 <i>Didymium squamulosum</i>			
574.	39029 <i>Echinostelium minutum</i>			
575.	42241 <i>Elaeomyxa reticulospora</i>			Y
576.	39030 <i>Enerthenema papillatum</i>			
577.	39033 <i>Fuligo septica</i>			
578.	39041 <i>Licea kleistobolus</i>			
579.	39046 <i>Licea rufocuprea</i>			Y
580.	39048 <i>Lycogala epidendrum</i>			
581.	39054 <i>Oligonema schweinitzii</i>			
582.	39058 <i>Perichaena depressa</i>			
583.	39061 <i>Physarum bitectum</i>			
584.	39062 <i>Physarum bivalve</i>			
585.	39063 <i>Physarum cinereum</i>			
586.	39064 <i>Physarum citrinum</i>			Y
587.	39065 <i>Physarum compressum</i>			
588.	39069 <i>Physarum famintzinii</i>			Y
589.	39072 <i>Physarum melleum</i>			
590.	39074 <i>Physarum pusillum</i>			
591.	39076 <i>Physarum sessile</i>			
592.	39079 <i>Physarum viride</i>			
593.	39083 <i>Stemonitis fusca</i>			
594.	39088 <i>Stemonitis virginiensis</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
595.	39090 <i>Stemonitopsis gracilis</i>			
596.	40882 <i>Stemonitopsis hyperopta</i>			
597.	39095 <i>Trichia botrytis</i>			
598.	39096 <i>Trichia contorta</i>			
599.	39097 <i>Trichia decipiens</i>			
600.	39100 <i>Trichia persimilis</i>			
601.	39101 <i>Trichia varia</i>			
602.	39102 <i>Trichia verrucosa</i>			
603.	39103 <i>Tubifera ferruginosa</i>			
604.	39104 <i>Willkommlangea reticulata</i>			

Conservation Codes

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

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



EPBC Act Protected Matters Report

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

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

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

Report created: 05/10/15 17:04:00

[Summary](#)

[Details](#)

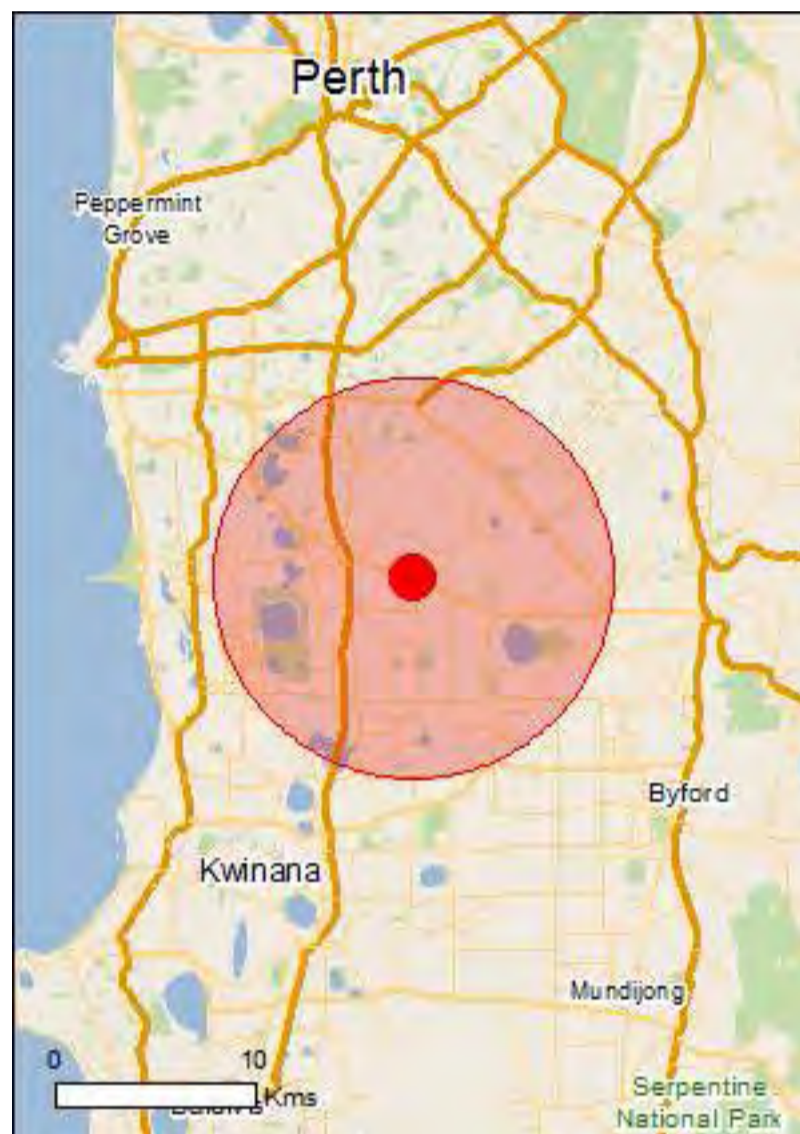
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

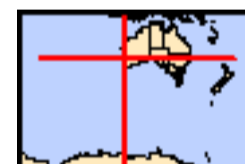
[Acknowledgements](#)



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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	28
Listed Migratory Species:	21

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	28
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	11
Regional Forest Agreements:	None
Invasive Species:	44
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale and thomsons lakes Peel-yalgorup system	Within Ramsar site 30 - 40km upstream

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
Claypans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species	[Resource Information]
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Name	Status	Type of Presence
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Birds

Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
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Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
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Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
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Calyptorhynchus baudinii Baudin's Black-Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Roosting known to occur within area
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Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
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Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
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Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
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Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
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Insects

Leioproctus douglasiellus a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
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Neopasiphae simplicior A native bee [66821]	Critically Endangered	Species or species habitat likely to occur
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Name	Status	Type of Presence within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Darwinia foetida Muceha Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus balanites Cadda Road Mallee, Cadda Mallee [24264]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D.Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area
Thelymitra manginii K.Dixon & Batty ms. [67443]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species

Name	Status	Type of Presence
		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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area

Name	Threatened	Type of Presence
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

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

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

Name
Commonwealth Land -

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

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur

Name	Threatened	Type of Presence within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Balannup Lake	WA
Forrestdale Lake	WA
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Modong	WA
Piara	WA
Thomsons Lake	WA
Unnamed WA48291	WA
Unnamed WA49299	WA
Unnamed WA49561	WA
Wandi	WA

Invasive Species [\[Resource Information \]](#)

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

Name	Status	Type of Presence
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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
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area

Mammals

Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
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Name	Status	Type of Presence
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
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 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 linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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 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
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		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

Nationally Important Wetlands		[Resource Information]
Name	State	
Forrestdale Lake	WA	
Gibbs Road Swamp System	WA	
Thomsons Lake	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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

-32.13396 115.8882

Acknowledgements

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

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-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, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- 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.

X	Y	PopId	NameId	Taxon	ConsStatus	WARank	PopNumber	SubPopCode	Gda94Lat	Gda94Long	PopStatus	Location	District	Vesting	Purpose1	Purpose2	CountDate	Method	MatureCou	JuvenileCo	SeedlingCo	LiveTotal	PlantTypeC	AreaOccup	inFlower	Population
115.9689	-32.11423	108822	38481	Austrostipa jacobiana	T	CR	1	A	-32.11423	115.968912		Passmore Street, both sides. 121-132m NE of Phoebe Street along Passmore St. Southern River.	SWAN COASTAL	LGA	VER		30/01/2014	ACT_CLMP	113	0	0	0	CLUMPS	190	N	HEALTHY
115.9686	-32.11415	108824	38481	Austrostipa jacobiana	T	CR	1	B	-32.11415	115.968632		Private Property Lot 1789 Phoebe St, Southern River. 118m NE of Phoebe St along Passmore St. Just inside the private property on the N side of the Rd.	SWAN COASTAL	PRI			30/01/2014	ACT_CLMP	3	0	0	0	CLUMPS		N	HEALTHY
115.9224	-32.10947	84969	1596	Caladenia huegelii	T	CR	8		-32.10947	115.922417		Warton Rd, ca 1km NE of junction with Niholson Rd., within grounds of Banksia Hill Prison, res. 35153 (It is possible that the population is on the northern side of Warton Rd).	SWAN COASTAL	MPR	PRS		13/10/2004		0			0			N	
115.9174	-32.17708	84932	1596	Caladenia huegelii	T	CR	12		-32.17708	115.917389	X	*Extinct?* 52m W of Freeman Rd, S of swamp near firebreak. (Lot 12?)	SWAN COASTAL	PRI			15/10/1997	ACT_IND	0			0				N
115.9306	-32.10322	97262	1596	Caladenia huegelii	T	CR	19	A	-32.10322	115.930639		Adj to Warton Rd on SE side of road, 300m SW of Warton/Ranford Rds jnc. S end of popn 150m SSE of Warton Rd along transmission line & N end of popn 172m SE of Warton Rd. Lot 2 of Loc 408.	SWAN COASTAL	LGA	KEN		12/10/2004		0			0				N
115.9279	-32.10469	97263	1596	Caladenia huegelii	T	CR	19	B	-32.10469	115.927889	X	Pop. extinct due to urban development; W of Warton Rd on SW bdy of Loc 119.	SWAN COASTAL	PRI			15/10/1997	ACT_IND	0			0				N
115.9305	-32.10019	97264	1596	Caladenia huegelii	T	CR	19	C	-32.10019	115.9305	X	Pop. extinct due to urban development; W of Warton Rd & Ranford Rd jnc. Loc 119.	SWAN COASTAL	PRI			15/10/1997	ACT_IND	0		0	0				N
115.8575	-32.12758	84944	1596	Caladenia huegelii	T	CR	41		-32.12758	115.8575	X	EXTINCT - Area cleared for Kwinana Freeway on-ramp (NW corner of Beeliar Rd & Kwinana Freeway in bushland. North from second overhead light)	SWAN COASTAL	MRD	VER		23/10/2006		0			0				N
115.8813	-32.1258	97288	1596	Caladenia huegelii	T	CR	42	A	-32.1258	115.881304		Lot 820 (previously part of Lot 136), Fraser Rd. WAPC owned private property. East side of Fraser Road. Plants scattered throughout the remaining bushland. Bush Forever Site 390 covers most of Lot 820.	SWAN COASTAL	SPC	GVT		23/09/2011	ACT_IND	447			0	PLANTS	112380	Y	HEALTHY
115.8778	-32.12608	97289	1596	Caladenia huegelii	T	CR	42	B	-32.12608	115.877778		Lot 9004 (Lot 135) Fraser Road, Banjup. Located on the west side of Fraser Road.	SWAN COASTAL	PRI			14/10/2005	ACT_IND	0			0			Y	MODERATE
115.8853	-32.12458	97290	1596	Caladenia huegelii	T	CR	42	C	-32.12458	115.885278		Lot 131 Fraser Road, Banjup. Located along the southern boundary of the lot, from the southern terminal to the northern terminal transmission line route.	SWAN COASTAL	PRI			9/10/2004		5			5			Y	
115.8777	-32.12661	97291	1596	Caladenia huegelii	T	CR	42	D	-32.12661	115.877722		Fraser Road, Banjup, within the road reserve.	SWAN COASTAL	LGA	VER		23/09/2011		0			0				N
115.8763	-32.12839	106241	1596	Caladenia huegelii	T	CR	42	E	-32.12839	115.876306		Lot 821 (previously part of Lot 136) Fraser Road, Banjup. Private property owned by the Housing Commission. East side of Fraser Road [ca. 340m along Fraser Rd from Armadale Rd].	SWAN COASTAL	PRI			14/10/2005	ACT_IND	0			0			Y	MODERATE
115.8851	-32.12617	106242	1596	Caladenia huegelii	T	CR	42	F	-32.12617	115.885111		Private Property, Lot 4, Armadale Rd, Banjup. Adjacent to Lots 820 & 821 Fraser Road. Previously included as part of Pop 42A. Part of Lot 4 is Bush Forever Site 390. [Plants found in the vegetation in the northern and western parts of Lot 4].	SWAN COASTAL	PRI			14/10/2005	ACT_IND	0			0			Y	MODERATE
115.9372	-32.10658	84946	1596	Caladenia huegelii	T	CR	48		-32.10658	115.937194	X	**Land cleared under permit** Lot 106 Wright Rd, SW cnr. of Wright/Ranford Rds, Forrestdale.	SWAN COASTAL	PRI			2/02/2005		0			0				N
115.8857	-32.09778	97297	1596	Caladenia huegelii	T	CR	56	A	-32.09778	115.885694		Jandakot Airport. Located in narrow remnant along the SW edge of the runway running NE/SW (RWY 06L/24R from airport map). The plant is found approximately 50m SW from the corner of the track that goes over the runway. Need airport permission to enter.	SWAN COASTAL	COM	AIR		24/09/2004		0			0				N

115.8759	-32.08653	97299	1596	Caladenia huegelii	T	CR	56	C	-32.08653	115.875944	Jandakot Airport 'Industrial Park', within triangle between Hope Rd, railway line and just east of Marriott Rd, mostly around N-S powerline tack, north of Gate 40.	SWAN COASTAL	COM	AIR	29/09/2005	ACT_IND	156	156	Y
115.8748	-32.09511	97300	1596	Caladenia huegelii	T	CR	56	D	-32.09511	115.874778	Jandakot Airport 'Industrial Park'. In remnant south of Hope Rd, southwest of airport buildings. Enter Gate 38 off Hope Rd, 400m south then 300m east into bush.	SWAN COASTAL	COM	AIR	29/09/2005	ACT_IND	2	2	Y
115.8689	-32.09047	97301	1596	Caladenia huegelii	T	CR	56	E	-32.09047	115.868944	Jandakot Airport 'Industrial Park'. in triangle between Hope Rd, railway line (just south of Roe Hwy extension) and just east of Marriott Rd to the east. Enter Gate 37 off Hope Rd, ca. 180m west of gate then ca. 50m north of the remnant.	SWAN COASTAL	COM	AIR	29/09/2005	ACT_IND	6	6	Y
115.868	-32.08711	97302	1596	Caladenia huegelii	T	CR	56	F	-32.08711	115.867972	Jandakot Airport 'Industrial Park'. in triangle between Hope Rd, railway line (just south of Roe Hwy extension) and just east of Marriott Rd to the east. Enter Gate 37 off Hope Rd, in northeast corner of park.	SWAN COASTAL	COM	AIR	29/09/2005	ACT_IND	3	3	Y
115.8754	-32.0875	97303	1596	Caladenia huegelii	T	CR	56	G	-32.0875	115.875389	Jandakot Airport.	SWAN COASTAL	COM	AIR	28/09/2005		0	1	Y
115.8861	-32.18222	97312	1596	Caladenia huegelii	T	CR	60	A	-32.18222	115.886111	Private Property, 36 (Lot 149) Stefanelli Road, Wandii.	SWAN COASTAL	PRI		11/10/2005	ACT_IND	6	6	Y
115.8854	-32.18168	97313	1596	Caladenia huegelii	T	CR	60	B	-32.18168	115.885354	Private Property, Lot 51 (previously part of Lot 137 which was subdivided) Rowley Road, Wandii, scattered in bush in southern half of block.	SWAN COASTAL	PRI		11/10/2005	ACT_IND	11	0	Y
115.886	-32.18184	106221	1596	Caladenia huegelii	T	CR	60	D	-32.18184	115.885978	Private Property, Lot 52 (previously part of Lot 137 which was subdivided) Rowley Road, Wandii, scattered in bush in southern half of block.	SWAN COASTAL	PRI		10/10/2005	ACT_IND	5	0	Y
115.8869	-32.14725	84954	1596	Caladenia huegelii	T	CR	61		-32.14725	115.886889	Private Property 384 Bartram Street, Banjup, remnant at back of property.	SWAN COASTAL	PRI		5/10/2005		1	1	Y
115.8893	-32.16136	84955	1596	Caladenia huegelii	T	CR	62		-32.16136	115.889306	Western edge of Denis De Young Reserve Banjup.	SWAN COASTAL	LGA	REC	3/10/2005	ACT_IND	18	18	N
115.9381	-32.11433	84957	1596	Caladenia huegelii	T	CR	64		-32.11433	115.938111	Private Property Lot 9006, Wright Road, Harrisdale (previously Lot 1001 Wright Road, Forrestdale). ##Unverified - not considered to occur at this site##	SWAN COASTAL	PRI		30/09/1994	ESTMT	0	1	N
115.8819	-32.15181	84960	1596	Caladenia huegelii	T	CR	67		-32.15181	115.881944	Unvested Reserve No. 41438, east of Shirley Balla Swamp, Banjup.	SWAN COASTAL	NON	GVT	8/10/2006	ACT_IND	4	4	Y
115.8953	-32.16894	84964	1596	Caladenia huegelii	T	CR	72		-32.16894	115.89525	Private Property, Lot 3 (54 Oxley Road), Banjup. Ca. 20m S of water tank.	SWAN COASTAL	PRI		19/09/2007	ACT_IND	1	1	Y
115.9559	-32.15628	97369	1637	Diuris purdiei	T	EN	4	A	-32.15628	115.95593	Armada Golf Course (R 27165). 10-20m from Forrest Rd, ca 500m NW of Stirling Rd.	SWAN COASTAL	LGA	REC	14/01/2004		0	0	N
115.9483	-32.16	97370	1637	Diuris purdiei	T	EN	4	B	-32.16	115.948333	Armada Golf Course (R 27165). Follow NW-SE running firebreak from Stirling Rd to powerline, follow powerline NE for 250m to edge of pop.	SWAN COASTAL	LGA	REC	14/01/2004		0	0	N
115.9452	-32.13978	85053	1637	Diuris purdiei	T	EN	6		-32.13978	115.945194	PP, Lot 66 Anstey Rd, 'Jandakot Regional Park'. NE of junction with Keane Rd. 100m from Keane Rd, ca 60m NW of Anstey Rd & 500m from Keane Rd, 50m NW of Anstey Rd.	SWAN COASTAL	PRI		14/01/2004		0	0	Y
115.9348	-32.10434	85041	1637	Diuris purdiei	T	EN	11		-32.10434	115.934818	PP, Loc 1569. E side of Ranford Rd, 500m SE of Warton Rd.	SWAN COASTAL	PRI		17/10/1984		0	0	Y
115.8307	-32.13212	99183	4763	Dodonaea hackettiana			4	A	-32.13212	115.830652	Along the NE side of Kogolup Lake, Yangebup. For 0.6 km NNE along the lake edge from Wedge Rd.	SWAN COASTAL	PRI		15/10/1980		0	0	N
115.8307	-32.13767	99184	4763	Dodonaea hackettiana			4	B	-32.13767	115.830652	N verge of Wedge Rd, along the S edge of Kogolup Lake, Yangebup.	SWAN COASTAL	LGA	VER	15/10/1980		0	0	N
115.8293	-32.14045	99185	4763	Dodonaea hackettiana			4	C	-32.14045	115.829263	N edge of Thomsons Lake. W end of Haring Rd, Success.	SWAN COASTAL	NON	OTH	15/10/1980		0	0	N

115.8209	-32.14323	99186	4763	<i>Dodonaea hackettiana</i>		4	D	-32.14323	115.82093	NW edge of Thomsons Lake. 0.6 km W of Wedge Rd and 0.5 km E of Lorimer Rd.	SWAN COASTAL	NON	OTH	15/10/1980	0	0	N		
115.8237	-32.15989	99189	4763	<i>Dodonaea hackettiana</i>		4	A	-32.15989	115.823708	Russell Rd, Wattleup. From Pearse Rd, E for approx 0.6 km.	SWAN COASTAL	LGA	VER	15/10/1980	ACT_IND	27	27	N	
115.8237	-32.15156	99190	4763	<i>Dodonaea hackettiana</i>		4	B	-32.15156	115.823708	S side of Russell Rd, Wattleup. NW corner of Harry Waring Marsupial Reserve.	SWAN COASTAL	CC	CFF	OTH	15/10/1980	ACT_IND	13	13	N
115.8293	-32.15712	99191	4763	<i>Dodonaea hackettiana</i>		4	C	-32.15712	115.829263	S edge of Thomsons Lake. From 0.5 to 1.5 km E of Pearse Rd.	SWAN COASTAL	LGA	NRE	CFA	15/10/1980		0	0	N
115.8301	-32.16545	99193	4763	<i>Dodonaea hackettiana</i>		4	E	-32.16545	115.830097	Harry Waring Marsupial Reserve. E side of Banganup (Toodjabubup) Lake. 375 m S of Russell Rd.	SWAN COASTAL	CC	CFF	OTH	15/10/1980	ESTMT	15	23	N
115.8293	-32.10573	87266	4763	<i>Dodonaea hackettiana</i>		4		-32.10573	115.829263	SE side of the junction of Forrest Rd and Mason Rd, ca 1 km S of Bibra Lake.	SWAN COASTAL	PRI			11/11/1981		0	0	N
115.9223	-32.181	85084	1639	<i>Drakaea elastica</i>	T	CR		-32.181	115.922319	**Extinct - area cleared** Private Property Loc 694, Lot 1. 200m SW of the Rowley Rd and Nicholson Rd junction.	SWAN COASTAL	PRI			28/07/2005	ESTMT	0	0	N
115.9548	-32.15795	85085	1639	<i>Drakaea elastica</i>	T	CR		-32.15795	115.954819	**Presumed Extinct - not seen since 1978** North boundary of Armadale Golf Course, just west of Forrest Rd.	SWAN COASTAL	LGA	REC		28/07/2005		0	0	N
115.8786	-32.08628	85072	1639	<i>Drakaea elastica</i>	T	CR		-32.08628	115.878556	Jandakot Airport. Ca. 400m S of Leeming Rd and 200m E of Marriot Rd. W of airport's N infrastructure. Shire of Cockburn.	SWAN COASTAL	COM	AIR		27/09/2005	ACT_IND	4	4	N
115.9143	-32.15684	91320	13635	<i>Drakaea micrantha</i>	T	EN		-32.15684	115.914263	PP (Loc 33,37,1 or 2?). SW of Forrestdale. N of Gibbs Rd, ca 500m W of Nicholson Rd. Armadale-Kelmscott.	SWAN COASTAL	PRI			14/11/2002		0	0	N
115.9404	-32.14045	90842	13191	<i>Drosera occidentalis subsp. occidentalis</i>		4		-32.14045	115.940374	Lot 66, N corner of Keane and Anstey Rds, Forrestdale.	SWAN COASTAL	PRI			19/10/1989	ESTMT	0	20000	N
115.9487	-32.16267	90822	13191	<i>Drosera occidentalis subsp. occidentalis</i>		4		-32.16267	115.948708	Recreation Reserve 750 m S of Armadale Golf Course, at approx. 200 m W of Stirling Rd and 400 m N of Oxley Rd.	SWAN COASTAL	LGA	REC		6/11/1989	ESTMT	100	100	N
115.939	-32.14184	98909	4027	<i>Jacksonia sericea</i>		4	A	-32.14184	115.938985	Lot 100 Anstey Rd, Forrestdale.	SWAN COASTAL	PRI			9/11/1990		0	0	N
115.9348	-32.13767	98910	4027	<i>Jacksonia sericea</i>		4	B	-32.13767	115.934818	Lot 101 Anstey Rd, Forrestdale.	SWAN COASTAL	PRI			9/11/1990		0	0	N
115.9513	-32.16219	84469	942	<i>Lepidosperma rostratum</i>	T	EN		-32.16219	115.951333	Armadale Golf Course Shire Reserve 27165, Lot 460 [E of Forestdale Lake Nature Reserve]. Ca. 130m S of the south most fairway at the golf course. Ca. 25m W of Stirling Road.	SWAN COASTAL	LGA	REC		1/09/2009	ESTMT	1000	1000	Y
115.9473	-32.13767	96770	36200	<i>Ornduffia submersa</i>		4		-32.13767	115.947318	Lot 66 Anstey Rd, Forrestdale. 1.4 km SW of Ranford Rd and 1.5 NW of Anstey Rd, in winter-wet water course.	SWAN COASTAL	PRI			27/09/1989	ACT_IND	25	25	N
115.9501	-32.15989	96771	36200	<i>Ornduffia submersa</i>		4		-32.15989	115.950097	Armadale Golf Course, SW corner. 80 m S of 7th fairway at 70-80 m from the 7th tee-off.	SWAN COASTAL	LGA	REC	GOL	5/11/1990	ACT_IND	6	6	N
115.9333	-32.13333	89292	7756	<i>Styloidium longitubum</i>		3		-32.13333	115.933333	Un-named Reserve (ID: 32926), Anstey Rd, Jandakot.	SWAN COASTAL	NON	GVT		30/11/1991		0	0	N
115.9473	-32.13767	93718	44444	<i>Tripterococcus sp. Brachylobus (A.S. George 14234)</i>		4		-32.13767	115.947318	NE of Anstey Rd and Keane Rd junction. Between Anstey Rd and drain.	SWAN COASTAL	PRI			11/12/1990	ACT_IND	80	80	Y
115.8866	-32.153	93725	44444	<i>Tripterococcus sp. Brachylobus (A.S. George 14234)</i>		4		-32.153	115.886569	Reserve 41438 (Location 418), cnr of Liddlow & Gibbs Rds, Banjup.	SWAN COASTAL	NON	GVT		21/02/1992	ESTMT	10	10	N
115.9668	-32.11545	92657	14714	<i>Verticordia lindleyi subsp. lindleyi</i>		4		-32.11545	115.966762	NW side of the track which extends SW from the end of Passmore St, Southern River. 1 km SW of junction with Holmes Rd, on the north side of the trotting track.	SWAN COASTAL	PRI			11/05/1990	ESTMT	12	12	N
115.9601	-32.12223	92658	14714	<i>Verticordia lindleyi subsp. lindleyi</i>		4		-32.12223	115.960065	NW side of Passmore St, Southern River. Immediately east of the Dog Training Ground, ca. 0.2 km NE of the junction with Ranford Rd.	SWAN COASTAL	PRI			2/08/2012		0	0	N
115.9348	-32.13211	92660	14714	<i>Verticordia lindleyi subsp. lindleyi</i>		4		-32.13211	115.934818	East corner of Anstey and Keane Rds, Jandakot. Lots 100, 101.	SWAN COASTAL	PRI			30/11/1991		0	0	N
115.8895	-32.166	92664	14714	<i>Verticordia lindleyi subsp. lindleyi</i>		4		-32.166	115.889541	Denis De Young Reserve, Banjup. East side of Liddlow Rd, ca. 475 m north of the junction with Oxley Rd.	SWAN COASTAL	LGA	REC		15/06/1991		0	0	N

Taxon	Status	Rank	IUCNCriteria	EPBC	DPaWRegion	DPaWDistrict	Distribution	FloweringPeriod	RecoveryPlan
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)		1			SWAN	PERTH HILLS,SWAN COASTAL	North Dandalup, Mundijong, Gosnells, Jandakot, Serpentine, Mundijong	My,Aug	
Amanita drummondii		3			SCST,SWAN,WARR	ALBANY,DONNELLY,FRANKLAND,SWAN COASTAL	Jandakot, Yunderup, Perup, Mount Roe N.P., Denmark, Albany		
Byblis gigantea		3			MWST,SWAN	MOORA,PERTH HILLS,SWAN COASTAL	Yule Brook, Cannington, Jandakot, Brookton Highway, Cervantes	Sep-Jan	
Dodonaea hackettiana		4			SWAN	SWAN COASTAL	Wattleup, Thompson Lake, Kings Park, Jandakot, Bibra Lake-The Spectacles, Gingin, Peron, Baldivis, Beeliar, Baldivis, Harry Waring Marsupial Reserve	Jul-Oct	
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)		3			SWAN	SWAN COASTAL	Serpentine, Kenwick, Upper Swan, Gingin, Forrestdale, Bullsbrook, Mandurah, Arrowsmith, Capel	-	
Jacksonia gracillima		3			SWAN,SWST	BLACKWOOD,SWAN COASTAL	Mundijong, Forrestdale, Capel, Elgin, Modong N.R., Forrestdale, Ambergate	Oct-Nov	
Lepidosperma rostratum	T	EN	B1ab(iii)+2ab(iii)	EN	SWAN	SWAN COASTAL	Cannington, Kenwick, Forrestdale Lake NR	Aug	
Microtis quadrata		4			SCST,SWAN,WARR,WHTB	ALBANY,FRANKLAND,SWAN COASTAL,GREAT SOUTHERN	Pinjarra, Jandakot, Albany, Lake Barker, Denamrk , Baufort Inlet	Dec-Jan	
Ornduffia submersa		4			SCST,SWAN,SWST,WARR	ALBANY,DONNELLY,FRANKLAND,PERTH HILLS,SWAN COASTAL,WELLINGTON	Gunapin, Boyanup, Lake Muir, Denmark, Forrestdale, Kenwick, Frankland River, Lane Poole	Sep-Oct	
Stylidium longitubum		3			SWAN,SWST,WHTB	BLACKWOOD,SWAN COASTAL,WELLINGTON,GREAT SOUTHERN	Upper Swan, Bullsbrook, Bunbury, Midland, Busselton, Arthur River, Jandakot, Mundijong, Karnup	Nov	
Thysanotus glaucus		4			MWST,SCST,SWAN,SWST,WHTB	BLACKWOOD,ALBANY,ESPERANCE,MOORA,PERTH HILLS,SWAN COASTAL,GREAT SOUTHERN	Regans Ford, Forrestdale, Busselton, Lake King, West Mt Barren, Lesueur NPK	Nov-Feb	
Verticordia lindleyi subsp. lindleyi		4			MWST,SWAN	MOORA,PERTH HILLS,SWAN COASTAL	Gillingarra-Forrestdale, Cannington, Guildford, Muchea, Gingin, Murray River, Moore River, Serpentine	Nov-Jan	

X	Y	Sheet	NameID	Taxon	Cons_Code	Plant_Desc	Site_Descr	Vegetation	Frequency	Notes	Locality	Latitude	Longitude	Geocode_Precision	Date
115.9686	-32.1142	7770111	38481	Austrostipa jacobsoniana	T	Erect, perennial, caespitose grass. 1.2 m high x 0.15 m wide. Flowers green. Reproductive method: seeds.	Roadside on coastal plain. Dry white/grey sand, well drained.	Xanthorrhoea and Acacia shrubs with Eragrostis curvula dominant grass.	21-50 plants.	Population structure: adult, 50% fruiting. Other alien species: many (4 of more).	N side of Passmore Street, ca 130 m E of Phoebe Street	-32.1142	115.9686	GPS	1 14/11/2003
115.95	-32.1167	6600840	38481	Austrostipa jacobsoniana	T	Perennial grass clump. height: 110 cm and width: 20 cm at base of clump. Lemma lobes, most florets shed.	Soil surface: leaf litter. Colour: grey. Type: sandy clay, hard set. Landform: sand plain. Geology: granite. Collected from east side of road verge next to cleared farmland.	Remnant bushland. Species: Eucalyptus calophylla, Acacia sp., Xanthorrhoea sp., Eragrostis curvula, Paspalum dilatatum, Avena sp.	about 100 plants in two groups of about 50, on each side of the road.	Only known Austrostipa juncifolia in Perth region.	Passmore Street between Phoebe Street and Holmes Street, Southern River 2.5 miles N of Forrestdale along Nicholson Road	-32.1167	115.95	MAN	3 29/12/2003
115.9667	-32.1303	1488651	3178	Byblis gigantea		3 Flowers deep pink.	On sandy flat.	With Rushes, Stackhousia, Verticordia.				-32.1303	115.9667	AUTO	3 29/02/1960
115.9319	-32.1333	3415015	3178	Byblis gigantea		Perennial soft shrub, from rootstock. In flower, 3 flowers pink-purple, anthers yellow.	Winter wet, grey sandy clay over clay. In sandy soil.	Melaleuca teretifolia open shrubland. Jarrah - Banksia woodland.		Abundance: scattered in area.	Nicholson road, Jandakot Bartram Road, Jandakot	-32.1333	115.9319	MAN	0 29/12/1992
115.8333	-32.1167	256021	1596	Caladenia huegelii	T			Closed Banksia woodland. Banksia sp., Stirlingia latifolia, Hibbertia spp., Hypocalymma robustum, Conostephium pendulum		Abundance: 23 plants flowering. Plants found only in 'depression' ca 50 m x 75 m.	300 m E (right) on sand track, 300 m N up Fraser Road from Forrest Road, Banjup	-32.1167	115.8333	MAN	3 7/09/1958
115.8793	-32.1254	4421205	1596	Caladenia huegelii	T	Up to 60 cm high.	Coastal plain. Grey sand.	Closed Banksia woodland. Banksia sp., Stirlingia latifolia, Hibbertia spp., Hypocalymma robustum, Conostephium pendulum		Abundance: 23 plants flowering. Plants found only in 'depression' ca 50 m x 75 m.	300 m E (right) on sand track, 300 m N up Fraser Road from Forrest Road, Banjup	-32.1254	115.8793	GPS	1 20/09/1996
115.8793	-32.1254	4421213	1596	Caladenia huegelii	T	Up to 60 cm high.	Coastal plain. Grey sand.	Low woodland - low forest over scrub and heath; Banksia attenuata, B. menziesii, B. ilicifolia, Allocasuarina fraseriana, Eucalyptus todtiana, E. marginata over Adenanthos.				-32.1254	115.8793	GPS	1 20/09/1996
115.9167	-32.1333	908622	1596	Caladenia huegelii	T	To 80 cm tall, one with two flowers, no odour.	In grey sand on gently undulating terrain.	Low open woodland of Melaleuca preissiana over Low Open Shrubland of Melaleuca thymoides over Dasyopogon sp. and Desmodium sp. herbland on lower slopes.	2 mature plants, one dead over 2 sq m.	Condition of population: healthy. Healthy population but at risk from disturbance given location and proximity to sand.	900 metres SW of Randford Road on Warton Road, Canning Vale, Prisons Department	-32.1333	115.9167	MAN	3 9/09/1985
115.8851	-32.1262	6752624	1596	Caladenia huegelii	T	Ca 30 cm tall. Linear hairy leaf 15 cm x 1 cm.	Grey sand.				Bush Forever Site 390, Fraser Road Bushland, Banjup	-32.1262	115.8851	GPS	1 30/10/2003
115.88	-32.1267	7439938	1596	Caladenia huegelii	T		Private land. Flat. White / grey sand.		452 mature plants.		Lot 4, 131, 135 and 136, Fraser road. Fro. Armadale road head E onto Fraser road, Banjup	-32.1267	115.88	GPS	1 21/10/2004
115.8667	-32.1333	6534163	16245	Cyathochaeta teretifolia		3					In or adjacent to Emma Treeby Reserve, S Armadale Road, Banjup	-32.1333	115.8667	MAN	3 10/12/1995
115.9833	-32.1667	7536313	1637	Diuris purdiei	T		Flat. Moist grey sand-loam. Fire last season.	Associated species: Dryandra sp., Xanthorrhoea sp., Marri, Grevillea sp., Watsonia, Blowfly grass, sedges, grasses.		Condition of population: moderate.	Fletcher Park, Armadale, Swan Region Intersection Mason and Forrest roads, Jandakot	-32.1667	115.9833	TOPO	3 7/10/2005
115.8333	-32.1167	1157663	4763	Dodonaea hackettiana		4 Shrub 2.5 m high. Fruit red/green.	Grey sand.				Russell Road (S side of Reserve) between Thomsons Lake and Marsupial Reserves, Wattleup	-32.1167	115.8333	MAN	3 20/12/1980
115.8497	-32.1664	4260171	4763	Dodonaea hackettiana		4				2159/62/2.	Thomson's Lake Reserve, Jandakot	-32.1664	115.8497	AUTO	2 28/11/1993
115.8333	-32.1333	1157655	4763	Dodonaea hackettiana		4				Abundance: large population, dominant shrub. (Within population 3262-3267).		-32.1333	115.8333	MAN	3 /09/1962
115.8167	-32.1167	1157124	4763	Dodonaea hackettiana		4 Erect shrub, 1 m high, variable age structure.	Disturbed area, in sandy paddock.	Eucalyptus marginata open forest, with grasses, Carpobrotus sp.		Abundance: large population, dominant shrub. (Within population 3262-3267).	20 km S of Perth, 1 km S of Bibra Lake on E side of Forrest Road	-32.1167	115.8167	MAN	3 5/12/1978
115.8167	-32.1167	1157132	4763	Dodonaea hackettiana		4 Erect shrub, 2 m high, variable age structure.	Disturbed area, in sandy paddock.	Eucalyptus marginata open forest, with grasses, Carpobrotus sp.		Abundance: large population, dominant shrub. (Within population 3262-3267).	20 km S of Perth, 1 km S of Bibra Lake on E side of Forrest Road	-32.1167	115.8167	MAN	3 5/12/1978
115.9667	-32.1667	232238	13635	Drakaea micrantha	T	Decumbent perennial to 0.3 m high x 1.4 m diam.	Flat, well-drained but adjacent to winter-wet swamp; pale grey sand.	In Banksia low open woodland.			SW of Forrestdale Bushland near Shirley Balla Swamp, north of Gibbs Rd, Banjup	-32.1667	115.9667	MAN	4 2/10/1977
115.8814	-32.1564	8415331	20462	Jacksonia gracillima		3 Prostrate or decumbent shrub, branches ascending to 50 cm x 1.5 m wide. Flowers orange-red. In flower.	Winter wet flats, peaty sand over clay.	Banksia woodland.	infrequent.			-32.1564	115.8814	GPS	1 14/11/2010
115.9333	-32.1333	1595644	20462	Jacksonia gracillima		3 Decumbent shrub, ascending branches to 50 cm, plant to 1.5 m across. Flowers yellow-red, in full flower.	Sand dune. Grey sand over white sand. Soil: Grey sand. Topography/drainage: Seasonally wet poorly drained flat. Geomorphology: Guildford formation (pinjarra plain).	Banksia attenuata/B. Menziesii low woodland.		Abundance: common in area.	Anstey Road, Forrestfield	-32.1333	115.9333	MAN	0 9/11/1990
115.9333	-32.1333	1595636	20462	Jacksonia gracillima		3 in full flower.				Abundance: common in area.	Reserve no. 32926, Anstey Road, Forrestfield	-32.1333	115.9333	MAN	0 9/11/1990
115.9529	-32.1577	4463773	20462	Jacksonia gracillima		3 Swamp Form. Low spreading shrub.		Vegetation: Hypolaena exsulca, Lyginia barbata Dense Low Sedges.			Forrestdale Lake Nature Reserve near golf course (plot fl-1)	-32.1577	115.9529	GPS	1 31/10/1992
115.9482	-32.1363	5206472	20462	Jacksonia gracillima		3 Spreading, compact shrub 100 cm high x 100 cm wide. Standard orange with darker band near base, wings orange, keel darker orange. Buds very angular.	Swan Coastal plain, winter wet Bassendean Sands. Littered, grey, peaty, loamy sand.	Open Low Woodland B over Dense Heath B over Low Sedges (Muir 1977). With Melaleuca preissiana, Pericalymma elliptica, Melaleuca seriata.	locally common.		Anstey Road, Forrestdale	-32.1363	115.9482	GPS	1 15/11/1998
115.9336	-32.1333	6836305	20462	Jacksonia gracillima		3 Low sprawling shrub usually 40 cm high x 80 cm wide (occasionally 70 cm high x 100 cm). Standard orange with darker orange band close to base, then with basal yellow eye; wings red in basal half then orange distally; keel red.	Coastal plain. Dry, grey sand. Edge of seasonal wetland.	Banksia woodland over dense heath 2-3 m. Banksia menziesii, B. attenuata, Melaleuca thymoides, Kunzea glabrescens.	locally common.		Close to N corner of block of remnant bushland bounded by unmade sections of Hale and Keane Roads, Forrestdale	-32.1333	115.9336	GPS	1 20/10/2003

115.9183	-32.1397	6836445	20462	<i>Jacksonia gracillima</i>		3	Low spreading shrub to 30 cm x 120 cm. Standard yellow-orange with red band close to base and yellow eye; wings yellow-orange in distal half, red basally, keel red.	Coastal plain, low flat. Dry, but in area of high water table. Grey sand.	Open heath over dense herbs. <i>Kunzea glabrescens</i> , <i>Melaleuca thymoides</i> , <i>Dasyopogon bromeliifolius</i> , <i>Phlebocarya ciliata</i> .	occasional.	Piara Nature Reserve, Forrestdale, off N-S track ca 300 m from powerline access track	-32.1397	115.9183	GPS	1	12/11/2003	
115.9418	-32.1238	8642176	20462	<i>Jacksonia gracillima</i>		3	Shrub.	Soil: Grey sand. Topography/drainage: Seasonally wet poorly drained flat. Geomorphology: Guildford formation (pinjarra plain).	Vegetation: <i>Melaleuca uncinata</i> Low Scrub B over <i>Leptocarpus</i> spp. Low Sedges.		Undeveloped road reserve (Skeet Road) plants scattered ca 1-2 km SW of Ranford Road, Harrisdale. Along firebreak and track	-32.1238	115.9418	GPS	1	24/11/2011	
115.9509	-32.1629	4494156	942	<i>Lepidosperma rostratum</i>	T		Erect perennial sedge.	Soil: Grey sand. Topography/drainage: Seasonally wet poorly drained flat. Geomorphology: Guildford formation (pinjarra plain).	Vegetation: <i>Melaleuca uncinata</i> Low Scrub B over <i>Leptocarpus</i> spp. Low Sedges.		Forrestdale Lake Nature Reserve, S of golf course (plot fl-3).	-32.1629	115.9509	GPS	1	31/10/1992	
115.9509	-32.1629	4520831	942	<i>Lepidosperma rostratum</i>	T		Erect perennial sedge.	Soil: Grey sand. Topography/drainage: Seasonally wet poorly drained flat. Geomorphology: Guildford formation (pinjarra plain).	Vegetation: <i>Melaleuca uncinata</i> Low Scrub B over <i>Leptocarpus</i> spp. Low Sedges.		Forrestdale Lake Nature Reserve, S of golf course (plot fl-3).	-32.1629	115.9509	GPS	1	12/05/1992	
115.9523	-32.1571	6985246	942	<i>Lepidosperma rostratum</i>	T		Tufted perennial herb.	Seasonally wet poorly drained flat grey sandy clay.	Low dense sedgeland with scattered <i>Melaleuca</i> and <i>Kunzea</i> shrubs.	locally common.	Forrestdale Lake Nature Reserve (adj. Plot FLO3)	-32.1571	115.9523	GPS	1	16/06/2004	
115.9519	-32.1189	8372535	17976	<i>Meeboldina decipiens</i> subsp. <i>decipiens</i>		3	Slender small clumps. Male.	Swampy flat.	With small shrubs of <i>Melaleuca</i> .	very locally common.	Ranford Road, 2.9 km S of Warton Road, Gosnells	-32.1189	115.9519	TOPO	2	8/10/1995	
115.8331	-32.1167	282235	33742	<i>Microtis quadrata</i>		4		In black peaty soil.	Under paperbarks.		NW side of Lake Jandakot	-32.1167	115.8331	AUTO	3	11/11/1960	
115.9486	-32.1611	2245558	36200	<i>Ornduffia submersa</i>		4	Aquatic herb rooted in clay. Leaves and stems dying back.	Damp claypan.	<i>Melaleuca hamulosa</i> Heath B over open herbs and sedges.		Abundance: 6 plants counted	Armadale Golf Course, SW corner, c. 80 m S of 7th fairway at point 75-80 m from 7th tee off	-32.1611	115.9486	MAN	0	5/11/1990
115.9458	-32.1375	2245531	36200	<i>Ornduffia submersa</i>		4	Leaves elliptic, dying back.	Brown clay, winter wet depression. Dry claypan.	With herbs surrounded by <i>Melaleuca hamulosa</i> low scrub A over <i>Pericalymma ellipticum</i> , <i>Regelia ciliata</i> low heath C.			N of Anstey road - Kearne road junction, Forrestdale, E side of transmission line	-32.1375	115.9458	MAN	0	25/10/1990
115.9461	-32.1342	7684118	36200	<i>Ornduffia submersa</i>		4		On plain, grey sandy clay.	Open heath of <i>Melaleuca viminea</i> subsp. <i>viminea</i> , <i>Calothamnus hirsutus</i> , <i>Verticordia densiflora</i> and <i>Chaetanthus aristatus</i> . Associated species <i>Actinostrobos pyramidalis</i> , <i>Schoenus rigens</i> , <i>Regelia ciliata</i> , <i>Pericalymma ellipticum</i> , <i>Lyginia imberbis</i> .	Healthy population.	Bush Forever Site 342, Swan District	-32.1342	115.9461	UNK	2	22/09/2004	
115.85	-32.1083	1084135	11557	<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>		3		Sand ridge.	In <i>Banksia</i> woodland.			Prinsep Road, Jandakot	-32.1083	115.85	MAN	2	23/05/1978
115.8333	-32.1667	5592224	5237	<i>Pimelea calcicola</i>		3	Erect, perennial, dwarf shrub.	Brown sand and protruding limestone.	<i>Melaleuca/Acacia rostellifera</i> patches. Associated vegetation: <i>Dryandra sessilis</i> , <i>Phyllanthus calycinus</i> , <i>Hibbertia hypericoides</i> , <i>Ehrharta calycina</i> .			ca 75 m N of Retta Street on E side of Cockburn Road, Mount Brown (Beeliar) Regional Park,	-32.1667	115.8333	MAN	0	10/11/1997
115.9429	-32.1378	7693982	1008	<i>Schoenus pennisetis</i>		3	Very fine delicate tufted sedge to 0.06 m; small brown flower heads.	Seasonally waterlogged sandy plain. Grey acid sands.	With heathy vegetation.			Anstey Road Plot 1, occurs in 10 x 10 m plot located Anstey and Keane dampland, Armadale	-32.1378	115.9429	GPS	1	30/08/2007
115.9333	-32.1333	8017042	1008	<i>Schoenus pennisetis</i>		3	Tiny perennial, to ca 8 cm tall. Forms a low mat.	Flat low drainage line, white sandy clay over clay.	<i>Melaleuca</i> (<i>M. uncinata</i> , <i>M. incana</i> , <i>M. sp.</i>) low open shrubland.		Abundance: abundant.	Jandakot Nature Reserve, Greater Perth Gazetted Reserve 32926, Anstey road,	-32.1333	115.9333	UNK	3	7/09/2007
115.9333	-32.1333	1631063	18564	<i>Stylidium aceratum</i>		2	Annual herb, flowers pink with deep pink markings around throat-yellow.					Forrestdale	-32.1333	115.9333	MAN	0	9/11/1990
115.8331	-32.1167	3172805	7756	<i>Stylidium longitubum</i>		3	Ephemeral herb, flowers pink.					Bartram Road, Jandakot	-32.1167	115.8331	AUTO	3	22/11/1973
115.9333	-32.1333	4052609	7756	<i>Stylidium longitubum</i>		3	Erect annual herb, flowers pink, with distinct red line across near throat.	Winter wet flats. Grey sandy clay over clay.	<i>Melaleuca viminea</i> tall shrubland.		Abundance: abundant in area.	Anstey road, Jandakot	-32.1333	115.9333	MAN	0	30/11/1991
115.8333	-32.1667	2857685	25800	<i>Stylidium paludicola</i>		3	0.5 m tall, flowers pink.	Near edge of swamp.	Amongst <i>Juncus</i> .			Jandakot Marsupial Breeding Station at Banganup Lake	-32.1667	115.8333	MAN	0	4/12/1974
115.8667	-32.1	6239404	25800	<i>Stylidium paludicola</i>		3		In swampy area.				Hammond and Circus Roads, Jandakot	-32.1	115.8667	MAN	3	/11/1965
115.95	-32.1833	2963612	14333	<i>Tetradlea sp.</i> Granite (S. Patrick SP1224)		3						Swan District: Wongong	-32.1833	115.95	MAN	4	/10/1901
115.8331	-32.1167	279188	1717	<i>Thelymitra variegata</i>		3		In yellow sand.	With <i>Banksia attenuata</i> , <i>Casuarina fraseri</i> , <i>Hibbertia hypericoides</i> , etc.			Rusel Road, Jandakot	-32.1167	115.8331	AUTO	3	16/08/1959
115.9667	-32.1333	1053981	1334	<i>Thysanotus glaucus</i>		4	Leaves glaucous, flowers deep purple, very thickly fringed. Stamens 3, 1 larger.	On disturbed sandy soil.				2.5 miles N of Forrestdale along Nicholson road	-32.1333	115.9667	MAN	3	29/02/1960
115.9667	-32.1333	1053566	1334	<i>Thysanotus glaucus</i>		4	Leaves glaucous, flowers deep purple, very thickly fringed, stamens 3, 1 larger.	On disturbed sandy soil.				2.5 miles N of Forrestdale along Nicholson road	-32.1333	115.9667	MAN	3	29/02/1960
115.9458	-32.1389	2170175	44444	<i>Tripterocephalus sp. Brachylobus</i> (A.S. George 14234)		4	Multi-stemmed herb to 60 cm. Flowers with long pedicels in paniculate inflorescences.	Moist sandy flat.	On edge of regenerating <i>Regelia ciliata</i> heath B.			NE of Anstey road - Keane road junction, Forrestdale, between Anstey road and drain	-32.1389	115.9458	MAN	0	11/12/1990
115.8833	-32.15	2521296	44444	<i>Tripterocephalus sp. Brachylobus</i> (A.S. George 14234)		4	Slender erect multi-stemmed shrub to 40 cm. Flowers orange-yellow, in full flower.	Winter wet flats, peaty sand over clay.	<i>Hypocalymma angustifolium</i> low heath.	scattered groups of 5-15 plants.		Gazetted Reserve 418 [Reserve No. 41438], Bartrum Road swamp, Jandakot	-32.15	115.8833	MAN	3	21/02/1992
115.9653	-32.1167	2166690	14714	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		4	Erect dwarf shrub with pink/purple flowers.	White grey loamy sand on seasonally wet flat ground.	In heath with <i>Pericalymma ellipticum</i> , <i>Banksia telmatiaea</i> , sedges.		Abundance: 12 plants	Southern River, 0.8 km SW along Passmore road from Holmes road, walk 200 m W keeping N of trotting track	-32.1167	115.9653	MAN	0	11/05/1990
115.9667	-32.1667	1057154	14714	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		4	Shrub to 2 feet, flowers pink.	Swampy sand.				Forrestdale, ca 15 miles SSE of Perth	-32.1667	115.9667	MAN	3	7/11/1969
115.9583	-32.1239	2166704	14714	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		4	Erect dwarf shrub with pink/purple flowers.	Grey sand, flat terrain.	Heathland with <i>Pericalymma ellipticum</i> , <i>Beaufortia squarrosa</i> , <i>Dasyopogon sp.</i> , <i>Regelia inops</i> , <i>Melaleuca preissiana</i> .		Abundance: 40 plants	Southern River immediately E of German Shepherd Dog Training Ground on Passmore Street, W end	-32.1239	115.9583	MAN	0	11/05/1990
115.9333	-32.1333	4055500	14714	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>		4	Erect shrub to 50 cm. Flowers pink, in flower.	Winter wet flats, grey sand over clay.	<i>Banksia / Calothamnus</i> low open heath.		Abundance: uncommon and scattered	Anstey Road, Jandakot	-32.1333	115.9333	MAN	0	30/11/1991

115.9686	-32.1146	7410670	14714	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	4	Road verge.	Woodland of <i>Corymbia calophylla</i> over open low heath to low shrubland of mixed species including <i>Xanthorrhoea preissii</i> , <i>Melaleuca preissiana</i> and <i>Nuytsia floribunda</i> open woodland over <i>Kunzea glabrescens</i> tall shrubland over <i>Astartea scoparia</i> , <i>Regelia ciliata</i> and <i>Jacksonia gracillima</i> open heath.	Reproductive state: flowering. Potential threat from mining. Fire history not known. Population healthy.	Water Corporation Serpentine trunk to Canning Trunk water main, near Holmes Road, Huntingdale (Holmes Road Reserve)	-32.1146	115.9686	GPS	1	8/01/2003
115.9418	-32.1238	8642168	14714	<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	4	Shrub to 0.75 m.			Undeveloped road reserve (Skeet Road) ca 1 km SW of Ranford Road, Harrisdale	-32.1238	115.9418	GPS	1	24/11/2011

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**Appendix D: Threatened and Priority Flora and Fauna Species
Likelihood of Occurrence**

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Table D.1: Likelihood of occurrence of Threatened and Priority flora recorded within 10 km of the survey area (TPFL (Department of Parks and Wildlife 2015f), TP List (Department of Parks and Wildlife 2015c), WAHerb (Department of Parks and Wildlife 2015d), *NatureMap* (Department of Parks and Wildlife 2015a)). The TP List database is searched using place names. As a result, many of the records obtained from this database may occur beyond 50 km of the survey area.

Species	Habit and flowering information	Life form	Habitat	Likelihood of occurrence
Threatened				
<i>Andersonia gracilis</i>	Slender erect or open straggly shrub 0.1-0.5 m high. Flowers white-pink-purple, Sep to Nov.	Shrub	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Unlikely
<i>Austrostipa jacobiana</i>	Erect, perennial, caespitose grass 1.2 m high and 0.15 m wide. Flowers green, Sep to Nov.	Grass	Dry white/grey sand, well drained, sandy clay, hard set.	Potential
<i>Caladenia huegelii</i>	Tuberous, perennial herb 0.25-0.6 m high. Flowers green, cream and red, Sep to Oct.	Geophyte	Grey or brown sand, clay loam.	Likely
<i>Darwinia foetida</i>	Sep to Oct.	Low shrub	No information available.	Unlikely
<i>Diuris micrantha</i>	Tuberous, perennial herb 0.3-0.6 m high. Flowers yellow and brown, Sep to Oct.	Geophyte	Brown loamy clay. Winter-wet swamps in shallow water.	Unlikely
<i>Diuris purdiei</i>	Tuberous, perennial herb 0.15-0.35 m high. Flowers yellow, Sep to Oct Sep to Oct.	Geophyte	Grey-black sand, moist. Winter-wet swamps.	Potential
<i>Drakaea elastica</i>	Tuberous, perennial herb 0.12-0.3 m high. Flowers red, green and yellow, Oct to Nov.	Geophyte	White or grey sand. Low-lying situations adjoining winter-wet swamps.	Potential
<i>Drakaea micrantha</i>	Tuberous, perennial herb 0.15-0.3 m high. Flowers red and yellow, Sep to Oct.	Geophyte	White-grey sand.	Potential

Species	Habit and flowering information	Life form	Habitat	Likelihood of occurrence
<i>Eucalyptus x balanites</i>	Mallee to 5 m high, bark rough, flaky. Flowers white, Oct to Dec; Jan to Feb.	Mallee	Sandy soils with lateritic gravel.	Unlikely
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	Prostrate to erect shrub 0.1-2.5 m high. Flowers white-cream, Aug to Sep.	Shrub	Sandy, sandy loam. Winter-wet heath.	Unlikely
<i>Lepidosperma rostratum</i>	Rhizomatous, tufted perennial grass-like or herb (sedge) 0.5 m high. Flowers brown Jun to Jul.	Sedge	Peaty sand, clay.	Unlikely
<i>Synaphea</i> sp. Fairbridge Farm (D.Papenfus 696)	Dense, clumped shrub to 0.3 m high and 0.4 m wide. Flowers yellow, Oct.	Low shrub	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Unlikely
<i>Synaphea stenoloba</i>	Capitose shrub 0.3-0.45 m high. Flowers yellow, Aug to Oct	Low shrub	Sandy or sandy clay soils. Winter-wet flats, granite.	Unlikely
<i>Thelymitra dedmaniarum</i>	Tuberous, perennial herb to 0.8 m high. Flowers yellow, Nov to Dec or Jan	Geophyte	Granite	Unlikely
<i>Thelymitra stellata</i>	Tuberous, perennial herb 0.15-0.25m high. Flowers yellow and brown, Oct to Nov.	Geophyte	Sand, gravel, lateritic loam.	Unlikely
Priority 1				
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	Shrub 0.4-1.5 m high. Flowers yellow, May or Aug.	Shrub	Grey or black sand over clay. Swampy areas, winter wet lowlands.	Potential
Priority 2				
<i>Stylidium aceratum</i>	Fibrous rooted annual herb 0.05-0.09 m high leaves spatulate. Flowers pink/white, Oct to Nov.	Herb	Sandy soils, swamp heathland.	Potential

Species	Habit and flowering information	Life form	Habitat	Likelihood of occurrence
<i>Thelymitra variegata</i>	Tuberous, perennial herb 0.1-0.35 m high. Flowers orange, red, purple and pink, Jun to Sept.	Geophyte	Sandy clay, sand, laterite.	Unlikely
Priority 3				
<i>Byblis gigantea</i>	Small branched perennial herb (or sub-shrub) to 0.45 m high. Flowers pink-purple/white, Sep to Dec or Jan.	Herb or sub-shrub	Sandy-peat swamps. Seasonally wet areas.	Potential
<i>Cyathochaeta teretifolia</i>	Rhizomatous clumped robust perennial grass-like or herb (sedge) to 2 m high and 1 m wide. Flowers brown.	Sedge	Grey sand, sandy clay. Swamps, creek edges.	Potential
<i>Eryngium pinnatifidum</i> subsp. Palustre (G.J. Keighery 13459)	Tuberous herb. Flowers white-pale blue.	Herb	Alluvial flat, well-drained, winter-wet depressions/claypan, damplands. Grey sandy over clay, red brown clay loam, brown sand, grey sand.	Unlikely
<i>Jacksonia gracillima</i>	Prostrate or decumbent shrub to 1 m high and 1.5 m wide. Flowers yellow-orange-red	Shrub	Pale grey sand, peaty sand over clay. Adjacent to winter wet flats.	Potential
<i>Meeboldina decipiens</i> subsp. <i>decipiens</i>	Erect open perennial grass-like or herb (sedge) 0.6 m high. Flowers Oct.	Sedge	Sand and sandy peat. Swamps.	Unlikely
<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>	Shortly rhizomatous compactly tufted perennial grass-like or herb 0.15-0.4 m high. Flowers cream-white, Aug to Oct.	Herb	White or grey sand, lateritic gravel.	Unlikely
<i>Pimelea calcicola</i>	Erect to spreading shrub 0.2-1 m high. Flowers pink, Sep to Nov.	Shrub	Sand. Coastal limestone ridges.	Unlikely
<i>Schoenus pennisetis</i>	Tufted annual grass-like or herb (sedge) 0.05-0.15 m high. Flowers purple-black, Aug to Sep.	Sedge	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	Unlikely

Species	Habit and flowering information	Life form	Habitat	Likelihood of occurrence
<i>Stylidium paludicola</i>	Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Flowers pink, Oct to Dec.	Herb	Peaty sand over clay. Winter wet habitats. Marri and <i>Melaleuca</i> woodland, <i>Melaleuca</i> shrubland.	Potential
<i>Tetratheca</i> sp. Granite (S. Patrick SP1224)	Erect shrub to 0.4 m high. Flowers pink-purple.	Shrub	Clay, moist loam, clayey sand. Granite boulders.	Unlikely
Priority 4				
<i>Dodonaea hackettiana</i>	Erect shrub or tree 1-5 m high. Flowers yellow-green/red, mainly Jul to Oct.	Shrub or tree	Sand. Outcropping limestone.	Likely - Recorded
<i>Drosera occidentalis</i> subsp. <i>occidentalis</i>	Fibrous-rooted, rosette perennial herb to 0.01 m high. Flowers pink/white, Nov to Dec.	Herb	Sandy and clayey soils. Swamps and wet depressions.	Potential
<i>Jacksonia sericea</i>	Low spreading shrub to 0.6 m high. Flowers orange, usually Dec or Jan to Feb.	Shrub	Calcareous and sandy soils, plain with grey sand, slope with dry red-brown sand with limestone rock.	Potential
<i>Microtis quadrata</i>	Herb, flowers white.	Geophyte	Black peaty soil.	Potential
<i>Ornduffia submersa</i>	Aquatic herb. Flowers cream	Aquatic herb	Damp claypan. Brown clay, winter wet depression. Grey, sandy clay.	Unlikely
<i>Stylidium longitubum</i>	Erect annual (ephemeral) herb 0.05-0.12 m high. Flowers pink, Oct to Dec.	Herb	Sandy clay, clay. Seasonal wetlands.	Potential

Species	Habit and flowering information	Life form	Habitat	Likelihood of occurrence
<i>Thysanotus glaucus</i>	Caespitose glaucose perennial herb 0.1-0.2 m high. Flowers purple, Oct to Dec or Jan to Mar.	Herb	White, grey or yellow sand, sandy gravel.	Likely
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S. George 14234)	Slender erect mutli-stemmed herb to 0.6 m high. Flowers orange-yellow.	Shrub	Moist sandy flat. Winter wet flats, peaty sand over clay.	Potential
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	Erect shrub 0.2-0.75 m high. Flowers pink, May or Nov to Dec or Jan.	Shrub	Sand, sandy clay. Winter-wet depressions.	Potential

Table D.2: Criteria used to assess the likely presence of conservation significant flora in the survey area.

Likelihood of occurrence	
Likely	Species previously recorded within the survey area or within 5 km of the survey area and suitable habitat appears to be present in the survey area.
Potential	Species previously recorded within 5 km to 10 km of the survey area and/or suitable habitat appears to be present in the survey area.
Unlikely	No suitable habitat appears to be present in the survey area.

Table D.3: Likelihood of occurrence of conservation significant fauna previously recorded within 40 km of the survey area (Department of Parks and Wildlife 2015a).

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
REPTILES					
<i>Pseudemydura umbrina</i>	Western Swamp Turtle	EPBC Act - Critically Endangered; WC Act - Scheduled 1	Restricted to only two wild populations at Ellen Brook Nature Reserve and Twin Swamps Nature Reserve on the Swan Coastal Plain north-east of Perth where there are less than 200 individuals left.	No suitable habitat is found throughout the survey area and the survey area is outside this species known distribution	Low
<i>Ctenotus delli</i>	Darling Range Heath Ctenotus	Parks and Wildlife Priority 4	Occurs in Jarrah and Marri woodland with a shrub-dominated understorey on laterite, sand or clay, and occasionally on granite outcrops.	No suitable habitat is found throughout the survey area	Low
<i>Ctenotus gemmula</i>	Jewelled Southwest Ctenotus	Parks and Wildlife Priority 3	This species inhabits sand plains with heaths. It is also found in banksia or mallee woodlands.	No suitable habitat is found throughout the survey area	Low
<i>Ctenotus ora</i>	Coastal Plains Skink	Parks and Wildlife Priority 3	The coastal plains skink has only been found in low numbers in a small stretch of sand dunes on the Swan Coastal Plain south of Perth	No suitable habitat is found throughout the survey area	Low
<i>Lerista lineata</i>		Parks and Wildlife Priority 3	This species generally occurs within Banksia woodland, sandy coastal heath and low shrubland	No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Acanthopis antarcticus</i>	Southern Death Adder	Parks and Wildlife Priority 3	This species inhabit a range of habitats, including mallee woodlands, scrubland, semi-arid zones and rocky outcrops within their known distribution.	No suitable habitat is found throughout the survey area and the survey area is outside this species known distribution	Low
<i>Neelaps bimaculatus</i>	Black-naped Snake	Parks and Wildlife Priority 3	This species inhabits coastal sandplains in dense heaths, shrublands and woodlands	No suitable habitat is found throughout the survey area	Low
BIRDS					
<i>Leipoa ocellata</i>	Malleefowl	EPBC Act - Vulnerable; WC Act - Scheduled 3	Largely confined to arid and semi-arid woodland that is dominated by mallee eucalypts on sandy soils with less than 430 mm of rainfall annually	No suitable habitat is found throughout the survey area; this species is locally extinct on the Swan Coastal Plain	Low
<i>Oxyura australis</i>	Blue-billed Duck	Parks and Wildlife Priority 4	The Blue-billed Duck is almost wholly aquatic, and is seldom seen on land and congregate on large, deep open freshwater dams and lakes	No suitable habitat is found throughout the survey area	Low
<i>Apus pacificus</i>	Fork-tailed Swift	EPBC Act - Migratory; WC Act - Scheduled 5	Largely aerial, not dependent on terrestrial habitat. Uncommon in the south of Western Australia	N/A	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EPBC Act - Endangered; WC Act - Scheduled 2	Beds of tall, dense <i>Typha</i> , <i>Baumea</i> and sedges in freshwater swamps	No suitable habitat is found throughout the survey area	Low
<i>Ixobrychus dubius</i>	Australian Little Bittern	Parks and Wildlife Priority 4	This species occurs in diverse freshwater swamp habitats, mainly where tall rushes, reeds, <i>Typha</i> (cumbungi), shrub thickets or other dense cover is inundated by surface water	No suitable habitat is found throughout the survey area	Low
<i>Ardea modesta</i>	Eastern Great Egret	EPBC Act - Migratory; WC Act - Scheduled 5	Wide range of wetland habitats such as inland and coastal, freshwater and saline, permanent and ephemeral water bodies.	No suitable habitat is found throughout the survey area	Low
<i>Ardea ibis</i>	Cattle Egret	EPBC Act - Migratory; WC Act - Scheduled 5	Largely wetland species however can exploit drier open habitats more than other heron species.	No suitable habitat is found throughout the survey area	Low
<i>Plegadis falcinellus</i>	Glossy Ibis	EPBC Act - Migratory; WC Act - Scheduled 5	Shallows and adjacent flats of freshwater lakes and swamps, also river pools, flooded samphire and sewage ponds.	No suitable habitat is found throughout the survey area	Low
<i>Pandion cristatus</i>	Eastern Osprey	EPBC Act - Migratory; WC Act - Scheduled 5	Littoral and coastal habitats and terrestrial wetlands.	No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	EPBC Act - Migratory; WC Act - Scheduled 5	Require presence of large areas of open water and have been recorded at or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, saltmarsh and sewage ponds.	No suitable habitat is found throughout the survey area	Low
<i>Falco peregrinus</i>	Peregrine Falcon	WC Act - Scheduled 7	Cliffs along coasts, rivers and drainage lines and around wooded watercourses and lakes	No suitable habitat is found throughout the survey area	Low
<i>Pluvialis fulva</i>	Pacific Golden Plover	EPBC Act - Migratory; WC Act - Scheduled 5	Generally these species prefer coastal and near shore habitats for foraging and roosting or inland in aquatic wetlands and salt lakes during periods of migration as well as becoming resident within optimal habitats.	No suitable habitat is found throughout the survey area	Low
<i>Pluvialis squatarola</i>	Grey Plover	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Charadrius dubius</i>	Little Ringed Plover	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Charadrius mongolus</i>	Lesser Sand Plover	EPBC Act - Migratory; WC Act - Scheduled 2 and Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Charadrius leschenaultii</i>	Greater Sand Plover	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Thinornis rubricollis</i>	Hooded Plover	Parks and Wildlife Priority 4		No suitable habitat is found throughout the survey area	Low
<i>Rostratula australis</i>	Australian Painted Snipe	EPBC Act - Endangered; WC Act - Scheduled 2		No suitable habitat is found throughout the survey area	Low
<i>Gallinago hardwickii</i>	Latham's Snipe	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Gallinago stenura</i>	Pin-tailed Snipe	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Gallinago megala</i>	Swinhoe's Snipe	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Limosa limosa</i>	Black-tailed Godwit	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Limosa lapponica</i>	Bar-tailed Godwit	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Numenius phaeopus</i>	Whimbrel	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Numenius madagascariensis</i>	Eastern Curlew	EPBC Act - Migratory; WC Act - Scheduled 3 and Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Numenius minutus</i>	Little Curlew	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Xenus cinereus</i>	Terek Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Actitis hypoleucos</i>	Common Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Tringa brevipes</i>	Grey-tailed Tattler	EPBC Act - Migratory; WC Act - Scheduled 5; Parks and Wildlife Priority 4		No suitable habitat is found throughout the survey area	Low
<i>Tringa nebularia</i>	Common Greenshank	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Tringa stagnatilis</i>	Marsh Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Tringa glareola</i>	Wood Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Arenaria interpres</i>	Ruddy Turnstone	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris tenuirostris</i>	Great Knot	EPBC Act - Migratory; WC Act - Scheduled 3 and Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris canutus</i>	Red Knot	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris alba</i>	Sanderling	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris minuta</i>	Little Stint	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Calidris ruficollis</i>	Red-necked Stint	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris subminuta</i>	Long-toed Stint	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris melanotos</i>	Pectoral Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Calidris ferruginea</i>	Curlew Sandpiper	EPBC Act - Critically Endangered and Migratory; WC Act - Scheduled 1 and Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Philomachus pugnax</i>	Ruff	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Phalaropus lobatus</i>	Red-necked Phalarope	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Glareola maldivarum</i>	Oriental Pratincole	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Anous stolidus</i>	Common Noddy	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Anous tenuirostris melanops</i>	Lesser Noddy	EPBC Act - Vulnerable; WC Act - Scheduled 2		No suitable habitat is found throughout the survey area	Low
<i>Onychoprion anaethetus</i>	Bridled Tern	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Sternula nereis nereis</i>	Fairy Tern	EPBC Act - Vulnerable; WC Act - Scheduled 3		No suitable habitat is found throughout the survey area	Low
<i>Gelochelidon nilotica</i>	Gull-billed Tern	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Hydroprogne caspia</i>	Caspian Tern	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Chlidonias leucopterus</i>	White-winged Black Tern	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Sterna dougallii</i>	Roseate Tern	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Sterna hirundo</i>	Common Tern	EPBC Act - Migratory; WC Act - Scheduled 5		No suitable habitat is found throughout the survey area	Low
<i>Sterna paradisaea</i>	Arctic Tern	EPBC Act - Migratory		No suitable habitat is found throughout the survey area	Low
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	EPBC Act - Vulnerable; WC Act - Scheduled 3	Eucalypt forest where it feeds primarily on marri and jarrah fruit.	No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	EPBC Act - Endangered; WC Act - Scheduled 2	Woodland or forest that contains live or dead trees of salmon gum, wandoo, tuart, jarrah, flooded gum, karri or marri. Feeds on seeds, flowers and nectar of native proteaceous plant species (e.g. <i>Banksia</i> spp., <i>Dryandra</i> spp., <i>Grevillea</i> spp.), eucalypts and <i>Pinus</i> spp.	No suitable habitat is found throughout the survey area	Low
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo	EPBC Act - Vulnerable; WC Act - Scheduled 2	Eucalypt forest, where it feeds on mainly marri seeds, flowers, nectar and buds. Also feed on seeds of <i>Eucalyptus</i> , <i>Hakea</i> , <i>Banksia</i> and pine species.	No suitable habitat is found throughout the survey area	Low
<i>Cacatua pastinator pastinator</i>	Muir's Corella	EPBC Act - Vulnerable; WC Act - Scheduled 6	Eucalypt woodlands dominated by wandoo, marri and jarrah.	No suitable habitat is found throughout the survey area	Low
<i>Tyto novaehollandiae novaehollandiae</i>	Masked Owl	Parks and Wildlife Priority 3	Requires large hollows in old growth eucalypts for nesting and often favours areas with dense understorey, particularly along watercourses and gullies.	No suitable habitat is found throughout the survey area	Low
<i>Merops ornatus</i>	Rainbow Bee-eater	EPBC Act - Migratory; WC Act - Scheduled 5	Lightly wooded, preferably sandy country near water	Limited suitable habitat is found throughout the survey area	Moderate
<i>Motacilla cinerea</i>	Grey Wagtail	EPBC Act - Migratory; WC Act - Scheduled 5	Largely a seasonal migrant to Australia and very infrequently recorded in the southern parts of the country.	No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
MAMMALS					
<i>Dasyurus geoffroii</i>	Western Quoll, Chuditch	EPBC Act - Vulnerable; WC Act - Scheduled 3	Wandoo and salmon gum woodland, mallee, jarrah forest and mixed marri/jarrah forest	No suitable habitat is found throughout the survey area	Low
<i>Phascogale tapoatafa tapoatafa</i>	Wambenger Brush-tailed Phascogale	WC Act - Scheduled 3	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees.	No suitable habitat is found throughout the survey area	Low
<i>Myrmecobius fasciatus</i>	Numbat, Walpurti	EPBC Act - Vulnerable; WC Act - Scheduled 2	This species are found only in areas of eucalypt forest, but they were once more widespread in other types of semiarid woodland, spinifex grassland, and even in terrain dominated by sand dunes	No suitable habitat is found throughout the survey area; this species is locally extinct on the Swan Coastal Plain	Low
<i>Isodon obesulus fusciventer</i>	Southern Brown Bandicoot, Quenda	Parks and Wildlife Priority 5	Open woodland and scrubby vegetation on sandy soils. Often around swampy areas	Limited suitable habitat is found throughout the survey area	Moderate
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	EPBC Act - Vulnerable; WC Act - Scheduled 2	Inhabit coastal peppermint/tuart associations from Bunbury to Albany. On Swan Coastal Plain the highest densities occur in habitats with dense, lush vegetation.	No suitable habitat is found throughout the survey area	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong, Woylie	EPBC Act - Endangered; WC Act - Scheduled 1	Open forest and woodland with a low understorey of tussock grasses or woody scrub.	No suitable habitat is found throughout the survey area; this species is considered locally extinct on the Swan Coastal Plain	Low
<i>Notamacropus eugenii derbianus</i>	Tammar	Parks and Wildlife Priority 5	On the Western Australian mainland the species is restricted to tiny isolated populations in the southwest, inhabitation dense coastal heath and scrub and some dry sclerophyll forests	No suitable habitat is found throughout the survey area	Low
<i>Notamacropus irma</i>	Western Brush Wallaby	Parks and Wildlife Priority 4	Dry sclerophyll forest and woodland in southwest Western Australia including some mallee areas with grassy understorey and shrub thickets	No suitable habitat is found throughout the survey area	Low
<i>Setonix brachyurus</i>	Quokka	EPBC Act - Vulnerable; WC Act - Scheduled 3	Densely vegetated swamps and sometimes tea-tree thickets on sandy soils along creek systems and dense heath on slopes.	No suitable habitat is found throughout the survey area; this species is considered locally extinct on the Swan Coastal Plain	Low

Species Name	Common Name	Conservation status	Preferred habitat	Extent of habitat in the survey area	Likelihood of occurrence in the survey area
<i>Hydromys chrysogaster</i>	Water-rat	Parks and Wildlife Priority 4	Water rats live near permanent water in a diverse range of habitat that varies from fresh slow moving stream, brackish inland lakes and creeks to wetlands, rivers, estuaries and beaches on coastlines	No suitable habitat is found throughout the survey area	Low
<i>Falsistrellus mackenziei</i>	Western Falsistrelle	Parks and Wildlife Priority 4	Wet sclerophyll forest dominated by karri and in high rainfall zones of the jarrah and tuart forests.	No suitable habitat is found throughout the survey area	Low

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Appendix E: Vegetation Association and Condition Mapping

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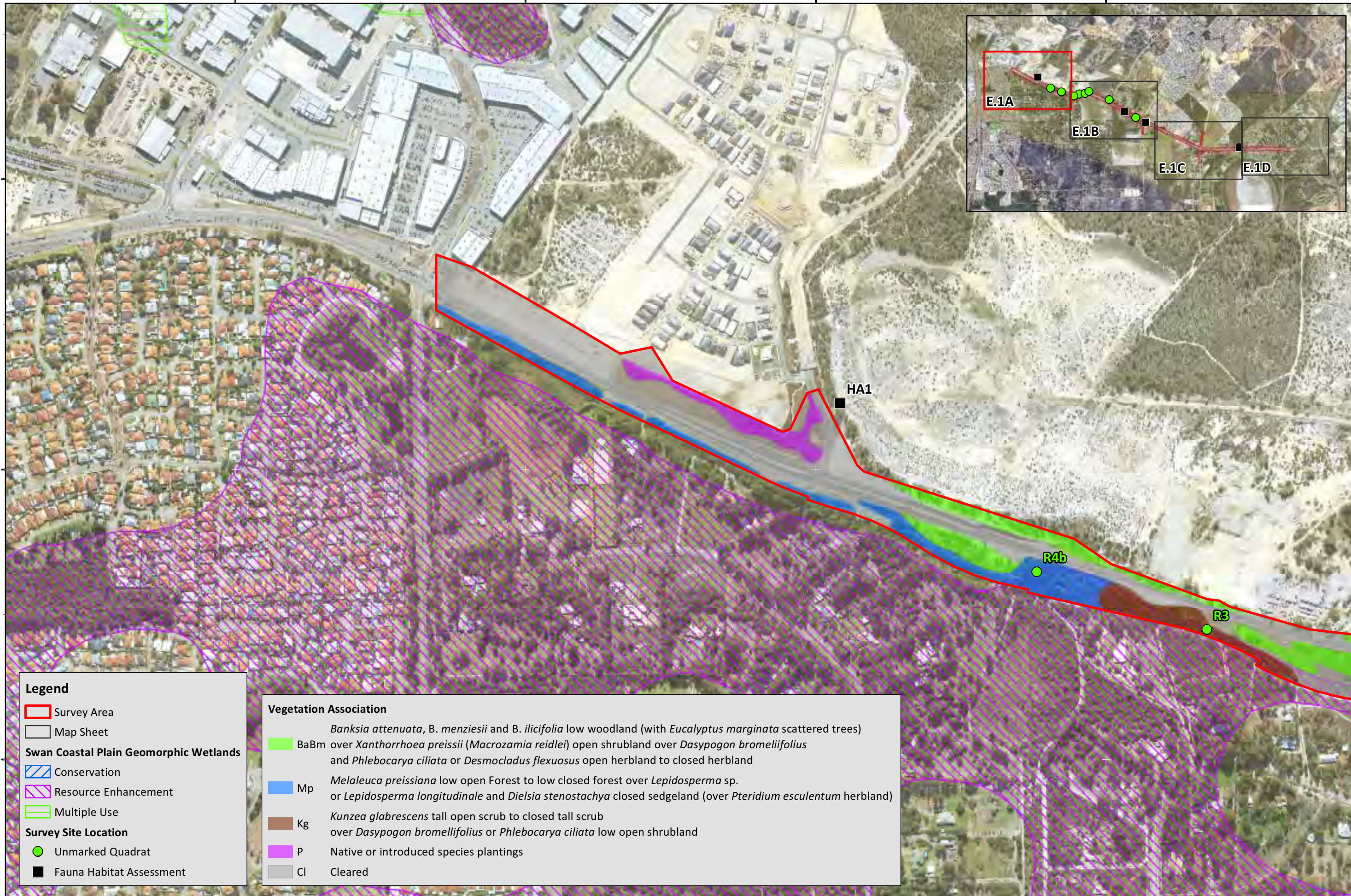
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Legend

- Survey Area
- Map Sheet
- Swan Coastal Plain Geomorphic Wetlands**
- Conservation
- Resource Enhancement
- Multiple Use
- Survey Site Location**
- Unmarked Quadrat
- Fauna Habitat Assessment

Vegetation Association

- BaBm *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* low woodland (with *Eucalyptus marginata* scattered trees) over *Xanthorrhoea preissii* (*Macrozamia reidleyi*) open shrubland over *Dasypogon bromeliifolius* and *Phlebocarya ciliata* or *Desmocladus flexuosus* open hermland to closed hermland
- Mp *Melaleuca preissiana* low open Forest to low closed forest over *Lepidosperma* sp. or *Lepidosperma longitudinale* and *Dielsia stenostachya* closed sedgeland (over *Pteridium esculentum* hermland)
- Kg *Kunzea glabrescens* tall open scrub to closed tall scrub over *Dasypogon bromeliifolius* or *Phlebocarya ciliata* low open shrubland
- P Native or introduced species plantings
- Cl Cleared

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.1A: Vegetation association mapping

Author: J. Oates

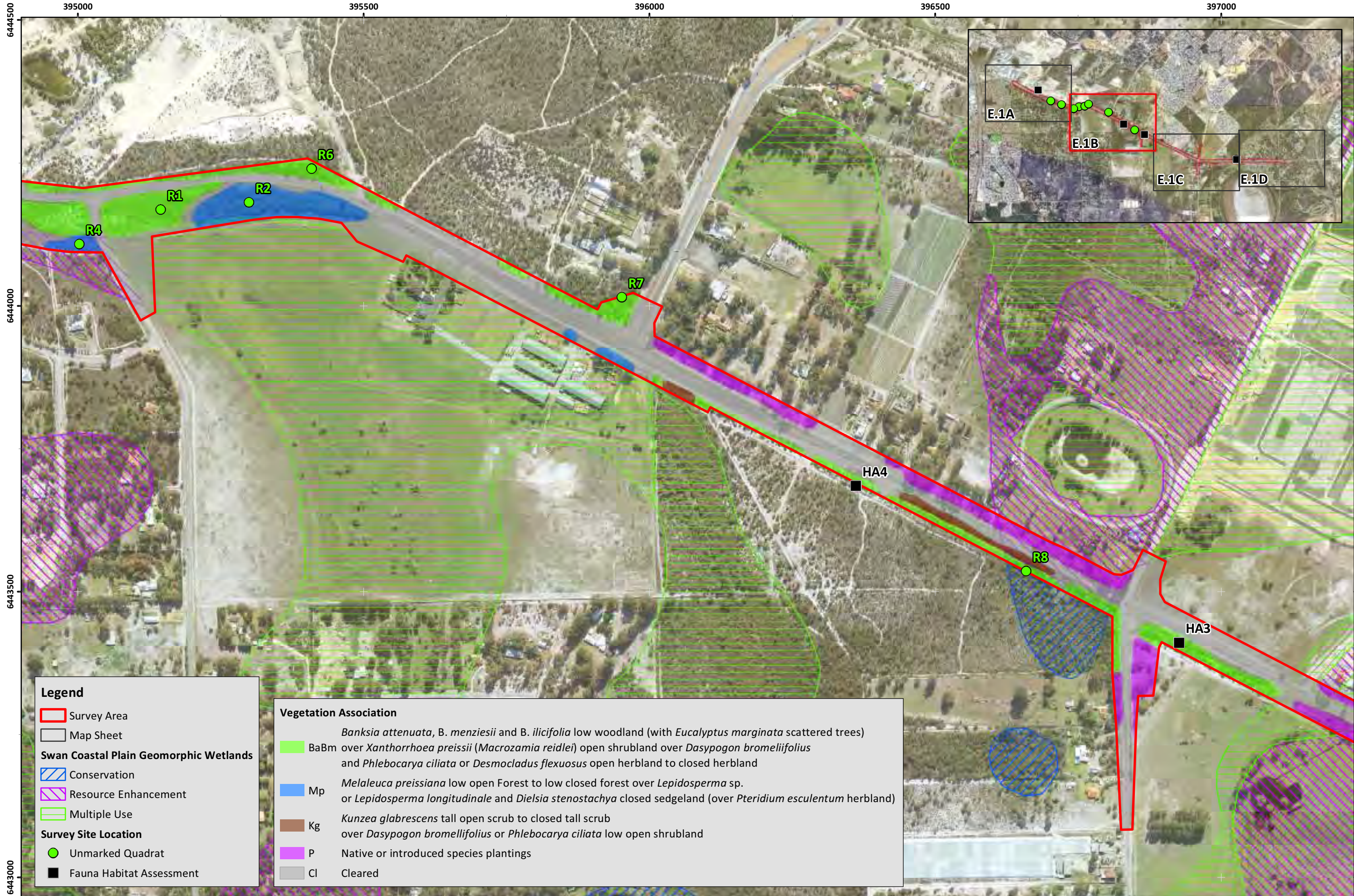
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Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE1A_VegAsso



Legend

- Survey Area
- Map Sheet

Swan Coastal Plain Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use

Survey Site Location

- Unmarked Quadrat
- Fauna Habitat Assessment

Vegetation Association

- BaBm *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* low woodland (with *Eucalyptus marginata* scattered trees) over *Xanthorrhoea preissii* (*Macrozamia reidleyi*) open shrubland over *Dasypogon bromeliifolius* and *Phlebocarya ciliata* or *Desmocladus flexuosus* open herbland to closed herbland
- Mp *Melaleuca preissiana* low open Forest to low closed forest over *Lepidosperma* sp. or *Lepidosperma longitudinale* and *Dielsia stenostachya* closed sedgeland (over *Pteridium esculentum* herbland)
- Kg *Kunzea glabrescens* tall open scrub to closed tall scrub over *Dasypogon bromeliifolius* or *Phlebocarya ciliata* low open shrubland
- P Native or introduced species plantings
- Cl Cleared

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.1B: Vegetation association mapping

Author: J. Oates

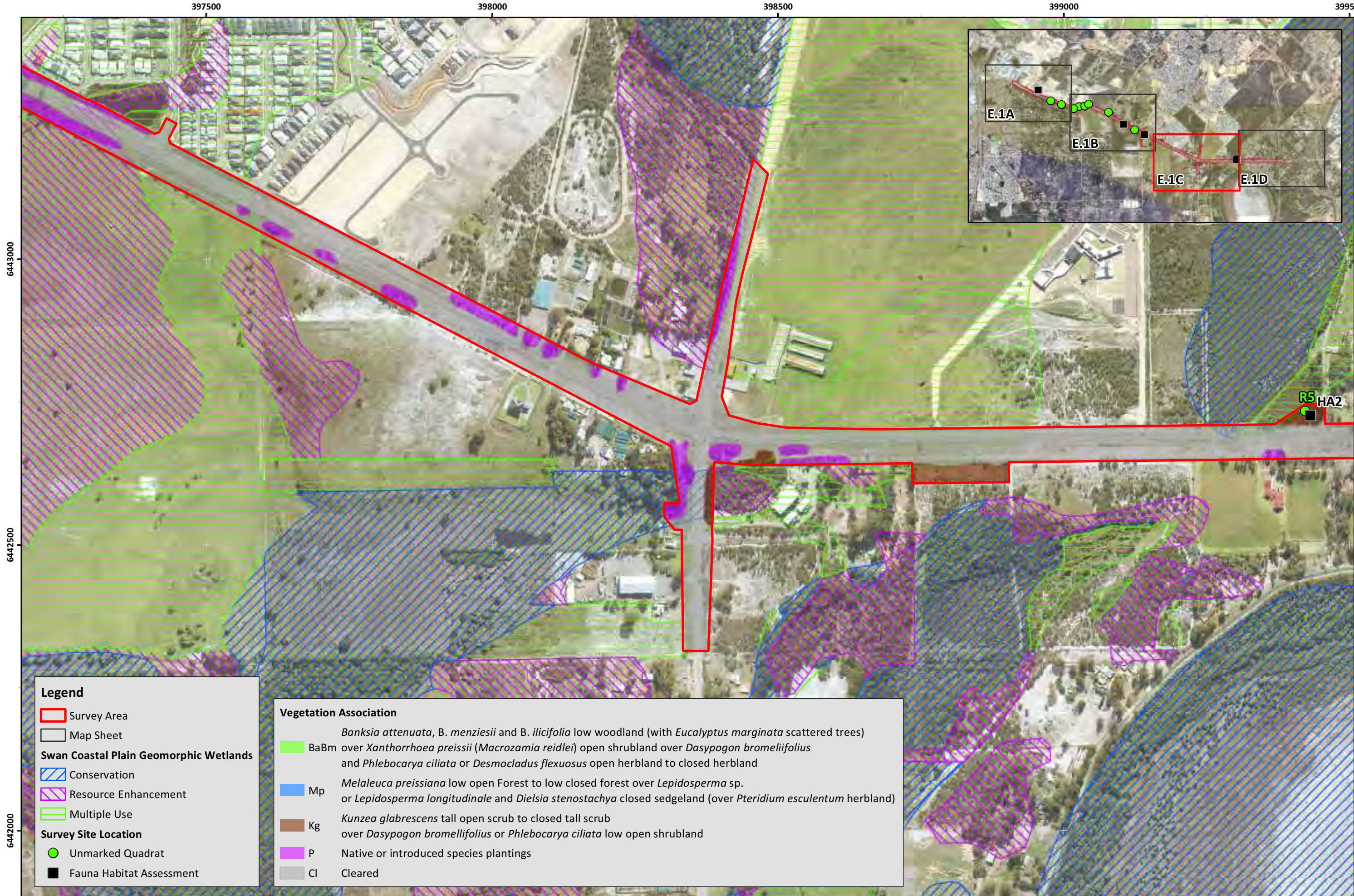
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Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE1B_VegAsso



Main Roads Western Australia
 Armadale Road Duplication Biological Assessment

Figure E.1C: Vegetation association mapping

Author: J. Oates

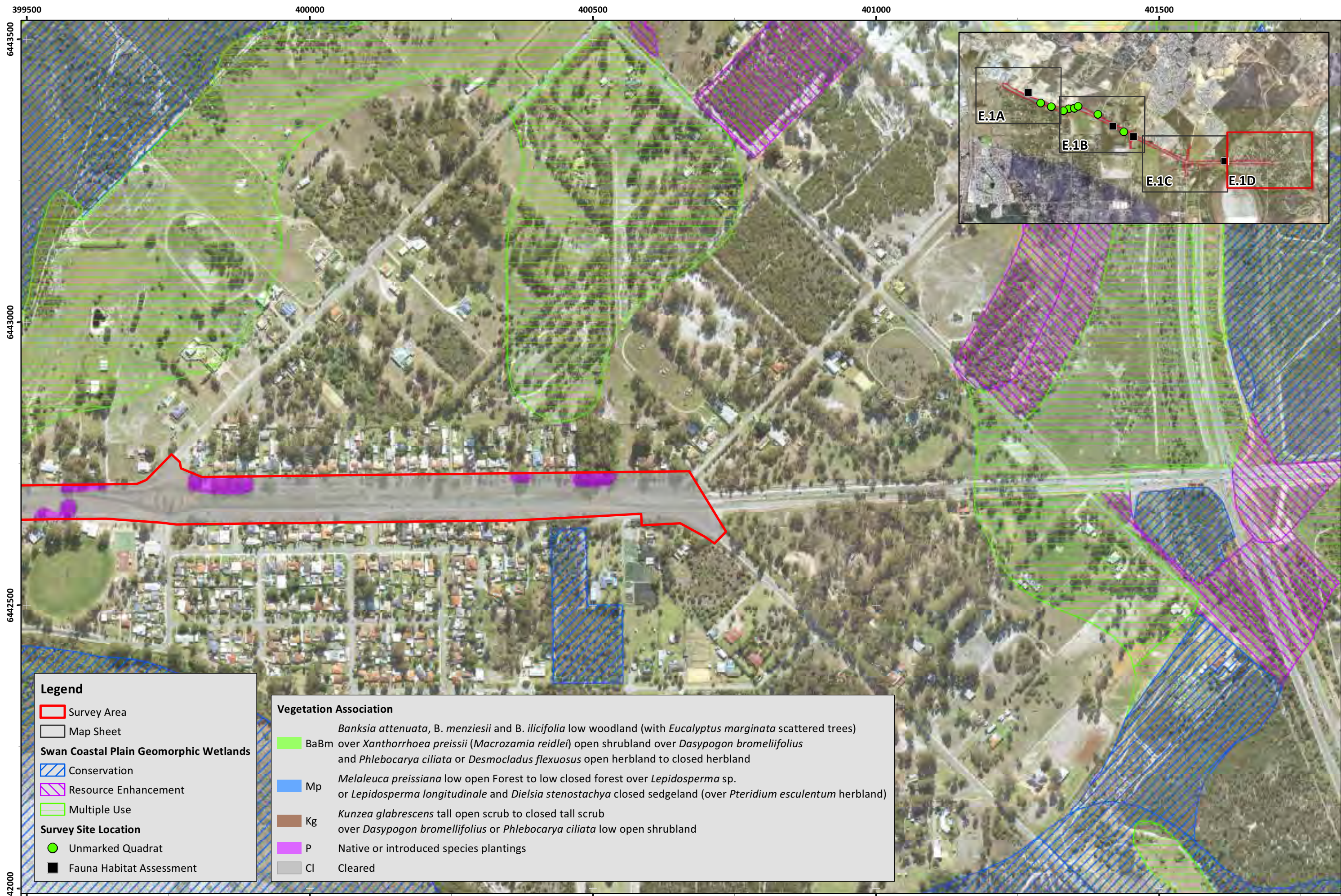
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Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE1C_VegAsso



Legend

- Survey Area
- Map Sheet
- Swan Coastal Plain Geomorphic Wetlands**
- Conservation
- Resource Enhancement
- Multiple Use
- Survey Site Location**
- Unmarked Quadrat
- Fauna Habitat Assessment

Vegetation Association

- BaBm *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* low woodland (with *Eucalyptus marginata* scattered trees) over *Xanthorrhoea preissii* (*Macrozamia reidleyi*) open shrubland over *Dasypogon bromeliifolius* and *Phlebocarya ciliata* or *Desmocladius flexuosus* open herbland to closed herbland
- Mp *Melaleuca preissiana* low open Forest to low closed forest over *Lepidosperma* sp. or *Lepidosperma longitudinale* and *Dielsia stenostachya* closed sedgeland (over *Pteridium esculentum* herbland)
- Kg *Kunzea glabrescens* tall open scrub to closed tall scrub over *Dasypogon bromeliifolius* or *Phlebocarya ciliata* low open shrubland
- P Native or introduced species plantings
- Cl Cleared

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.1D: Vegetation association mapping

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE1D_VegAsso

393000

393500

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6444500

6444000



Legend

- Survey Area
- Map Sheet
- Vegetation Condition**
- Excellent
- Good to Very Good
- Good
- Degraded
- Completely Degraded

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.2A: Vegetation condition mapping

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE2A_VegCond



Legend

- Survey Area
- Map Sheet

Vegetation Condition

- Excellent
- Good to Very Good
- Good
- Degraded
- Completely Degraded

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.2B: Vegetation condition mapping

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE2B_VegCond

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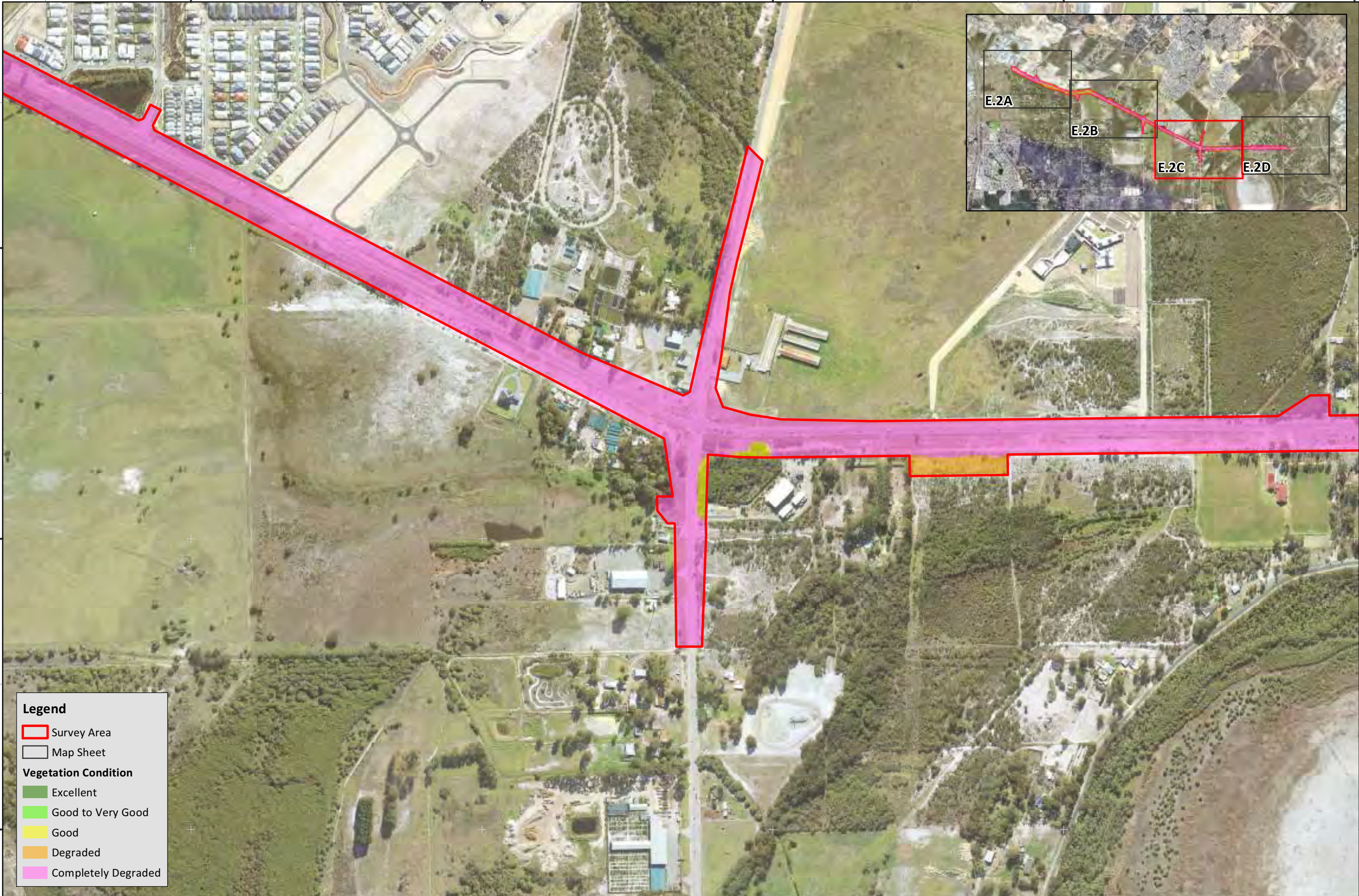
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6442500

6442000



Legend

- Survey Area
- Map Sheet
- Vegetation Condition**
- Excellent
- Good to Very Good
- Good
- Degraded
- Completely Degraded

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.2C: Vegetation condition mapping

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigE2C_VegCond



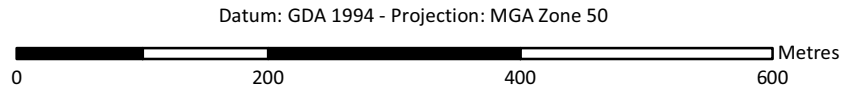
Legend

- Survey Area
- Map Sheet

Vegetation Condition

- Excellent
- Good to Very Good
- Good
- Degraded
- Completely Degraded

Main Roads Western Australia
 Armadale Road Duplication Biological Assessment
Figure E.2D: Vegetation condition mapping



Appendix F: Survey Site Data

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Site: 1

Location: Armadale Road

Type: 10x10m Relevé

Date: 2015-10-27

Described by: CH

MGA Zone: 50

Easting: 395145

Northing: 6444168

Habitat: Hillslope

Soil: Grey sand

Vegetation: *Eucalyptus marginata* low open woodland over *Banksia menziesii* and *B. attenuata* tall shrubland over *Xanthorrhoea preissii* open shrubland over *Desmocladius flexuosus* and **Moraea flaccida* low shrubland over **Ehrharta calycina* tussock grassland.

Veg Condition: Good

Fire Age: 0-2 years



Species List

Name	Cover (%)	Height (m)
* <i>Briza maxima</i>	0.5	0.3
* <i>Ehrharta calycina</i>	50	1.0
* <i>Moraea flaccida</i>	3	0.2
* <i>Pelargonium capitatum</i>	0.5	0.4
* <i>Ursinia anthemoides</i>	0.5	0.2
* <i>Acacia ?longifolia</i>	0.5	3.0
<i>Banksia attenuata</i>	5	5.0
<i>Banksia ilicifolia</i>	0.5	4.0
<i>Banksia menziesii</i>	10	5.0
<i>Burchardia congesta</i>	0.5	0.4
<i>Conostylis setigera</i>	0.5	0.4
<i>Dasyogon bromeliifolius</i>	0.5	0.35
<i>Desmocladius flexuosus</i>	15	0.2
<i>Dianella revoluta</i>	0.5	0.5
Ericaceae sp.	0.5	0.3
<i>Eucalyptus marginata</i>	3	8.0
<i>Gompholobium tomentosum</i>	0.5	0.5
<i>Hardenbergia comptoniana</i>	0.5	
<i>Hibbertia hypericoides</i>	0.5	0.4
<i>Hypolaena exsulca</i>	0.5	0.4

Name	Cover (%)	Height (m)
<i>Macrozamia riedlei</i>	0.5	2.0
<i>Nuytsia floribunda</i>	0.5	3.0
<i>Petrophile linearis</i>	0.5	0.4
<i>Xanthorrhoea preissii</i>	5	1.2

* denotes weed species

? denotes unconfirmed ID

Site: 2

Location: Armadale Rd

Type: 10x10m Relevé

Date: 2015-10-27

Described by: CH

MGA Zone: 50

Easting: 395299

Northing: 6444181

Habitat: Seasonal wetland

Soil: Loamy sand

Vegetation: *Melaleuca preissiana* low closed forest over **Acacia ?longifolia* and *Xanthorrhoea preissii*
 tall open shrubland over *Pteridium esculentum* closed heath.

Veg Condition: Good

Fire Age: No fire evident



Species List

Name	Cover (%)	Height (m)
* <i>Briza maxima</i>	0.5	0.2
* <i>Ehrharta calycina</i>	0.5	0.4
* <i>Fumaria capreolata</i>	0.5	0.3
* <i>Moraea flaccida</i>	0.5	0.2
* <i>Acacia ?longifolia</i>	2	4.0
<i>Astartea scoparia</i>	0.5	2.0
<i>Dasypogon bromeliifolius</i>	0.5	0.4
<i>Dianella revoluta</i>	0.5	0.5
<i>Kennedia prostrata</i>	0.5	
<i>Melaleuca preissiana</i>	90	7.0
<i>Phlebocarya ciliata</i>	0.5	
<i>Pteridium esculentum</i>	80	1.1
Restionaceae sp.	0.5	0.4
<i>Tricoryne elatior</i>	0.5	0.3
<i>Xanthorrhoea preissii</i>	3	2.5

* denotes weed species

? denotes unconfirmed ID

Site: 3

Location: Armadale Rd

Type: 10x10m Relevé

Date: 2015-10-27

Described by: CH

MGA Zone: 50

Easting: 394674

Northing: 6444224

Habitat: Plain

Soil: Grey sand

Vegetation: *Kunzea glabrescens* and *Xanthorrhoea preissii* tall closed scrub over *Phlebocarya ciliata* and *Dasypogon bromeliifolius* low open heath.

Veg Condition: Good

Fire Age: No fire evident



Species List

Name	Cover (%)	Height (m)
* <i>Ehrharta calycina</i>	0.5	1.0
* <i>Pelargonium capitatum</i>	0.5	0.2
* <i>Acacia ?longifolia</i>	0.5	1.0
<i>Adenanthos obovatus</i>	0.5	1.0
<i>Conostylis</i> sp.	0.5	0.3
<i>Dasypogon bromeliifolius</i>	15	0.4
<i>Euphorbia</i> sp.	0.5	0.4
<i>Gompholobium tomentosum</i>	0.5	0.3
<i>Hypocalymma angustifolium</i>	0.5	0.4
<i>Kunzea glabrescens</i>	70	5.0
<i>Phlebocarya ciliata</i>	30	0.3
Restionaceae sp.	0.5	0.3
<i>Xanthorrhoea preissii</i>	2	2.5

* denotes weed species

? denotes unconfirmed ID

Site: 4

Location: Armadale Rd

Type: 10x10m Relevé

Date: 2015-10-27

Described by: CH

MGA Zone: 50

Easting: 395003

Northing: 6444108

Habitat: Seasonal wetland

Soil: Grey sand

Vegetation: *Melaleuca preissiana* tall closed scrub over *Xanthorrhoea preissii* and *Hypocalymma angustifolium* open heath over *Phlebocarya ciliata* low shrubland over *Lepidosperma longitudinale* sedgeland.

Veg Condition: Good

Fire Age: No fire evident



Species List

Name	Cover (%)	Height (m)
* <i>Arctotheca calendula</i>	0.5	0.05
* <i>Briza maxima</i>	0.5	0.4
* <i>Briza minor</i>	0.5	0.02
* <i>Fumaria capreolata</i>	0.5	0.4
* <i>Lysimachia arvensis</i>	0.5	0.03
* <i>Pelargonium capitatum</i>	0.5	0.3
* <i>Acacia ?longifolia</i>	0.5	1.0
<i>Acacia ?willdenowiana</i>	0.5	0.2
<i>Boronia crenulata</i> subsp. <i>viminea</i>	0.5	0.5
* <i>Gladiolus</i> sp.	0.5	0.8
<i>Gompholobium tomentosum</i>	0.5	0.4
<i>Hypocalymma angustifolium</i>	15	1.2
<i>Lepidosperma longitudinale</i>	30	0.9
<i>Lolium</i> sp.	0.5	0.3
<i>Melaleuca preissiana</i>	80	6.0
<i>Phlebocarya ciliata</i>	15	0.4
<i>Trachymene pilosa</i>	0.5	0.05
<i>Xanthorrhoea preissii</i>	15	2.0

* denotes weed species ? denotes unconfirmed ID

Site: 4b

Location: Emma Treeby Reserve

Type: 10x10m Relevé

Date: 2015-10-29

Described by: CH

MGA Zone: 50

Easting: 394381

Northing: 6444323

Habitat: Winter wet dampland

Soil: Black loam

Vegetation: *Melaleuca preissiana* tall closed scrub over Restionaceae sp. closed sedgeland.

Veg Condition: Excellent

Fire Age: 2-5 years



Species List

Name	Cover (%)	Height (m)
* <i>Fumaria capreolata</i>	0.5	0.2
* <i>Lysimachia arvensis</i>	0.5	0.05
<i>Acacia</i> sp.	0.5	3.0
<i>Aotus gracillima</i>	0.5	2.0
<i>Melaleuca preissiana</i>	98	8.0
Restionaceae sp.	90	1.2
<i>Taxandria linearifolia</i>	0.5	3.0

* denotes weed species

? denotes unconfirmed ID

Site: 5

Location: Jandakot Regional Park

Type: 10x10m Relevé

Date: 2015-10-29

Described by: CH

MGA Zone: 50

Easting: 399422

Northing: 6442734

Habitat: Winter wet dampland

Soil: Grey sand

Vegetation: *Kunzea glabrescens* tall closed scrub over *Lyginia* sp. scattered sedges.

Veg Condition: Very Good

Fire Age: 2-5 years



Species List

Name	Cover (%)	Height (m)
* <i>Briza minor</i>	0.5	0.05
* <i>Ehrharta calycina</i>	0.5	0.35
* <i>Lotus subbiflorus</i>	0.5	0.05
* <i>Ursinia anthemoides</i>	0.5	0.05
<i>Acacia pulchella</i> var. <i>glaberrima</i>	0.5	0.4
<i>Crassula colorata</i>	0.5	0.03
Cyperaceae sp.	0.5	0.03
<i>Dianella revoluta</i>	0.5	0.5
? <i>Eucalyptus camaldulensis</i>	0.5	
<i>Gompholobium tomentosum</i>	0.5	0.3
<i>Jacksonia sternbergiana</i>	0.5	0.4
<i>Kennedia prostrata</i>	0.5	
<i>Kunzea glabrescens</i>	80	3.5
<i>Lyginia</i> sp.	0.5	0.3
<i>Macrozamia riedlei</i>	0.5	2.0
Poaceae sp.	0.5	0.03
<i>Regelia ciliata</i>	0.5	2.5

* denotes weed species

? denotes unconfirmed ID

Site: 6

Location: Armadale Rd

Type: 10x10m Relevé

Date: 2015-10-29

Described by: CH

MGA Zone: 50

Easting: 395409

Northing: 6444240

Habitat: Mid-upper slopes

Soil: Grey sand

Vegetation: *Banksia menziesii* and *B. attenuata* tall shrubland over *Xanthorrhoea preissii* and *Macrozamia riedlei* open shrubland over *Desmocladius flexuosus* and *Dasyopogon bromeliifolius* low shrubland over **Ehrharta calycina* very open tussock grassland.

Veg Condition: Good

Fire Age: 5-10 years



Species List

Name	Cover (%)	Height (m)
<i>*Avena barbata</i>	0.5	1.2
<i>*Briza maxima</i>	0.5	0.4
<i>*Ehrharta calycina</i>	2	1.2
<i>*Fumaria capreolata</i>	0.5	0.4
<i>*Hypochaeris glabra</i>	0.5	0.05
<i>*Moraea flaccida</i>	0.5	0.3
<i>*Ursinia anthemoides</i>	0.5	0.3
<i>*Acacia ?longifolia</i>	0.5	0.4
<i>Banksia attenuata</i>	10	6.0
<i>Banksia menziesii</i>	10	6.0
<i>Bossiaea eriocarpa</i>	0.5	0.3
<i>Burchardia congesta</i>	0.5	0.4
<i>Conostylis setigera</i>	0.5	0.4
<i>Dampiera linearis</i>	0.5	0.2
<i>Dasyopogon bromeliifolius</i>	8	0.5
<i>Desmocladius flexuosus</i>	8	0.3
<i>Dianella revoluta</i>	0.5	0.9
<i>Eucalyptus marginata</i>	0.5	1.1
<i>Gompholobium tomentosum</i>	0.5	0.4
<i>Hardenbergia comptoniana</i>	0.5	

Name	Cover (%)	Height (m)
<i>Lepidosperma</i> sp.	0.5	0.4
<i>Lobelia tenuior</i>	0.5	0.3
<i>Macrozamia riedlei</i>	1	1.4
<i>Melaleuca thymoides</i>	0.5	1.4
<i>Patersonia occidentalis</i>	0.5	0.4
<i>Sonchus</i> sp.	0.5	0.2
<i>Thysanotus dichotomus</i>	0.5	
<i>Xanthorrhoea preissii</i>	7	1.2

* denotes weed species

? denotes unconfirmed ID

Site: 7

Location: Armadale Rd

Type: 10x10m Relevé

Date: 2015-10-29

Described by: CH

MGA Zone: 50

Easting: 395952

Northing: 6444015

Habitat: Midslope, gentle flats

Soil: Loamy sand

Vegetation: *Banksia attenuata*, *B. menziesii* and *B. ilicifolia* tall open scrub over *Xanthorrhoea preissii* and *Hypocalymma angustifolium* open shrubland over *Dasypogon bromeliifolius*, *Phlebocarya ciliata* and *Patersonia occidentalis* low closed heath over **Avena barbata* very open tussock grassland with *Lepidosperma* sp. very open sedgeland.

Veg Condition: Good

Fire Age: No fire evident



Species List

Name	Cover (%)	Height (m)
<i>*Avena barbata</i>	5	0.6
<i>*Euphorbia terracina</i>	1	0.3
<i>*Fumaria capreolata</i>	3	0.5
<i>*Moraea flaccida</i>	0.5	0.3
<i>*Solanum nigrum</i>	0.5	0.7
<i>Allocasuarina fraseriana</i>	0.5	1.2
<i>Banksia attenuata</i>	30	5.5
<i>Banksia ilicifolia</i>	2	7.0
<i>Banksia menziesii</i>	3	5.5
<i>Burchardia congesta</i>	1	0.4
<i>Dasypogon bromeliifolius</i>	60	0.6
<i>Eucalyptus marginata</i>	0.5	
<i>Hypocalymma angustifolium</i>	1	1.0
<i>Lepidosperma</i> sp.	3	0.5
<i>Lyginia</i> sp.	0.5	0.4
<i>Melaleuca seriata</i>	0.5	1.5
<i>Melaleuca thymoides</i>	0.5	1.8
<i>Patersonia occidentalis</i>	15	0.4
<i>Phlebocarya ciliata</i>	20	0.35

Name	Cover (%)	Height (m)
<i>Sonchus</i> sp.	0.5	0.4
<i>Tricoryne elatior</i>	0.5	0.3
<i>Xanthorrhoea preissii</i>	3	1.0

* denotes weed species

? denotes unconfirmed ID

Site: 8

Location: Armadale Rd

Type: 10x10m Relevé

Date: 2015-10-30

Described by: CH

MGA Zone: 50

Easting: 396659

Northing: 6443536

Habitat: Wetland, dampland

Soil: Loam

Vegetation: *Melaleuca preissiana*, *Acacia pulchella* var. *glaberrima* and *Aotus gracillima* tall open scrub over *Kunzea glabrescens* and *Astartea scoparia* shrubland over *Dielsia stenostachya* and **Arctotheca calendula* low open heath over **Briza maxima* scattered tussock grasses with *Lepidosperma longitudinale* and Cyperaceae sp. open sedgeland.

Veg Condition: Excellent

Fire Age: No fire evident

Notes: Introduced fauna - rabbit



Species List

Name	Cover (%)	Height (m)
<i>*Arctotheca calendula</i>	3	0.3
<i>*Briza maxima</i>	1	0.3
<i>*Ehrharta calycina</i>	0.5	0.5
<i>*Orobanche minor</i>	0.5	0.2
<i>*Trifolium campestre</i>	0.5	0.05
Cyperaceae sp.	2	1.2
<i>Acacia pulchella</i> var. <i>glaberrima</i>	5	2.5
<i>Astartea scoparia</i>	2	1.2
Asteraceae sp.	0.5	0.5
<i>Caesia micrantha</i>	0.5	0.8
<i>Cassytha ?glabella</i>	0.5	
<i>Crassula colorata</i>	0.5	0.05
<i>Dielsia stenostachya</i>	50	0.5
<i>Drosera</i> sp.	0.5	
<i>Aotus gracillima</i>	3	2.5
<i>Kennedia prostrata</i>	0.5	
<i>Kunzea glabrescens</i>	10	2.0
<i>Lepidosperma longitudinale</i>	25	1.2

Name	Cover (%)	Height (m)
<i>Melaleuca preissiana</i>	40	4.5
<i>Thysanotus multiflorus</i>	0.5	0.4
Poaceae sp.	0.5	0.05

* denotes weed species

? denotes unconfirmed ID

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Appendix G: Vascular Flora Species List

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Table G1: Vascular flora species list recorded in the survey area.

Family	Species name	Weed	Conservation status
Aizoaceae	<i>*Carpobrotus edulis</i>	*	
Anarthriaceae	<i>Lyginia</i> sp.		
Apocynaceae	<i>*Gomphocarpus fruticosus</i>	*	
Araceae	<i>*Zantedeschia aethiopica</i>	*	
Araliaceae	<i>Trachymene pilosa</i>		
Asparagaceae	<i>Laxmannia squarrosa</i>		
	<i>Thysanotus dichotomus</i>		
	<i>Thysanotus multiflorus</i>		
Asteraceae	<i>*Arctotheca calendula</i>	*	
	Asteraceae sp.		
	<i>*Hypochaeris glabra</i>	*	
	<i>*Sonchus</i> sp.	*	
	<i>*Ursinia anthemoides</i>	*	
Brassicaceae	<i>*Raphanus raphanistrum</i>	*	
Campanulaceae	<i>Lobelia tenuior</i>		
Casuarinaceae	<i>Allocasuarina fraseriana</i>		
Colchicaceae	<i>Burchardia congesta</i>		
Crassulaceae	<i>Crassula colorata</i>		
Cyperaceae	Cyperaceae sp.		
	<i>Lepidosperma longitudinale</i>		
	<i>Lepidosperma</i> sp.		
Dasygogonaceae	<i>Dasygogon bromeliifolius</i>		
Dennstaedtiaceae	<i>Pteridium esculentum</i>		
Dilleniaceae	<i>Hibbertia hypericoides</i>		
Droseraceae	<i>Drosera</i> sp.		
Ericaceae	Ericaceae sp.		
Euphorbiaceae	<i>*Euphorbia terracina</i>	*	
	<i>Euphorbia</i> sp.		
	<i>*Ricinus communis</i>	*	
Fabaceae	<i>*Acacia ?longifolia</i>	*	
	<i>Acacia pulchella</i> ?var.		
	<i>Acacia pulchella</i> var. <i>glaberrima</i>		
	<i>Acacia</i> sp.		
	<i>Acacia ?willdenowiana</i>		
	<i>Aotus gracillima</i>		
	<i>Bossiaea eriocarpa</i>		
	<i>Daviesia decurrens</i>		
	<i>Gompholobium tomentosum</i>		
<i>Hardenbergia comptoniana</i>			

Family	Species name	Weed	Conservation status
Fabaceae	<i>Hovea trisperma</i>		
	<i>Jacksonia sternbergiana</i>		
	<i>Kennedia prostrata</i>		
	* <i>Lotus subbiflorus</i>	*	
	* <i>Trifolium campestre</i>	*	
Geraniaceae	* <i>Pelargonium capitatum</i>	*	
Goodeniaceae	<i>Dampiera linearis</i>		
	<i>Lechenaultia biloba</i>		
Haemodoraceae	<i>Conostylis setigera</i>		
	<i>Conostylis</i> sp.		
	<i>Phlebocarya ciliata</i>		
Hemerocallidaceae	<i>Caesia micrantha</i>		
	<i>Dianella revoluta</i>		
	<i>Tricoryne elatior</i>		
Iridaceae	* <i>Gladiolus caryophyllaceus</i>	*	
	* <i>Gladiolus</i> sp.	*	
	* <i>Moraea flaccida</i>	*	
	* <i>Watsonia</i> sp.	*	
	<i>Patersonia occidentalis</i>		
Lauraceae	<i>Cassytha ?glabella</i>		
Loranthaceae	<i>Nuytsia floribunda</i>		
Myrtaceae	<i>Astartea scoparia</i>		
	<i>Corymbia calophylla</i>		
	<i>Eremaea pauciflora</i>		
	? <i>Eucalyptus camaldulensis</i>		
	<i>Eucalyptus marginata</i>		
	<i>Eucalyptus todtiana</i>		
	<i>Hypocalymma angustifolium</i>		
	<i>Hypocalymma robustum</i>		
	<i>Kunzea glabrescens</i>		
	<i>Melaleuca preissiana</i>		
	<i>Melaleuca seriata</i>		
	<i>Melaleuca thymoides</i>		
	<i>Regelia ciliata</i>		
<i>Taxandria linearifolia</i>			
Orobanchaceae	* <i>Orobanche minor</i>	*	
Papaveraceae	* <i>Fumaria capreolata</i>	*	
Pinaceae	* <i>Pinus</i> sp.	*	
Poaceae	* <i>Avena barbata</i>	*	
	* <i>Briza maxima</i>	*	
	* <i>Briza minor</i>	*	

Family	Species name	Weed	Conservation status
Poaceae	<i>*Cenchrus setaceus</i>	*	
	<i>*Ehrharta calycina</i>	*	
	<i>Lolium</i> sp.		
	Poaceae sp.		
Polygonaceae	<i>*Acetosa vesicaria</i>	*	
Primulaceae	<i>*Lysimachia arvensis</i>	*	
Proteaceae	<i>Adenanthos cygnorum</i>		
	<i>Adenanthos obovatus</i>		
	<i>Banksia attenuata</i>		
	<i>Banksia ilicifolia</i>		
	<i>Banksia menziesii</i>		
	<i>Petrophile linearis</i>		
	<i>Stirlingia latifolia</i>		
Restionaceae	<i>Desmocladius flexuosus</i>		
	<i>Dielsia stenostachya</i>		
	<i>Hypolaena exsulca</i>		
	Restionaceae sp.		
Rosaceae	<i>*Rubus</i> sp.	*	
Rutaceae	<i>Boronia crenulata</i> subsp. <i>viminea</i>		
Sapindaceae	<i>Dodonaea hackettiana</i> P4		P4
Solanaceae	<i>*Solanum nigrum</i>	*	
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>		
Zamiaceae	<i>Macrozamia riedlei</i>		

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Appendix H: Conservation Significant Species Locations

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398000

398500

399000

399500

6443000

6442500



Legend

Survey Area

Conservation Significant Species Recorded

▲ *Calyptorhynchus banksii naso* - Fauna

▲ *Dodonaea hackettiana* - Flora

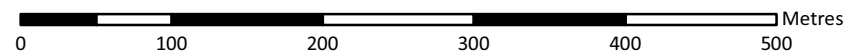
Main Roads Western Australia
Armadale Road Duplication Biological Assessment

Figure H.1: Locations of conservation significant species recorded within the survey area

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016

Figure Ref: 8206-15-BIDR-2Rev0_160415_FigH1_ConSigRecorded

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Appendix I: Declared Pest Species Locations

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Table I.1: Location of Declared pest species recorded within the survey area.

Species	Control category	Easting (MGA50, GDA94)	Northing (MGA50, GDA94)
* <i>Gomphocarpus fruticosus</i> Narrow Leaf Cotton Bush	C3	397630	6443063
* <i>Moraea flaccida</i> One-leaf Cape Tulip	C3	395299	6444181
		395409	6444240
		395952	6444015
* <i>Rubus</i> sp. Blackberry	C1	396805	6443460
		396805	6443461
* <i>Zantedeschia aethiopica</i> Arum Lily	C3	395952	6444015
		394385	6444350

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Legend

Survey Area

Declared Pest Species

- *Gomphocarpus fruticosus* (Narrow Leaf Cotton Bush)
- *Moraea flaccida* (One-leaf Cape Tulip)
- *Rubus* sp. (Blackberry)
- *Zantedeschia aethiopica* (Arum Lily)

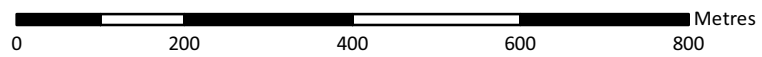
Main Roads Western Australia
 Armadale Road Duplication Biological Assessment

Figure I.1: Locations of Declared pest species recorded within the survey area

Author: J. Oates

Drawn: W. An

Datum: GDA 1994 - Projection: MGA Zone 50



Date: 15-04-2016



Figure Ref: 8206-15-BIDR-2Rev0_160415_FigI1_Pest

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Appendix 2
Supplementary vegetation survey –
targeted *Drakaea elastica* survey and
black cockatoo assessment (Strategen
2016)

To: John Braid

Date: 4 October 2016

Company: Main Roads

Project No: MRO16249.01

Fax/email: john.braid@mainroads.wa.gov.au

Inquiries: D. Panickar/D. Goundrey

Armadale Road Duplication - Tapper Road to Anstey Road Supplementary vegetation survey, targeted *Drakaea elastica* survey and black cockatoo assessment

Background

Main Roads Western Australia (MRWA) is proposing to duplicate approximately 7 km of Armadale Road, between Tapper Road in Atwell and Anstey Road in Forrestdale (the Project). MRWA proposes to duplicate this section of Armadale Road to increase traffic capacities in the locality within the City of Cockburn (CoC) and City of Armadale (CoA) local government areas.

The Project will involve the upgrade of intersections of Armadale Road between Tapper Road and Anstey Road and associated works including lighting, service relocations and drainage, including the following intersections:

- Tapper Road/Verde Drive, Atwell
- Fraser Road, Banjup
- Liddelow Road, Banjup
- Wright Road, Piara Waters
- Rossiter Avenue, Piara Waters
- Nicholson Road, Forrestdale.

In November 2015 Astron undertook a biological assessment which included a flora and vegetation survey and black cockatoo habitat assessment in relation to the Project (Astron survey area, Figure 1). During this assessment, Astron identified potential habitat for the orchid species *Drakaea elastica* within *Kunzea glabrescens* tall shrublands (Figure 1).

Drakaea elastica is listed as Threatened under section 178 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Threatened under Schedule 1 of the State *Wildlife Conservation Act 1950* (WC Act). No other vegetation associations within the Astron survey area were considered to contain suitable habitat for this species.

MRWA revised the study area in 2016, identifying additional areas that require investigation, which were not surveyed by Astron in 2015 (additional survey area). The additional survey area is indicated in Figure 1 and is predominantly located around the Armadale Road and Liddelow Road, Wright/Taylor Road, Warton Road and Nicholson Road intersections.

Based on the above Strategen was engaged by MRWA to undertake a supplementary broad level flora and vegetation survey to assist MRWA to determine the environmental approvals required to facilitate construction of the Project and to identify further investigations that may be required to support the environmental approvals.

The objectives of this survey were to:

- undertake a supplementary flora and vegetation survey to the Astron survey (2015), to define the flora and vegetation values within the additional survey area as per the vegetation types defined within the Astron survey (2015)
- undertake a targeted survey for *D. elastica* within the Astron mapped *K. glabrescens* tall shrublands. As well as undertake a targeted survey for *D. elastica* in any *K. glabrescens* tall shrublands, identified during the supplementary field survey
- undertake a Black cockatoo habitat assessment to confirm potential black cockatoo foraging, breeding and/or roosting habitat within the additional survey area.

Methodology

Supplementary flora and vegetation survey

Due to the restricted access to private property within the additional survey area, the supplementary flora and vegetation survey for vegetation within private properties focussed on the extrapolation of mapped vegetation type boundaries as provided by Astron (2015) and does not directly align with the standard approaches for Level 1 and Level 2 surveys as outlined in Guidance Statement 51 (EPA 2004). The survey of these private properties was primarily undertaken through visual observations made from the property boundary.

Some areas within the additional survey area were able to be traversed on foot, including Metropolitan Regional Scheme (MRS) Parks and Recreational Reserves and the vegetation along the roadsides. This allowed for more accurate observations regarding the changes in vegetation structure or composition to be recorded. The survey of these areas was undertaken in accordance with the Guidance Statement 51 (EPA 2004) and constitutes a supplementary Level 1 flora and vegetation survey to the original Level 2 Astron flora and vegetation survey. Five 10 x 10 m quadrats were established within the MRS reserves to confirm the vegetation types as per the vegetation types described within the Astron survey (2015).

The supplementary survey was undertaken over the course of two events by Daniel Panickar (Senior Consultant and Lead Ecologist – Strategen) and Dr. Jeffrey Cargill (Senior Botanist – Mattiske Consulting) on 28 July 2016 and by Daniel Panickar and Clare Courtauld (Ecologist - Strategen) on 11 August 2016.

Targeted flora survey

The targeted *D. elastica* field survey was undertaken in accordance with the *Draft survey guidelines for Australia's threatened orchids* (DotE 2013). The survey was undertaken over the course of two events by Daniel Panickar (Senior Consultant and Lead Ecologist – Strategen) and Dr. Jeffrey Cargill (Senior Botanist – Mattiske Consulting) on 28 July 2016 and by Daniel Panickar and Clare Courtauld (Ecologist - Strategen) on 11 August 2016.

The survey included areas of *Kunzea glabrescens* tall shrublands within the Astron Survey area (Figure 1) and areas of *Kunzea glabrescens* that were publically assessable within the additional survey area (Figure 2). These areas were ground-truthed and the vegetation types identified in the Astron survey were reclassified where necessary.

While *D. elastica* typically flowers in spring; individuals flower unreliably (i.e. not every year) and as a result, cannot be surveyed effectively during spring months. The ideal survey time for *D. elastica* is during July and August, when this species produces a distinctive and easily visible leaf. The leaf then dies off prior to spring (DEC 2009). Timing for the *D. elastica* survey was determined through consultation with Dr. Andrew Brown of the Department of Parks and Wildlife (Parks and Wildlife). The targeted surveys for *D. elastica* were undertaken area in accordance with methodologies specified in DotE (2013) via transects at a maximum distance of 10 m apart and recorded by GPS units.

Black cockatoo habitat survey

The additional survey area was inspected for black cockatoo habitat by Strategen personnel with relevant experience as specified by the *EPBC Act Referral guidelines for three threatened black cockatoo species* (DSEWPac 2012). The inspection included a significant tree assessment to identify any trees with the potential to be utilised by black cockatoos for breeding and an assessment of potential foraging habitat for signs of black cockatoo use.

Significant trees are defined as trees of suitable species with a diameter at breast height (DBH) greater than 500 mm (DSEWPac [now Department of Environment and Energy [DEE] 2012). Trees with a DBH greater than 500 mm are large enough to potentially contain hollows suitable for nesting black cockatoos, or have the potential to develop suitable hollows over the next 50 years. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds).

Due to restricted access into private property, the survey was primarily undertaken through visual observations of habitat made from the property boundary. Areas traversed on foot included publically accessible areas and potential habitat along roadsides. Significant trees were only surveyed in areas where access was not restricted.

Results

Flora and vegetation survey

The supplementary flora and vegetation survey identified four vegetation associations (three previously mapped by Astron in 2015 and an additional vegetation association that, following ground-truthing was mapped as *Beaufortia elegans* tall shrublands by Strategen), comprising an area of approximately 64.2 ha, as presented in Table 1 and Figure 1, including:

1. *Banksia* woodland.
2. *Melaleuca* damplands.
3. *Kunzea glabrescens* tall shrublands.
4. *Beaufortia elegans* tall shrublands (mapped as *Kunzea glabrescens* tall shrublands in Astron [2015]).

This includes three areas (totally approximately 0.4 ha) that were previously mapped as *Kunzea glabrescens* tall shrublands (Astron 2015) which were re-classified by Strategen as *Melaleuca* damplands after ground-truthing the area (Figure 2).

Native vegetation recorded in the additional survey area ranges from Completely Degraded to Good–Excellent vegetation condition, in accordance with the Keighery (1994) vegetation scale. Table 1 presents vegetation associations, habitat and condition recorded within the survey area, as determined in the Strategen vegetation and flora survey.

The additional survey area was largely degraded with a weed-dominated understorey. The additional survey area also contains large areas of planted and/or cleared vegetation covering approximately 44.9 ha (Table 1).

Targeted flora survey

No *D. elastica* individuals were found during the surveys. A large proportion of the *Kunzea glabrescens* tall shrublands within the Study area was dominated by the invasive species **Ehrharta calycina* (Veldt Grass), **Zantedeschia aethiopica* (Arum Lily), **Fumaria capreolata* (White Flower) and Poaceae spp. in the understorey, which tend to suppress growth of annual herb species and are therefore not considered suitable habitat for *D. elastica*. The *K. glabrescens* opposite Warton Road was particularly degraded and infested with exotic species, thus not comprising habitat for *D. Elastica*. Consequently, this area was not surveyed to the same level of intensity as the remainder of the Survey area (Figure 3).

Black cockatoo habitat survey

No significant trees were recorded within the additional survey area and no black cockatoos were observed during the survey. Based on visual observations from the private property boundaries, potentially significant trees may be present within private property.

The additional survey area contains approximately 6.2 ha *Banksia attenuata* and *Banksia menziesii* woodland, which was assessed as moderate quality foraging habitat for Carnaby's Black Cockatoo (CBC), Forest Red-tailed Black Cockatoo (FRTBC) and Baudin's Black Cockatoo (BCB).

Table 1: Vegetation associations recorded within the Study area

Vegetation association and code	Habitat	Vegetation condition	Additional survey area including reclassified areas
<p>BaBm: <i>Banksia</i> woodland <i>Banksia attenuata</i>, <i>B. menziesii</i> and <i>B. ilicifolia</i> low woodland (with <i>Eucalyptus marginata</i> scattered trees) over <i>Xanthorrhoea preissii</i> (<i>Macrozamia riedlei</i>) open shrubland over <i>Dasyogon bromeliifolius</i> and <i>Phlebocarya ciliata</i> or <i>Desmocladius flexuosus</i> open herbland to closed herbland. Associated species: <i>Allocasuarina fraseriana</i>, <i>*Avena barbata</i>, <i>Burchardia congesta</i>, <i>*Ehrharta calycina</i>, <i>*Euphorbia terracina</i>, <i>*Fumaria capreolata</i>, <i>Hypocalymma angustifolium</i>, <i>Lepidosperma</i> sp., <i>*Moraea flaccida</i>, <i>Patersonia occidentalis</i>.</p>	Mid to upper slopes on grey sand	Good	6.2
<p>Mp: <i>Melaleuca preissiana</i> damplands <i>Melaleuca preissiana</i> low open Forest to low closed forest over <i>Lepidosperma</i> sp. or <i>Lepidosperma longitudinale</i> and <i>Dielsia stenostachya</i> closed sedgeland (over <i>Pteridium esculentum</i> herbland). Associated species: <i>Acacia ?longifolia</i>, <i>Hypocalymma angustifolium</i>, <i>Phlebocarya ciliata</i>, <i>Xanthorrhoea preissii</i>.</p>	Seasonally wet Damplands with dark loamy sand	Good to Excellent	6.3*
<p>Kg: <i>Kunzea glabrescens</i> tall shrublands <i>Kunzea glabrescens</i> tall open scrub to closed tall scrub over <i>Dasyogon bromeliifolius</i> or <i>Phlebocarya ciliata</i> low open shrubland. Associated species: <i>Jacksonia sternbergiana</i>, <i>Macrozamia riedlei</i>, <i>Regelia ciliata</i>, <i>Xanthorrhoea preissii</i>.</p>	Flat sandy palusplains	Good to Very Good	2.5
<p>Be: <i>Beaufortia elegans</i> tall shrublands <i>Beaufortia elegans</i> tall open scrub to closed tall scrub over <i>Regelia ciliata</i> with occasional <i>Cassytha</i> spp.</p>	Seasonally wet Damplands with dark loamy sand	Good to Very Good	0.1
Planted			4.2
Cleared			44.9
TOTAL			64.2

*includes approximately 0.4 ha of vegetation was previously mapped by Astron (2015) as Kg that were reclassified to Mg.

Conclusion

The key outcomes from the survey were:

- four vegetation associations were identified within the additional survey area (including the re-classified Astron vegetation); however the majority of the survey area is cleared or planted with exotic species
- no individuals of the rare orchid species *Drakaea elastica* were located within the *Kunzea glabrescens* tall shrublands targeted as part of this survey
- approximately 6.2 ha of moderate quality foraging habitat for CBC and BBC was identified within the additional survey area. No significant trees for black cockatoos were recorded during the survey, although potentially significant trees may be present within private property.

Limitations

- areas of private property) were not able to be accessed as part of this survey and therefore a cockatoo habitat assessment and flora and vegetation survey is recommended to be undertaken to ground-truth the area if clearing is proposed in these areas
- areas of *Kunzea glabrescens* tall shrublands within private property were unable to be accessed as part of this survey and therefore a targeted *D. elastica* if clearing is proposed in these areas.

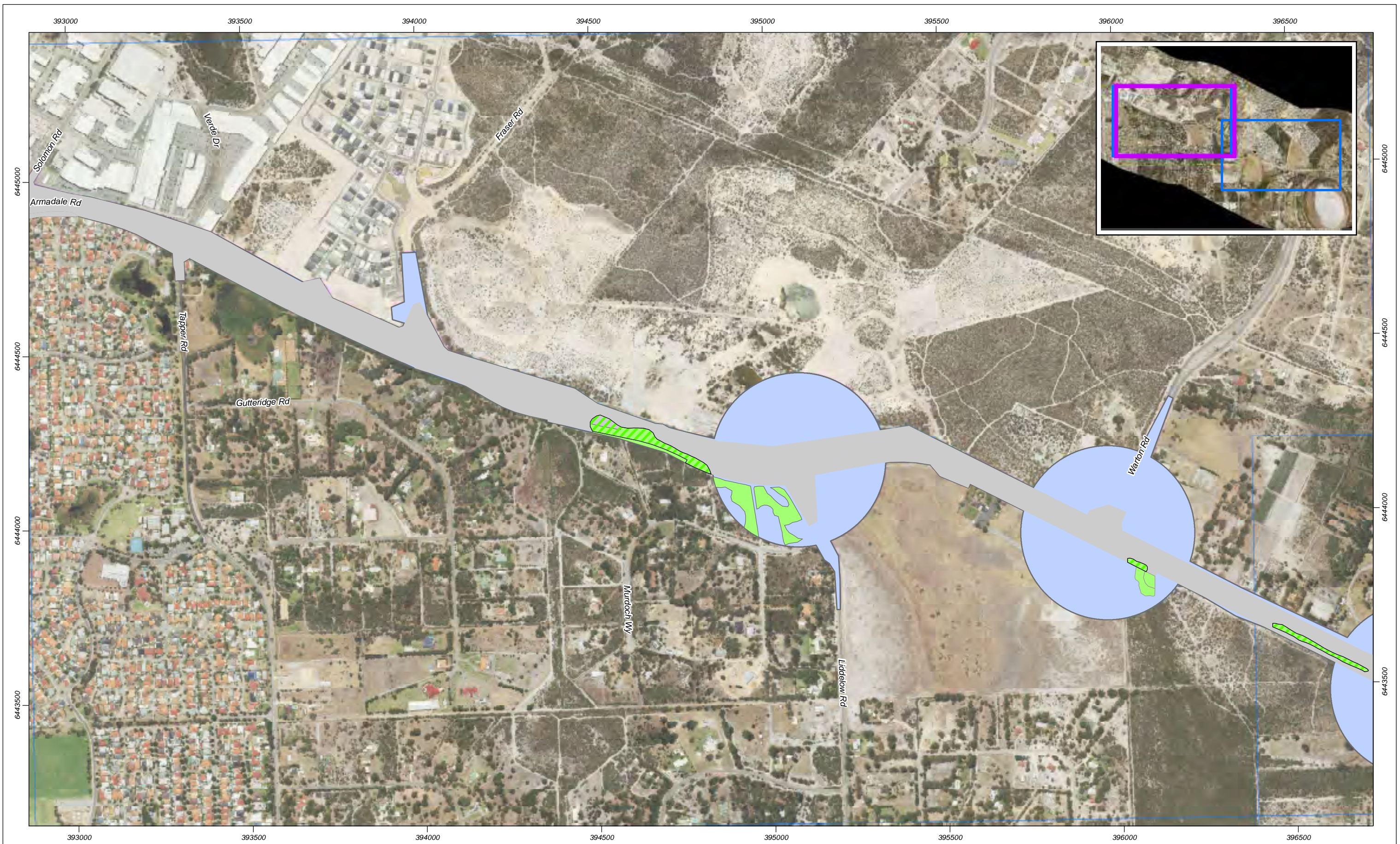


Figure 1: Study area

Legend

- Map sheet extent
- Astron survey area (Astron 2015)
- Additional survey area (Strategen 2016)
- Kg recorded in the Astron survey (Astron 2015)
- Kg recorded in the Strategen survey (2016)

Scale 1:10,000 at A3
 0 50 100 150 200 m



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 4/10/2016
 Author: JCrute
 Source: Aerial image and design: Client 06/2016_Wetlands: DPAW 2015

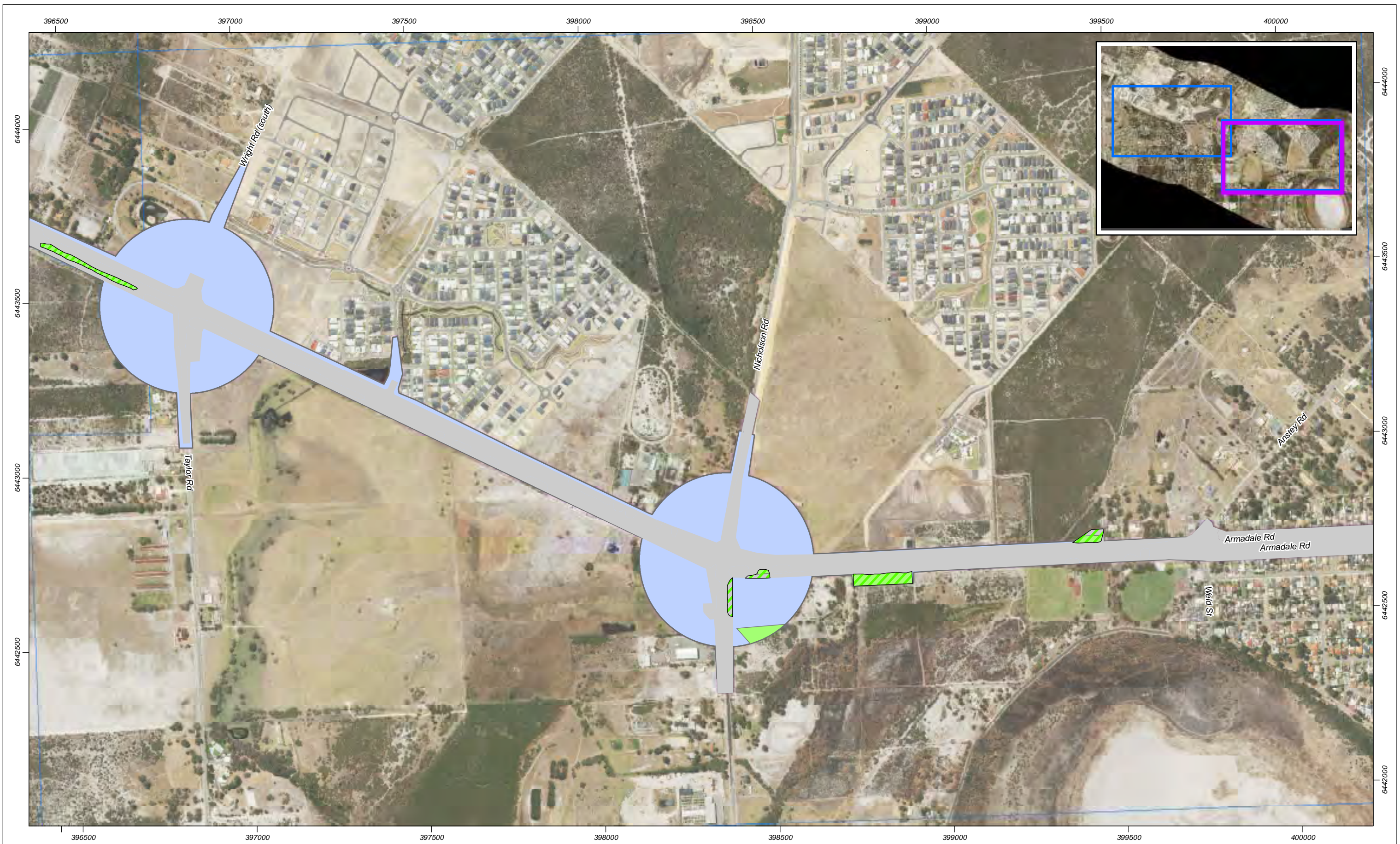


Figure 1: Study area

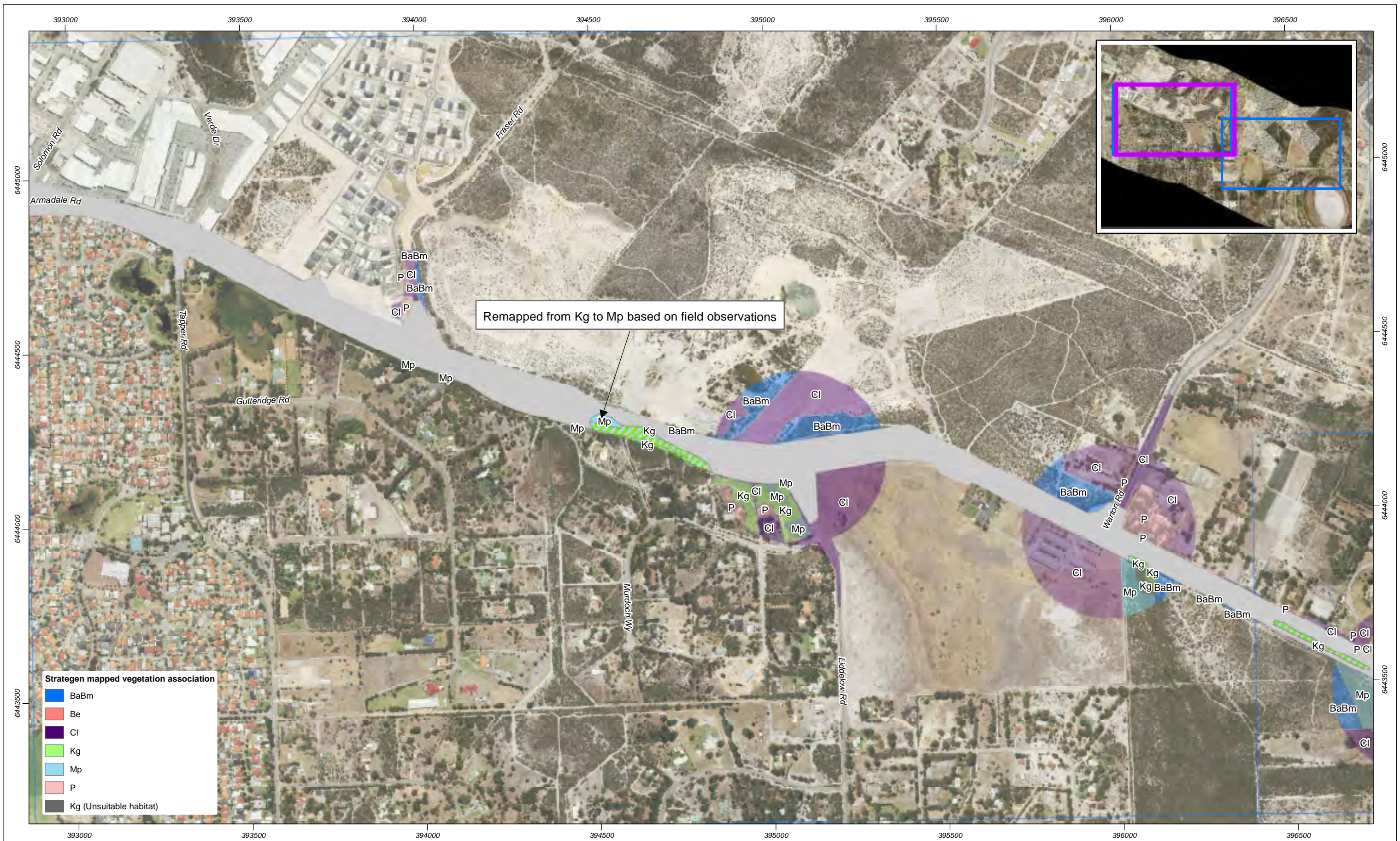
Legend

- Map sheet extent
- Astron survey area (Astron 2015)
- Additional survey area (Strategen 2016)
- Kg recorded in the Astron survey (Astron 2015)
- Kg recorded in the Strategen survey (2016)

Scale 1:10,000 at A3
 0 50 100 150 200 m



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 4/10/2016
 Author: JCrute
 Source: Aerial image and design: Client 06/2016_Wetlands: DPAW 2015



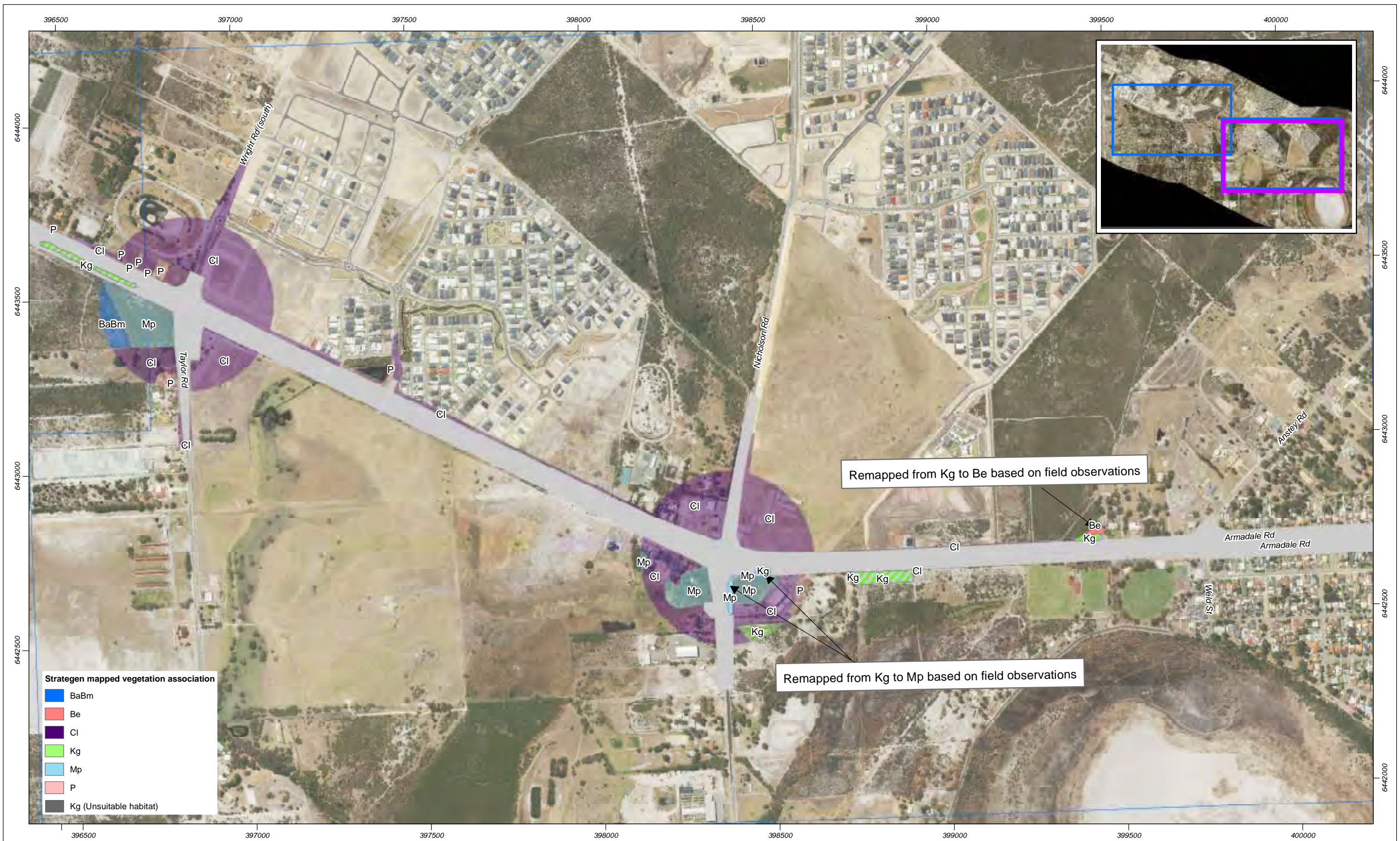


Figure 2: Survey results

Scale 1:10,000 at A3
 0 50 100 150 200 m

Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 30/09/2016
 Author: JCrute

Source: Aerial image and design: Client 06/2016. Wetlands: DPAW 2015.
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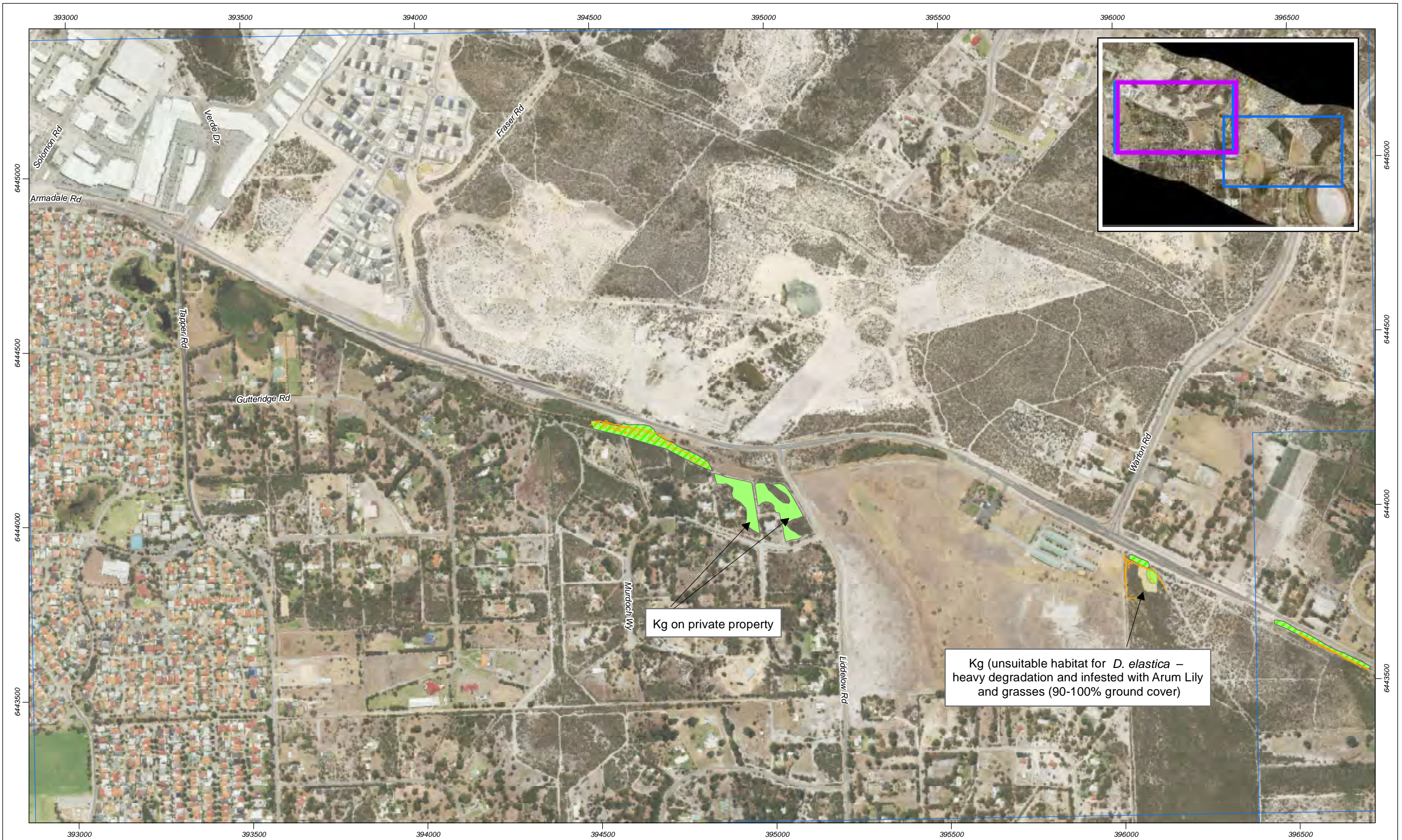


Figure 3: Targeted *Drakaea elastica* survey

Scale 1:10,000 at A3
 0 50 100 150 200 m



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 4/10/2016
 Author: JCrute
 Source: Aerial image and design: Client 06/2016. Wetlands: DPAW 2015.
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Legend

- Drakaea elastica* survey transects
- Kg within the Astron survey area
- Map sheet extent

Strategen mapped vegetation association

- Kg
- Kg (Unsuitable habitat)



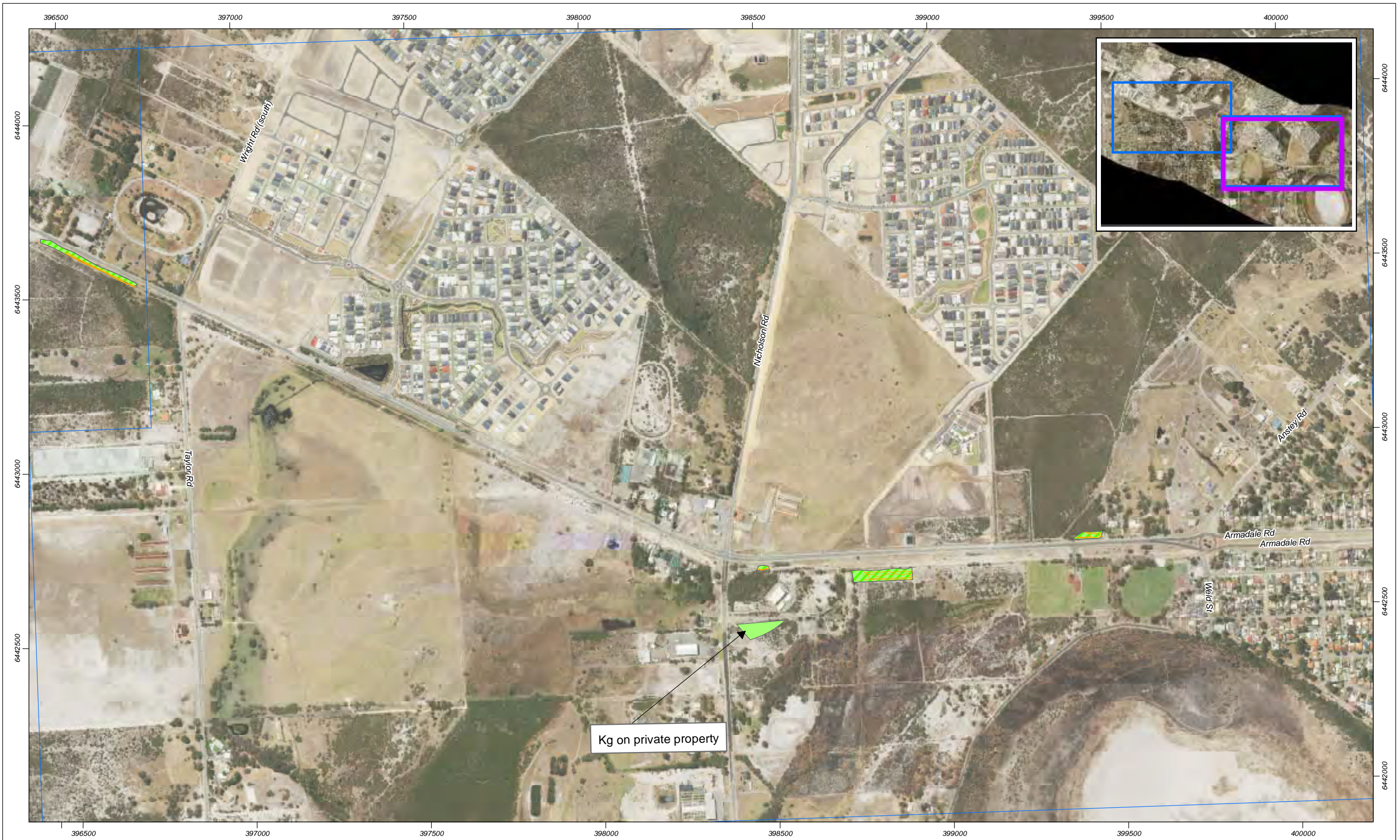
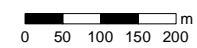


Figure 3: Targeted *Drakaea elastica* survey

Scale 1:10,000 at A3



Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 4/10/2016
 Author: JCrute

Source: Aerial image and design: Client 06/2016. Wetlands: DPAW 2015.
 Path: Q:\Consult\2016\MRO\MRO16249\ArcMap_documents\M001\MRO16249_01_M001_F003_RevC_1.mxd

Legend

- Drakaea elastica* survey transects
- Kg within the Astron survey area
- Map sheet extent

Strategen mapped vegetation association

- Kg
- Kg (Unsuitable habitat)

References

Department of the Environment (DotE) 2013, *Draft survey guidelines for Australia's Threatened Orchids*, [Online], Australian Government, Available from <https://www.environment.gov.au/resource/draft-survey-guidelines-australias-threatened-orchids> [August 2016].

Department of Environment and Conservation (DEC) 2009, Glossy-leafed Hammer Orchid (*Drakaea elastica*) Recovery Plan, [Online], Government of Western Australia, Available from <http://www.environment.gov.au/system/files/resources/f2fe52ea-343b-4fd2-9806-55e86d9b9d6c/files/drakaea-elastica.pdf> [August 2016].

Keighery B 1994, *Bushland Plant Survey: A Guide to Plant Community Survey for the Community*, Wildflower Society, Floreat.

Appendix 1
Curriculum vitae



Daniel Panickar BSc (Hons)

Senior Consultant

Daniel Panickar is an senior ecologist with over six years experience in conducting and managing botanical surveys throughout Western Australia, including rehabilitation monitoring and vegetation surveys in the Jarrah Forest, Goldfields, Northern Sandplains, Pilbara, Kimberley, Swan Coastal Plain and South Coast bioregions.

Prior to commencing work at Strategen in January 2013, Daniel worked for Matiske Consulting as an experienced ecologist. During his time at Matiske Consulting and Strategen, Daniel has gained invaluable experience in conducting field surveys including Threatened and Priority flora searches (including Threatened orchid species), rehabilitation monitoring, riparian health assessments and vegetation mapping. Daniel's role at Strategen has expanded and seen him take on a coordinator and management role for ecological projects throughout the state.

Daniel has managed several large biological projects throughout Western Australia and has been responsible for leading teams in the field, coordinating data management and analysis, plant identification, managing sub-consultants, client liaison, provision of strategic advice and reporting. Additionally, Daniel has been intimately involved in the review and development of bauxite and coal mining rehabilitation programs in the south-west of Western Australia.

The study of ecological relationships between invertebrates and plants has been a major focus of Daniel's prior sponsored research and employment with the former Department of Environment and Conservation which adds to a broad level of experience in environmental issues.

Daniel's key skills include:

- Level 1 and Level 2 flora and vegetation assessments
- Vegetation mapping, monitoring and condition assessment
- Targeted flora surveys (including Threatened orchids such as *Caladenia huegelii* and *Drakaea elastica*)
- Fauna habitat assessment
- Environmental impact assessment
- EPBC Act referrals
- Bushfire management
- Providing strategic advice.

Since joining Strategen in January 2013, Daniel has been involved in the following projects:

- On-site vegetation surveys, off-site rehabilitation monitoring and project advice for the Fiona Stanley Hospital Project
- Development and preparation of a Vegetation Management Plan for Ibis Place, High Wycombe
- Development and preparation of Environmental Management Plans for Main Roads WA (Malaga Drive-Reid highway intersection)
- Vegetation surveys for Main Roads WA (Reid Highway Duplication, Malaga Drive-Reid highway intersection, Shelley Bridge duplication, Albany Highway widening [SLK 138-140])
- Vegetation and fauna assessments for LandCorp, Satterley Property Group, Peet Limited, Dampier Bunbury Natural Gas Pipeline, Alcoa of Western Australia Limited and CSR Limited
- EP Act and EPBC Act referrals for the Tronox Cooljarloo West development
- Project management (subconsultant management and report review) for the Tronox Cooljarloo West development
- Environmental Impact Assessment (PER level) for the Tronox Cooljarloo West development
- Environmental Impact Assessment (API level) for Iron Ore Holdings Bungaroo development.



Selected project examples

Karnup sand mining project (Threatened orchid survey)

Urban Resources Pty Ltd engaged Strategen to undertake a targeted orchid survey for the Threatened (Declared Rare Flora – Extant) orchid species *Caladenia huegelii*, *Drakaea elastica* and *Drakaea micrantha* within their proposed mining expansion area for the Karnup Sand Mining Project. The site encompassed approximately 50 ha of vegetated areas and cleared tracks and contained areas of potential habitat for the orchid species which were identified during a flora and vegetation survey undertaken by Strategen in May 2015.

Following this identification of habitat, consultation with Andrew Brown of the Department of Parks and Wildlife was undertaken to determine the appropriate time to undertake a targeted survey for the orchids and identify the appropriate methodology given the site's variable condition. A targeted transect survey in accordance with methodologies specified in *Draft survey guidelines for Australia's Threatened Orchids* (DotE 2013) was undertaken within the site to locate any orchids present.

Murdoch University proposed aquatic centre (Threatened orchid surveys)

Murdoch University engaged Strategen to undertake an environmental and hydrological review of an area within the university's landholdings considered development into a comprehensive sports precinct including aquatic facilities and associated infrastructure. Desktop surveys identified potential habitat for the Threatened (Declared Rare Flora – Extant) (T(DRF)) orchid species *Caladenia huegelii* and *Drakaea elastica* within the campus grounds. Following the identification of potential habitat, Strategen were commissioned to undertake a targeted survey for *C. huegelii* and *D. elastica* within the development area.

Surveys were undertaken for both species over the course of two events in August and September 2015 in accordance with methodologies specified in *Draft survey guidelines for Australia's Threatened Orchids* (DotE 2013) to locate any orchids present.

Referee

Professor Kingsley Dixon
Curtin University of Technology
0428 285 565
Kingsley.Dixon@curtin.edu.au

Clare Courtauld BSc (Env Sc) (Hons) (Conservation Biology)
Environmental Scientist



Clare Courtauld completed her Bachelor of Science from Murdoch University in 2012 and graduated from the University of Western Australia with first class honours in Conservation Biology in 2013. Prior to joining Strategen in October 2015, Clare has previously worked as a Research Assistant and Supervisor at the University of Western Australia & Kings Park Biodiversity Conservation Centre. She has also worked for the Department of Environment Regulation in the air quality sector and as a rehabilitation officer and team leader at Men of the Trees and Conservation Volunteers Australia. Clare has also undertaken extensive volunteer work both locally and overseas.

Clare's key skills include:

- Flora and vegetation surveys.
- Plant identification.
- Coordination and interpretation of data.
- Report preparation.
- Management skills.
- Research and technical and problem solving skills.
- Communication skills.

Clare's previous work has involved:

University of Western Australia & Kings Park Biodiversity Conservation Centre

- Working as part of a team and autonomously to deliver research outcomes in order to improve restoration of ecological communities as part of Pilbara and Southwest mine site restoration projects.
- Preparation of reports, scope of research, project methodologies, risk assessment reports and experimental trials within strict deadlines.
- Plant species identification, seed collection and cataloguing of herbarium specimens.
- Designing and conducting laboratory and field trials, soil analyses, environmental monitoring, data collection, statistical analysis and data presentation.
- Supervisory role to several honours and biology students, aiding in experimental designs and proofreading.

Department of Environment Regulation

- Design and develop a user-friendly, updated database of all emissions produced by Australian brickworks companies, analysing the change in emissions produced by different companies over the previous 10 years.
- Presenting the internship outcomes to relevant stakeholders and in a written report.
- Coordinate liaison with industry personnel and responsibly deal with confidential information.
- Undertake site visits to further understand industry processes, company procedures and processes and the ongoing reduction of emission outputs.

Men of the Trees

- Coordinating volunteer days and competently leading large teams.
- Organising rehabilitation, planting native plant species suited to the allocated sites.

Conservation Volunteers Australia

- Coordinating conservation volunteer days and competently leading large teams in conservation activities.
- Organising volunteer program, conducting education programs and presentations.



Since joining Strategen, Clare has been involved in the following projects:

- Lake Clifton flora and vegetation survey (Cape Bouvard).
- Forrestfield North flora, vegetation and black cockatoo habitat assessment (Shire of Kalamunda).
- Viveash Stage 2 development flora and vegetation survey (Pindan).
- Binningup Desalination Plant flora and vegetation monitoring survey and report (Water Corporation).
- Upper Swan Development Biological Report and Environmental Assessment Report (Satterley).
- Lakelands Development Revegetation Plan of Works (Peet).
- Barfield Road targeted orchid survey (*Caladenia huegelii*) and flora and vegetation survey (Blokk Property Australia).



Dr Jeff Cargill

Senior Ecologist

SUMMARY OF SKILLS AND EXPERIENCE

Jeff has extensive experience in botanical and ecological studies throughout Western Australia including baseline vegetation studies (Levels 1 and 2), threatened and priority flora surveys, and rehabilitation and vegetation monitoring programs. Jeff also has significant experience in the development and implementation of mine rehabilitation and closure plans and environmental risk assessments.

Significant experience has been gained in designing projects, managing teams, assessing environmental values, reviewing options and adapting methodology of long-term monitoring projects and producing high level technical reports. In addition, Jeff is responsible for providing technical advice on sample design and methodology and biological data analysis for projects undertaken by Mattiske Consulting.

As a Project Coordinator, Jeff has responsibility for the client management, direction, delivery, and oversight of botanical and ecological studies undertaken by the Mattiske Consulting team.

QUALIFICATIONS

Ph.D. (Environmental Science)
(Edith Cowan University)

B.Sc. (First Class Honours) (Edith
Cowan University)

B.Sc. (Environmental Management)
(Edith Cowan University)

CURRENT COMPANY POSITION

2010 – current:

Senior Ecologist & Project
Coordinator

Mattiske Consulting Pty Ltd

Key Skills and Experience

Project management and planning	✓
Infrastructure projects	✓
Mining projects	✓
Land development projects	✓
Biological data analysis	✓
Sample design and methodology	✓
Vegetation and condition mapping	✓
Threatened and Priority Ecological Communities	✓
Multi-layered assessments	✓
Environmental assessment and approvals	✓
Local and regional scale studies	✓
Technical review and reporting	✓
Team development and training	✓
Environmental risk assessments	✓
Mine rehabilitation and closure plans	✓
Client and stakeholder liaison	✓

PERSONAL ATTRIBUTES

Jeff has an extensive skillset developed from experiences working within the academic, mining, public and private environmental sectors. He has the proven ability to lead ecological teams across a wide range of projects and deliver high quality technical reports to the satisfaction of clients.

ADDITIONAL QUALIFICATIONS

- Marcsta Mining General Safety Induction
- WA Mine Driving Permit with Alcoa
- Contractor Responsible Person (Alcoa)
- Apply First Aid Training with St John Ambulance (HLTFA311A)
- 4WD defensive Training with Drive Safe Australia
- "C" class Drivers Licence
- Aveling Fundamentals of Supervision
- Flora Collection Permit (Issued under *WC Act 1950*)
- Aveling Safety Leadership
- Aveling Fire Training

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admin@mattiske.com.au



Client: Sheffield Resources Limited (via MBS Environmental) - Kimberley

Extensive work on baseline flora and vegetation studies (Level 2), and targeted threatened and priority flora surveys in vast areas in the Kimberley region associated with mineral exploration and mine development approvals (Thunderbird Project Area) (2016). Dr Cargill is involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Dampier Bunbury Pipeline (DBP)

Extensive work on baseline flora and vegetation studies on major infrastructure projects across various regions associated with the expansion of the pipeline (Level 1 and 2) (2011 to 2016). Targeted threatened and priority flora, and priority ecological community searches along the course of the pipeline (Dampier to Bunbury). Rehabilitation assessment within various bioregions along the course of the pipeline (Dampier to Bunbury). Development and implementation of Environmental Risk Assessments for the DBNGP (Dampier to Bunbury). Project coordinator and Senior Ecologist for works associated with the CS2-Tubridgi-Wheatstone Gas Pipeline (Onslow), Ashburton North Gas Pipeline (Onslow), and Fortescue Valley Gas Pipeline (Onslow to Solomon Mine – FMG). Dr Cargill is involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Multiple Projects for RPS Group

Extensive work on baseline flora and vegetation studies (Level 1 and 2) and establishment and design of long-term monitoring transects for major infrastructure and land development projects in the Pilbara and South-West Regions (2011 to 2016). Site assessments of Threatened and Priority Ecological Communities on the Swan Coastal Plain. Project coordinator and Senior Ecologist for works associated with the Anketell Strategic Industrial Area (Roebourne), Tumulus Spring Assessment (Serpentine), and Preston Beach land development (Mandurah).

Client: Multiple Projects for Strategen

Extensive work on baseline flora and vegetation studies (Level 1 and 2) for major infrastructure and land development projects in the south-west of Western Australia (2012 to 2016). Project coordinator and senior ecologist for works associated with the Ocean Reef Marina development (Joondalup) and DBNGP corridor widening (Kwinana to Bunbury).

Client: Mamba Resource Management

Baseline flora and vegetation studies (Level 1) for proposed drilling operations near Juna Downs (Karijini NP) (2015 to 2016). Dr Cargill is involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Alcoa of Australia Limited

2010 - Current (multiple tasks and projects as Project Manager and Senior Ecologist)

Extensive work on baseline flora and vegetation studies on multiple projects in the Jarrah Forest region associated with mineral exploration (baseline vegetation studies), mine development approvals, stream-zone monitoring, residue rehabilitation and rehabilitation assessment of current mine operations (2010 – 2016). Extensive work related to flora and vegetation studies (Level 1 and 2) and conservation category wetland assessments within the Alcoa Pinjarra Farmlands. Dr Cargill is involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Perth Airport Pty Ltd

Extensive work on baseline flora and vegetation studies (Level 1 and 2), targeted threatened and priority flora surveys, development and implementation of survey methodologies for federal approval, and assessment of threatened and priority ecological communities (2014 to 2015). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Premier Coal Limited

Extensive work on multiple projects in the Jarrah Forest region associated with the design and establishment of long-term forest control plots, mine development approvals and rehabilitation assessment of current and past mine operations (2011 to 2015). In addition, development and implementation of mine rehabilitation and closure completion criteria(s) for mining operations in the Collie Coal Basin. Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

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Client: Jandakot Airport Pty Ltd

Baseline flora and vegetation studies (Level 1) and targeted threatened and priority flora surveys for infrastructure developments (2014). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Department of Water

Extensive work undertaking spatio-temporal vegetation studies on the Jandakot and Gnangara Mounds, and Samson Brook (2010 to 2016). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: South32 Worsley Alumina

Extensive work on multiple projects in the Jarrah Forest region associated with the design and establishment of long-term forest control plots, level 1 flora and vegetation surveys, mine development approvals and rehabilitation assessment of current and historic mine and refinery (BRDA) operations (2012 to 2016). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: City of Swan

Planning, design and establishment of permanent vegetation monitoring plots in the northern Jarrah Forest. In addition, conducting Threatened and Priority Flora surveys and weed mapping (2015 to 2016). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: AAH Holdings Pty Ltd

Baseline flora and vegetation studies within the northern Jarrah Forest, in view of clearing applications for private landholders (2015). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting.

Client: WA Limestone Pty Ltd

Baseline flora and vegetation studies (Level 2), and assessment of threatened and priority ecological communities for the Yanchep Ridges development (2013 to 2014). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Griffin Coal Limited

Extensive work on the planning, design and establishment of long-term post-impact stream-zone monitoring transects in the Collie Coal Basin (2011 to 2013). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Regis Resources

Baseline flora and vegetation studies and Threatened and Priority Flora surveys (2012 to 2013). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Macarthur Minerals Pty Ltd

Extensive work on baseline flora and vegetation studies (Level 1 and 2), targeted threatened and priority flora surveys, and targeted priority ecological surveys for the Ularring Hematite Project (Lake Giles) (2011 to 2012). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

Client: Forest Products Commission

Extensive work on the planning, design and completion of spatio-temporal vegetation studies in the 31-Mile Brook Catchment area (2012). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation, reporting and project coordination.

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Client: Atlas Iron Limited

Extensive work on baseline flora and vegetation studies (Level 2) for the Balla to Anketell Point Port Slurry Pipeline Corridor (Roebourne) (2011). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation and reporting.

Client: Water Corporation of Western Australia

Definition Jarrah Forest structure and vegetation values in the Wungong Catchment, including long-term monitoring programs associated with impacts to vegetation associated with water usage (2010 to 2011). Dr Cargill has been involved in all phases of the work including design, planning, field studies, data interpretation and reporting.

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Appendix 3
Aboriginal and European Heritage
survey reports



**REPORT OF AN ABORIGINAL HERITAGE
SURVEY FOR THE ARMADALE ROAD
DUPLICATION PROJECT IN THE CITY OF
ARMADALE AND CITY OF COCKBURN,
WESTERN AUSTRALIA**

A report prepared for Main Roads Western Australia

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ACKNOWLEDGEMENTS

The authors would like to thank the following organisations and individuals who helped with the management of this Aboriginal heritage survey:

- Mr John Braid – Main Roads Western Australia (Principal Environment Officer)
- Ms Marni Baetge – Main Roads Western Australia (Environment Officer)
- Mr Sergio Martinez – Main Roads Western Australia (Project Manager)
- Mr Todd Craig – Main Roads Western Australia (Principal Heritage Officer)
- Mr JJ McDermott – Main Roads Western Australia (Heritage Contractor)
- Mr Brian Norris – WSP Parsons Brinckerhoff (Project Manager)
- Ms Hayley Martin – WSP Parsons Brinckerhoff (Civil Engineer)
- Ms Orlagh Brady – WSP Parsons Brinckerhoff (Graduate Civil Engineer)
- Ms Lyndall Ford – Department of Aboriginal Affairs (Heritage Information Officer)
- Ms Carolyn Fennelle – South West Aboriginal Land and Sea Council (Legal Officer)
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- Mrs Leah Mackie – Brad Goode and Associates Pty Ltd (Research & Mapping Assistant)

Whadjuk WC2011/009 Native Title Claim group representatives

- Ms Glenys Yarran
- Mr Harry Nannup Senior
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- Mr Stan Headland
- Ms Kezia Jacobs-Smith
- Mr Harry Nannup Junior
- Mr Jaymee Garrod

DISCLAIMER

All of the information contained in this report is believed to be correct and accurate at the time it was recorded. The author does not take responsibility or accept any liability for errors or omissions contained in the report based upon information supplied by others.

Warning: This document may contain names, images or material that relates to deceased Aboriginal persons. Permission was sought and granted by the consulted informants to cite this information.

***Note:** This report, in terms of its assessment under Section 5 of the Western Australian *Aboriginal Heritage Act 1972*, should be read in conjunction with the archaeological report by O'Reilly (2017).

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MAPPING

Datum Used: GDA 1994 MGA Zone 50. Handheld GPS Unit Garmin 60ST (+/- 10m)

GLOSSARY OF TERMS

The Proponent – Main Roads Western Australia
The Consultant – Brad Goode and Associates Pty Ltd
ACMC – Aboriginal Cultural Material Committee
AHA – Western Australian *Aboriginal Heritage Act 1972*
AHIS – Aboriginal Heritage Inquiry System
BGA – Brad Goode and Associates Pty Ltd
CHMP – Cultural Heritage Management Plan
DAA – Department of Aboriginal Affairs
GIS – Geographic Information Systems
Main Roads – Main Roads Western Australia
NSHA – Noongar Standard Heritage Agreement
NTC – Native Title Claim
PB – Parsons Brinckerhoff
SWALSC – South West Aboriginal Land and Sea Council
Whadjuk – Whadjuk WC2011/009 Native Title Claim group

EXECUTIVE SUMMARY ETHNOGRAPHIC SURVEY

Main Roads Western Australia ('the proponent') is proposing a duplication of Armadale Road in the City of Armadale and City of Cockburn, Western Australia.

Specifically, Main Roads Western Australia (Main Roads) wishes to duplicate approximately 7km of Armadale Road between Tapper Road in Atwell and Anstey Road in Forrestdale.

As part of the duplication works, the following intersections along Armadale Road require upgrades and/or improvements:

- Tapper Road/Verde Drive, Atwell
- Fraser Road, Banjup
- Liddelow Road, Banjup
- Wright Road, Piara Waters
- Rossiter Avenue, Piara Waters
- Nicholson Road, Forrestdale

In addition, the project will allow for the future potential widening of the Armadale Road/Kwinana Freeway Bridge with the proposed works aiming to increase traffic capacities within the locality of the City of Cockburn and the City of Armadale local government areas.

The total survey area of approximately 8.3km encompasses the areas of impact and a modest buffer zone to allow any minor project amendments, installation of drainage structures and/or establishment of laydown/turn-around areas. Construction works will be undertaken with a range of heavy machinery and will substantially impact the area within the road footprint and adjacent road reserve. As such, the width of the Armadale Road survey corridor ranges between 60 – 130m.

Prior to proceeding, Main Roads wishes to determine if there are any sites or places of Aboriginal heritage significance, as defined by Section 5 of the Western Australian *Aboriginal Heritage Act* (AHA), which will be affected by the proposed works, thereby fulfilling their obligations under the AHA.

As such, Brad Goode and Associates Pty Ltd ('the consultants') were commissioned to conduct an ethnographic and archaeological Site Identification Aboriginal Heritage Survey with several representatives of the Whadjuk WC2011/009 Native Title Claim (NTC) group.

In relation to this survey a search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System (AHIS) was conducted on the 20th February 2017 in order to determine if any previously recorded Aboriginal heritage sites or places located within the Armadale Road Duplication survey corridor would be impacted upon by the proposed works (see Appendix 1: DAA Sites and Places Register Search).

The search revealed that there are **no** previously recorded DAA ethnographic sites and **one** other heritage place, Place ID 3423 'Forrest Road', which has a DAA extent intersecting the Armadale Road survey corridor (see Table 1: Summary of Aboriginal heritage sites or places within the project area).

Three other heritage places, Place ID 3300 'Readymix Sandpit 2', Place ID Readymix Sandpit 1' and Place ID 3301 'Banjup: Calsil' also have DAA place extents intersecting the survey road corridor. However, as they are archaeological places they will be discussed in the accompanying archaeological report (see O'Reilly 2017).

Archival research has revealed that Place ID 3423 'Forrest Road' was reported to be a water and food source for a nearby camp and a meeting place on a 'pad' (or traditional walk path) from Medina to Armadale (O'Connor 1991: 17). 'Forrest Road' was recorded as having associations with the Dreaming creation serpent called the *Waugal* who sustained the water at the swamp and whose spirit was reported to continue to reside in the swamp (ibid: 18). An examination of the DAA place file has revealed that no specific mythology regarding the swamp has been recorded. However, it was reported that the Forrest Road swamp is part of a chain of water bodies along the coast which are linked through the travels of the *Waugal* and form a traditional path that Aboriginal people travelled along (Anthropos 2010: 17). The camp was reported to be used from the 1920s until the 1940s by seasonal Aboriginal workers undertaking bean-stake cutting from Tea Trees on nearby farms and who sunk shallow wells at the side of the swamp (ibid: 17-18; Venz & Glendenning 2001: 25). It was also reported by an Aboriginal informant that births could have taken place next to the Forrest Road swamp, however no specific details have been recorded in regards to this (O'Connor 1991: 17).

In relation to the current survey, Place ID 3423 'Forrest Road' is located to the west of Kwinana Freeway along Midgegooroo Avenue. A triangular portion of the DAA place extent, measuring approximately 44m NW/SE x 60m W/E x 75m S/E, intersects with the western end of the road survey corridor.

As Place ID 3423 'Forrest Road' is **not a site** under the AHA, the proponent has no further legal obligations under the AHA in relation to this place and **is not required** to take any action in relation to the AHA.

As a result of ethnographic consultations held with several South West Aboriginal Land and Sea Council (SWALSC) nominated representatives from the Whadjuk WC2011/009 Native Title Claim group on the 21st of February 2017, it has been determined that, to the knowledge of the Whadjuk Traditional Owners, there are **no new ethnographic sites** of significance, as defined by Section 5 of the AHA, located within the Armadale Road Duplication survey corridor.

During the consultations the Whadjuk Traditional Owners advised that DAA Place ID 3423 'Forrest Road' and Site ID 3713 'Lake Forrestdale' are places along a traditional 'run' or walk path between the coast and the Darling Ranges. The lake, swamp and surrounding wetlands were reported to be used as water and food sources by Nyungars who camped near the embankments of the waterways. Nyungar families were also reported by the Traditional Owners to have camped there whilst they undertook seasonal bean-stick cutting and tomato growing in the Forrestdale, Banjup, Atwell and Cockburn areas. Lake Forrestdale was reported to have been extensively used as a food and water source and camping ground by Nyungar families, with one elder recalling that he camped near the Lake with his family in the 1960s whilst he undertook seasonal work in the area.

The Traditional Owners also advised that two *Waugals* created the waterways in the area during the Dreaming. The spirits of the *Waugals* were reported to continue to reside in the waterways, until one disappeared after the construction of Adventure World next to Bibra Lake.

During the consultations it was also reported by the Whadjuk women that Lake Forrestdale, the Forrest Road swamp and other freshwater sources in the area could have been utilised as women's sites, however they were not aware of any specific women's sites located within the road survey corridor.

During the consultations the Traditional Owners advised that, due to the existence of previously recorded artefact scatters, sand dunes and wetlands in the area, it is likely that subsurface artefacts could be present in the survey road corridor. As such, the Traditional Owners requested that archaeological monitors be present during any ground disturbing works in order to observe any archaeological material which may be uncovered as a result of the works.

As a result of the ethnographic survey, the following recommendations in relation to the Western Australian *Aboriginal Heritage Act 1972* (AHA) are made:

It is recommended that Main Roads Western Australia can proceed with the proposed Armadale Road Duplication Project without undue risk of breaching Section 17 of the AHA in relation to ethnographic Aboriginal heritage sites, as defined by Section 5 of the AHA.

It is also recommended that Main Roads Western Australia gives due consideration to the Whadjuk WC2011/009 Native Title Claim group representatives' requests that:

- Aboriginal archaeological monitors be present during any ground disturbing works in order to observe any artefacts which may be uncovered as a result of the works; and
- Main Roads Western Australia consults with the Whadjuk Working Party in regards to the process of salvaging and relocating artefacts pertaining from Aboriginal occupation of the land.

EXECUTIVE SUMMARY ARCHAEOLOGICAL SURVEY

In November 2016, WSP Parsons Brinckerhoff, on behalf of Main Roads Western Australia, commissioned an archaeological survey of their Armadale Road Duplication Project Area. This area extends eastwards for approximately 8.3km from the intersection of Midgegooroo Avenue and Beeliar Drive in the City of Cockburn to the intersection of Armadale Road and Anstey Road in the City of Armadale, and encompasses a number of intersections along it.

Main Roads Western Australia propose to duplicate that part of Armadale Road between Tapper Road in suburban Atwell and Anstey Road in suburban Forrestfield and upgrade and/or improve various intersections along this part of Armadale Road. They also propose to undertake associated road works in and around the Armadale Road and Kwinana Freeway Bridge. While the majority of the Armadale Road Duplication Project Area is between 60m and 130m wide, it is much wider at the various intersections along it with a maximum width of approximately 550m at the Armadale Road and Kwinana Freeway Bridge intersection.

The archaeological survey discussed in this report was undertaken to identify and record any Aboriginal archaeological sites that may be located within the Armadale Road Duplication Project Area, in order that Main Roads Western Australia and/or their contractors can avoid disturbing them or, as required under Section 18 of the Western Australian *Aboriginal Heritage Act 1972*, seek the consent of the Minister for Aboriginal Affairs to proceed with activities that may disturb Aboriginal heritage sites.

The archaeological survey of the Armadale Road Duplication Project Area (the survey area) included research at the Heritage and Culture Division, Department of Aboriginal Affairs (WA) to assess and investigate the results of previous archaeological surveys and investigations that overlapped part(s) of the survey area. In addition, the results of other archaeological surveys and investigations undertaken in the vicinity of the survey area as well as in the wider region were also reviewed. Sources of environmental information were also utilised before a systematic archaeological survey of the designated survey area was conducted.

As a result of research at the Heritage and Culture Division, Department of Aboriginal Affairs (WA) and a search of their Aboriginal Sites and Places Database, it was established that **no** registered Aboriginal archaeological sites or sites with an archaeological component, are located within the designated survey area. However, it was established that **three** 'other heritage places', the Readymix Sandpit 1 (ID 4108), the Readymix Sandpit 2 (ID 3300) and the Banjup Calsil (ID 3301) artefact scatters have been recorded in the past and were identified at positions that place them, or may place them within the designated survey area.

According to information contained in the relevant file, the Readymix Sandpit 1 (ID 4108) other heritage place was initially identified and recorded in 1973 on the north side of and fronting onto Forrest Road (now called Armadale Road) approximately 1km east of Solomon Road and just before Fraser Road. The location of the Readymix Sandpit 1 (ID 4108) other heritage place is described in the relevant file as a 'sand quarry' where extensive excavation and clearing had taken place. It is also noted in the relevant file that a random sample of artefacts was collected from the Readymix Sandpit 1 (ID 4108) other heritage place at the time it was initially identified. During the course of the archaeological survey described in this report, the location of the Readymix Sandpit 1 (ID 4108) other heritage place was targeted and scrutinised for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified. It was also established that the land north of and fronting onto Armadale Road (formerly Forrest Road) between Solomon Road and Fraser Road has been universally disturbed and now contains houses, retail outlets and associated infrastructure. It is concluded here that the Readymix Sandpit 1 (ID 4108) other heritage place no longer exists.

The Readymix Sandpit 2 (ID 3300) other heritage place was also initially identified and recorded in 1973. This artefact scatter was located on the north side of Forrest Road (now called Armadale Road) approximately 0.5km east of Solomon Road in an area of bare sand where extensive excavation, clearing and general disturbance had taken place. It is also noted in the relevant file that, at the time it was identified, continuing quarrying was a threat to this other heritage place. All visible artefacts were collected from the Readymix Sandpit 2 (ID 3300) other heritage place at the time it was initially identified and recorded and subsequently deposited with the then Western Australian Museum. During the course of the archaeological survey described in this report, the location of the Readymix Sandpit 2 (ID 3300) other heritage place was targeted and scrutinised for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified. It was also established that the majority of the land on the north side of Armadale Road (formerly Forrest Road) approximately 0.5km east of Solomon Road has been universally disturbed and now contains retail and commercial outlets and associated infrastructure. It is concluded here that the Readymix Sandpit 2 (ID 3300) other heritage place no longer exists.

The Banjup Calsil (ID 3301) other heritage place was initially identified in 1971 on the western margin of an extensive sand quarry located on the north side of Forrest Road (now called Armadale Road) approximately 2.5km east of Solomon Road. It is noted in the relevant file that the general area 'is thoroughly disturbed by sand extraction to a depth of 6m' and that all visible artefacts were collected from the Banjup Calsil (ID 3301) other heritage place. During the course of the archaeological survey described in this report, the location of the Banjup Calsil (ID 3301) other heritage place was targeted and scrutinised for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified. It was also established that the majority of the land on the north side of Armadale Road (formerly Forrest Road) approximately 2.5km east of Solomon Road has been universally disturbed and now contains a large sand quarry. It is concluded here that the Banjup Calsil (ID 3301) other heritage place no longer exists.

As a result of the archaeological survey of the Armadale Road Duplication Project Area, **no** Aboriginal archaeological sites or material were identified. However, it was established that **three** 'other heritage places', the Readymix Sandpit 1 (ID 4108), the Readymix Sandpit 2 (ID 3300) and the Banjup Calsil (ID 3301) artefact scatters have been recorded in the past and were identified at positions that place them, or may place them within the Armadale Road Duplication Project Area. It is noted here that the Banjup Calsil (ID 3301) other heritage place was assessed by the Aboriginal Cultural Material Committee at their meeting on 13 June 2000 as 'not a site' (Resolution ID: 003080, Resolution Number: 00/0880). As a consequence, no action is required pertaining to this other heritage place.

With respect to the Readymix Sandpit 1 (ID 4108) other heritage place, the Aboriginal Cultural Material Committee concluded at their meeting on 01 August 2000, that the information that has been lodged with the Registrar of Aboriginal Sites pertaining to this place was insufficient to complete an assessment within the terms of Section 5 of the *Aboriginal Heritage Act 1972* (Resolution ID: 004350, Resolution Number: 00123).

Similarly, with respect to the Readymix Sandpit 2 (ID 3300) other heritage place, the Aboriginal Cultural Material Committee concluded at their meeting on 13 June 2000, that the information that has been lodged with the Registrar of Aboriginal Sites pertaining to this place was insufficient to complete an assessment within the terms of Section 5 of the *Aboriginal Heritage Act 1972* (Resolution ID: 003080, Resolution Number: 00/088).

As a result of the archaeological survey of the Armadale Road Duplication Project Area, **it is recommended** that Main Roads Western Australia be permitted to proceed with work associated with their proposed Armadale Road Duplication Project **on the condition** that they request the Department of Aboriginal Affairs re-assess the Readymix Sandpit 1 (ID 4108) and

Readymix Sandpit 2 (ID 3300) other heritage places as 'not sites' on the basis that artefacts have been collected in the past from both these places, that the land where both were once located has been universally disturbed and the places subsequently destroyed, and that no Aboriginal archaeological artefacts or material were identified at or about these places when they were targeted and scrutinised for the presence of Aboriginal archaeological material during the course of the archaeological survey described in this report.

If the Department of Aboriginal Affairs does not re-assess the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places as 'not sites' it will be necessary for Main Roads Western Australia to apply to the Minister for Aboriginal Affairs for consent to proceed with activities that may disturb Aboriginal heritage sites under Section 18 of the Western Australian *Aboriginal Heritage Act 1972*.

If such an application is made **it is recommended** that consent be granted **unconditionally** as artefacts have been collected in the past from both the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places, the land where both these other heritage places were once located has been universally disturbed and the places subsequently destroyed, and no Aboriginal archaeological artefacts or material were identified at or about these places when they were targeted and scrutinised for the presence of Aboriginal archaeological material during the course of the archaeological survey described in this report.

It is also recommended that, in the event of any artefactual material or skeletal material being discovered in the course of work associated with the Armadale Road Duplication Project or any other activities, work should stop while the Department of Aboriginal Affairs undertake an investigation. In the case of skeletal material being uncovered, work must cease immediately and the Western Australian Police must be notified.

Furthermore, **it is recommended** that Main Roads Western Australia personnel and contractors be advised of their obligations under Section 15 of the *Aboriginal Heritage Act 1972*, to report the discovery of any Aboriginal cultural material which may be uncovered in the course of their work or any other activities.

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REPORT

Report of an Aboriginal Heritage Survey for the Armadale Road Duplication Project in the City of Armadale and City of Cockburn, Western Australia

ISSUE

Main Roads Western Australia ('the proponent') is proposing a duplication of Armadale Road in the City of Armadale and City of Cockburn, Western Australia.

The proponent wishes to determine if there are any sites or places of Aboriginal heritage significance, as defined by Section 5 of the Western Australian *Aboriginal Heritage Act 1972* (AHA), that will be affected by this proposed work thereby fulfilling their obligations under the AHA.

REPORT OBJECTIVES

To report on archival research in order to determine if any previously recorded Aboriginal Heritage sites or places will be affected by the above project proposal.

To report on consultations held with representatives of the Whadjuk WC2011/009 Native Title Claim (NTC) group in order to determine if any new Aboriginal Heritage sites or places will be affected by the above project proposal.

To report upon management recommendations should any sites or places of significance as defined by Section 5 of the AHA be identified as being located within the project area.

To report upon any recommendations and/or the significance of the sites or places should the proponent be required to make application under Section 18 of the AHA for consent to use the land that may contain an Aboriginal site.

BACKGROUND

On 2nd November 2016, Ms Marni Baetge (Environment Officer) from Main Roads Western Australia (Main Roads) contacted Brad Goode and Associates Pty Ltd ('the consultants') in regards to an ethnographic and archaeological Site Identification Aboriginal Heritage Survey for the proposed Armadale Road Duplication project.

Specifically, Main Roads wishes to duplicate approximately 7km of Armadale Road between Tapper Road in Atwell and Anstey Road in Forrestdale.

As part of the duplication works, the following intersections along Armadale Road require upgrades and/or improvements:

- Tapper Road/Verde Drive, Atwell
- Fraser Road, Banjup
- Liddelow Road, Banjup
- Wright Road, Piara Waters
- Rossiter Avenue, Piara Waters
- Nicholson Road, Forrestdale

In addition, the project will allow for the future potential widening of the Armadale Road/Kwinana Freeway Bridge with the proposed works aiming to increase traffic capacities within the locality of the City of Cockburn and the City of Armadale local government areas.

The total survey area of approximately 8.3km encompasses the areas of impact and a modest buffer zone to allow any minor project amendments, installation of drainage structures and/or establishment of laydown/turn-around areas. Construction works will be undertaken with a range of heavy machinery and will substantially impact the area within the road footprint and adjacent road reserve. As such, the width of the Armadale Road survey corridor ranges between 60 – 130m.

Prior to proceeding, Main Roads wishes to determine if there are any sites or places of Aboriginal heritage significance, as defined by Section 5 of the AHA, which will be affected by the proposed works, thereby fulfilling their obligations under the AHA.

As such Mr Brain Norris (Principal Project Manager, Transport) from WSP Parsons Brinckerhoff, on behalf of Main Roads, commissioned Brad Goode and Associates Pty Ltd (BGA) to undertake an archaeological and ethnographic Site Identification Aboriginal Heritage Survey of the proposed Armadale Road Duplication Project area.

As a result of this scope of work Mr Brad Goode and Ms Louise Huxtable (Anthropologists) from BGA conducted an ethnographic Aboriginal heritage survey for the Armadale Road Duplication Project with several representatives from the Whadjuk WC2011/009 NTC group on the 21st of February 2017.

Mr Tom O'Reilly (Archaeologist) from BGA, assisted by Whadjuk representative Mr Stanley Headland, conducted an archaeological Aboriginal heritage survey for the Armadale Road Duplication on the 15th and 16th of February 2017.

The following report details the results of this survey.

LOCATION



Figure 1: Location of the survey area.

ETHNOGRAPHIC AND HISTORICAL BACKGROUND

TRADITIONAL WHADJUK CULTURE

Before colonial settlement the land in the south west of Western Australia was occupied by the Bibbulmun Nyungar people who shared a common language with thirteen local dialect variations (Bates 1966: 59). These thirteen socio-dialectal groups, sometimes referred to as 'tribes', inhabited the area to the west of a line drawn roughly from Jurien Bay in the north to Esperance in the south east (ibid). They collectively shared the name of Nyungar and differed from their inland neighbours through their language and initiation practices (Berndt & Berndt 1979: 81; Tilbrook 1983: 18; Bates 1985: 151-162). Various spellings are used, however *Nyungar* is a term of identity still actively used today.

The area around Perth was part of the territory of the *Wadjuk* or *Whadjuk group* (Berndt & Berndt 1979: 82; Tindale 1974: 260). Tindale describes their territory as extending from the,

...Swan River and northern and eastern tributaries inland to beyond Mt Helena; at Kalamunda, Armadale, Victoria Plains, south of Toodyay, and western vicinity of York; at Perth; south along the coast to near Pinjarra (Tindale 1974: 260).

The Bibbulmun Nyungar people were seen to have traditional initiation practices that varied from those of their inland neighbours; they practised nasal septum piercing and cicatrization (scarring) of the upper body rather than circumcision as an initiation rite (Berndt & Berndt 1979: 81-84; Bates 1985: 151-162; Tindale 1974: 260).

The Bibbulmun Nyungars recognised two primary moieties, the *Manitchmat*, or 'fair people of the white cockatoo', and the *Wordungmat*, or 'dark people of the crow' (Bates 1966: 60). These moieties formed the basis for social organisation and marriage between a further four subdivisions or semi-moieties, the *Tondarup*, *Didarruk*, *Ballaruk* and *Nagarnook* (ibid). Different Bibbulmun Nyungar groups practised matrilineal or patrilineal descent with the only lawful marriage being the, 'cross-cousin marriage of paternal aunts' children to the maternal uncles' children' (ibid: 24-25).

Coastal Nyungar groups, including the *Whadjuk*, had matrilineal moieties with two exogamous matrilineal clan divisions in each (Bates 1966: 60). Berndt and Berndt (1979) note that ritual affiliation was inherited through the father, adding that the work of Bates (1966) suggests local patrilineal descent groups whereby an individual inherited an affiliation to a conception (or birth) totem as well as its particular place and ritual (Berndt & Berndt 1979: 81). They elaborate,

Thus, a person belonged to the moiety and totemic clan of his (or her) mother, but also to the local descent group of his (or her) father. Within the father's land division, a person's conception (or birth) totem, a particular natural species, was mythically defined vis-a-vis a territorial centre which was, in turn, the focus of ritual (Berndt & Berndt 1979: 81).

Berndt and Berndt (1992: 90) noted that most relationships in Aboriginal societies were expressed in kin terms and that a network of obligations and responsibilities linked people and provided an atmosphere of familiarity and intimacy within the group. They elaborate,

In Aboriginal Australia kinship is the articulating force for all social interaction. The kinship system of a particular tribe or language unit is in effect a shorthand statement about the network of interpersonal relations within that unit - a blueprint to guide its members. It does not reflect, except in ideal terms, the actuality of that situation; but it does provide a code of action which those members cannot ignore if they are to live in relative harmony with one another. And kinship, in this situation, pervades all aspects

of social living. We cannot understand or appreciate traditional life in Aboriginal Australia without knowing something, at least, of its social organisation and structure - of which kinship is the major integrating element, or, to put it another way, the fine mesh which holds the society together (Berndt & Berndt 1992: 90).

Within the Bibbulmun Nyungars each socio-linguistic group, like the *Whadjuk*, consisted of a number of smaller groups (Green 1984: 9). These smaller groups were made up of around 12 to 30 persons, usually related men, wives and children and at times visiting relatives from other groups, and are sometimes described as a family band or horde (ibid). For every subgroup there was a tract of land with which they most closely identified themselves and over which they camped, hunted, gathered food and had proprietary rights and custodial duties (Silberbauer 1994: 74; Stanner 1965: 21). Members of the group exercised the greatest rights to the resources on that land, although other groups would also have some rights of access and use gained through birth or marriage. Places of conception and birth held strong bonds and spiritual connections for individuals. Group members generally lived within their area except when travelling over larger distances and areas to visit other groups for meetings, ceremonies or trade (ibid).

As well as rights and use of particular tracts of land acquired through birth and marriage, the individual also acquired spiritual links and the obligations of a custodian. These links to the land linked the individual to the mythic figures of Aboriginal Dreaming (Silberbauer 1994: 74; Stanner 1965: 21). The Dreaming refers to a period of creation when mythical figures transformed the landscape creating hills, lakes, rivers and animals. Many myths are grounded in the landscape with different Dreaming figures transforming the land and infusing it with a living spirit (Machin 1996: 25). Belief in the Rainbow Serpent as a major Creative Ancestral Being is widespread in Australia including the southwest of Western Australia (Radcliffe-Brown 1926: 19).

In *Whadjuk* beliefs the Rainbow Serpent was referred to as the *Waugal*, a creative Dreaming spirit associated with water which manifests as a mythic water snake (Bates 1985: 219-221). Bates (1966; 1985) recorded stories of *Waugal* mythology and the creation around 1900 and, "saw the *woggal* themes permeating the folklore of the Bib[b]ulmun" (Bates cited in Hallam 1979: 83). Wherever the *Waugal* had stopped or lived was considered to be 'winnaitch', a place where the spirit remained and a place to be avoided and/or associated with special ritual (Bates 1985: 221). Reported myths relate how the *Waugal* created the entire Swan and Canning River system as it moved down and over the landscape forming the route and shaping the banks, pools and nearby lakes as it went (O'Connor et al. 1989: 23). Widespread Nyungar belief also associates the *Waugal* with many of the major rivers in the Darling Range as well as many of the smaller springs, swamps, pools and lakes located on the Swan Coastal Plain (ibid).

Early colonial diaries, journals and records of the Swan River settlement indicate the river systems and chain of lakes and wetlands extending from Moore River to Mandurah were popular habitation and meeting places with rich hunting and gathering resources. Fish, waterfowl, tortoises, reed rhizomes, zamia palm seeds, frogs, marron and gilgie (freshwater crayfish) are amongst the food resources described (Hammond 1933; Moore 1884). Hammond observed that places such as Bibra Lake with good food supplies were popular camping and birthing places to which people regularly returned (Hammond 1933: 17). Camps at different sites varied from a single family up to as many as 200 people for special gatherings with the length of stay varying from one night to seven or eight nights depending on food resources (ibid: 25-26).

A systematic study of these early ethnohistorical sources was undertaken by Hallam (1971; 1986) and related to archaeological material, surveys and excavations during the 1970s and early 1980s. Hallam aimed to identify patterns of Aboriginal land occupancy on the Swan Coastal Plain and adjacent coast and scarp environments to the Darling Plateau. Collation of

ethnographic evidence suggested regular and repeated patterns of usage and movement which included seasonal hunting and gathering activities, as well as travel between the inland and coast. Hallam concluded that during winter when water was readily available, Nyungars dispersed into smaller groups to scatter into the inland hill country to hunt and gather (Hallam 1986: 12). During spring, as roots and yams, eggs and young birds became available, they moved back, regrouping and moving towards the coastal rivers and wetlands where food and water was plentiful during the summer months (ibid). Larger gatherings for meetings, trade or ceremonies were observed during this time (ibid: 13).

After summer and the autumn months of fishing in the shallow river estuaries where “mullet, salmon and Taylor-fish abounded” (Moore 1884: 16), the groups would again move eastward as the oncoming winter approached. The collation of ethnographic information indicated that movement and occupation within the coastal zone were along “defined routes” or “pads” (Hammond 1933: 16-19) which ran behind the coastal sand-dunes linking native wells and river crossings with the swamps and wetlands of the coastal sand plain (Bassendean Sands). At Perth there was a concentration of east–west movement and occupation, linking the coastal sand plain to campsites at the foot of the Darling Scarp and into the foothills of the range.

Hammond (1933) notes,

Another pad led from the Perth crossings through Kelmscott, Beenup, Wongong, the Serpentine River, and Mundup to the Pinjarra Ford. From the Pinjarra ford the principal track led on to Bunbury, Busselton, Margaret River, Blackwood River, Nannup, Augusta, Nornalup, Denmark, Albany, and Ongerup...There were also many cross pads to and from the main camping places, mostly for use in the winter, when the natives had to live on animals and roots because the rivers were flooded and very little fish could be caught (Hammond 1933: 19).

Ethnohistorical records suggest that major roads in the South West follow the position of these “pads.” The Albany Highway, for example, follows a route surveyed by Hillman in 1836 which in turn followed,

... the worn pathways of the Aboriginals (sic) and the course of the Neerigen Brook, and before climbing over the Darling Scarp’s wooded slopes to Kelmscott, it converged on another well-trodden track leading south (Popham 1980: 17).

Hallam observed that the ethnohistorical records of campsites, activities, routes of movement and nodes of occupation were reflected in the distribution (and nature) of archaeological sites across the Swan Coastal Plain. She notes that statistically “the bulk of sites lie around the lakes and swamps of the coastal sand plain [Bassendean Sands], the most extensive zone” (Hallam 1986: 5). This reflected ethnohistorical sources which indicated traditional Aboriginal occupation favoured areas around the lakes and swamps of the coastal plain and waterways, including the Wungong River and Neerigen Brook, given the availability of fresh water and food resources (Hallam 1971: 11; Hallam 1986: 5; Hammond 1933: 15; and McDonald & Coldrick 2013: 14).

Both the archaeological and ethnographic evidence attest to the importance of rivers, lakes and swamps for traditional and historic Aboriginal habitation and good hunting and gathering locations. They were also to be favoured areas for colonial settlement resulting in direct conflict of interests.

According to Makin (1970) and Brown (1983) early writers such as Symmons (1840), Lyon (1833) and Armstrong (1836) recorded that the Swan River Nyungars had a system of land ownership that divided up the country around the river between local clan groups. Each clan had a tract of land with which they most closely identified, referred to by Moore (1884: 39) as *Kalla*

or 'fireplace'. These groups had primary rights to the resources of the clan territory and acted as custodians for sacred sites within these territories, although neighbouring groups also had some rights of access to land, such as through marriage connections (Le Souef 1993: 30-43).

Lyons described districts within Perth in terms of an area name and a single leader. The *Mooro* tribe occupied the district of *Yellowgonga*, *Beeloo* was the district of *Munday* and *Beeliah* was the district of *Midgegooroo* (see Lyon's 1833 map of Aboriginal Tribal Districts surrounding Perth cited in Brown 1983: 6). Armstrong also recognized that land appeared to be assigned to specific families, rather than being held in common by the wider 'tribe' (Brown 1983: 5).



Figure 2: Place names and territories as told to Robert Lyon by Yagan in 1832 (cited in Green 1984: 50)

According to Makin (1970) from Fremantle (*Wol-yal-lu*) up the river to Butlers Bay (*Bi-ri-gap*) and to Mt Eliza (*Ga-ra-katta*) was the 'Land of *Yal-gong-ga*', his sons, wives and children (Makin 1970: 72-74). From Mt Eliza past the flats (*Min-da-rop*) near the Narrows Bridge to the Peninsula (*Wu-rut*) north of the farm belonging to Colonial Secretary Mr Brown at Bassendean was the land of 'Monday' (or Munday) (*ibid*). From the Bassendean ferry jetty to the head of the Swan River was the land of *Ngu-nyt* (*ibid*). The Canning tribes occupied the left (south) bank of the Swan River and the adjacent Canning River. The land from Fremantle to Preston Point and Point Walter around to Butlers Bay, the entrance to the Canning River, was *Djar, Gar-bal, Yurjil* and *Nin-g-ara* (*ibid*). From the entrance of the Canning River past Mill Point to near Guildford was *Bi-nan, Yur-gan* (*ibid*). From Guildford to the Swan River head were *Mol-li-dobbin, Mol-li-mig-rat* and *Wiban* and other branches of the family (*ibid*).

EUROPEAN SETTLEMENT AND SOCIAL DISTRUPTION

Settlement at the Swan River began in 1829 when Captain Charles Fremantle landed with a party at the Swan River with the purpose of annexing the, "whole of the Western part of Australia in the name of Britain" (May 1997: 7). Upon arrival, the Canning River was explored and the land was surveyed before being opened for settlers to purchase to farm (*ibid*). By 1830 portions of land that fronted the river bank in Bayswater were occupied by the assignees of the allotments, and the diary of Ms Anne Whatley made the observation that, 'This year must necessarily be one of experiments, disappointments, and privations...' as the colonists set about building houses and planting crops without advanced knowledge of the seasons (*ibid*: 12).

At the time of colonisation the study area of this report was part of what Lyons (cited in Green 1979: 131) referred to as the territory of *Beeliar* which encompassed an area from a line drawn due east from Mangles Bay, extending northwards to the foreshores of the Swan and Canning Rivers. This was seen as the territory of the Aboriginal leader *Midgegooroo* while the territory from the Canning River to the hills was known as *Beeloo* and seen as the territory of *Munday* (ibid). Carden (1968) elaborates,

The Canning River divided an area peopled by two tribes – the Beeloo and the Beeliar. (From) the Canning to the sea, was the land belonging to Midgegooroo and his famous son Yagan. Within four years of white settlement Yagan, Midgegooroo and Munday were proclaimed outlaws; two died violently within months of the proclamation but the third was finally pardoned (Carden 1968: 19).

Colonial settlement had a large effect on the traditional lives of Aboriginals. During the first few years of settlement, Green notes that ‘Yellagonga’s people speared cobbler fish along the muddy foreshore of the Swan River and exchanged surplus fish for bread and flour’ (Green 1984: 51). However, by 1831 Settlers and farms along the river areas claimed the most fertile and productive areas, monopolising water sources for stock and agriculture while also relying on natural food resources such as fruit, nuts, reptiles, birds and eggs, gilgie, mullet and cobbler (ibid). Hunting grounds were lost and food supplies became scarce as ‘land was fenced: game was shot or frightened away’ (May 1997: 18). Aboriginal people trespassed onto settler’s properties, stealing stock and the burning of crops and property infuriated settlers which led to retaliation (ibid; Carden 1968: 21).

Yagan, a member of the *Beeliar* group, became well known and was observed to be involved in these transgressions as well as part of a group who conducted a retaliatory killing on the road between Fremantle and the Canning River (Moore 1884: 206). Fear, anger and hostility fuelled a succession of killings on both sides. In 1833 *Yagan*, *Midgegooroo* and *Munday* were claimed as outlaws and a reward was set for 30 pounds for Yagan, dead or alive (ibid). He was eventually shot by a teenager named William Keats’s who was himself fatally wounded while his younger brother escaped (ibid). Before *Yagan’s* body could be recovered by his family, his head and distinctive shoulder cicatrices were cut off and smoked for preservation by one of the settlers (ibid).

Aboriginal occupation of the Swan Coastal Plain continued into the contact era and may have intensified as Aboriginal people were forced off their traditional lands and took up a pattern of coexistence alongside and within the areas of European farming (Hallam 1986). Historical accounts of camps at Bibra Lake and the general Canning River wetland areas are supported by descriptions of well used paths connecting from Perth along the north river bank to North Fremantle where a shallow river crossing connected to a pad which continued on to Bibra Lake, and through Rockingham to Mandurah (Hammond 1933: 17). Historical use of the camps around Cockburn and the Armadale area up until the 1950s and as late as 1980s continue to be recorded by Aboriginal Consultants in ethnographic Aboriginal Heritage reports (see Locke, Murphy & McDonald 1991: 4).

ARCHIVAL RESEARCH

Archival research involved an examination of the Department of Aboriginal Affairs (DAA) Sites and Places Register, a review of any relevant site and place files, and a review of any unpublished ethnographic reports that relate to the Armadale Road survey corridor in the City of Armadale and City of Cockburn, Western Australia.

SITES AND PLACES REGISTER SEARCH

The DAA Aboriginal Sites and Places Register categorises places reported to be of importance and significance to Aboriginal people into two separate categories.

The first category contains sites classified as **‘Registered.’** Registered sites have been assessed by the Aboriginal Cultural Materials Committee (ACMC) as meeting the definition of Section 5 of the AHA and are fully protected under the law. Disturbance to land that contains such sites requires a Section 18 application for ministerial consent should proponents wish to use the land that contain these sites.

‘Other Heritage Places’ is the second category of places contained upon the Aboriginal Sites and Places Register. These types of places include reported places **‘Lodged’** and awaiting ACMC assessment, and places where the information has been assessed but there is **‘Insufficient Information’** to make a final determination under Section 5 of the AHA but there is enough information to warrant these places temporary protection in Law. Disturbance to land that contains such places requires a Section 18 application for ministerial consent should proponents wish to use the land that contain these places.

Within ‘Other Heritage Places’ the final category is **‘Stored Data.’** Such places have been assessed by the ACMC but fail to meet the definition of Section 5 of the AHA. Places in this category are not sites under the AHA and are not protected in Law. Proponents have no further legal requirements for such places should they wish to use the land, unless further information is reported leading to such a place being reassessed as a site in terms of Section 5 of the AHA.

In relation to this project a search of the DAA’s Aboriginal Heritage Inquiry System (AHIS) was conducted on the **20th February 2017** in order to determine if there are any previously recorded Aboriginal sites or places located within the Armadale Road Duplication Project area which could be impacted upon by the proposed works (see Appendix 1: DAA Sites and Places Register Search).

The search revealed that there are **no** previously recorded DAA ethnographic heritage sites and **one** other heritage place, Place ID 3423 ‘Forrest Road’, with a DAA extent intersecting the Armadale Road survey corridor (see Table 1: Summary of Aboriginal heritage sites or places).

Three other heritage places, Place ID 3300 ‘Readymix Sandpit 2’, Place ID Readymix Sandpit 1’ and Place ID 3301 ‘Banjup: Calsil’ also have DAA place extents intersecting with the survey road corridor. However, as they are archaeological places they will be discussed in the accompanying archaeological report (see O’Reilly 2017).

Table 1: Summary of Aboriginal heritage sites or places within the project area.

ID	Name	Status	Access	Restricted	Location (GDA94 Z50)*		Type
					mE	mN	
Other Heritage Places							
3423	Forrest Road	S	O	N	391803	6444940	Myth, Camp, Meeting Place, Plant Resource, Water Source, Other:?

* Please note: Coordinates are indicative locations that represent the centre of sites as shown on maps produced by the DAA – they may not necessarily represent the true centre of all sites.

LEGEND: **R** – Registered Site, **I** - Insufficient Information, **S** - Stored Data/Not a Site, **L** - Lodged awaiting assessment, **O** – Access Open, **C** - Closed Access, **N** – File Not Restricted, **N/A** – Not Available.

REVIEW OF RELEVANT HERITAGE PLACE FILES

Place ID 3423 'Forrest Road'

The Forrest Road Swamp was first recorded by O'Connor in 1991 as a water/food source for a nearby camp, a water source, a meeting place on a 'pad' (or traditional walk path) from Medina to Armadale and as having associations with a *Waugal* mythology (O'Connor 1991: 17; O'Connor 1991: DAA Site Recording Form). On the DAA site recording form the camp was reported to be used, "by members of the Michael Family from the 1920s on, and reputedly by earlier Nyungars. Births may have taken place there, hence the spiritual attachment" (O'Connor 1991: DAA Site Recording Form). The camp was reported to be a permanent habitation up until the 1960s with seasonal bean-stake cutter camps located outwards from this central camp (O'Connor 1991: 17-18). These seasonal workers sank shallow wells at the side of the swamp in order to obtain water (ibid: 17-18). It was also reported that the source of water in the swamp was sustained by the actions of a water-creative spirit the *Waugal*, whose spirit continued to reside in the swamp (ibid).

The site was reported by O'Connor to extend, "N/S from Forrest Road [now Armadale Road] to the top of rise approximately 200 metres south of swamp, and E/W to top of rise approximately 300 metres from Swamp either side" (O'Connor 1991: DAA Site Recording Form). On this site recording form O'Connor (1991) notes that the original site registration forms suggested that there were two sites at Forrest Road, namely the camp and the mythological site. However, it was advised that it was the opinion of the Aboriginal informants that there is instead one composite site (ibid).

In June 2000 the ACMC assessed 'Forrest Road' and found that there was 'Insufficient Information' for it to meet the criteria for the definition of a site under the AHA (Resolution ID 3080). As such it was placed on the 'Interim Register' at the DAA.

In June 2001, during a survey for the proposed Thomsons Lake Regional Centre in North Jandakot, Venz and Glendenning from McDonald, Hales and Associates reported that archival research identified that, "this camping and mythological site focuses on a swamp located just north of Beeliar Drive and west of North Lake Road" (Venz & Glendenning 2001: iii, 21). During the survey the Aboriginal informants advised that the site held significance for mythological and environmental reasons due to its association with the *Waugal* and as a food resource area (ibid: 22, 25). However, no specific mythology regarding the swamp was recorded (ibid: 25). It was also reported that Aboriginal families camped in the area during the 1940s whilst cutting bean sticks from Tea Trees (ibid).

In April 2002 the ACMC reassessed 'Forrest Road' and found that it met the definition of a site under Section 5(a) (b) and 39.2(a) (b) (c) of the AHA (Resolution ID 3833). As such it was placed on the 'Permanent Register' at the DAA.

In June 2007 the ACMC again reassessed 'Forrest Road' and found that it did not meet the definition of a site under the AHA (Resolution ID 5426). As a result of this reassessment Place ID 3423 'Forrest Road' is currently listed on the DAA AHIS as 'Stored Data: Not a Site'.

In June 2010, during a survey for LandCorp, Anthropos Australis recommended that the boundary of Place ID 3423 'Forrest Road' be remapped and reregistered as an Aboriginal heritage site under the AHA in order to protect the swamp/wetland and its remaining environs from any further development (Anthropos 2010: 21). During ethnographic consultations the Aboriginal informants reported that the Forrest Road swamp was, "part of a chain of water bodies along the coastal plain and that Aboriginal people historically travelled from one lake to the next" (ibid: 17). It was also advised that the water bodies are also linked through the travels of the *Waugal* (ibid).

In relation to the current survey, Place ID 3423 'Forrest Road' is located to the west of Kwinana Freeway along Midgegooroo Avenue. A triangular portion of the DAA place extent, measuring approximately 44m NW/SE x 60m W/E x 75m S/E, intersects with the western end of the road survey corridor.

As Place ID 3423 'Forrest Road' is **not a site** under the AHA, the proponent has no further legal obligations under the AHA in relation to this place and **is not required** to take any action in relation to the AHA.

REVIEW OF RELEVANT ETHNOGRAPHIC REPORTS

Anthropos Australis Pty Ltd 2010, *Report of Aboriginal Heritage Consultation with the Nyungar Family Groups regarding the Proposed Development at the Cockburn Central Town Centre Project Area, Beeliar Drive, Cockburn, Perth, Western Australia*, report prepared for Landcorp, June 2010 [DAA Report ID 28191].

In 2010 LandCorp commissioned Anthropos Australis Pty Ltd (Anthropos) to conduct an Aboriginal Heritage Consultation for the proposed development at the Cockburn Central Town Centre Project on Beeliar Drive in Cockburn (Anthropos 2010: 1).

Specifically, LandCorp wished to develop the Cockburn Central Town Centre, part of the Cockburn Central Regional Centre, on the corner of Forrest Road and Beeliar Drive (Anthropos 2010: 1). LandCorp purchased the land from the WA Planning Commission who had previously been granted a Section 18 consent in 2002 from the DAA in order to use the land located within DAA ID 3423 'Forrest Road' (ibid). However, the DAA advised LandCorp to resubmit a Section 18 application in order to use this land (ibid). Therefore, LandCorp wished Anthropos to consult with the Nyungar Family Groups in regards to the application (ibid).

Archival research conducted by Anthropos Australis (2010) revealed that there were two previously recorded Aboriginal sites, Site ID 3423 'Forrest Road' and Site ID 18751 'Thomsons Lake Regional Centre', located within the project area (Anthropos 2010: 9).

During ethnographic consultations held with several representatives from the Whadjug Nyongars of the Swan River and Plains (the Corunna Family), the Wilkes Family, the Garlett Family, the Warrell Family, the Bropho Family, the Independent Aboriginal Environment Group and the Ballaruk Group, it was advised that water bodies hold significance to Aboriginal people as places for camping and hunting (Anthropos 2010: 17-19). The swamp/wetland at Forrest Road was reported to be part of a chain of water bodies located along the coastal plain which Aboriginal people historically travelled along (ibid). The water bodies were also reported to be mythologically linked through the travels of the *Waugal* (ibid). During the survey the Nyungar family groups requested that the boundary of Site ID 3423 'Forrest Road' be moved off the cleared survey area in order to preserve the remaining undeveloped land and swamp/wetlands in the area (ibid). The Nyungar families stated that they did not wish to see any further developments impinging on the Forrest Road waterway (ibid). The wider swamp area, which had been cleared of vegetation located east of North Lake Road and Forrest Drive, was reported to once be a Nyungah camping place (ibid: 18). It was also reported that North Swamp is used as a breeding ground for freshwater turtles and as such it was requested by the Aboriginal informants that the swamp/wetland be protected (ibid: 19).

As a result of the survey Anthropos (2010) recommended that the boundary of Place ID 3423 'Forrest Road' be remapped and reregistered as an Aboriginal heritage site under the AHA in order to protect the swamp/wetland and its remaining environs from any further development (Anthropos 2010: 21). If this was not possible, it was recommended that LandCorp lodge a Section 18 notice under the AHA in order to use the land located within the Forrest Road site (ibid).

In relation to the current BGA (20147) survey, the Anthropos Australis survey area is located from Kwinana Freeway in the east, Midgegooroo Avenue in the west, Beeliar Drive in the south and North Lake Road/Tea Tree Close in the north.

O'Connor, R. 2004, *Report on an Aboriginal Heritage Survey of the Passmore Road section of the Serpent-Canning DN 1400 link main*, report prepared for the Water Corporation, February 2004 [DAA Report ID 20880].

In 2004 the Western Australian Water Corporation commissioned O'Connor to conduct an Aboriginal Heritage survey for the Passmore Road section of the Serpentine-Canning DN1400 Link Main (O'Connor 2004: 1).

Specifically, the Water Corporation wished to install a pipeline from Nicholson Road and Armadale Road in Forrestdale, Passmore Road in Southern River and Verna Street in Gosnells (O'Connor 2004: 1).

Archival research conducted by O'Connor (2004) revealed that there were two previously recorded DAA registered ethnographic sites located within the project area, namely Site ID 3511 'Southern River' and Site ID 3538 'Canning River' (O'Connor 2004: 7-8).

During ethnographic consultations held with several representatives from the Ballaruk group, the Metropolitan Working Group and the Bibulmun group, it was determined that the works would impact upon the Southern River and Canning River (O'Connor 2004: 9-10). It was further advised by the Traditional Owners that the proposed ground disturbance works associated with the Southern River and Canning River crossings could uncover skeletal or cultural material (ibid).

As a result of the survey O'Connor (2004) recommended that the Water Corporation make a formal application under Section 18 of the AHA pursuant to carrying out the works within the Southern River and Canning River sites (O'Connor 2004: 12).

In relation to the current BGA (2017) survey, the O'Connor (2004) survey is a 50m wide survey corridor which overlays Anstey Road and travels west along Armadale Road for 1.3km to Nicholson Road.

O'Connor, R. 2003, *Report on an Ethnographic Survey of a Proposed Water Pipeline Route in Forrestdale*, report prepared for the Western Australian Water Corporation, August 2003 [DAA Report ID 20680].

In 2003 the Western Australian Water Corporation commissioned O'Connor to conduct an Ethnographic Aboriginal Heritage survey for a proposed water pipeline route in Forrestdale (O'Connor 2003: 1).

Specifically, the Water Corporation wished to install a new water pipeline from a pumping station at the corner of Nicholson Road and Armadale Road to an existing pumping station located to the east of Tonkin Highway on Connell Avenue in Gosnells (O'Connor 2003: 1).

Archival research conducted by O'Connor (2003) revealed that there were two previously recorded DAA registered ethnographic sites located within the project area, namely Site ID 3511 'Southern River' and Site ID 3538 'Canning River' (O'Connor 2003: 6-7).

During ethnographic consultations held with several representatives from the Ballaruk group, the Metropolitan Working Group and the Bibulmun group, it was revealed that there were no new ethnographic sites located within the project area (O'Connor 2003: 7-8). The cultural heritage significance of the Canning River and Southern River was confirmed by the Traditional

Owners during the consultations, however no specific mythologies or details were provided (ibid).

In relation to the current BGA (2017) survey, the O'Connor (2003) survey is a 50m wide survey corridor which overlays Anstey Road and travels west along Armadale Road for approximately 1.5km to Nicholson Road.

O'Connor, R. and Hart, T. 2003, *Report on an Ethnographic Survey of the proposed south west metropolitan railway alignment*, report prepared for New Metro Rail, October 2003 [DAA Report ID 20653].

In 2003 the New Metro Rail commissioned O'Connor and Hart to conduct an ethnographic Aboriginal heritage survey for a proposed railway line and stations beginning at Perth City and running south along the centre of Kwinana Freeway to Rockingham and on to Mandurah (O'Connor & Hart 2003: 2-3).

Archival research conducted by O'Connor and Hart (2003) revealed that DAA ID 3423 'Forrest Road' was recorded as a mythological site, camp, meeting place and water source situated within close proximity to the proposed railway alignment and could be impacted upon by the proposed car parking area for the Thomsons Lake Station (O'Connor & Hart 2003: 14, 17).

During ethnographic consultations held with several Aboriginal representatives from the Metropolitan area, it was determined that the topography of DAA ID 3423 'Forrest Road' has been altered by road constructions since it was first recorded in 1991 (O'Connor & Hart 2003: 31). Whilst the proposed works were ascertained to avoid the swamp and former well site, it was reported that it was uncertain whether the former camping area of the site would be impacted upon by the works (ibid).

In relation to the current BGA (2017) survey, the O'Connor and Hart (2003) survey is a 60m wide survey corridor which intersects the current study area along the Kwinana Freeway.

BSD Consultants 2002, *Summary Report: Section 18 Notice to Disturb Aboriginal Sites, Armadale Road Duplication – From Nicholson Road to Southern River, Armadale Road, Forrestdale*, report prepared for Main Roads Western Australia, June 2002 [DAA Report ID 106241].

In 2002 Main Roads Western Australia commissioned BSD Consultants Pty Ltd (BSD) to conduct a summary report for a Section 18 consent notice under the AHA in order to disturb Aboriginal Sites for the Armadale Road Duplication project (BSD 2002: i).

Specifically, Main Roads wished to reconstruct approximately 5km of Armadale Road between Nicholson Road to the west and Wungong Bridge over Southern River to the east (BSD 2002: 1).

Previous archaeological and ethnographic surveys had been conducted for the project by McDonald, Hales and Associates (2002), Australian Interaction Consultants (2001) and Fisher Research (2002) which were included in this report (the author's review of these surveys is given below). Archival research conducted by BSD revealed that previously recorded DAA archaeological Site ID 15907 'Proposed Forrestdale Industrial Area PFIE-3', DAA ethnographic Site ID 3511 'Southern River' and newly recorded archaeological site 'ARDP-01', had potential to be disturbed by the proposed roadworks (BSD 2002: 3).

In relation to the current BGA (2017) survey, the BSD Consultants (2002) survey is located along Armadale Road, overlaying approximately 1.5km of the current survey corridor between Nicholson Road and Anstey Road.

Fisher, S. and Waite, M. 2002, *Report on an ethnographic survey of the proposed redevelopment of Armadale Road, from Wungong Brook Bridge to Nicholson Road Armadale, with the Combined Metropolitan Native Title Claim constituents from the Corunna and Wilkes families*, report prepared for BSD Consultants, February 2002 [included with DAA Report ID 106241].

In 2002 BDS Consultants, on behalf of Main Roads Western Australia, commissioned Fisher Research Pty Ltd to conduct an ethnographic survey of the proposed redevelopment of Armadale Road with constituents of the Combined Metropolitan Native Title Claim Working Group (CMNTCWG) from the Corunna and Wilkes families (Fisher & Waite 2002: 1).

Specifically, Main Roads wished to reconstruct and expand approximately 5km of Armadale Road to the south of the existing road in the existing road reserve, between the termination of the dual carriageway east of the Southern River crossing and to the west of Nicholson Road (Fisher & Waite 2002: 1).

Archival research conducted by Fisher Research (2002) revealed that there are two previously recorded DAA ethnographic sites, Site ID 3511 'Southern River' and Site ID 3512 'Wungong Brook', which would likely be disturbed by the proposed development (Fisher & Waite 2002: 6).

During ethnographic consultations held with several representatives from the CMNTCWG, no new ethnographic sites of significance were identified during the survey (Fisher & Waite 2002: 15). During the survey the Aboriginal informants advised that the wetlands to the north of Armadale Road are part of a *Waugal* Dreaming site, DAA ID 18194 'Waugal Whiskers' (ibid: 9). It was advised that during the winter water from the wetlands feeds into Lake Forrestdale via a series of culverts, drainage channels and underground water sources (ibid: 10). The Aboriginal informants reported that the *Waugal*, "pushes this water out to replenish and reinvigorate the lake" (ibid). Bulrushes (*Typha* sp.) were reported to hold significance as 'Waugal Whiskers' or *Waugal Nganga*, and were advised to be growing through the 'scars' (i.e., drainage channels) that Europeans had made in the land (ibid). The *Waugal Nganga* were seen as evidence that the *Waugal* was still present in the area, maintaining the health of the waterways, wetlands and the Jandakot Water Mound (ibid).

As a result of this survey Fisher Research (2002) recommended that Section 18 applications would be required under the AHA in order to carry out the proposed works within Site ID 3511 'Southern River' and Site ID 3512 'Wungong Brook' (Fisher & Waite 2002: 16). It was further recommended that Main Roads seek consent under Section 18 of the AHA as it was determined that Site ID 3713 'Lake Forrestdale' and Site ID 3714 'Neerigen Brook' would likely be impacted upon by stormwater runoff from the proposed development (ibid).

In relation to the current BGA (2017) survey, the Fisher Research (2002) survey is a 60m wide survey corridor located along Armadale Road, overlaying approximately 1.5km of the current survey corridor between Nicholson Road and Anstey Road.

McDonald, Hales and Associates 2002, *Report of an Aboriginal Heritage Survey: Proposed Armadale Road Duplication Project, Forrestdale, Western Australia*, report prepared for BSD Consultants, April 2002 [included with DAA Report ID 106241].

In 2001 BSD Consultants, on behalf of Western Infrastructure, commissioned McDonald, Hales and Associates to conduct an Aboriginal heritage survey for a proposed 5km duplication of Armadale Road between Nicholson Road and Southern River at Forrestdale (McDonald, Hales & Associates 2002: 1).

Archival research conducted by McDonald, Hales and Associates (2002) revealed that there were two previously recorded DAA ethnographic sites that intersected the proposed Armadale Road Duplication survey corridor, namely Site ID 3511 'Southern River' and Site ID 3512 'Wungong Brook' (McDonald, Hales & Associates 2002: 29). DAA Site ID 3714 'Neerigen Brook 1' was also identified to be located approximately 100m south of the project area (ibid).

During ethnographic consultations held with several representatives from the Bibbulmun Tribal group, the Independent Environmental Group, the Walley/Gentle Family, the Hanson Family and the Ballaruk Aboriginal Corporation, no new ethnographic sites of significance were identified within the survey corridor (McDonald, Hales & Associates 2002: 32). The Southern River and Wungong Brook were determined to be Aboriginal heritage sites and as such the Aboriginal informants expressed their concerns about the impact of the project on the rivers (ibid: 32, 33). It was reported that Aboriginal people had camped in the vicinity of Armadale Road in the 1940s whilst they were cutting beansticks (ibid: 32). They were reported to undertake hunting in the area and utilised the food and water sources at Forrestdale Lake (ibid).

As a result of this survey McDonald, Hales and Associates (2002) recommended that Section 18 applications under the AHA be made in order to carry out the proposed works which were determined to impact upon Site ID 3511 'Southern River' and Site ID 3512 'Wungong Brook' (McDonald, Hales & Associates 2002: 33). It was also recommended that Section 18 applications would be required if the works were to disturb Site ID 3714 'Neerigen Brook' and Site ID 3713 'Forrestdale Lake' (ibid).

In relation to the current BGA (2017) survey, the McDonald, Hales and Associates (2002) survey corridor is located along Armadale Road, overlaying approximately 1.5km of the current survey corridor between Nicholson Road and Anstey Road.

Parker, S. and Parker, R. 2001, *Site Identification, ethnographic survey under the Aboriginal Heritage Act (1972) of the proposed Armadale Road Duplication project from Nicholson Road to Wungong Brook in Armadale*, report prepared for Western Infrastructure, December 2001 [DAA Report ID 106005/106039].

In 2001 Western Infrastructure, on behalf of Main Roads, commissioned Australian Interaction Consultants (AIC) to conduct a Site Identification ethnographic Aboriginal heritage survey for proposed roadworks of Armadale Road from Nicholson Road in the west to Wungong Brook in the east (Parker & Parker 2001: 7).

Archival research conducted by Parker and Parker (2001) revealed that there were three previously recorded DAA ethnographic sites located within the vicinity of the survey corridor (Parker & Parker 2001: 11).

During ethnographic consultations held with several representatives from the Nyungah Circle of Elders, the Swan Valley Nyungah Community and the Garlett Family, it was advised that the spiritual wellbeing of Lake Forrestdale and the nearby Wungong Brook relied on the health of the waterways, turtles and birds, and was intertwined with the spirituality of the waterway itself (Parker & Parker 2001: 14). As such the waterways were defined to be places of significance to Nyungah people (ibid: 15). It was further reported that whilst the Aboriginal informants were inspecting the survey corridor near Lake Forrestdale they noticed that artefactual evidence was present in areas where there had previously been ground disturbance (ibid). As such they concluded that, "the entire dunal system was probably the host of a continuous assemblage of artefactual material" (ibid).

In relation to the current BGA (2017) survey, the AIC (2001) survey corridor is located along Armadale Road, with approximately 1.5km overlaying the survey road corridor between Anstey Road and Nicholson Road.

Venz, T. and Glendenning, W. 2001, *Report of an Aboriginal Heritage Survey of the proposed Thomsons Lake Regional Centre, North Jandakot*, report prepared for LandCorp, June 2001 [DAA Report ID 19409].

In January 2001 LandCorp commissioned McDonald, Hales and Associates to conduct an Aboriginal heritage survey of the proposed Thomsons Lake Regional Centre at North Jandakot (Venz & Glendenning 2001: 1).

The Thomsons Lake locality had been identified as an important regional centre and as such LandCorp wished the consultants to identify the need for further archaeological or ethnographic studies within the project area in order to remain compliant with the AHA (Venz & Glendenning 2001: 2).

Archival research conducted by Venz and Glendenning (2001) revealed that there was one previously recorded ethnographic site, Site ID 3423 'Forrest Road', located within the Thomsons Lake Regional Centre survey area (Venz & Glendenning 2001: 21).

During ethnographic consultations held with several representatives of the Bibbulmun Tribal Group, the Ballaruk Aboriginal Corporation, the Combined Metropolitan Group and the Bropho, Colbung, Hume, Hansen, Bennell, Wally and Gentle families, it was determined that the Forrest Road swamp is significant due to its mythological association with the *Waugal* (Venz & Glendenning 2001: 25). However, no information specific to this mythology or the site was provided (ibid). A number of waterways in the area, including North Lake, Bibra Lake, Thomsons Lake, Kogolup Lake and Lake Coogee, were reported to form a lake chain and ecological framework for Aboriginal seasonal and social movements throughout the area (ibid: 23, 25-26). A campsite was reported to be located in the area to the northwest of the Forrest Road swamp, near the intersection of Poletti Road and North Lake Road, with one informant advising that a family had camped in the area during the 1940s whilst cutting bean sticks from Tea Trees (DAA Place ID 18752 'Camp Site') (ibid: 25). The Tea Trees and Paperbark trees in the area were reported to be important to Nyungar people as they had been used traditionally for medicinal purposes, with the Tea Trees also reportedly being used to make spears (ibid: 27).

As a result of this survey Venz and Glendenning (2001) recommended that LandCorp lodge a Section 18 application under the AHA in order to undertake proposed modifications to DAA ID 3423 'Forrest Road' (Venz & Glendenning 2001: 30).

In relation to the current BGA (2017) survey, the Venz and Glendenning (2001) survey area is situated west from Kwinana Freeway to Poletti Road, overlaying approximately 600m of the survey area along Beeliar Drive.

O'Connor, R. 2001, *Report on an Ethnographic Survey of the Proposed South West Metropolitan Railway Reserve*, report prepared for the Department of Transport, May 2001 [DAA Report ID 20507].

In 1994 the Department of Planning and Urban Development commissioned O'Connor to conduct an ethnographic survey of a proposed South West Corridor Transport Reserve (O'Connor 2001: 1). The resulting report was submitted to the DAA in January 2001 (ibid). As a result of the comments from the DAA, as well as alterations to the 1994 rail alignment, another ethnographic survey for the South West Metropolitan Rail Reserve was commissioned in March 2001 (ibid).

Specifically, the Department of Transport wished to construct a high speed passenger train system between Perth and Mandurah (O'Connor 2001: 1). The survey area was a 50m wide corridor on both sides of the rail route from its entire length between the Anketell Tunnel and Mandurah (ibid: 2).

Archival research conducted by O'Connor (2001) revealed that no areas of significance to Aboriginal people had been recorded within the project area since the 1994 report (O'Connor 2001: 6). The 1994 report by O'Connor, Quartermaine and Yates is reviewed by the author below.

During ethnographic consultations held with several representatives of the Gnaala Karla Booja WC1998/058 and Ballaruk WC1998/086 Native Title Claim groups, as well as members from the Naramaya Aboriginal Corporation and elders from the Peel Region group, no ethnographic information pertaining to the Cockburn and Armadale areas were recorded. The Aboriginal informants did, however, request that the rail and road works have a 50m buffer zone from nearby lakes and wetlands (O'Connor 2001: 7-8). The Traditional Owners also requested that an ochre site, located between Lakelands and Paganoni Road, and an Aboriginal cultural meeting area / social gathering place, located on the west side of Johnson Road and south of Orton Road, avoid being impact upon as a result of the proposed works (ibid: 7, 8-9).

As a result of this survey O'Connor (2001) recommended that Aboriginal monitors be present during the clearing of bushland areas; that information regarding the planning and design for water catchment, runoff, drainage points and pond provisions be provided to the Aboriginal informants; and that seed collection occur prior to vegetation clearing (O'Connor 2001: 10).

In relation to the current BGA (2017) survey, the O'Connor (2001) survey area is a 100m wide survey corridor running along the Kwinana Freeway, overlaying a small portion of the Armadale Road survey corridor.

Locke, R. and Burke, S. 1998, *Report of an Aboriginal Heritage Survey Thompsons Lake Estate*, report prepared for Richard Noble and Company, September 1998 [DAA Report ID 102213].

In June 1998 Richard Noble and Company, on behalf of Gold Estates of Australia, commissioned McDonald, Hales and Associates to conduct an Aboriginal heritage survey of a proposed housing subdivision and associated infrastructure in Jandakot (Locke & Burke 1998: 1).

Specifically, Gold Estates Australia wished to develop land roughly bounded by Bartram Road, Hammond Road and the Thomsons Lake reserve (Locke & Burke 1998: 1).

Archival research conducted by Locke and Burke (1998) revealed that there were two previously recorded DAA ethnographic sites, DAA ID S02731 'Twin Bartram Swamps' and DAA ID S02730 'Hammond Road Swamp', located within the wider Thomsons Lake area (Locke & Burke 1998: 1, 29). An ethnographic campsite, DAA ID S02672, was also determined to be located a short distance outside of the survey area, however no further details were provided (ibid: 29).

During ethnographic consultations held with several representatives of the Ballaruk Aboriginal Corporation, Nyungar Circle of Elders and other Nyungar groups, it was determined that Nyungar people camped in the Thomsons Lake region as late as the 1980s (Locke & Burke 1998: 30). A campsite, located some 100m south of Bartram Road and 250m west of the Kwinana Freeway, was reported to be ethnographically significant as it was utilised by people moving along traditional north-south runs based upon seasonal game and work availability cycles (ibid). The consultants recorded this campsite as 'TLE1' (ibid). During the consultations the Aboriginal informants expressed their concerns about the wetlands and watercourses in the area, advising that they are the manifestation of the/a *Waugal* and are of cultural significance (ibid: 32). However, no specific mythology regarding the *Waugal* was reported (ibid).

As a result of the survey, Locke and Burke (1998) recommended that the proponents seek permission under Section 18 of the AHA in order to impact upon the land located within DAA ID S02731 'Twin Bartram Swamps' and the newly recorded 'TLE1' ethnographic campsite (Locke & Burke 1998: 36)

In relation to the current BGA (2017) survey, the Locke and Burke (1998) survey area is located to the east of Kwinana Freeway and the south of Beeliar Drive.

Collard and Collard Consultants 1998, *Aboriginal Heritage Survey Consultation: Proposed Development Thompson's Lake*, report prepared for McDonald, Hales and Associates, July 1998 [DAA Report ID 103577].

In June 1998 McDonald, Hales and Associates, on behalf of Richard Noble and Associates, commissioned Collard and Collard Consultants to conduct an Aboriginal heritage survey consultation for a proposed development at Thomsons Lake (Collard & Collard 1998: 1).

During ethnographic consultations held with representatives from the Nyungar Circle of Elders and related groups, it was reported that there was a camping spot located to the north of Thomsons Lake, however the exact location was not known (Collard & Collard 1998: 1).

As a result of the survey, Collard and Collard Consultants (1998) recommended that existing Aboriginal heritage sites in the area be protected and that the project proceed as planned, as documented in the accompanying McDonald, Hales and Associates report (DAA Report ID 102213) (Collard & Collard 1998: 3).

In relation to the current BGA (2017) survey, the Collard and Collard (1998) survey area is located to the east of Kwinana Freeway and the south of Beeliar Drive.

O'Connor, R., Quartermaine, G. and Yates, A. 1994, *Report on an Aboriginal Site Survey of the Proposed South West Corridor Transport Reserve*, report prepared for the State Planning Commission Department of Planning and Urban Development, September 1994 [DAA Report ID 105233].

The Department of Planning and Urban Development commissioned O'Connor, Quartermaine and Yates to conduct an Aboriginal site survey for the proposed South West corridor transport reserve (O'Connor et al. 1994: 1).

The survey area was approximately 80km in length and 100m in width, beginning in Jandakot in the north and reaching through Wattleup, Kwinana, Rockingham and Mandurah in the south (O'Connor et al. 1994: 1).

Archival research conducted by O'Connor et al. (1994) revealed that there were no previously recorded DAA sites of significance located within the survey area (O'Connor et al. 1994: 7).

During ethnographic consultations held with several representatives of the Ballaruk Aboriginal Corporation, the Medina Aboriginal Cultural Group, elders from the Kwinana/Medina region and elders of the Mandurah/Peel region it was determined that no Aboriginal sites of significance would be impacted upon by the proposed project (O'Connor et al. 1994: 8). Anstey Swamp and Paganoni Swamp were reported by the Traditional Owners to be areas of generalised significance and as such the proposed alignment was amended to avoid impacting upon the wetlands (ibid: 9, 11).

As a result of the survey O'Connor et al. (1994) recommended that the project could proceed without requiring any necessary statutory approvals for its advancement in regards to Aboriginal heritage considerations (O'Connor et al. 1994: 12).

In relation to the current BGA (2017) survey the O'Connor et al. (1994) survey is an 80km wide, 100m in width corridor along the Kwinana Freeway, beginning from Mandurah in the south to Cockburn in the north.

O'Connor, R. and Bennell, P. 1991, *Report on an Aboriginal Consultation and an Ethnographic Survey of the Forrest Road to Thomas Road Section of the Kwinana Freeway*, report prepared for the Main Roads Department, April 1991 [DAA Report ID 104160].

In 1991 the Main Roads Department commissioned O'Connor and Bennell to conduct an Aboriginal Consultation and Ethnographic survey for a proposed extension of the Kwinana Freeway from Forrest Road to Thomas Road (O'Connor & Bennell 1991: 1).

Archival research conducted by O'Connor and Bennell (1991) revealed that there were no previously recorded DAA ethnographic sites of significance located within the survey area (O'Connor & Bennell 1991: 9). Mather Reserve, located approximately 1.5km east of the proposed Kwinana Freeway route to the immediate north of Bartram Road, was identified to be the nearest previously recorded site to the survey area (ibid: 9-10). The Mather Reserve wetlands were reported to have been fed by springs which were believed to be maintained by the creative actions of a *Waugal* (ibid: 10). The swampland was also reported to be used as a source of *yogoyne* or tortoise (ibid).

During ethnographic consultations held with several Nyungar representatives it was reported that the Michael/Bennell/Walley family established a permanent camp in the 1920s/1930s, located approximately 300m southeast of the junction of Forrest Road and Prinsep Road (O'Connor & Bennell 1991: 8, 17). The Michael Family were reported by the Aboriginal people consulted in the survey as having the longest association with the survey area which was utilised until the 1960s (ibid: 8, 17-18). The camp was reported not to be a 'stickcutters camp' (as reported by Locke & Murphy 1990), but was instead a permanent habitation whereby makeshift shelters were constructed in the scrubland immediately south of Forrest Road (O'Connor & Bennell 1991: 17). The water source of the camp was reported to be, "a nearby swamp around whose margins the occupants sank shallow wells" (ibid: 17-18). It was advised that the water in the wells was supplied by the *Waugal* and that the campsite and water sources are significant to the Aboriginal informants due to its former use, historical association, Aboriginal sentiment and the sacred belief that the source of water in the area is sustained by the actions of a *Waugal* (ibid: 18).

During the ethnographic consultations a number of additional water sources in the vicinity of the survey area were also reported to have significance. Two wetlands, located between Forrest Road and Bartram Road to the west of the Kwinana Freeway, and a wetland system called Lake Balmanup or Mandogalup Swamp, located between Rowley Road and Hope Valley Road, were reported to be Aboriginal sites of significance due to their use as water sources, tortoise-hunting areas and due to their mythological associations with the *Waugal* who was reported to sustain their water supplies (O'Connor & Bennell 1991: 18-19).

As a result of the survey O'Connor and Bennell (1991) recommended that Main Roads should make application under Section 18 of the AHA in order to carry out the proposed roadworks within the land between Rowley Road and Hope Valley Road (O'Connor & Bennell 1991: 21). It was also recommended that a plaque be positioned within the road reserve at the Aboriginal camp and water source located near the junction of Prinsep and Forrest Roads (ibid).

In relation to the current BGA (2017) survey, the O'Connor and Bennell (1991) survey area is an approximate 150m wide corridor along the Kwinana Freeway from Thomas Road in the south to Armadale Road/Beeliar Drive in the north.

Locke, R. and Murphy, A. 1990, *Report of an Aboriginal Sites Survey of the Thompson's Lake Area*, report prepared for Feilman Planning Consultants Pty Ltd and LandCorp, May 1990 [DAA Report ID 103280].

In 1990 Feilman Planning Consultants Pty Ltd and LandCorp commissioned McDonald, Hales and Associates to conduct an Aboriginal heritage survey for Aboriginal sites in the Thomsons Lake Area (Locke & Murphy 1990: 3). The proposed development area covered approximately 500 hectares, roughly bounded by Gibbs and Bartram Roads to the south, Tapper Road to the east, Hannard Road to the west, and Forrest Road in the North (ibid).

Archival research conducted by Locke and Murphy (1990) revealed that there were no previously recorded DAA ethnographic heritage sites located within the survey area (Locke & Murphy 1990: 9). However, a previously unrecorded campsite was located in close proximity to the northwest of the survey area during the accompanying archaeological inspection (ibid). An additional four previously recorded sites, DAA ID S01865 'Kangaroo', DAA ID S0188 'Yangebup Lake', DAA ID S0192 'Bibra Lake' and DAA ID S02209 'North Lake and Bibra Lake', were identified as located within a 5km radius of the project area (ibid: 12). These sites were reported to be reflective of an Aboriginal pattern of occupancy and movement following a chain of freshwater lakes across the region (ibid: 13).

During ethnographic consultations held with three Aboriginal informants it was determined that there were no new ethnographic sites of significance located within the survey area (Locke & Murphy 1990: 12). An Aboriginal informant indicated that there had been a campsite used from the 1940s – 1950s located in the area, however he was unable to report on the exact location of the campsite and therefore was unable to determine whether it would be impacted on by the proposed works (ibid: 9-10, 15). When the informant advised that he would consult with his relatives in regards to the location of the campsite, he did not report back to the consultants and the location of the camp was unable to be clarified (ibid). It was therefore unable to be clarified whether this reported camp was the same camp identified during the archaeological survey (ibid: 15).

As a result of this survey the consultants concluded that it was unlikely that the reported campsite met the definition of a site under the AHA (Locke & Murphy 1990: 15). However, it was recommended that the campsite uncovered during the archaeological survey be mapped in order to determine its location, and the potential for the proposed works to disturb it, in relation to the project area (ibid).

In relation to the current BGA (2017) survey, the Locke and Murphy (1990) survey area comprises a 2km x 3.5km survey area which extends west of Tapper Road and south of Armadale Road.

Reynolds, R. 1984, *A Survey for Aboriginal Sites on the Proposed Route of the Kwinana Freeway Southern Extension (South Street to Thomas Road)*, report prepared for the Main Roads Department, June 1984 [DAA Report ID 104489].

In May and June 1984 Robert Reynolds conducted an archaeological and ethnographic Aboriginal heritage survey for the Main Roads Department for a proposed extension to the Kwinana Freeway from South Street in Murdoch to Thomas Road in Medina (Reynolds 1984: 2).

Archival research conducted by Reynolds (1984) revealed that the chain of lakes from North Lake to the Spectacles were a major economic resource in traditional Aboriginal society which continued to be used sporadically in contemporary times (Reynolds 1984: 3).

During the ethnographic survey it was reported by an Aboriginal informant that a camping area on the northern edge of North Lake was established in the 1940s and utilised by the Indich, Jackson, Reagan and Cooma families (Reynolds 1984: 3). These families walked to Willagee to obtain food and clothing and to Bibra Lake for fresh water (ibid). Reynolds (1984: 6) concluded that, as a result from information gathered from both historical sources and the Aboriginal informants, activity was centred on the chain of lakes situated approximately 2km west of the proposed Kwinana Freeway route. None of the Aboriginal informants were reported to have any objections to the proposed route (ibid).

As a result of the survey Reynolds (1984) recommended that Main Roads could proceed with the proposed works on the provision that they apply to the Western Australian Museum for permission to disturb a small artefact site (DAA ID S1988) (Reynolds 1984: 7).

In relation to the current BGA (2017) survey, the Reynolds (1984) survey area is an approximate 150m wide corridor along the Kwinana Freeway from Thomas Road in the south to South Street in the north.

O'Connor, R., Bodney, C. and Little, L. 1985, *Preliminary Report on the Survey of Aboriginal Areas of Significance in the Perth Metropolitan and Murray River Regions*, report prepared for the Centre for Prehistory at the University of Western Australia on behalf of the Department of Aboriginal Sites at the Western Australian Museum, July 1985 [DAA Report ID 102670].

In 1985 the Centre for Prehistory at the University of Western Australia, on behalf of the Department of Aboriginal Sites at the Western Australian Museum, commissioned O'Connor, Bodney and Little to carry out the ethnographic component of a project examining Aboriginal sites in the Perth Metropolitan region (O'Connor et al. 1985: 1).

The survey area focused on the Perth Metropolitan region bounded by the Yanchep National Park in the north, Gidgegannup in the east and Pinjarra in the south (O'Connor et al. 1985: 2).

In the southern region of the Perth Metropolitan area, Bibra Lake, North Lake and Lake Forrestdale were reported to be a chain of freshwater lakes linking the Swan River to the Murray River (O'Connor et al. 1985: 85-86). O'Connor reported that there was little ethnographic evidence supporting Hammond (1933), who stated that this chain of lakes was a native pad (or path) from the ocean at North Fremantle to Bibra Lake, Rockingham, Mandurah and then along both sides of the Murray River to Pinjarra (Hammond 1933: 17 cited in O'Connor et al. 1985: 86). O'Connor further reported that a *Waugal* inhabited the lakes and maintained the flow of the springs that fed the lakes (O'Connor et al. 1985: 86). It was further reported that Lake Forrestdale, "is the home of a powerful *Waugal* who is associated with rain" (ibid: 90). Disturbance of the reeds around the verge of Lake Forrestdale was reported to be forbidden as it could unleash the destructive power of the *Waugal* (ibid). As Lake Forrestdale was a source of turtles, it was reported that families from Pinjarra, Mandurah and Armadale camped at the north-western edge of the lake under the shade of the *Melaleuca* trees present (ibid: 92).

As a result of the reported ethnographic information regarding North Lake, Bibra Lake and Lake Forrestdale it was recommended that the sites be registered under the AHA (O'Connor et al. 1985: 121).

In relation to the current BGA (2017) survey, the O'Connor, Bodney and Little (1985) survey area is located over the entirety of the Armadale Road survey corridor.

OUTCOMES OF ARCHIVAL RESEARCH

In relation to this survey a search of the DAA Aboriginal Heritage Inquiry System was conducted on the **20th February 2017** in order to determine if any previously recorded Aboriginal heritage sites or places are located within the Armadale Road Duplication survey corridor which could be impacted upon by the proposed works (see Appendix 1: DAA Sites and Places Register Search).

The search revealed that there are **no** previously recorded ethnographic heritage sites and **one** other heritage place, Place ID 3423 'Forrest Road', with a DAA extent intersecting the Armadale Road survey corridor (see Table 1: Summary of Aboriginal heritage sites or places within the project area).

Three other heritage places, Place ID 3300 'Readymix Sandpit 2', Place ID Readymix Sandpit 1' and Place ID 3301 'Banjup: Calsil' are also located with DAA site extents intersecting the survey road corridor. However, as they are archaeological places they will be discussed in the accompanying archaeological report (see O'Reilly 2017).

Archival research has revealed that Place ID 3423 'Forrest Road' was reported to be a water and food source for a nearby camp and a meeting place on a 'pad' (or traditional walk path) from Medina to Armadale (O'Connor 1991: 17). 'Forrest Road' was recorded as having associations with the Dreaming creation serpent called the *Waugal* who sustained the water at the swamp and whose spirit was reported to continue to reside in the swamp (ibid: 18). An examination of the DAA place file has revealed that no specific mythology regarding the swamp has been recorded. However, it was reported that the Forrest Road swamp is part of a chain of water bodies along the coast which are linked through the travels of the *Waugal* and form a traditional path that Aboriginal people travelled along (Anthropos 2010: 17). The camp was reported to be used from the 1920s until the 1940s by seasonal Aboriginal workers undertaking bean-stake cutting from Tea Trees on the nearby farms and who sunk shallow wells at the side of the swamp (ibid: 17-18; Venz & Glendenning 2001: 25). It was also reported by an Aboriginal informant that births could have taken place next to the Forrest Road swamp, however no specific details have been recorded in regards to this (O'Connor 1991: 17).

In relation to the current survey, Place ID 3423 'Forrest Road' is located to the west of Kwinana Freeway along Midgegooroo Avenue. A triangular portion of the DAA place extent, measuring approximately 44m NW/SE x 60m W/E x 75m S/E, intersects with the western end of the road survey corridor.

As Place ID 3423 'Forrest Road' is **not a site** under the AHA, the proponent has no further legal obligations under the AHA in relation to this place and **is not required** to take any action in relation to the AHA.

IDENTIFICATION OF SPOKESPEOPLE

THE RIGHT TO SPEAK ON HERITAGE ISSUES

Various authors have discussed the contemporary problem of whom in the Aboriginal Community has the authority to speak on heritage issues within an area. O'Connor (et al. 1989: 51) suggests that when this question is posed to people in Aboriginal Australia, answers are usually framed by such terms as 'the Traditional Owners', i.e., those people who are defined by place of birth, or descent. Myers (1986) presents a broader and more contemporary view of 'ownership' based upon descent and association,

An estate, commonly a sacred site, has a number of individuals who may identify with it and control it. They constitute a group solely in relationship to this estate... Identification refers to a whole set of relationships a person can claim or assert between himself or herself and a place. Because of this multiplicity of claims, land holding groups take essentially the form of bilateral, descending kindred. Membership as a recognised owner is widely extended, and therefore groups are not a given (Myers 1986: 128).

Myers (1986) further clarifies the current perception of 'ownership',

....such rights exist only when they are accepted by others. The movement of the political process follows a graduated series of links or claims of increasing substantiality, from mere identification and residual interest in a place to actual control of its sacred association. The possession of such rights as recognised by others, called 'holding' (*kanyininpa*) a country, is the product of negotiation (Myers 1986: 128-129).

While the notion of descent is clearly an important criterion within Myers analysis, it must be seen in terms of the contemporary Nyungar situation. Nyungar tradition in the south west has been seriously eroded since colonisation, lines of descent have been broken and previously forbidden and mixed marriages have interconnected many Nyungar groups who would not have traditionally had a close association (Machin 1993: 20). Consequently, in contemporary times the criteria of historical 'association' may in some cases also be regarded as a 'right to speak' on heritage issues within an area,

Traditional subsistence no longer sufficed to support Aboriginals so they combined this with menial work on farms and over time new relationships to land developed. As a consequence, the more recent history associated with their involvement with European agriculture and labour patterns is often more relevant than the pre-contact mode of attachment to an old way of life and the roots of the identity as original owners of the land. Biographical associations are often tied to post-settlement labour patterns and identification. These can predominate. This is part of a dynamic process of ethnicity, identity and tradition (Machin 1995: 11).

O'Connor (et al. 1989) identified several criteria's for determining contemporary community spokespeople. A spokesperson must have a long-term association with an area, usually as a young person, and extensive contact with a member of the 'pivotal generation of the culture transmitters', i.e., those people whom, as children themselves, had contact with people who could pass on traditional knowledge. A spokesperson must also demonstrate knowledge of the region's natural resources, hunting, fishing and camping grounds, local water sources and flora. This is important because a person without this knowledge is unlikely to be seen by their fellow Nyungars as truly being from that country, despite having been born or lived in that area. In some cases, people from outside a specific region have established themselves by political activism. They are accepted by their fellow Nyungars because they may have participated in mainstream white pursuits, such as advanced education, or legal and political careers, that have

empowered them within the broader community. As such, these people are a valuable resource to the local Aboriginal Community. The people consulted in this survey fulfil at least one of these criteria.

NATIVE TITLE CLAIMS OVER THE SURVEY AREA

Currently lodged with the Register of Native Title Claims and the Schedule of Applications, held by the Commonwealth Native Title Tribunal, there is one registered Native Title application that overlays the project area. The Schedule of Applications includes registered applications, unregistered applications and applications still undergoing the registration test.

- **Whadjuk People WC2011/009 WAD242/11 (Registered)**

Applicants: Mr C. Davis, Mr N. Morich, Mr N. Wilkes, Mr T. Nettle, Ms D. Wynne.

SELECTION OF SPOKESPEOPLE FOR THIS SURVEY

As the representative body under the *Native Title Act 1993* for the registered Whadjuk People WC2001/009 Native Title Claim (NTC) group, the South West Aboriginal Land and Sea Council (SWALSC) were required to select representatives to be consulted with in regards to the project.

In line with the terms of the Main Roads Noongar Standard Heritage Agreement (NSHA), an Activity Notice for the project was submitted to SWALSC. On the 1st of February 2017 Ms Carolyn Fennelle (Legal Officer) from SWALSC emailed Mr JJ McDermott (Heritage Officer) from Main Roads with a list of appropriate people to be consulted with in regards to the project. The following Whadjuk representatives were nominated by SWALSC to attend the survey:

- Rev. Cedric Jacobs
- Ms Glenys Yarran
- Mr Harry Nannup
- Ms Dorothy Getta
- Ms Tanya Bodney
- Mr Stanley Headland
- Mr Russell Hansen
- Ms Esandra Colbung

Of these nominated representatives Rev. Cedric Jacobs, Mr Russell Hansen, Ms Tanya Bodney and Ms Esandra Colbung were unable to attend the survey. Prior to the survey commencing SWALSC endorsed Ms Kezia Jacobs-Smith to attend the survey in place of her grandfather, Rev. Cedric Jacobs. Mr Jayme Garrod and Mr Harry Nannup Junior were also present on the survey (accompanying other representatives), however, as they were not nominated by SWALSC to participate in the survey they were not financially reimbursed for their time.

The following SWALSC-nominated representatives attended the ethnographic consultations on the 21st February 2017:

Ms Glenys Yarran was born in York to parents Mr Thomas Ponton Lawrence, from the Burswood area, and Ms Mary Blurton, from Katanning. Ms Yarran's paternal grandparents are Ms Susan Indich, from Perth, and Mr Lorenzo Ponton, who was born at Thomas River in Esperance. Ms Yarran's maternal grandparents are Ms Philamena Gibbs, from Katanning, and Mr Matthew Blurton, from Quairading. Ms Yarran undertook schooling in York, Northam and New Norcia, before undertaking employment at Landcare, the Avon Catchment Council and the Ngunamoor Organisation. Ms Yarran shares a cultural association to the project area through her traditional familial descent, in particular through her apical ancestor Thurban. Ms Yarran was selected by SWALSC to participate in this survey.

Mr Harry Nannup (Senior) was born on an Aboriginal Reserve in Pinjarra to parents Mr Joseph Nannup, from Busselton, and Ms Dulcie Hart, from Williams and Quindanning. Mr Nannup's paternal grandparents were Mr David Nannup, whose father was Mr David William Nannup, and Ms Emily Jones, an Irish midwife. Mr Nannup is a member of both the South

West Boojarah and the Gnaala Karla Booja Native Title Claim groups due to his ties to the *Bindjareb* people. Mr Nannup grew up living at camps along the Serpentine River and the Lake Forrestdale area before attending mission schools in Wandering, New Norcia and Pinjarra. Upon leaving school Mr Nannup commenced work as a general labourer, at the Aboriginal Medical Services in Perth and as a member of the Mandurah Community Museum's Indigenous Advisory Group. Mr Nannup was selected by SWALSC to participate in this area as a Traditional Owner with historical and familial ties to the Forrestdale area.

Ms Dorothy (Doris) Getta was born in Kellerberrin to Mr Patrick Getta, from the Swan River area, and Ms Christine Michael, from Northam. Both her parents were taken as children to the New Norcia Mission. As such details about Ms Christine Michael's parents are unknown. Ms Getta's paternal grandfather was Mr Peter Getta from the Swan River area. His parents were Mr Paul Getta and Ms Theresa Walback from the Swan River region. Ms Getta attended schooling in Fremantle and Midland and worked picking grapes in the Upper Swan region. Ms Getta is a member of the Whadjuk NTC claim group and shares a cultural association to the project area through her great-grandmother. Ms Getta was nominated by SWALSC to participate in the ethnographic survey.

Mr Stanley Headland was born in Kununoppin to parents Mr Hugh Headland who was born in Bassendean and Ms Blanch Headland (nee Anderson) from Moora. Mr Headland attended schools in Karrinyup, Meriden and then the Gnowangerup Agricultural College. Mr Stanley Headland was nominated by SWALSC as a member of the Whadjuk WC2011/009 Native Title Claim group to participate in this survey.

Ms Kezia Jacobs-Smith was born in the Swan District to her mother Ms Karen Jacobs. Ms Jacobs-Smith maternal grandparents are Reverend Cedric Jacobs, from York, and Mrs Margaret Jacobs, from the United Kingdom. Reverend Jacobs' parents are Mr Leslie Jacobs and Mrs Eileen Jacobs (nee Garlett). Mr Leslie Jacobs' parents are Mr Edward Jacobs and Mrs Ava Jacobs. Ms Jacobs-Smith's apical ancestor is *Doornung* from Guildford. Doornung's son was called *Moorytch* who was married to a woman called *Wooleenan* and together had a daughter called *Ngoweran*. Ngorweran was the mother of Ava, Ms Jacob-Smith's great-great grandmother. Ms Jacobs-Smith undertook schooling in Mandurah and at the University of Western Australia before working with IES Enviro-Scapes. Ms Jacobs-Smith shares a cultural association to the project area through her mother's familial connections to country and is a member of the Whadjuk WC2011/009 Native Title Claim group. Ms Jacobs-Smith was endorsed by SWALSC to attend the survey in place of her grandfather who was unable to attend.

COMMUNITY CONSULTATION

AIMS

- To establish contact with Aboriginal people who retain traditional or current knowledge pertaining to the region.
- To determine if there are any sites or places of significance, as defined by Section 5 of the AHA, within the project area.
- To record any ethnographic information provided about identified sites or places.
- To generate consensual recommendations from the Aboriginal community representatives in regards to any Section 18 requests and to record management strategies for identified ethnographic and archaeological sites.

METHOD

To arrange the survey the selected informants were contacted by phone with an onsite meeting arranged. At the commencement of the meeting the informants were briefed as to the details of the project with the aid of the project plans and previously recorded Aboriginal heritage sites overlaid upon a large scale air photo map.

Ethnographic information was recorded in a notebook and photographs of the survey process were taken. GPS coordinates of any cultural features were recorded in the field and transferred to mapping software ArcView V10 where final maps were produced.

COMMUNITY CONSULTATION PROCESS

On the 21st of February 2017 BGA consultants, Mr Brad Goode and Ms Louise Huxtable (Anthropologists), met 7 members of the Whadjuk WC2011/009 Native Title Claim group, Ms Glenys Yarran, Mr Harry Nannup Senior, Ms Dorothy (Doris) Getta, Mr Stan Headland, Ms Kezia Jacobs-Smith, Mr Harry Nannup Junior and Mr Jaymee Garrod, at 1pm at the Alfred Skeet Oval, located on the southern side of Armadale Road in Forrestdale at GPS coordinates 399354mE 6442621mN. Mr John Braid (Principal Environment Officer), Mr Todd Craig (Principal Heritage Officer) and Mr Sergio Martinez (Project Manager) from Main Roads, as well as Ms Hayley Martin (Civil Engineer) from WSP Parsons Brinckerhoff, were also in attendance to provide technical details in regards to the project.

Mr Goode began the survey by introducing the participants and explaining that Main Roads wish to undertake roadworks on Armadale Road, beginning at Anstey Road in Forrestdale and extending west to Tapper Road just before the Kwinana Freeway. He added that the survey will also take into consideration the possible future widening of the Kwinana Freeway/Armadale Road Bridge.

Ms Yarran enquired into why some Traditional Owners were present on the survey who are not members of the Whadjuk Native Title Claim group and expressed her concerns that they may be inappropriately speaking for country that they are not culturally authorised to do so.

Mr Goode responded by explaining that several of the Traditional Owners have familial connections and knowledge which extend over multiple native title claim groups. As such, Mr Goode explained, they have an interest in the survey area and have a right, under the AHA, to be consulted with in regards to the project. Mr Goode then went on to explain the survey team selection methodology used whereby the participants are chosen by SWALSC due to their family relationships, historical connection or cultural knowledge associated with the survey area.

Mr Goode then explained that the survey corridor is too unsafe to inspect by slowly driving along Armadale Road due to the volume of traffic. As such the group would remain at the meeting place and discuss the project with the aid of an aerial photographic map depicting the survey corridor.



Figure 3: The ethnographic survey team discussing the proposed Armadale Road Duplication project at the Alfred Skeet Oval, view south-west.

Mr Goode advised that BGA archaeologist Mr Tom O'Reilly, assisted by Mr Stan Headland, had conducted an archaeological inspection of the survey corridor on foot and had not found any artefacts. He stated that this included examining three archaeological places (Place ID 3301 'Banjup: Calsil'; Place ID 4108 'Readymix Sandpit 1'; and Place ID 3300 'Readymix Sandpit 2') which have DAA place extents overlaying the survey corridor. Mr Goode advised that survey corridor has been heavily disturbed by the construction of multiple developments and as such the archaeologist had not found any artefacts at the previously recorded places (see O'Reilly 2017).

Mr Headland agreed with Mr Goode and stated that the archaeological sites have all been disturbed by construction works.

Mr Craig added that the surface artefacts of two of the archaeological places were collected by the Western Australian Museum in the 1970s (see O'Reilly 2017).

In addition to the archaeological sites, Mr Goode explained, there is an ethnographic place (Place ID 3423) located at the western end of the survey corridor called 'Forrest Road'. He explained that this place has been heavily impacted upon by developments as well and has a small portion of the DAA extent overlaying the survey road corridor.

Mr Martinez then explained the proposed works in depth, referring to a CAD drawing of the project. He stated that from Anstey Road in Forrestdale to Tapper Road in Atwell, Main Roads are proposing to widen the existing two lane road to a four lane motorway, with some sections of the road being widened an additional two lanes to create a six lane motorway. The Armadale Road/Kwinana Freeway Bridge would also likely undergo upgrades and widening in the future, however these plans had not been finalised. As part of this project, Mr Martinez added, several intersections are proposed to be upgraded which will include the construction of roundabouts at the Liddelow Road, Warton Road, Wright/Taylor Road and Nicholson Road intersections. Several new slip lanes and access roads are also proposed to be constructed along Armadale Road, as well as the upgrading of existing access roads. A new road is also proposed to be

developed to the north of Liddelow Road which will be accounted for in the upgrading of the Liddelow Road/Armadale Road intersection. A footbridge and bus bay are also proposed to be constructed near Trusty Way.



Figure 4: Mr Sergio Martinez (Project Manager) from Main Roads explaining the proposed Armadale Road Duplication project to the Traditional Owners, view south.

Mr Goode then enquired into the width of the road widening.

Mr Martinez responded that the width of the widening would vary at different sections along Armadale Road but on average the road duplication would be contained within the existing fence lines on either side of the current road.

Ms Jacobs-Smith enquired into whether vegetation clearing would only be undertaken in the area between the existing fence lines or whether there would be a buffer zone outside of the fence lines in which clearing would also occur.

Mr Martinez responded that vegetation clearing would predominately be conducted within the fence lines, however some vegetation clearing may also be necessary outside of the existing fence lines where the creation of new access roads, slip lanes and intersection upgrades are required.

Mr Goode then enquired into how run-off from the road is proposed to be managed.

Mr Martinez responded that drainage would be captured in detention basins which will be placed along Armadale Road at intervals.

Mr Goode clarified that therefore, due to the detention basins, there should be no potential impacts upon the wetlands in the vicinity of the survey road corridor as a result of the roadworks.

Mr Martinez agreed.

Mr Goode then enquired into whether there would be much cutting into the natural landscape in order to carry out the works on Armadale Road.

Mr Martinez responded that there would be some localised cutting required due to the different elevation levels in the topography of the land along the road. However, he added, the material from the cuttings will be reused in the road building if it is deemed suitable.

Here Mr Goode enquired into whether the Traditional Owners have any questions in regards to the technical aspects of the project.

Mr Headland enquired into whether monitors would be required during the works in case artefacts are uncovered.

Mr Goode responded that this decision would be made by Main Roads, however they would give due consideration to monitoring if it is requested by the Traditional Owners. He stated that, as there are previously recorded artefact scatters, sand dunes and wetlands in the area, additional artefacts could be present in the survey road corridor. Mr Goode explained that in order for artefacts to be of value they need to be found in their original condition and context. As the survey road corridor has been heavily disturbed and artefacts have likely been disturbed and/or relocated, he elaborated, the artefacts lose their scientific significance.

Ms Jacobs-Smith responded that the artefacts are still seen to have cultural significance to the Traditional Owners, despite being disturbed. She stated that artefacts contain importance and value as evidence of the Traditional Owners ancestors' occupation of the area and how these ancestors shaped and modified different materials for various uses. Ms Jacobs-Smith added that the artefacts can contain value outside of the scientific definition of 'value'.

Mr Headland agreed and observed that there is a quarry located to the north of Armadale Road near Banjup. As such, he stated, there could be artefacts located beneath the surface and Aboriginal monitors should therefore be present during the ground disturbing works to observe any archaeological material that is uncovered as a result of the works.

Mr Nannup Senior agreed and stated, "Our people lived and camped in this area. It is sacred and we don't want the evidence of the old fellas lost. Whatever comes out of the ground gets wiped off [removed] and that's a concern".

Mr Goode then enquired into whether the Traditional Owners are of the view that if any artefacts are found during the works they should be relocated and if so where. He also enquired into whether any rituals are required if artefacts are found.

Mr Headland responded that if artefacts are found during the works they should be removed temporarily until the works are completed and then returned to where they were found.

Ms Jacobs-Smith responded that the artefacts may not be able to be put back into their original location if they are situated within the road building area.

Mr Goode advised that there is a legal process to be followed when artefacts are uncovered, whereby the works are to stop and an archaeologist is to be called in to record and salvage the material. He stated that once the artefacts are salvaged, it is up to the Traditional Owners as to if and where they are relocated. Mr Goode added that he is of the opinion that there is potential for artefacts to be present beneath the ground surface due to the number of resources in the area that could have been traditionally and historically utilised by Nyungar people.

Ms Yarran stated that the artefacts in the area are significant due to their association with the "old people" (Nyungar ancestors).

Mr Goode advised the group that Lake Forrestdale (located approximately 400m south of the most eastern end of the survey road corridor) is a DAA registered site, being recorded as a camp, hunting ground and mythological place. He enquired into whether the Traditional Owners are aware of any other ethnographic sites or places located within the survey road corridor.

Mr Headland responded that Forrest Road is an ethnographic campground, however it is no longer registered with the DAA.

Mr Goode agreed and advised the Traditional Owners that Forrest Road was recorded as a historical camp site where a *Waugal* story was reported. He added that artefact scatters had also been found at the camp. Mr Goode stated that just because a place is not registered as a DAA site, it does not mean that it is not a place of importance to Aboriginal people.

Ms Yarran stated that developments have destroyed a number of sacred sites along Armadale Road.

In relation to Lake Forrestdale Mr Nannup Senior stated,

The lake is a culture place, the old people camped all around the lake. My aunt and uncle used to camp right around the lake, there were Nyungar camps everywhere. I was 16 then, I'm 71 now so it was a fair while ago [around 1962]. They camped all the way from this lake, across near the wetlands and swamps and up to the other swamp [at Forrest Road]. The younger people would be employed to work for bean cutting and tomato growing and their families would camp nearby. They would camp from here up past the freeway. There used to be two *Waugals* in the lakes. One *Waugal* would call to the other *Waugal* on the other side, they would talk to each other. The *Waugals* had been there as far back as I can remember but after they made Adventure World one of the *Waugal's* disappeared (pers. comm. H. Nannup Senior 21/2/2017).

Mr Goode enquired into what happens if the *Waugal* disappears. In response, Ms Getta said that the waterways dry up if the *Waugal* disappears.



Figure 5: Mr Brad Goode (Anthropologist) from BGA, right, pointing out the direction of wetlands located in the Forrestdale, Banjup and Atwell areas, view south-east.

Mr Goode enquired into whether the Traditional Owners knew of any camps or *Waugal* places located within the survey corridor.

Mr Nannup Senior responded that he did not know of any specific camps located along the survey road corridor, however Nyungars would move camps depending on the availability of food and water. As such, he stated, that there were no specific places for camping and Nyungars would move all over the area.

Ms Yarran agreed but stated that they would return to the same camps for food and water “after going walkabout”.

Ms Getta explained that camps at the swamps, lake and wetlands would be reused as Nyungars followed a traditional run between the coast and inland to the Darling Ranges.

Mr Nannup reiterated that Nyungars would undertake seasonal work, such as bean-stick cutting and growing tomatoes, and would camp near where they would be working, as well as near freshwater and food sources.

The men then briefly left the meeting so that the women could discuss any women’s sites located within the survey corridor.



Figure 6: Ms Louise Huxtable (Anthropologist) from BGA, left, discussing possible women’s sites within the Armadale Road survey corridor with the Whadjuk women, view north-west.

Ms Huxtable advised the women that when the Forrest Road site was first recorded it was reported that a possible women’s site was located near the swamp (see O’Connor 1991: 17). As such she enquired into whether the women were aware of any such sites at Forrest Road or located within the survey road corridor.

Ms Yarran responded that she did not know of any specific women’s sites located within the survey corridor, however due to the availability of resources across the landscape they could be present, including at the swamp at Forrest Road.

Ms Jacobs-Smith agreed and stated that if there was freshwater in the area then it could be possible that there were women's sites at, or next to, the water sources at Forrest Road and Lake Forrestdale, however she was not aware of any specific sites located within the survey corridor.

Ms Getta agreed.

The women spoke further about the defining features of women's sites and their uses, however as this information is gender sensitive and is not specific to the survey road corridor, it will not be discussed in detail here.

The men then re-joined the group.

Here Ms Jacobs-Smith requested that Main Roads attend a Whadjuk Working Party meeting in order to discuss a formal policy regarding the discovery of artefacts during Main Roads' projects.

Mr Craig responded that Main Roads already abide by a formal process in regards to uncovered artefacts.

Ms Jacobs-Smith advised that the Traditional Owners could have more of an input into the process in order to make it more culturally sensitive and acceptable to both parties.

Mr Craig responded that the policy Main Roads follow is the legal process required, however they can consult with the Traditional Owners in regards to the relocation of uncovered artefacts.

Ms Jacobs-Smith responded that Main Roads could still approach the Whadjuk Working Party to ensure that their existing process is culturally appropriate.

Mr Headland advised that if artefacts are found deep below the surface then they are significant as they have been there a long time and are evidence of their ancestors living in the area a long time ago.

Mr Nannup Senior added that if the artefacts are small they are not as significant as larger ones which can be held in the palm of a hand.

Mr Headland agreed.

Mr Goode then enquired into whether the Traditional Owners understood the proposed works.

The Traditional Owners responded yes.

Mr Goode then enquired into whether there were any final comments or questions in regards to the project.

Ms Jacobs-Smith stated that, on behalf of her grandfather, she would like to advise that,

...just because the DAA have deemed Aboriginal heritage sites to either have significance or not, it does not mean that those places do not have significance for Aboriginal people. All of the land is significant and important to the Whadjuk people and all individuals are responsible for their own spiritual health in relation to the activities they conduct on the land (Ms K. Jacobs-Smith pers. comm. 21/02/2017).

Mr Goode enquired into whether a spiritual ritual was required prior to the proposed roadworks taking place.

Ms Jacobs-Smith responded that rituals are required to placate spirits and that, again, all individuals are responsible for their own spiritual health. As such, she stated, the Traditional Owners would not be required to conduct a propriety ritual for the works that Main Roads wish to carry out and that it would be up to the individual Main Roads personnel and contractors to look after their spiritual health.

Mr Goode advised that two out of the three previously recorded archaeological places (Place ID 4108 'Readymix Sandpit 1' and Place ID 3300 'Readymix Sandpit 2') are 'Lodged' on the DAA AHIS, legally requiring Main Roads to seek consent under Section 18 of the AHA in order to carry out the works located within the DAA extent of the places. Mr Goode enquired into whether the Traditional Owners have any recommendations regarding this consent notice.

The Traditional Owners responded no and stated that they would support Main Roads making this application under the AHA to disturb the archaeological places.

The consultants then enquired into when the project is scheduled to begin.

Mr Martinez responded that the works are planned to begin in late 2017 and finish in late 2018.

Mr Goode then stated that the Whadjuk Working Party should receive a copy of the consent notice from SWALSC, as well as a copy of the BGA report detailing the ethnographic and archaeological surveys.

Mr Goode enquired into whether the Traditional Owners had any final recommendations in regards to the project.

The Traditional Owners responded no.

This concluded the ethnographic consultation.



Figure 7: The survey team on the completion of the ethnographic consultation in regards to the proposed Armadale Road Duplication project, view north-west.

COMMUNITY CONSULTATION OUTCOMES

As a result of ethnographic consultations held with several SWALSC-nominated representatives from the Whadjuk WC2011/009 Native Title Claim group on the 21st of February 2017, it has been determined that, to the knowledge of the Whadjuk Traditional Owners, there are **no new ethnographic sites** of significance, as defined by Section 5 of the AHA, located within the Armadale Road Duplication survey corridor.

During the consultations the Whadjuk Traditional Owners advised that DAA Place ID 3423 'Forrest Road' and Site ID 3713 'Lake Forrestdale' are places along a traditional 'run' or walk path between the coast and the Darling Ranges. The lake, swamp and surrounding wetlands were reported to be used as water and food sources by Nyungars who camped near the embankments of the waterways. Nyungar families were also reported by the Traditional Owners to have camped there whilst they undertook seasonal bean-stick cutting and tomato growing in the Forrestdale, Banjup, Atwell and Cockburn areas. Lake Forrestdale was reported to have been extensively used as a food and water source and camping ground by Nyungar families, with one elder recalling that he camped near the Lake with his family in the 1960s whilst he undertook seasonal work in the area.

The Traditional Owners also advised that two *Waugals* created the waterways in the area during the Dreaming. The spirits of the *Waugals* were reported to continue to reside in the waterways, until one disappeared after the construction of Adventure World next to Bibra Lake.

During the consultations it was also reported by the Whadjuk women that Lake Forrestdale, the Forrest Road swamp and other freshwater sources in the area could have been utilised as women's sites, however they were not aware of any specific women's sites located within the road survey corridor.

During the consultations the Traditional Owners advised that, due to the existence of previously recorded artefact scatters, sand dunes and wetlands in the area, it is likely that subsurface artefacts could be present in the survey road corridor. As such, the Traditional Owners requested that archaeological monitors be present during any ground disturbing works in order to observe any archaeological material which may be uncovered as a result of the works.

In relation to archaeological Place ID 4108 'Readymix Sandpit 1' and Place ID 3300 'Readymix Sandpit 2', the Traditional Owners advised that they support Main Roads seeking ministerial consent under Section 18 of the AHA in order to carry out the proposed works.

RECOMMENDATIONS

As a result of the ethnographic survey, the following recommendations in relation to the Western Australian *Aboriginal Heritage Act 1972* (AHA) are made:

It is recommended that Main Roads Western Australia can proceed with the proposed Armadale Road Duplication Project without undue risk of breaching Section 17 of the AHA in relation to ethnographic Aboriginal heritage sites, as defined by Section 5 of the AHA.

It is also recommended that Main Roads Western Australia gives due consideration to the Whadjuk WC2011/009 Native Title Claim group representatives' requests that:

- Aboriginal archaeological monitors be present during any ground disturbing works in order to observe any artefacts which may be uncovered as a result of the works; and
- Main Roads Western Australia consults with the Whadjuk Working Party in regards to the process of salvaging and relocating artefacts pertaining from Aboriginal occupation of the land.

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**REPORT ON AN ARCHAEOLOGICAL SURVEY OF THE
ARMADALE ROAD DUPLICATION PROJECT IN THE CITY OF
ARMADALE AND CITY OF COCKBURN, WESTERN
AUSTRALIA**



A report prepared for Main Roads Western Australia

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March 2017

INTRODUCTION

An archaeological survey for Aboriginal archaeological sites was commissioned by WSP Parsons Brinckerhoff, on behalf of Main Roads Western Australia, in November 2016. The primary aim of this survey was to examine the Armadale Road Duplication Project Area in the Cities of Cockburn and Armadale in Western Australia, and to record and report any Aboriginal archaeological sites that may be located within it. A preliminary assessment of the archaeological significance of any such site(s) will be given and their extent determined in order that Main Roads Western Australia can avoid disturbing them or, as required under Section 18 of the Western Australian *Aboriginal Heritage Act 1972* (AHA), seek the consent of the Minister for Aboriginal Affairs to proceed with activities that may disturb Aboriginal heritage sites.

Within the Armadale Road Duplication Project Area, Main Roads Western Australia proposes to duplicate that part of Armadale Road between Tapper Road in suburban Atwell and Anstey Road in suburban Forrestfield, and upgrade and/or improve various intersections along this part of Armadale Road. They also propose to undertake associated road works in and around the Armadale Road and Kwinana Freeway Bridge. In the following pages the Armadale Road Duplication Project Area is referred to as the survey area. Knowledge of the location and extent of any Aboriginal archaeological sites that exist within the survey area will facilitate the making of management decisions that will ensure that any such sites are not inadvertently impacted upon or disturbed by any of the proposed works mentioned above or related activities.

As part of the archaeological survey of the Armadale Road Duplication Project Area, data was gathered from reports on previous archaeological surveys and investigations that intersect this area as well as those undertaken in the vicinity of the survey area and in the wider region. Details of previously recorded and/or registered Aboriginal archaeological sites and other heritage places identified within the survey area were obtained from the relevant files held at the Heritage and Culture Division, Department of Aboriginal Affairs (WA) and, where possible, from unpublished reports on previous archaeological surveys. In addition to this, a review of maps, environmental information and academic research carried out within the wider region was also undertaken. The fieldwork associated with the archaeological survey was conducted in February 2017 by archaeologist Mr Thomas O'Reilly with some assistance from Whadjuk representative Mr Stan Headland.

LOCATION OF SURVEY AREA

The survey area discussed in this report comprises a discrete irregularly shaped area that extends eastwards for approximately 8.3km from the intersection of Midgegooroo Avenue and Beelii Drive in the City of Cockburn to the intersection of Armadale Road and Anstey Road in the City of Armadale, and encompasses a number of intersections along it (Figure 8).

While the majority of the Armadale Road Duplication Project Area is between 60m and 130m wide, it is much wider at the various intersections along it with a maximum width of approximately 550m at the Armadale Road and Kwinana Freeway Bridge intersection (Figure 9). It is noted here that the majority of the survey area has been universally disturbed as a result of past and present land use practices.



Figure 8: Location Plan: Armadale Road Duplication Project Area.



Figure 9: Armadale Road Duplication Project Area.

ENVIRONMENTAL BACKGROUND

Climate

The Perth region, within which the survey area is located, lies within a Dry Mediterranean climatic zone averaging between five and six dry months per year (Beard 1981). The climate is characterised by cool, wet winters and hot, dry summers. According to the climate averages recorded at Perth over the last twenty years, the average maximum temperature during the winter months (June-August) is 18.9°C and the average minimum is 8.2°C. In the summer (December-February) the equivalent temperatures are 30.6°C maximum and 17.6°C minimum (Bureau of Meteorology, Australia 2017).

The survey area lies within a region that has received an average annual rainfall of approximately 734mm since 1993. Approximately 54% of this rain falls in the winter months, and less than 5% in the summer, the rest being distributed between spring and autumn (Bureau of Meteorology, Australia 2017). Typically there is a summer drought of several months duration, when high evaporation exacerbates the shortage of surface water.

Geology

The geology of the area in and around the survey area has been mapped and described on the Pinjarra 1:250 000 map sheet and accompanying notes (Wilde and Low 1980).

In general, the survey area is located on the Perth Basin, a polycyclic basin consisting of a Silurian to early Neocomian sequence deposited in an interior-fracture setting, and an overlying late Neocomian Quaternary sequence laid down in a marginal sag basin (Cockbain 1990:495). That part of the Perth Basin that lies between the Darling Fault and the Indian Ocean is known as the Swan Coastal Plain, a narrow strip of land between 15 and 30km wide, that extends from around Jurien Bay southwards to Busselton (McArthur 1991). Most of the Swan Coastal Plain is

covered by Quaternary sediments of fluvial and aeolian deposits that have been deposited in a series of geomorphic entities sub-parallel to the present coastline (McArthur and Bettenay 1974). Five geomorphic entities are recognised by McArthur and Bettenay (1974) the most westerly of which is the Quindalup Dune System that borders the present coastline. The Quindalup Dune System is bounded to the east by the Spearwood Dune System with the Bassendean Dunes lying between this and the Pinjarra Plain which is adjacent to the most easterly feature of the Swan Coastal Plain the Ridge Hill Shelf. The Ridge Hill Shelf occurs as a series of lateritic covered spurs at the base of the Darling Scarp.

Geologically, the survey area is located near the eastern edge of the Bassendean Dune System close to the Pinjarra Plain. McArthur and Bettenay (1974) describe the Bassendean Dune System as being generally poorly drained and comprising low hills interspersed with swampy areas. According to McArthur (1991: 27) “the sand grains of the Bassendean Dune System are characteristically well rounded and of high sphericity with frosted surfaces and are well sorted. These properties indicate that the sand came ashore after transport and sorting by water and then was further sorted by wind”.

As has been noted above, the majority of the survey area has been universally disturbed as a result of past and present land use practices. Despite this, the surface geology was visible throughout most parts of the survey area, particularly in the eastern half. With the exception of that part of the survey area that slopes downwards to the south at and about the intersection of Armadale Road and Liddelow Road, the survey area is generally relatively flat and has a surface geology that can be characterised as grey/white sand (Figure 10). According to Beard (1981), the soils of the Bassendean Dunes are extremely leached and have podzolized white quartz sands with B horizons of iron and organic matter accumulation.



Figure 10: Looking east from corner of Armadale Road and Wright Road along north side of survey area with surface geology typical of survey area.

Vegetation

Beard (1981) notes the relationship between specific soil types and vegetation. The survey area and its surrounds are located within the Bassendean Dune System of the Drummond Botanical Subdistrict. Generally, where natural vegetation remains within the Bassendean Dune System it comprises *Banksia* low woodland that is dominated by *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Eucalyptus todtiana* and *Nuytsia floribunda* with a dense understorey of sclerophyll shrubs (Beard 1981).

Given the level of disturbance within the survey area, almost all of the natural vegetation has been removed as a result of land clearing for paddocks and infrastructure including roads, a water pipeline, a buried gas pipeline, buried fibre optic cable, construction sites, residential and commercial developments and associated infrastructure.

At the time of the archaeological survey described in this report the vegetation within the eastern half of the survey area was dominated by various areas of dense grasses (Figure 11) and sparse grasses (Figure 12), with the occasional *Eucalyptus* spp. tree to 10m. As a consequence, surface visibility within this part of the survey area was variable and averaged <10% in areas of dense grasses and approximately 80% in areas of sparse grasses. The exception to this was an area of remnant bush or regrowth on the south side of Armadale Road at and about Warton Road. In this part of the survey area there are *Banksia* spp. trees to 4m, the occasional *Eucalyptus* spp. tree to 5m and numerous shrubs to 2m over relatively dense grasses. As a consequence, surface visibility in this part of the survey area was low and averaged <20%. It is noted that this area of remnant bush or regrowth is sign posted 'Jandakot Regional Park'.



Figure 11: Looking east along south side of Armadale Road at area of typically dense grasses in eastern part of survey area between Wright Road and Nicholson Road.



Figure 12: Looking east along south side of Armadale Road at area of typically sparse grasses in eastern part of survey area between Nicholson Road and Anstey Road.

In the western part of the survey area the vegetation was generally similar to that described above with two notable exceptions. The first of these is at and around the intersection of Armadale Road and Liddelow Road where the ground slopes downwards to the south and where there is a relatively small area containing numerous paperbark trees to 5m over an understorey of dense grasses located between Armadale Road and a cleared paddock. Surface visibility in this part of the survey area was very low and averaged <10%. The second exception is along the south side of Armadale Road west of Liddelow Road. In this part of the survey area the vegetation is also relatively dense and comprises *Banksia* spp. trees to 4m, *Eucalyptus* spp. trees to 6m, some patches of paperbark trees to 4m, grass trees to 1.5m and numerous shrubs to 3m over dense grasses. As a consequence, surface visibility in this part of the survey area was low and averaged <10%. It is noted that this part of the survey area is sign posted 'Emma Treeby Reserve' (Figure 13).

While those parts of the survey area containing relatively dense vegetation had low surface visibility, the surface visibility throughout the remainder of the survey area was generally very good and averaged between 60% and 80%. This was the result of a general absence or sparseness of vegetation. At the western end of the survey area there was little or no natural surface visible as a consequence of the extent of recent residential and commercial developments.



Figure 13: Looking south at area sign posted 'Emma Treeby Reserve' in western half of survey area.

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

DEFINITIONS

The commonest Aboriginal archaeological materials found in Australia are discarded stone tools, or the debris from making such tools by knapping. These artefacts formed a small but durable part of the Aboriginal tool-kit. Often stone tools were used to manufacture other tools from organic materials that have not survived. Where numerous artefacts occur in context and in association they constitute an artefact scatter and together comprise the scatter's artefact assemblage.

Artefact scatters generally represent campsites. Large scatters are places that were regularly occupied, sometimes for long periods and represent the accumulation of many overlapping smaller camps. Small scatters are the remains of sites that were briefly occupied, probably on several occasions. Very small scatters may be evidence of an overnight camp, meal-time camp or work area where specific activities were carried out.

Many stone arrangements have been interpreted as ceremonial sites, but this rarely can be established. Stone arrangements can consist of hundreds of stones arranged in elaborate lines or in mounds, or can be a single line or small cluster. Solitary placed or standing stones may have served as a sign; for example, as a warning to avoid a specific site or as an indicator of water. Some stone arrangements are the remains of hunting hides or the bases of huts.

A place where stone was obtained for making stone tools is a quarry. Generally quarries contain knapping centres or core reduction areas where knapping was intensive. Quarries are found at occurrences of highly siliceous stone, such as chalcedony, chert, silcrete, quartz, *etc.* Finished artefacts are not common at quarries and the vast majority of material found at this type of site is waste, called debitage or debris, from making tools or preparing cores for transport off the quarry for later use.

Apart from concentrations of artefacts at campsites, there are also solitary artefacts that are distributed at a very low density across the landscape. These form a background scatter that probably represents evidence of dispersed hunting and gathering activities. In some instances, isolated finds are found beside watercourses in a long ribbon known as a ‘creekline scatter’.

For the purposes of the survey discussed in this report, an archaeological “site” is defined as a place where “significant traces of human activity are identified” (Renfrew & Bahn 1991: 42). In other words, where there is substantial *in situ* evidence of past Aboriginal occupation or activity. This is a scientific definition, not a legal definition.

The decision as to whether a place might or might not constitute a “site” under Section 5 of the AHA is made by the Aboriginal Cultural Material Committee. Excerpts from the Act are included in Appendices 4 and 5. Most types of Aboriginal sites are described in more detail in Appendix 5. It is important to note that all sites, whether known or not, are protected under the AHA and that it is an offence to disturb or conceal a site, or remove artefacts, without appropriate consent.

REGISTERED SITES AND OTHER HERITAGE PLACES

As a result of research undertaken at the Heritage and Culture Division, Department of Aboriginal Affairs (WA) [DAA] and a search of their Aboriginal Sites and Places Database prior to the archaeological survey of the designated survey area, it was established that **no** Aboriginal archaeological sites or sites with an archaeological component are registered at positions that place them within the designated survey area. However, it was also established that **three** ‘other heritage places’ with archaeological components are have been identified at locations in the past that place them within the designated survey area. Details of these other heritage places are given in Table 2.

Table 2: Details of the other heritage places with an archaeological component located within the Armadale Road Duplication Project Area.

ID	Name	Status	Access	Restriction	Location (GDA94 Z50)*		Site Type
					mE	mN	
4108	Readymix Sandpit 1	L	O	N	393989	6444524	Artefact Scatter
3300	Readymix Sandpit 2	L	O	N	393339	6444799	Artefact Scatter, Camp
3301	Banjup Calsil	S	O	N	395707	6444461	Artefact Scatter, Camp

* Please note: Coordinates are indicative locations that represent the centre of sites and other heritage places as shown on maps produced by the DAA – they may not necessarily represent the true centre of all sites.

R – Registered Site, I – Insufficient Information, S – Stored Data, L – Lodged, O – Open, N – No Restrictions.

According to information contained in the relevant file, the Readymix Sandpit 1 (ID 4108) other heritage place was initially identified and recorded in 1973 on the north side of and fronting onto Forrest Road (now called Armadale Road) approximately 1km east of Solomon Road and just before Fraser Road. The Readymix Sandpit 1 (ID 4108) other heritage place’s location is described in the relevant file as a ‘sand quarry’ where extensive excavation and clearing has taken place.

The co-ordinates given on the DAA Aboriginal Sites and Places Database locates the Readymix Sandpit 1 (ID 4108) other heritage place at the intersection of Ghostgum Avenue and Armadale Road (Figure 14). These co-ordinates are deemed to be reliable by the Department of Aboriginal Affairs. With respect to the road names used above, it is likely that during the course of urban development that the alignment of Fraser Road has been changed and its southern end renamed Ghostgum Avenue. It is noted here that at the time of the archaeological survey of the Armadale Road Duplication Project Area, the land at and about the intersection of Ghostgum Avenue and Armadale Road had been landscaped and is further developed than is shown in Figure 14.

While no estimation is given in the relevant file of the size of the Readymix Sandpit 1 (ID 4108) artefact assemblage, it was noted that quartz flakes, fragments, chips, flaked pieces, an adze, a steep scraper and two bipolar pieces were observed at the time it was initially recorded. . In addition, a number of flakes, chips and flaked pieces, three scrapers and one bipolar piece that had all been manufactured on fossiliferous chert, as well as three lumps of dolerite were also observed. It is also noted in the relevant file that a random sample of artefacts were collected from the Readymix Sandpit 1 (ID 4108) other heritage place at the time it was initially identified and recorded in 1973.

During the course of the archaeological survey described in this report, the location of the Readymix Sandpit 1 (ID 4108) other heritage place was targeted and scrutinised for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified. It was also established that the land north of and fronting onto Armadale Road (formerly Forrest Road) between Solomon Road and Ghostgum Avenue (formerly Fraser Road) has been universally disturbed and now contains houses, retail outlets and associated infrastructure.

It is noted here, that at their meeting on 01 August 2000, the Aboriginal Cultural Material Committee concluded that the information that has been lodged with the Registrar of Aboriginal Sites pertaining to the Readymix Sandpit 1 (ID 4108) other heritage place was insufficient to complete an assessment within the terms of Section 5 of the AHA (Resolution ID: 004350, Resolution Number: 00123).

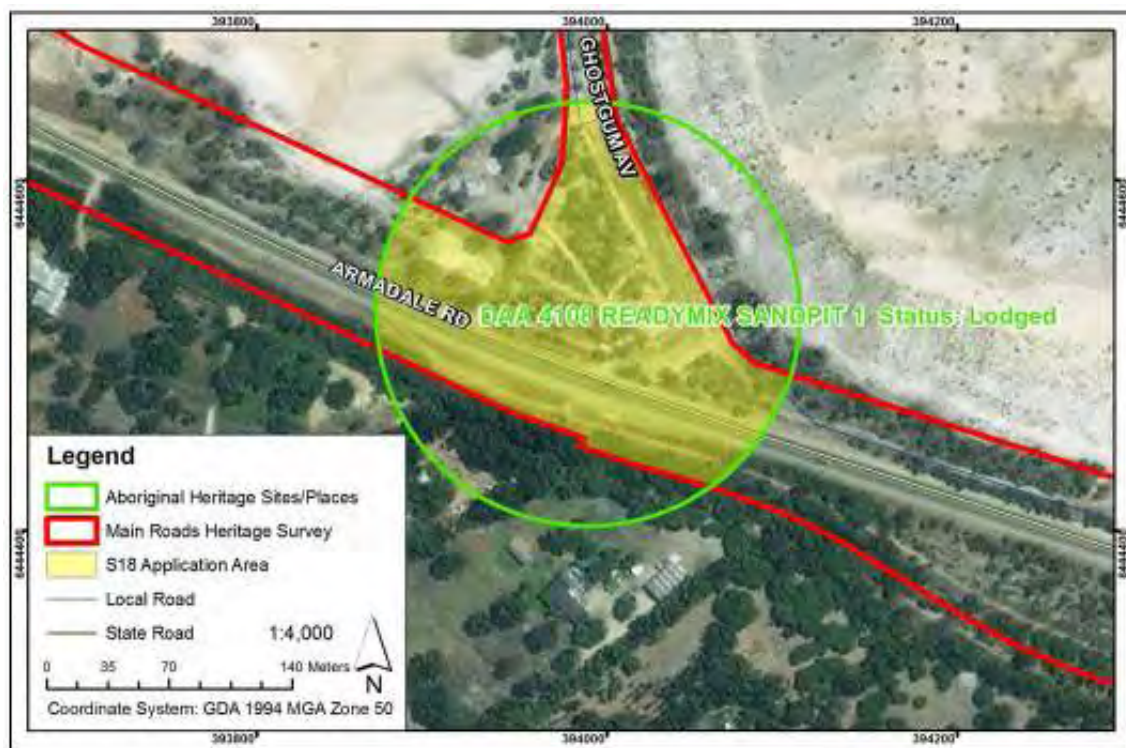


Figure 14: Location of the Readymix Sandpit 1 (ID 4108) other heritage place according to the Department of Aboriginal Affairs' spatial data.

According to information contained in the relevant file, the Readymix Sandpit 2 (ID 3300) other heritage place was initially identified and recorded in 1973. This artefact scatter was located on the north side of Forrest Road (now called Armadale Road) approximately 0.5km east of Solomon Road in an area described as bare sand where extensive excavation, clearing and general disturbance had taken place. It is also noted in the relevant file that, at the time it was identified, continuing quarrying was a threat to this other heritage place.

The co-ordinates given on the DAA Aboriginal Sites and Places Database locates the Readymix Sandpit 2 (ID 3300) other heritage place at the intersection of Verde Drive and Armadale Road (Figure 15). These co-ordinates are deemed to be reliable by the Department of Aboriginal Affairs. It can be clearly seen on Figure 15 that, with the exception of small area on the northeast side of the Verde Drive and Armadale Road intersection, that the land at and about this intersection has been universally disturbed and modified as a result urban development.

The Readymix Sandpit 2 (ID 3300) other heritage place is described in the relevant file as large, but no figures are given. Its artefact assemblage is described as comprising lumps, nodules, fragments, flakes, chips, flaked pieces, micro-cores, utilised flakes, utilised flaked pieces, utilised micro-cores, steep scrapers, scrapers, a backed blade and at least one other tool, all of which had been manufactured on quartz, and fragments, flakes, chips, flaked pieces, micro-cores, utilised flakes, steep scrapers, scrapers, an adze and at least one other tool, all of which had been manufactured on fossiliferous chert. It is noted in the relevant file that a total collection of artefacts (n=122) was taken from the Readymix Sandpit 2 (ID 3300) other heritage place at the time it was initially recorded and subsequently deposited with the then Western Australian Museum.

During the course of the archaeological survey described in this report, the location of the Readymix Sandpit 2 (ID 3300) other heritage place was targeted and scrutinised for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified. It was also established that, with the exception of small area on the northeast side of the Verde Drive and Armadale Road intersection, that the land at and about this intersection has been universally disturbed and modified as a result urban development.

It is noted here, that at their meeting on 13 June 2000, the Aboriginal Cultural Material Committee concluded that the information that has been lodged with the Registrar of Aboriginal Sites pertaining to the Readymix Sandpit 2 (ID 3300) other heritage place was insufficient to complete an assessment within the terms of Section 5 of the AHA (Resolution ID: 003080, Resolution Number: 00/088).

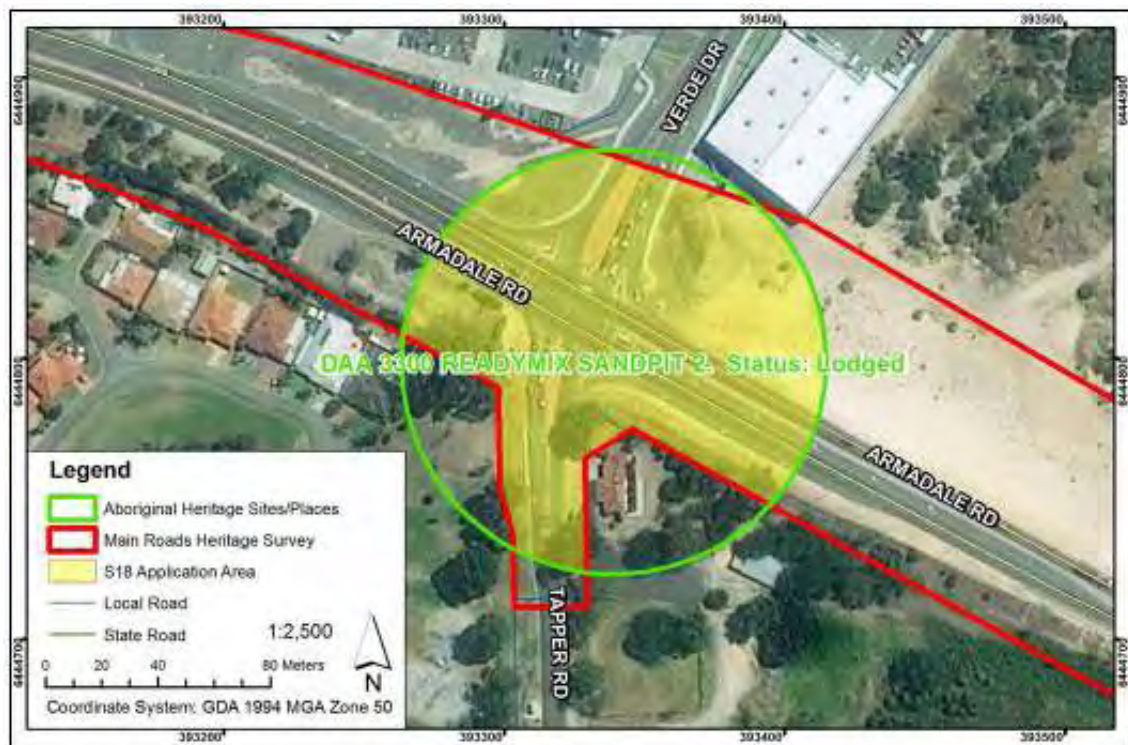


Figure 15: Location of the Readymix Sandpit 2 (ID 3300) other heritage place according to the Department of Aboriginal Affairs' spatial data.

According to information contained in the relevant file, the Banjup Calsil (ID 3301) other heritage place was initially identified in 1971 on the western margin of an extensive sand quarry located on the north side of Forrest Road (now called Armadale Road) approximately 2.5km east of Solomon Road. The Banjup Calsil (ID 3301) other heritage place's location is described in the relevant file as 'throughout an extensive sand quarry with most of the artefacts identified along its western margin'. It is also noted in the relevant file that the general area at and about the Banjup Calsil (ID 3301) other heritage place's location 'is thoroughly disturbed by sand extraction to a depth of 6m'.

The co-ordinates given on the DAA Aboriginal Sites and Places Database locates the Banjup Calsil (ID 3301) other heritage place approximately 340m north-northeast of Armadale Road at its closest point. These co-ordinates are deemed to be reliable by the Department of Aboriginal Affairs. While the Banjup Calsil (ID 3301) other heritage place was recorded as covering an area of 360m x 180m when it was initially identified, it is represented on the DAA Aboriginal Sites and Places Database as a circle with a diameter of approximately 1.4km which extends southwards over Armadale Road and eastwards over Wharton Road.

The Banjup Calsil (ID 3301) other heritage place's artefact assemblage is described as comprising nodules, lumps, flakes, blades, chips, micro-flaked pieces, flaked pieces, utilised flakes, adzes and five scrapers, all of which had been manufactured on quartz, and flakes, chips, flaked pieces and three scrapers, all of which had been manufactured on fossiliferous chert. It is noted in the relevant file that a total collection of artefacts (n=120) was taken from the Banjup Calsil (ID 3301) other heritage place at the time it was initially recorded and subsequently deposited with the then Western Australian Museum.

During the course of the archaeological survey described in this report, that part of the Banjup Calsil (ID 3301) other heritage place's location that coincides with the survey area and as mapped by the DAA, was targeted and scrutinised for the presence of Aboriginal archaeological material. As a consequence, no Aboriginal archaeological artefacts or material were identified. It was also established that the majority of the land on the north side of Armadale Road (formerly Forrest Road) approximately 2.5km east of Solomon Road has been universally disturbed and now contains a large sand quarry.

It is noted here that the Banjup Calsil (ID 3301) other heritage place was assessed by the Aboriginal Cultural Material Committee at their meeting on 13 June 2000 as 'not a site' (Resolution ID: 003080, Resolution Number: 00/0880). As a consequence, no action is required pertaining to this other heritage place.

REVIEW OF RELEVANT ARCHAEOLOGICAL REPORTS

As a result of research undertaken at the Heritage and Culture Division, DAA and a search of their Heritage Survey Database, it was established that they have a record of **five** archaeological surveys having been undertaken in the past in areas that abut, coincide with or intersect a part or parts of the Armadale Road Duplication Project Area. The reports on these surveys are reviewed here and their results presented.

Brown, S. 1979, *Dampier to Perth Natural Gas Pipeline Route: a survey for Aboriginal Sites*, Unpublished report prepared for the State Energy Commission.

and

Pickering, M. 1982, *An Archaeological Survey of the Dampier to Perth Natural Gas Pipeline Route, Section 6: Muchea to Wagerup*, Unpublished report prepared for the State Energy Commission.

The archaeological survey described in Brown's report focussed on a relatively narrow corridor approximately 1486km long and which extended from Dampier to Wagerup, south of Perth. Pickering's survey focussed on the southern end of this corridor between Muchea and

Wagerup and coincides with that surveyed by Brown. This corridor now contains the Dampier to Perth Natural Gas Pipeline. Of relevance here is that part of the corridor that crosses the Armadale Road Duplication Project Area immediately west of Anstey Road.

While numerous Aboriginal archaeological sites were identified along and adjacent to the corridor surveyed by Brown and Pickering, none were identified within that part that coincides with the Armadale Road Duplication Project Area.

Locke, R. and Murphy, A. 1990, *Report of an Aboriginal Sites Survey of the Thompsons Lake Area*, Unpublished report prepared for Fielman Planning Consultants Pty Ltd and Landcorp.

While this report was not available at the time of writing, the area covered by the survey of the Thompsons Lake Area coincides with the southern side of the Armadale Road Duplication Project Area west of Tapper Road and a small part in that area in the northeast corner of the Armadale Road and Kwinana Freeway intersection. According to the Department of Aboriginal Affairs' Aboriginal Sites and Places Database, no Aboriginal archaeological sites or other heritage places were identified within these parts of the Armadale Road Duplication Project Area.

Quartermaine, G. 2003, *Report on an archaeological investigation for Aboriginal Sites, Tamworth Reservoir to Kerosene Lane, Baldvis, and Nicholson Road pump station to Connell – Manning PRV site, pipeline route alignments*.

The archaeological survey described in Quartermaine's report focussed on two 50m wide corridors within which it was proposed to install water pipelines. Of relevance here is the western end of the approximately 12km corridor surveyed from the Nicholson Road pump station to the Connell – Manning PRV site. Specifically, that part of this corridor that extends eastwards from Nicholson Road to just before Anstey Road was located on the north side of Armadale Road and probably abutted the majority of the northern side of the Armadale Road Duplication Project Area between Nicholson Road and Anstey Road as well as intersecting small parts of it.

As a result of his survey of that part of the Nicholson Road pump station to the Connell – Manning PRV corridor located between Nicholson Road to just before Anstey Road, no Aboriginal archaeological sites were identified by Quartermaine.

Quartermaine, G. 2004, *Report on an Archaeological investigation for Aboriginal Sites, Serpentine – Canning DN 1400 Link Main Pipeline Route Alignment*.

The archaeological survey described in Quartermaine's report focussed on 50m wide corridor, 13.5km long and which extended from the Nicholson Road Pump Station to the Connell – Manning PRV site. Of relevance here is the western end of this corridor which overlaps that part of Armadale Road Duplication Project Area between Nicholson Road and Anstey Road.

As a result of his survey of that part of the Serpentine – Canning DN 1400 Link Main Pipeline Route Alignment between Nicholson Road and Anstey Road, no Aboriginal archaeological sites were identified by Quartermaine.

PREVIOUS ARCHAEOLOGICAL RESEARCH

The Armadale Road Duplication Project Area is located on the Swan Coastal Plain that is contained within the broader southwest region of Western Australia. Previous archaeological research conducted in the southwest of Western Australia documents, amongst other things, the antiquity of human occupation in this region. At present the earliest occupation date for the southwest of Western Australia is in the order of 47,000 years Before Present (BP) obtained from archaeological deposits at Devil's Lair (Dortch 2002), located approximately 20km north

of Cape Leeuwin in the Leeuwin-Naturaliste Region. Some other sites of Pleistocene age recorded in the south-west include Upper Swan *c.*38,000 BP (Pearce and Barbetti 1981), Helena River *c.*29,000 BP (Schwede 1983) and Kalgan Hall *c.*18,000 BP (Ferguson 1985). There are at least 46 dated archaeological sites in south-western Australia which together span the period from *c.*38,000 BP to the present (*cf.* Smith 1993). In a wider regional context, these sites provide a more or less continuous record of human occupation of this region.

The artefact assemblages at the majority of previously recorded sites on the Swan Coastal Plain are dominated by quartz. Many sites also contain a proportion of fossiliferous chert, a superior raw material for artefact manufacture. The sources of this material, believed to lie off the Western Australian coast in the general vicinity of Mandurah, were submerged approximately 6,000 years ago with the last eustatic change, a 140 metre rise in sea level (Glover 1975). Although the timing of the loss of access to this resource is not precise, the presence of fossiliferous chert in an assemblage may indicate the relative age of a site. Hallam (1987) developed a relative dating scheme based on the relative proportions of lithic material and artefact types represented in artefact assemblages that are outlined as follows. Sites classified as Early Phase assemblages include artefacts of fossiliferous chert. Middle Phase assemblages contain backed artefacts and adzes, while Late Phase assemblages are quartz-rich with high proportions of chips. Final Phase assemblages are those with worked glass and/or ceramic artefacts. Assemblages could, of course, belong to more than one phase (Hallam 1987:20). Although there are obvious inadequacies with this approach it is one of the only methods available for assigning a relative date to open artefact scatters.

The majority of previously recorded archaeological sites on the Swan Coastal Plain are usually found on intact or deflated Holocene dunes and represents a general background scatter reflecting single activity episodes or ephemeral activities. Much of the internal complexity of these sites has been destroyed due to natural processes such as aeolian deflation, or from disturbance as a result of development.

The distribution of archaeological sites on the Swan Coastal Plain is not uniform. Larger sites and site clusters are found at highly favourable locations indicating that these locations were occupied repeatedly over a long time frame. Favoured locations on the coastal plain included areas of predictably high productivity, such as those with reliable fish runs and large seasonal game resources (Anderson 1984; Meagher and Ride 1979). At times of plenitude this resource security facilitated the support of large gatherings that served to enhance group identity and cohesion (Gibbs 1987). These favourable locations correspond to the major wetlands, lakes and estuaries of the coastal plain and the rivers that drain into them. The vast majority of sites that have been located are within 500 metres of water sources, indicating that Aboriginal habitation of the area was closely linked to the availability of wetland resources. The high seasonal productivity and the availability of fresh water at wetlands would clearly have made them a focus for Aboriginal habitation.

The results of previous archaeological surveys, studies and research, as well as the data on registered sites and other heritage places presented above, demonstrates the types of Aboriginal archaeological sites already known to have existed in the survey area and the wider region around it. In addition to this, these results, together with the environmental information already discussed, enables predictions to be made about probable site locations and the types of archaeological material and/or sites that could reasonably be expected to be found as a result of the archaeological survey of the Armadale Road Duplication Project Area. The underlying geology and the vegetation regime within the survey area preclude the likelihood of sites such as rock shelters, engravings or art sites being present. The types of archaeological sites or material, if any, that are most likely to be located within the Armadale Road Duplication Project Area would be various types of lithic artefacts either singularly or in scatters.

SURVEY METHODS

The fieldwork associated with the archaeological survey of Armadale Road Duplication Project Area was undertaken in February 2017 by archaeologist Mr Thomas O'Reilly with some assistance from Whadjuk representative Mr Stan Headland. The methods utilised prior to and during the archaeological survey are outlined below.

Prior to undertaking the field component of the archaeological survey, a search of the Aboriginal Sites and Places Database at the Heritage and Culture Division, Department of Aboriginal Affairs (WA), was made to determine if any Aboriginal archaeological sites, or sites with an archaeological component, or any other heritage places with an archaeological component, are located within the designated survey area. At the same time, site files pertaining to any registered Aboriginal archaeological sites or sites with an archaeological component in the vicinity of the survey area were also examined as were the files pertaining to other heritage places with an archaeological component. A review of reports detailing the results of previous archaeological surveys and investigations carried out in the vicinity of the survey area was also undertaken as was a review of archaeological research conducted in the wider region.

Geological and vegetation maps were also examined prior to the field survey to ascertain the physical geography and geomorphology of the land within the survey area. Any areas of interest identified from these maps, or areas identified as having a high probability of containing Aboriginal archaeological sites, would subsequently be targeted during the field survey.

The designated survey area was surveyed for the presence of Aboriginal archaeological sites and material by walking a meandering transect along both sides of Armadale Road and the intersections along it. These transects followed the general alignment of the survey area. The land at and about the locations of the previously recorded other heritage places identified as being located within the survey area was targeted and scrutinised for the presence of any Aboriginal archaeological material.

In general, surface visibility throughout the survey area was variable. Areas of low surface visibility (<10% to 20%) included those parts in the eastern half of the survey area dominated by patches of dense grasses, and an area of remnant bush or regrowth on the south side of Armadale Road at and about Warton Road. Similarly low surface visibility was encountered in the western half of the survey area at and around the intersection of Armadale Road and Liddelow Road where the ground slopes downwards to the south and where there is a relatively small area containing numerous paperbark trees over an understorey of dense grasses, and along the south side of Armadale Road west of Liddelow Road where the vegetation is also relatively dense.

Throughout the remainder of the survey area surface visibility was generally very good and averaged between 60% and 80%. This was the result of a general absence or sparseness of vegetation. Along cleared tracks and firebreaks the surface visibility was 100% while at the western end of the survey area there was little or no natural surface visible as a consequence of the extent of recent residential and commercial developments.

RESULTS

As a result of research undertaken at the Heritage and Culture Division, Department of Aboriginal Affairs (WA) and a search of their Aboriginal Sites and Places Database prior to the archaeological survey of the Armadale Road Duplication Project Area, it was established that **no** Aboriginal archaeological sites or sites with an archaeological component are registered at positions that place them within the designated survey area. However, it was established that **three** 'other heritage places', the Readymix Sandpit 1 (ID 4108), the Readymix Sandpit 2 (ID 3300) and the Banjup Calsil (ID 3301) artefact scatters have been recorded in the past and were identified at positions that place them, or may place them within the Armadale Road Duplication Project Area.

During the course of the archaeological survey described in this report, the locations of the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places were targeted and scrutinised for the presence of Aboriginal archaeological material, as was that part of the Banjup Calsil (ID 3301) other heritage place that coincides with the survey area. As a consequence, no Aboriginal archaeological artefacts or material were identified at or about any of these places. Furthermore, it was established that the land at and about the co-ordinates given on DAA's Aboriginal Sites and Places Database for the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places has been universally disturbed and now contain houses, retail outlets and associated infrastructure and landscaping.

As a result of the archaeological survey of Armadale Road Duplication Project Area **no** Aboriginal archaeological sites or material were identified.

CONCLUSIONS

DISCUSSION

An archaeological survey for Aboriginal archaeological sites within the Armadale Road Duplication Project Area was undertaken on behalf of Main Roads Western Australia. The fieldwork associated with the archaeological survey was conducted in February 2017 by archaeologist Mr Thomas O'Reilly with some assistance from Whadjuk representative Mr Stan Headland. The survey area discussed in this report has been universally disturbed as a result of past and current land use practices.

The survey area was surveyed and examined for the presence of Aboriginal archaeological sites and/or material by walking linear transects along both sides of Armadale Road and the intersections along it, as well as targeting high site potential areas or areas where Aboriginal archaeological material had been identified in the past. Given the degree of surface visibility in general throughout the survey area and the intensity of coverage, it is considered that the archaeological survey was sufficient to locate any Aboriginal archaeological sites present on the surface. It should be noted that sites can be exposed and/or concealed as a result of both wind and water erosion. It is also possible that archaeological material lies below the surface and may be exposed as a result of environmental factors or work undertaken within the surveyed area. Main Roads Western Australia should be aware of this when undertaking road works and/or associated activities within the survey area or any other ground disturbing work.

The above results are consistent with other investigations in the past. As a consequence of her research and fieldwork undertaken as part of the Metropolitan Sites Project Southern Region Yates (2000) noted that artefacts had been collected from the Readymix Sandpit 1 (ID 4108) other heritage place and that this collection and the ongoing quarrying and associated industrial activity in the area had resulted in the destruction of this other heritage place. In addition to this, correspondence contained within the file pertaining to the Readymix Sandpit 1 (ID 4108) other heritage place, notes that in 2013 anthropologist Rory O'Connor and archaeologist John Cecchi

‘undertook purposive pedestrian transects spaced at ten metres apart . . . on the land bounded by Armadale Road to the south, Frasers Road to the east, the sand pit flanking Biscayne Way to the west and the perimeter of this sand pit to the north’. While the street names may have changed, the area targeted and scrutinised by O’Connor and Cecchi covered the ground where the Readymix Sandpit 1 (ID 4108) other heritage place was reported to be located. As a result of their work, O’Connor and Cecchi did not identify any Aboriginal artefacts or archaeological material and concluded that the Readymix Sandpit 1 (ID 4108) other heritage place is not located within the area they scrutinised or no longer exists.

It is noted here, that at their meeting on 01 August 2000, the Aboriginal Cultural Material Committee concluded that the information that has been lodged with the Registrar of Aboriginal Sites pertaining to the Readymix Sandpit 1 (ID 4108) other heritage place was insufficient to complete an assessment within the terms of Section 5 of the *Aboriginal Heritage Act 1972* (Resolution ID: 004350, Resolution Number: 00123).

Correspondence contained within the file pertaining to the Readymix Sandpit 2 (ID 3300) other heritage place states that in April 2008, the then Department of Indigenous Affairs suggested to a property developer that Section 18 assessment for this other heritage place is unlikely to be required as a result of the site having been destroyed during the course previous road improvements.

At a meeting on 13 June 2000, the Aboriginal Cultural Material Committee also concluded that the information that has been lodged with the Registrar of Aboriginal Sites pertaining to the Readymix Sandpit 2 (ID 3300) other heritage place was insufficient to complete an assessment within the terms of Section 5 of the *Aboriginal Heritage Act 1972* (Resolution ID: 003080, Resolution Number: 00/088).

The Banjup Calsil (ID 3301) other heritage place was assessed by the Aboriginal Cultural Material Committee at their meeting on 13 June 2000 as ‘not a site’ (Resolution ID: 003080, Resolution Number: 00/0880). As a consequence, no action is required pertaining to this other heritage place.

RECOMMENDATIONS

On the basis of the results of the archaeological survey of the Armadale Road Duplication Project Area (the survey area) and the above discussion, the following recommendations are made;

It is recommended that Main Roads Western Australia be allowed to proceed with their proposal to undertake the duplication of that part of Armadale Road between Tapper Road in suburban Atwell and Anstey Road in suburban Forrestfield, and upgrade and/or improve various intersections along this part of Armadale Road as well undertaking associated road works in and around the Armadale Road and Kwinana Freeway Bridge **on the condition** that they request the Department of Aboriginal Affairs re-assess the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places as ‘not sites.’

If such request is made, the Department of Aboriginal Affairs should re-assess the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places as ‘not sites’ on the basis that artefacts have been collected in the past from both these places, that the land where both were once located has been universally disturbed and the places subsequently destroyed, and that no Aboriginal archaeological artefacts or material were identified at or about these places when they were targeted and scrutinised for the presence of Aboriginal archaeological material during the course of the archaeological survey described in this report.

If the Department of Aboriginal Affairs does not re-assess the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places as ‘not sites’ Main Roads Western Australia will need to apply to the Minister for Aboriginal Affairs for consent to proceed with activities that may disturb Aboriginal heritage sites under Section 18 of the Western Australian *Aboriginal Heritage Act 1972*.

If such an application is made **it is recommended** that consent be granted **unconditionally** as artefacts have been collected in the past from both the Readymix Sandpit 1 (ID 4108) and Readymix Sandpit 2 (ID 3300) other heritage places, the land where both these other heritage places were once located has been universally disturbed and the places subsequently destroyed, and no Aboriginal archaeological artefacts or material were identified at or about these places when they were targeted and scrutinised for the presence of Aboriginal archaeological material during the course of the archaeological survey described in this report.

It is also recommended that, in the event of any artefactual material or skeletal material being discovered in the course of work associated with the Armadale Road Duplication Project and/or any other activities, work should stop while the Department of Aboriginal Affairs undertake an investigation. In the case of skeletal material being uncovered, work must cease immediately and the Western Australian Police must be notified.

Furthermore, **it is recommended** that Main Roads Western Australia personnel and contractors be advised of their obligations under Section 15 of the *Aboriginal Heritage Act 1972*, to report the discovery of any Aboriginal cultural material which may be uncovered in the course of their work or any other activities.

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APPENDIX 1: DAA SITES AND PLACES REGISTER SEARCH



Search Criteria

No Registered Aboriginal Sites in Shapefile - Heritage Survey 30Jan17 (6)

Disclaimer

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The information provided is made available in good faith and is predominately based on the information provided to the Department of Aboriginal Affairs by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at heritageenquiries@daa.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land **within or adjacent to** the following Indigenous Land Use Agreement(s): Whadjuk People ILUA

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines and Petroleum (DMP) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMP, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at <https://www.dpc.wa.gov.au/lantu/Claims/Pages/SouthWestSettlement.aspx>.

Further advice can also be sought from the Department of Aboriginal Affairs (DAA) at heritageenquiries@daa.wa.gov.au.



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Coordinate Accuracy

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Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Aboriginal Affairs to the place

Status:

- o **Registered Site:** The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*
- o **Other Heritage Place which includes:**
 - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*
 - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*

Status Reason: e.g. Exclusion - Relates to a portion of an Aboriginal site or heritage place as assessed by the Aboriginal Cultural Material Committee (ACMC). e.g. such as the land subject to a section 18 notice.

Origin Place ID: Used in conjunction with Status Reason to indicate which Registered Site this Place originates from.

Access and Restrictions:

- o **File Restricted = No:** Availability of information (other than boundary) that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- o **File Restricted = Yes:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the [Request to Access Restricted Information](#) letter and form.
- o **Boundary Restricted = No:** place location is shown as accurately as the information lodged with the Registrar allows.
- o **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact DAA.
- o **Restrictions:**
 - **No Restrictions:** Anyone can view the information.
 - **Male Access Only:** Only males can view restricted information.
 - **Female Access Only:** Only females can view restricted information

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.








List of Registered Aboriginal Sites with Map

No Results



Legend

Selected Heritage Sites

-  Registered Sites
-  Aboriginal Community Occupied
-  Aboriginal Community Unoccupied
-  Town
-  Search Area

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Search Criteria

4 Other Heritage Places in Shapefile - Heritage Survey 30Jan17 (5)

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- o **File Restricted = No:** Availability of information (other than boundary) that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- o **File Restricted = Yes:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the [Request to Access Restricted Information](#) letter and form.
- o **Boundary Restricted = No:** place location is shown as accurately as the information lodged with the Registrar allows.
- o **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact DAA.
- o **Restrictions:**
 - **No Restrictions:** Anyone can view the information.
 - **Male Access Only:** Only males can view restricted information.
 - **Female Access Only:** Only females can view restricted information

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.






List of Other Heritage Places with Map

ID	Place Name	File Restricted	Boundary Restricted	Restrictions	Status	Status Reason	Origin Place ID	Type	Knowledge Holders	Coordinates	Legacy ID
3300	READYMIX SANDPIT 2.	No	No	No Gender Restrictions	Lodged			Artefacts / Scatter, Camp		393339mE 6444799mN Zone 50 [Reliable]	S0019 6
3301	BANJUP: CALSIL.	No	No	No Gender Restrictions	Stored Data / Not a Site			Artefacts / Scatter, Camp		395707mE 6444461mN Zone 50 [Reliable]	S0019 7
3423	FORREST ROAD.	No	No	No Gender Restrictions	Stored Data / Not a Site			Mythological, Camp, Meeting Place, Plant Resource, Water Source, Other: ?	*Registered Knowledge Holder names available from DAA	391803mE 6444940mN Zone 50 [Reliable]	S0272 2
4108	READYMIX SANDPIT 1	No	No	No Gender Restrictions	Lodged			Artefacts / Scatter		393989mE 6444524mN Zone 50 [Reliable]	S0129 4



Legend

Selected Heritage Places

-  Other Heritage Places
-  Aboriginal Community Occupied
-  Aboriginal Community Unoccupied
-  Town
-  Search Area

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Geothermal Application, Geothermal Title, Mining Tenement, Petroleum Application, Petroleum Title boundary data copyright © the State of Western Australia (DMP) (2017.2)

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APPENDIX 2: LETTER OF ADVICE

Brad Goode & Associates Pty Ltd
 Consulting Anthropologist
 Heritage Assessments

79 Naturaliste Terrace
 DUNSBOROUGH WA 6281
 (08) 9755 3716
 bradnlee@westnet.com.au
 ACN: 134 732 040
 ABN: 41 134 732 040

21st February 2017

We the undersigned have been consulted by Brad Goode & Associates Pty Ltd, on behalf of Main Roads Western Australia, regarding the proposed Armadale Road Duplication Project in the City of Armadale, Western Australia. We would like to make the following recommendations in relation to the Western Australian *Aboriginal Heritage Act 1972* (AHA):

There are no new ethnographic sites as defined by section 5 of the AHA located within the Armadale Road Duplication Project, known by the Traditional Owners who attended the ethnographic survey. We recommend that there are Aboriginal archaeological monitors during any ground disturbing works in order to observe any artefacts which may be uncovered as a result of the works.

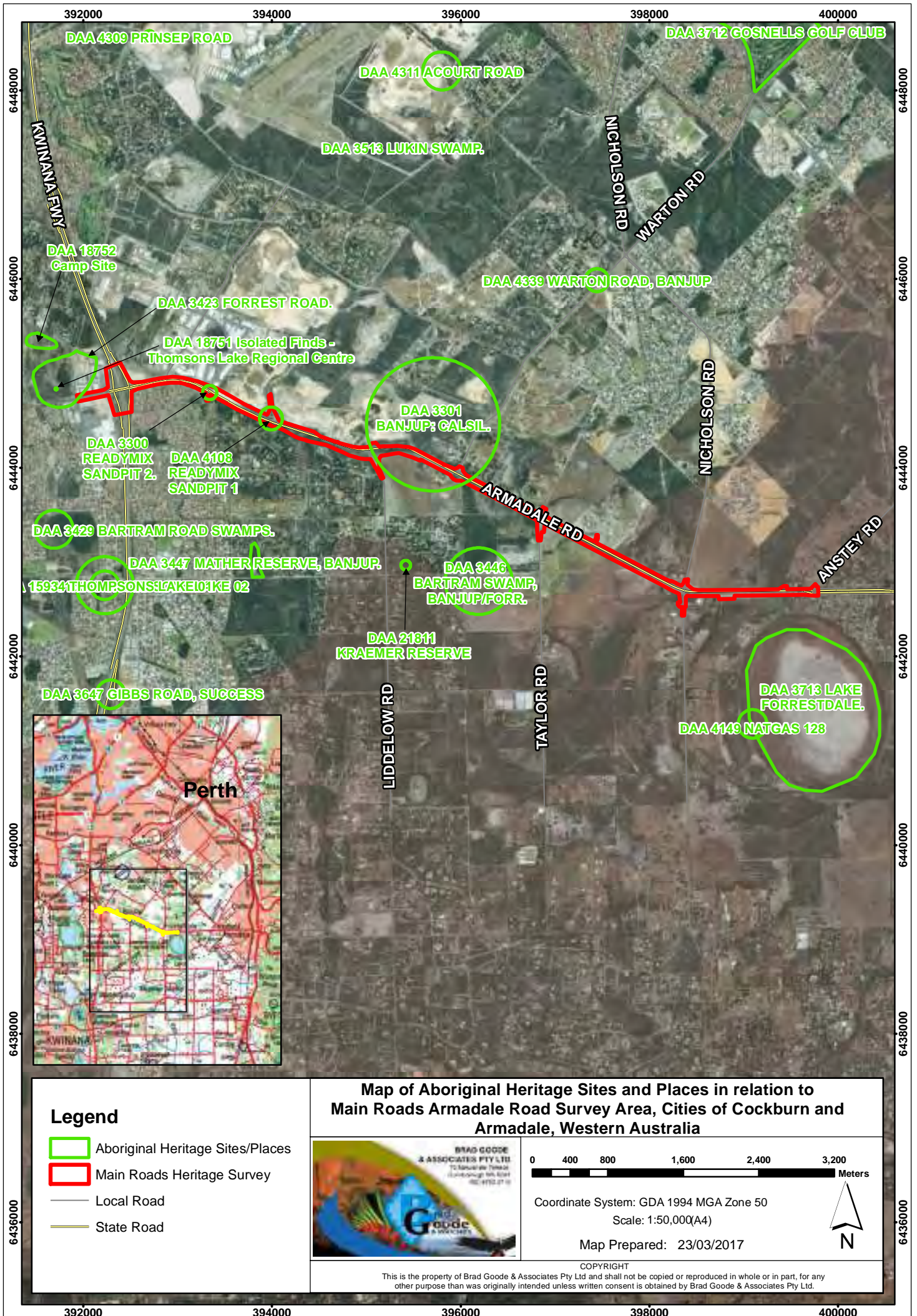
We also recommend that Main Roads speak to the Whadjuk Working Party in regards to policy in regards to salvaging artefacts.

Whadjuk WC2011/099 Native Title Claim group		
Cedric Jacobs	21.02.2017	<i>[Signature]</i>
Glenys Yarran	21.02.2017	<i>[Signature]</i>
Russell Hansen	21.02.2017	<i>[Signature]</i>
Harry Nannup	21.02.2017	<i>[Signature]</i>
Stanley Headland	21.02.2017	<i>[Signature]</i>
Tanya Bodney	21.02.2017	<i>[Signature]</i>
Dorothy Getta	21.02.2017	<i>[Signature]</i> Dorothy
Esandra Colbung	21.02.2017	<i>[Signature]</i>

[Signature]

[Signature]

APPENDIX 3: MAP OF THE PROJECT AREA IN RELATION TO ABORIGINAL HERITAGE SITES



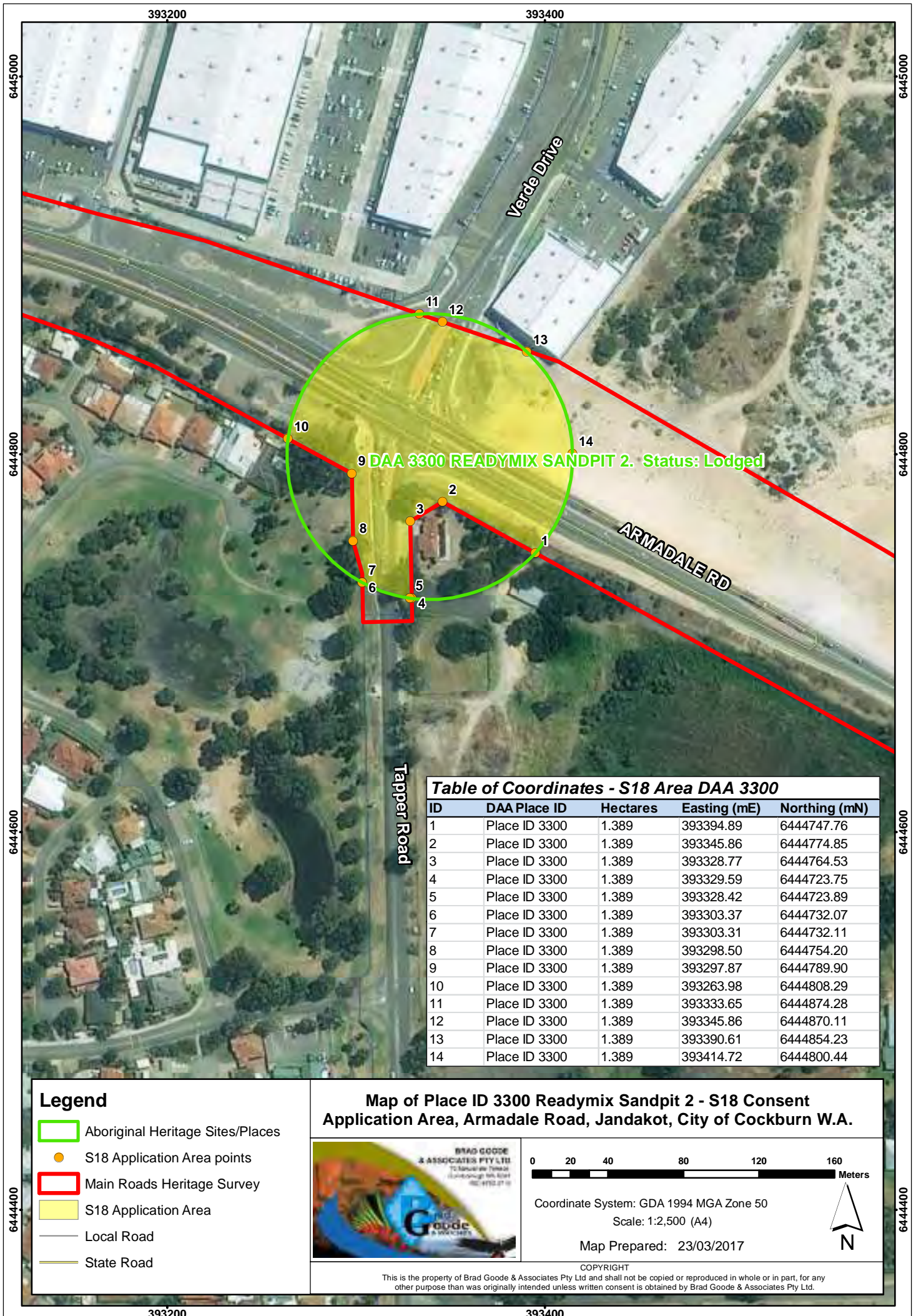


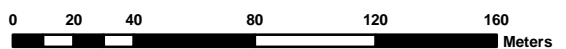
Table of Coordinates - S18 Area DAA 3300

ID	DAA Place ID	Hectares	Easting (mE)	Northing (mN)
1	Place ID 3300	1.389	393394.89	6444747.76
2	Place ID 3300	1.389	393345.86	6444774.85
3	Place ID 3300	1.389	393328.77	6444764.53
4	Place ID 3300	1.389	393329.59	6444723.75
5	Place ID 3300	1.389	393328.42	6444723.89
6	Place ID 3300	1.389	393303.37	6444732.07
7	Place ID 3300	1.389	393303.31	6444732.11
8	Place ID 3300	1.389	393298.50	6444754.20
9	Place ID 3300	1.389	393297.87	6444789.90
10	Place ID 3300	1.389	393263.98	6444808.29
11	Place ID 3300	1.389	393333.65	6444874.28
12	Place ID 3300	1.389	393345.86	6444870.11
13	Place ID 3300	1.389	393390.61	6444854.23
14	Place ID 3300	1.389	393414.72	6444800.44

Legend

- Aboriginal Heritage Sites/Places
- S18 Application Area points
- Main Roads Heritage Survey
- S18 Application Area
- Local Road
- State Road

Map of Place ID 3300 Readymix Sandpit 2 - S18 Consent Application Area, Armadale Road, Jandakot, City of Cockburn W.A.



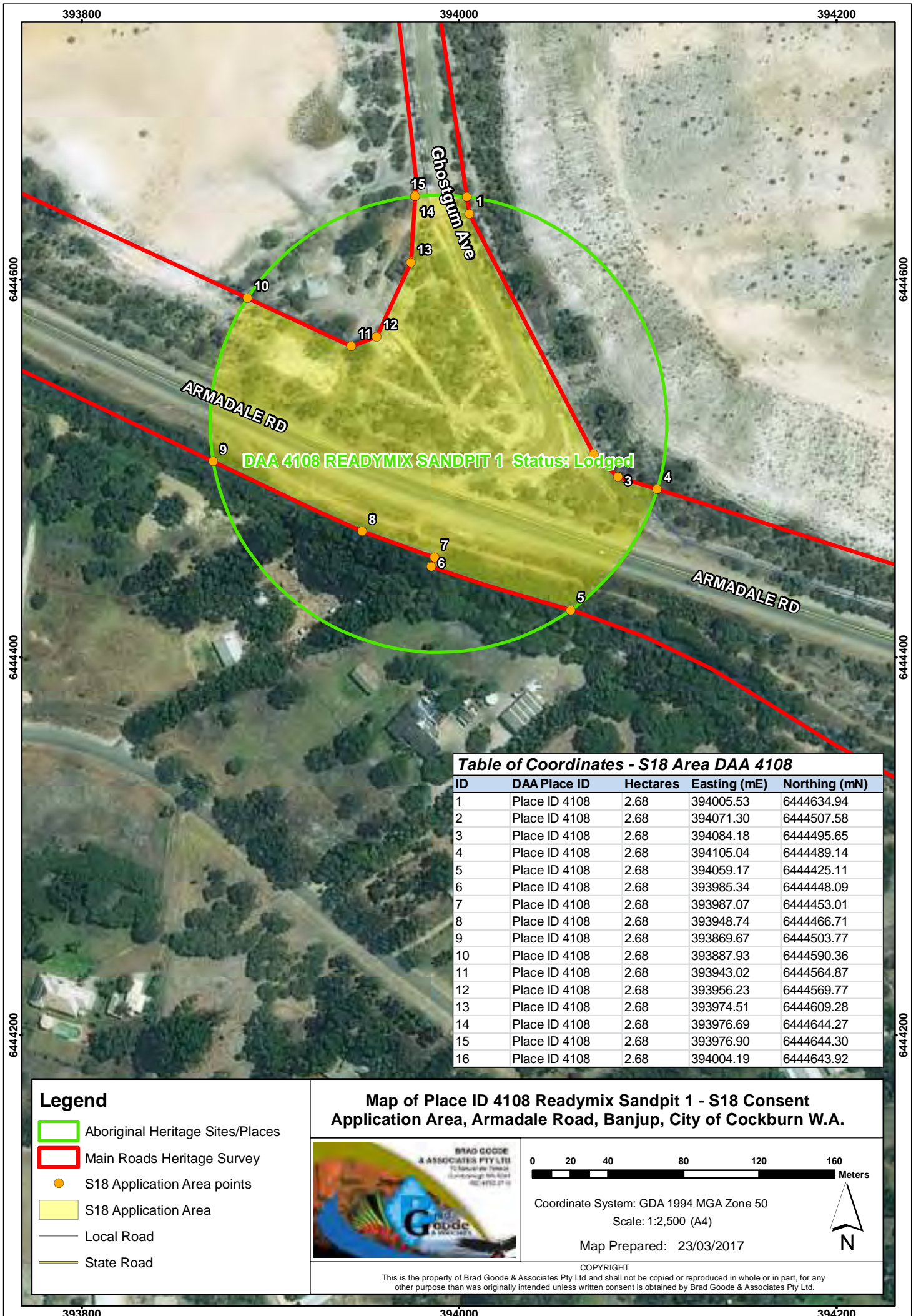
Coordinate System: GDA 1994 MGA Zone 50
Scale: 1:2,500 (A4)

Map Prepared: 23/03/2017



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DAA 4108 READYMIX SANDPIT 1 Status: Lodged

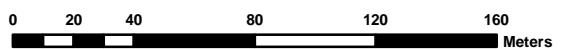
Table of Coordinates - S18 Area DAA 4108

ID	DAA Place ID	Hectares	Easting (mE)	Northing (mN)
1	Place ID 4108	2.68	394005.53	6444634.94
2	Place ID 4108	2.68	394071.30	6444507.58
3	Place ID 4108	2.68	394084.18	6444495.65
4	Place ID 4108	2.68	394105.04	6444489.14
5	Place ID 4108	2.68	394059.17	6444425.11
6	Place ID 4108	2.68	393985.34	6444448.09
7	Place ID 4108	2.68	393987.07	6444453.01
8	Place ID 4108	2.68	393948.74	6444466.71
9	Place ID 4108	2.68	393869.67	6444503.77
10	Place ID 4108	2.68	393887.93	6444590.36
11	Place ID 4108	2.68	393943.02	6444564.87
12	Place ID 4108	2.68	393956.23	6444569.77
13	Place ID 4108	2.68	393974.51	6444609.28
14	Place ID 4108	2.68	393976.69	6444644.27
15	Place ID 4108	2.68	393976.90	6444644.30
16	Place ID 4108	2.68	394004.19	6444643.92

Legend

- Aboriginal Heritage Sites/Places
- Main Roads Heritage Survey
- S18 Application Area points
- S18 Application Area
- Local Road
- State Road

Map of Place ID 4108 Readymix Sandpit 1 - S18 Consent Application Area, Armadale Road, Banjup, City of Cockburn W.A.



Coordinate System: GDA 1994 MGA Zone 50
Scale: 1:2,500 (A4)

Map Prepared: 23/03/2017



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APPENDIX 4: OBLIGATIONS RELATING TO SITES UNDER THE W.A. ABORIGINAL HERITAGE ACT 1972

15. Report of findings

Any person who has knowledge of the existence of any thing in the nature of Aboriginal burial grounds, symbols or objects of sacred, ritual or ceremonial significance, cave or rock paintings or engravings, stone structures or arranged stones, carved trees, or of any other place or thing to which this Act applies or to which this Act might reasonably be suspected to apply shall report its existence to the Registrar, or to a police officer, unless he has reasonable cause to believe the existence of the thing or place in question to be already known to the Registrar.

16. Excavation of Aboriginal sites

(1) Subject to Section 18, the right to excavate or to remove any thing from an Aboriginal site is reserved to the Registrar.

(2) The Registrar, on the advice of the Committee, may authorise the entry upon and excavation of an Aboriginal site and the examination or removal of any thing on or under the site in such manner and subject to such conditions as the Committee may advise.

17. Offences relating to Aboriginal sites

A person who –

- (a) excavates, destroys, damages, conceals or in any way alters any Aboriginal site;
- or
- (b) in any way alters, damages, removes, destroys, conceals, or who deals with in a manner not sanctioned by relevant custom, or assumes the possession, custody or control of, any object on or under an Aboriginal site,

commits an offence unless he is acting with the authorisation of the Registrar under Section 16 or the consent of the Minister under Section 18.

18. Consent to certain uses

(1) For the purposes of this section, the expression “**the owner of any land**” includes a lessee from the Crown, and the holder of any mining tenement or mining privilege, or of any right or privilege under the *Petroleum Act 1967*, in relation to the land.

(1a) A person is also included as an owner of land for the purposes of this section if –

- (a) the person –
 - (i) is the holder of rights conferred under Section 34 of the *Dampier to Bunbury Pipeline Act 1997* in respect of the land or is the holder's nominee approved under Section 34(3) of that Act; or
 - (ii) has authority under Section 7 of the *Petroleum Pipelines Act 1969* to enter upon the land;

or

(b) the person is the holder of a distribution licence under Part 2A of the *Energy Coordination Act 1994* as a result of which the person has rights or powers in respect of the land.

(2) Where the owner of any land gives to the Committee notice in writing that he requires to use the land for a purpose which, unless the Minister gives his consent under this section, would be likely to result in a breach of Section 17 in respect of any Aboriginal site that might be on the land, the Committee shall, as soon as it is reasonably able, form an opinion as to whether there is any Aboriginal site on the land, evaluate the importance and significance of any such site, and submit the notice to the Minister together with its recommendation in writing as to whether or not the Minister should consent to the use of the land for that purpose, and, where applicable, the extent to which and the conditions upon which his consent should be given.

(3) Where the Committee submits a notice to the Minister under subsection (2) he shall consider its recommendation and having regard to the general interest of the community shall either -

(a) consent to the use of the land the subject of the notice, or a specified part of the land, for the purpose required, subject to such conditions, if any, as he may specify; or

(b) wholly decline to consent to the use of the land the subject of the notice for the purpose required,

and shall forthwith inform the owner in writing of his decision.

(4) Where the owner of any land has given to the Committee notice pursuant to subsection (2) and the Committee has not submitted it with its recommendation to the Minister in accordance with that subsection the Minister may require the Committee to do so within a specified time, or may require the Committee to take such other action as the Minister considers necessary in order to expedite the matter, and the Committee shall comply with any such requirement.

(5) Where the owner of any land is aggrieved by a decision of the Minister made under subsection (3) he may apply to the State Administrative Tribunal for a review of the decision.

[(6) repealed]

(7) Where the owner of any land gives notice to the Committee under subsection (2), the Committee may, if it is satisfied that it is practicable to do so, direct the removal of any object to which this Act applies from the land to a place of safe custody.

(8) Where consent has been given under this section to a person to use any land for a particular purpose nothing done by or on behalf of that person pursuant to, and in accordance with any conditions attached to, the consent constitutes an offence against this Act.

APPENDIX 5: NOTES ON THE RECOGNITION OF ABORIGINAL SITES

Section 4 of the *Aboriginal Heritage Act 1972* defines the meaning of "Aboriginal Site" as a place to which this Act applies by the operation of Section 5 (see below).

5. Application to places

This Act applies to –

(a) any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;

(b) any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;

(c) any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the State;

(d) any place where objects to which this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.

The following notes were taken from 'Notes on the Recognition of Aboriginal Sites' published by the W.A. Museum as a guide to the recognition of Aboriginal sites.

Habitation Sites (Artefact Scatters)

These are commonly found throughout Western Australia and usually contain evidence of tool-making, seed grinding and other food processing, cooking, painting, engraving or numerous other activities. The archaeological evidence for some of these activities is discussed in details under the appropriate heading below.

Habitation sites are usually found near an existing or former water source such as a gnamma hole, rock pool, spring or soak. They are generally in the open, but they sometimes occur in shallow rock shelters or caves. It is particularly important that none of these sites be disturbed as the stratified deposits which may be found at such sites can yield valuable information about the inhabitants when excavated by archaeologists.

Seed Grinding

Polished or smoothed areas are sometimes noticed on/near horizontal rock surfaces. The smooth areas are usually 25cm wide and 40 or 50cm long, They are the result of seed grinding by the Aboriginal women and indicate aspects of past economy.

Quarries

When outcrops of rock suitable for the manufacture of stone tools were quarried by the Aborigines, evidence of the flaking and chipping of the source material can usually be seen *in*

situ and nearby. Ochre and other mineral pigments used in painting rock surfaces, artefacts and in body decoration are mined from naturally occurring seams, bands and other deposits. This activity can sometimes be recognised by the presence of wooden digging sticks or the marks made by these implements.

Habitation Structures

Aboriginal people sheltered in simple ephemeral structures, generally made of branches and sometimes of grass. These sites are rarely preserved for more than one occupation period. Occasionally rocks were pushed aside or used to stabilise other building materials. When these rock patterns are located they provide evidence for former habitation sites.

Middens

When a localised source of shellfish and other foods has been exploited from a favoured camping place, the accumulated ashes, hearth stones, shells, bones and other refuse can form mounds at times several metres high and many metres in diameter. Occasionally these refuse mounds or middens contain stone, shell or bone tools. These are most common near the coast, but examples on inland lake and river banks are not unknown.

Stone Artefact Factory Sites

Pieces of rock from which artefacts could be made were often carried to camp sites or other places for final production. Such sites are usually easily recognisable because the manufacturing process produces quantities of flakes and waste material which are clearly out of context when compared with the surrounding rocks. All rocks found on the sandy coastal plain, for example, must have been transported by human agencies. These sites are widely distributed throughout the State.

Marked Trees

Occasionally trees are located that have designs in the bark which have been incised by Aborigines. Toeholds, to assist the climber, were sometimes cut into the bark and sapwood of trees in which possums and other arboreal animals sheltered. Some tree trunks bear scars where sections of bark or wood have been removed and which would have been used to make dishes, shield, spear throwers and other wooden artefacts. In some parts of the state wooden platforms were built in trees to accommodate a corpse during complex rituals following death.

Burials

In the north of the state it was formerly the custom to place the bones of the dead on a ledge in a cave after certain rituals were completed. The bones were wrapped in sheets of bark and the skull placed beside this. In other parts of Western Australia the dead were buried, the burial position varying according to the customs of the particular area and time. Natural erosion, or mechanical earthmoving equipment occasionally exposes these burial sites.

Stone Structures

If one or more stones are found partly buried or wedged into a position which is not likely to be the result of natural forces, then it is probable that the place is an Aboriginal site and that possibly there are other important sites nearby. There are several different types of stone arrangements ranging from simple cairns or piles of stones to more elaborate designs. Low weirs which detain fish when tides fall are found in coastal areas. Some rivers contain similar structures that trap fish against the current. It seems likely that low stone slab structures in the south west jarrah forests were built to provide suitable environments in which to trap some small animals. Low walls or pits were sometimes made to provide a hide or shelter for a hunter.

Elongated rock fragments are occasionally erected as a sign or warning that a special area is being approached. Heaps or alignments of stones may be naturalistic or symbolic representations of animals, people or mythological figures.

Paintings

These usually occur in rock shelters, caves or other sheltered locations which offer a certain degree of protection from the weather. The best known examples in Western Australia occur in the Kimberley region but paintings are also found throughout most of the state. One of several coloured ochres as well as other coloured pigments may have been used at a site. Stencilling was a common painting technique used throughout the state. The negative image of an object was created by spraying pigment over the object which was held against the wall.

Engravings

This term describes designs which have been carved, pecked or pounded into a rock surface. They form the predominant art form of the Pilbara region but are known to occur in the Kimberleys in the north to Toodyay in the south. Most engravings occur in the open but some are situated in rock shelters.

Caches

It was the custom to hide ceremonial objects in niches and other secluded places. The removal of objects from these places, the taking of photographs of the places or objects or any interference with these places is not permitted.

Ceremonial Grounds

At some sites the ground has been modified in some way by the removal of surface pebbles, or the modeling of the soil, or the digging of pits and trenches. In other places there is no noticeable alteration of the ground surface and Aborigines familiar with the site must be consulted concerning its location.

Mythological Sites

Some of the types of sites already described have a place in Aboriginal mythology. In addition there are many Aboriginal sites with no man-made features which enable them to be recognised. They are often natural features in the landscape linked to the Aboriginal account of the formation of the world during the creative "Dreaming" period in the distant past. Many such sites are located at focal points in the creative journeys of mythological spirit beings of the Dreaming. Such sites can only be identified by Aboriginal people who are familiar with the associated traditions.

HERITAGE ASSESSMENT & HERITAGE IMPACT STATEMENT

Armadale Road Duplication Project



PREPARED FOR
MAIN ROADS WESTERN AUSTRALIA

MARCH 2017

HERITAGE ASSESSMENT & IMPACT STATEMENT ARMADALE ROAD

Between Tapper Road, Atwell and Anstey Road, Forrestdale

prepared by

Annabel Wills Architecture

for

Main Roads Western Australia

State Government of Western Australia

March 2017

Cover: Railway Bridge/ Banjup Memorial Park, Feb 2017

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Annabel Wills Architecture Pty Ltd as Trustee for the AG Discretionary Trust trading as Annabel Wills Architecture. ABN 77 503 933 457.

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1.0 INTRODUCTION

1.1 Background

Main Roads Western Australia (Main Roads) proposes to duplicate approximately 7km of Armadale Road, specifically between the intersections of Tapper Road, Atwell and Anstey Road, Forrestdale, and wishes to determine the potential impact of these works on places of cultural heritage significance that may be located within the Study Area.

Main Roads commissioned Annabel Wills Architecture in February 2017 to assess the cultural heritage significance of all places within the Study Area that are listed on the State Register of Heritage Places, Local Government Municipal Heritage Inventories (MHI) and any other non-statutory heritage lists or surveys.

1.2 Project Team

Heritage architecture consultants, Annabel Wills Architecture, undertook the Heritage Assessment. The team comprises:

- Annabel Wills Director (BAppSc; B.Arch)
- Jamie-Lee Bartle Graduate Architect (BEnvDes; M.Arch)
- Carmel Given Graduate Historian (BA Cultural Heritage; PHA WA)

The assessment considered all buildings and structures within the study area, not only those listed in heritage-related databases and records. This was to ensure that nothing had been overlooked in previous heritage studies, Local Government MHI reviews, or any other surveys.

Three site visits were paid to places within the Study Area; an initial overview was undertaken by Annabel Wills and Carmel Given in consultation with Main Roads staff members Marni Baetge and John Braid on 22 February 2017. A second site visit by the consultants was carried out later that day to assess places in more detail and take photographs. A further visit was made on 13 March 2017.

Figures have been drawn by Jamie Lee Bartle from materials provided by Main Roads. Historical information was researched and collated by historian Carmel Given. Physical Assessments, Statements of Cultural Heritage Significance and Heritage Impact Statements have been compiled by heritage architect Annabel Wills and Carmel Given.

1.3 Limitations

The study has not investigated any possible Aboriginal associations that might pertain to the site, as these are not related to this study.

The study has not investigated any environmental impact on the places within the Study Area, as this is outside of the scope of Cultural Heritage studies, which relates to the built environment.

Figure 1 - Study Area



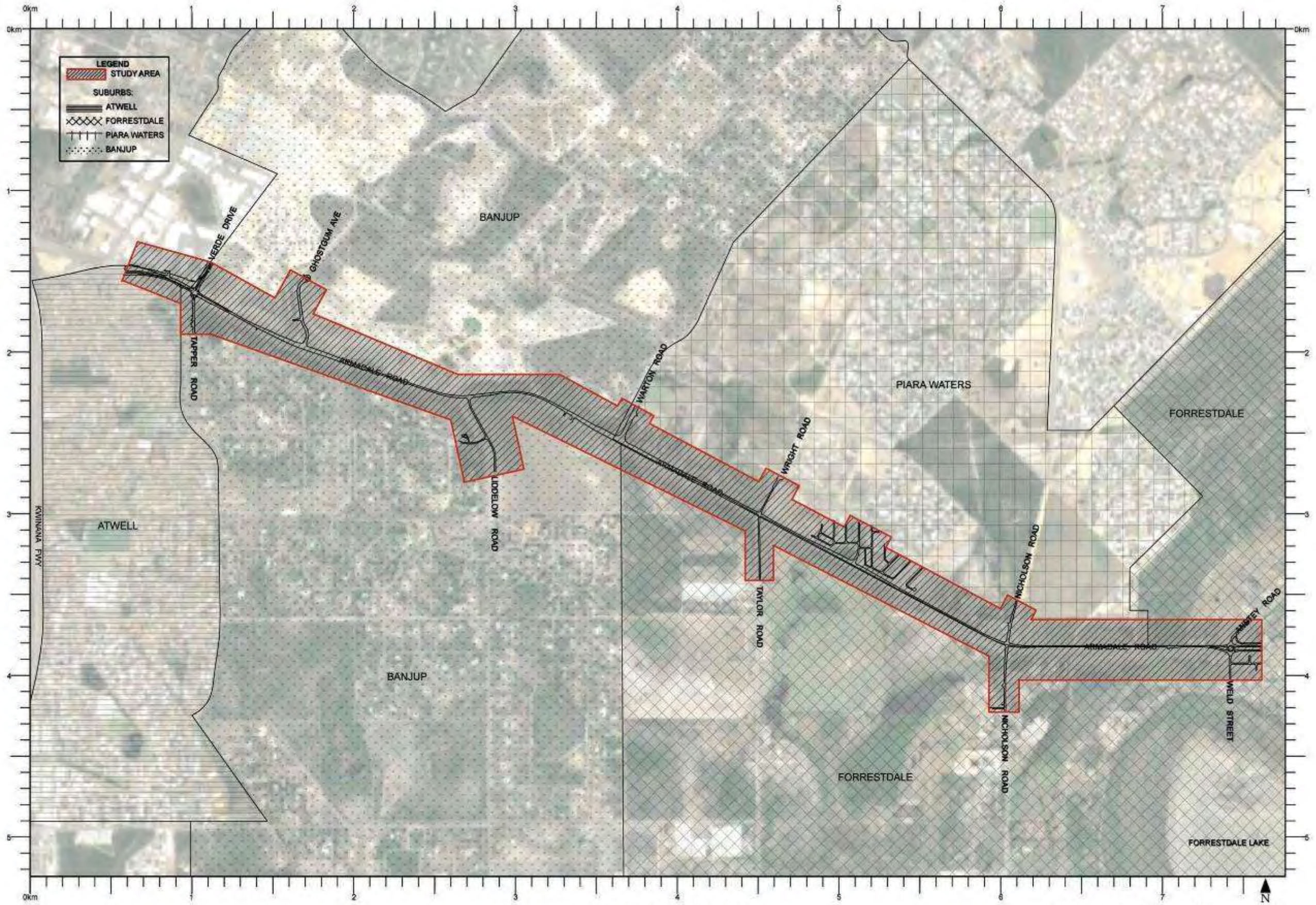


FIGURE 1 - STUDY AREA SITE PLAN

SCALE 1:20,000 0 200m 500m 1km

1.4 Heritage Listings

No places within the Study Area are listed on the State Register of Heritage Places. Three places within or near the Study Area have heritage listings under their specific LGA's Municipal Heritage Inventory.

Place	MHI Ref No	MHI Management Category	State Heritage Office Ref No	Other ¹
Banjup Memorial Park	City of Cockburn MHI Place No. 2, Adopted 15 April 1997	B	10162	NT, RNE
Armadale to Fremantle Railway Line Remnants	City of Armadale MHI Place No 115, Adopted 25 June 2012	A	24580 (Parent entry for 24581, 24582 & 24004)	
Forrestdale Lake and Wetlands	City of Armadale MHI Place No 032, Adopted 1 Dec 2008	A	4403	NT, RNE

1.5 Methodology

Step 1 – Preliminary Assessment

Compile a list of places of interest using Landgate aerial photographs, LGA IntraMaps and aerial photographs provided by Main Roads to ensure a thorough survey of current places.

Desktop research using the State Heritage Office database, LGA MHI information and an initial site visit to determine places which may require further research and a physical assessment; ie a heritage assessment. (Section 2.0 of this report)

Step 2 - Prepare Heritage Assessments

(Sections 3.0 & 4.0 of this report)

Step 3 - Heritage Impact Statements

Consider information from Main Roads on proposed works to determine which, if any, places of cultural heritage significance will be impacted on by the works. Prepare Heritage Impact Statements if necessary.

(Sections 5.0 & 6.0 of this report)

Step 4 – Recommendations

Consider and recommend the possible ways forward for Main Roads.

(Section 7.0 of this report)

¹ National Trust of WA (NT) and Register of the National Estate (RNE) are non-statutory listings. They record and provide information on places of interest.

2.0 PRELIMINARY ASSESSMENT OF PLACES OF INTEREST

After reviewing aerial photographs from Landgate, LGA IntraMaps and information provided by Main Roads, a total of nine places were listed as needing further investigation.

These places were either flagged due to being listed on the LGA's MHI, of some historical or social interest, or situated close enough to the current road to warrant further investigation.

From west to east along Armadale Road the places considered were:

Place	Location
House	3 Tapper Rd, Banjup
House	37 Gutteridge Rd, Banjup
Banjup Memorial Park	Reserve 38912, (361 Armadale Rd) Banjup
House	423 Armadale Rd, Piara Waters
Armadale to Fremantle Railway Line and Bridge	Lot 718, Armadale Road, Forrestdale
Forrestdale Store	386 Nicholson Rd, Piara Waters
Forrestdale Sports Association	760-766 Armadale Rd, Armadale
Forrestdale Hall	3 Weld St, Armadale
Forrestdale Lake and Wetlands	Commercial Road, Forrestdale

In the following preliminary assessments, a brief desktop research was undertaken using Landgate aerial photographs, Post Office Directories, MHI & Heritage Council of Western Australia databases and Trove digitised newspapers.

The physical assessment included a review of Landgate aerial and a street survey only; the owners were not approached and the house was not inspected by the consultants.

Location maps were taken from the LGA's IntraMaps service.

Figure 2 – Places Considered for Assessment

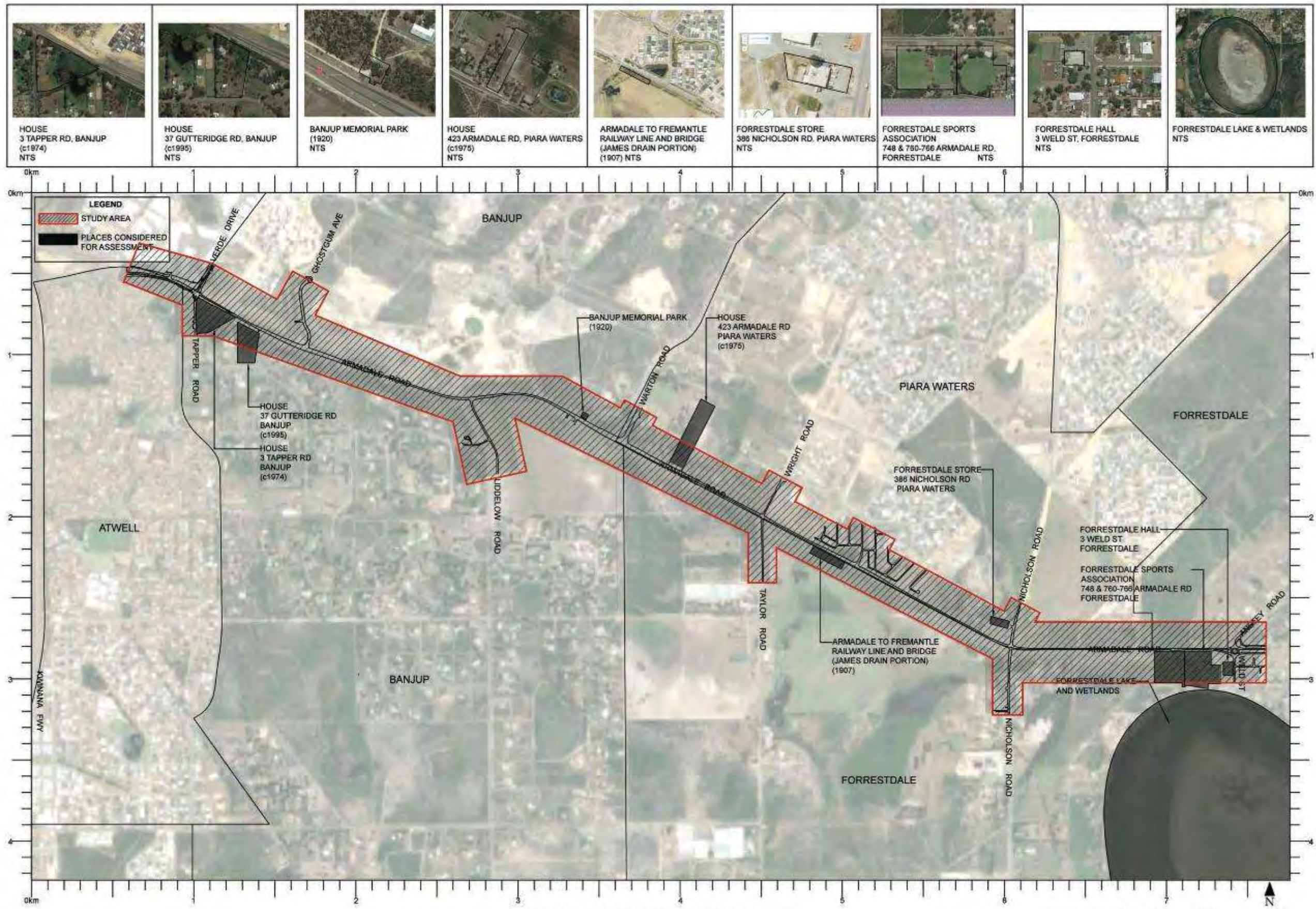






FIGURE 2 - PLACES CONSIDERED FOR ASSESSMENT



2.1 House, 3 Tapper Rd, Banjup

Location (Lot 1) 3 Tapper Road, Banjup	Photo
	
<p>Construction Date Circa 1974</p>	
<p>HCWA Place No N/A</p>	
<p>Heritage Listings Nil</p>	
<p>History</p> <p>Aerial photos show two buildings on the lot in 1953; indicating it was one of the earlier lots developed in the region. The current buildings were erected circa 1974 and the earlier buildings were demolished c1983.</p> <p>The house is considered below threshold from an initial street survey and desktop research, and would be unlikely to be added to the City of Cockburn's MHI in the next review.</p>	
<p>Physical Description</p> <p>The house is a single-story painted/rendered masonry and tile house built in the 1970s. The house is one of two structures on a property that is 4.0792 ha in area. It is situated very close to the triangular corner of the Lot and close to the intersection of Armadale and Tapper Roads. It faces Tapper Road. The other structure is set well back from both roads.</p> <p>After reference to the study area and the lot boundaries of this place it is clear that the house is outside of the road reserve boundary.</p>	
<p>Conclusion</p> <p>The house has no particular cultural heritage significance.</p> <p>The house is outside of the Study Area.</p>	
<p>No further assessment required.</p>	



2.2 House, 37 Gutteridge Rd, Banjup

<p>Location (Lot 5), 37 Gutteridge Road, Banjup</p>	<p>Photo</p>
	
<p>Construction Date Circa 1970; 1995</p>	
<p>HCWA Place No N/A</p>	
<p>Heritage Listings Nil</p>	
<p>History</p> <p>Landgate Aerials show a house was built on the lot between 1965 and 1974; and then it seems the place was either rebuilt or extended and redeveloped between 1995-2000.</p> <p>The house is considered below threshold from an initial street survey and desktop research, and would be unlikely to be added to the City of Cockburn's MHI in the next review.</p>	
<p>Physical Description</p> <p>The house is a single-story painted brick and iron-roofed house dating from the 1990s. The house is one of several structures on a property that is 2.2035 ha in area. It has driveway access from Armadale Road, but the house itself is set well back from the road reserve.</p> <p>After reference to the study area and the lot boundaries of this place it is clear that the house is outside of the road reserve boundary.</p>	
<p>Conclusion</p> <p>The house has no particular cultural heritage significance.</p> <p>The house is outside of the Study Area.</p>	
<p>No further assessment required.</p>	

2.3 Banjup Memorial Park



<p>Location (Lot 615), 361 Armadale Rd, Treeby (Banjup) Reserve 38912</p>	<p>Photo</p>
	
<p>Construction Date 1919-1920</p>	
<p>HCWA Place No 10162</p>	
<p>Heritage Listings MHI Category B: Local and State Significance for Historical and Social values.</p>	
<p>History The monument was dedicated in 1919 and the Banjup Memorial Park was established in 1920. A memorial plaque was dedicated to those men from Banjup who had enlisted in World War One indicating whether they had died or were wounded. Recommendations of a report in 2012 by Griffiths Architects were carried out in 2013, to set the park boundary back from Armadale Road, in anticipation of the Duplication Project.</p>	
<p>Physical Description The Banjup Memorial Park is located in Rose Shanks Reserve near the intersection of Armadale and Warton Roads. It stands in a bush setting accessed from Armadale Road and is surrounded by a white timber post and rail fence. A small memorial plaque is located at the front of the park, and an avenue of trees (14 in number to represent the 14 men listed on the memorial plaque) guides visitors to a newer granite memorial. There is a flag pole at the north end of the park and a bench seat is supplied nearby for visitors.</p>	
<p>Conclusion The Banjup Memorial Park has considerable cultural heritage significance (Historical and Social values). The Banjup Memorial Park, although recently moved back from the road reserve, may be affected by the Duplication Project, particularly in relation to public access.</p>	
<p>This place requires a full Heritage Assessment including a Statement of Significance. (See Section 3.0)</p>	

2.4 House, 423 Armadale Rd, Piara Waters




Location (Lot 14) 423 Armadale Rd, Piara Waters	Photo
	
Construction Date circa 1975	
HCWA Place No N/A	
Heritage Listings Nil	
<p>History</p> <p>Landgate Aerials show that this house was erected between 1974 and 1977; however, its physical appearance suggests an earlier origin; perhaps circa 1950. It may have been relocated from elsewhere.</p> <p>However, the house is considered below threshold from an initial street survey and desktop research, and would be unlikely to be added to the City of Armadale’s MHI in the next review. While it is representative of a certain type of architecture, specifically Inter-War/California Bungalow in a vernacular style, it is not rare or a good example, and has low integrity and authenticity. Note: Further research may uncover some historical value, relating to the use of the house, its former residents, or the history of land use.</p>	
<p>Physical Description</p> <p>The house is set on a lot of 4.1362 ha, facing south onto Armadale Road. Aerial photos suggest the property operates as a rural/market garden business. The house is a single storey painted timber and iron house in a vernacular style and materials that references the Inter-War/California Bungalow style of architecture.² Walls are painted weatherboard. The façade is asymmetrical with a hipped roof and a protruding room with a simple gable over. There is a separate dropped verandah roof at a different pitch, supported by square timber posts. The gable front has a timber framed window with steel awning over. The side has timber casement and multipaned windows. The front verandah is semi-enclosed with fibrous cement/corrugated iron sheeting. To the rear of the house is a fibrous cement sheeted skillion room/lean to. There are various sheds and outbuildings beyond. The house seems abandoned, and is in poor condition, although the roof appears relatively recent.</p> <p>After reference to the study area and the lot boundaries of this place it is clear that the house is outside of the road reserve boundary.</p>	
<p>Conclusion</p> <p>The house has little/some cultural heritage significance (Aesthetic value).</p> <p>The house is outside of the Study Area.</p>	
<p>No further assessment required.</p>	

² Apperly, R., Irving, R., Reynolds, P. A Pictorial Guide to Identifying Australian Architecture. Styles and Terms from 1788 to the Present, Angus and Robertson, North Ryde, 1989, pp 206-209.

2.5 Armadale to Fremantle Railway Line Remnants

Location Lot 718, Armadale Road, Forrestdale	Photo
	
Construction Date From 1907 (decommissioned 1964)	
HCWA Place No 24580	
Heritage Listings MHI Category A (James Drain Portion), D (Nicholson to Taylor Rd) & E (Armadale Road from Liddlelow Road to Cockburn Road): Local and State Significance for Historical values.	
<p>History</p> <p>The Jandakot-Armadale Railway was constructed by the Railway Construction Branch, Public Works Department (PWD). Work commenced at Jandakot on 20 February 1907. Jandakot had been the terminus of the railway since the section from Robb's Jetty opened on 1 April 1906. This railway was built to serve the settlers along its route but it was also a short cut for goods, timber and coal to the port of Fremantle. The railway was opened for goods and passenger traffic from 15 July 1907, while the official opening was performed by the Minister for Works, James Price, on 22 July 1907. A special train was run for the occasion from Fremantle through to Armadale. At the time of the opening there were only two intermediate sidings; No.1 Siding (later Banjupp) and No.2 Siding (later Forrestdale).</p> <p>In the early 1960s a new bauxite railway was proposed by Alcoa in Kwinana directly to Mundijong in the Darling Ranges. This eliminated the need to maintain a parallel railway from Armadale to Robbs Jetty. Train services from Bibra Lake to Armadale were therefore suspended from 23 January 1964.</p>	
<p>Physical Description</p> <p>The construction of Armadale Road along the railway reserve has eliminated much of the railway. There are the remains of a bridge over the James Drain in Forrestdale between Nicholson and Taylor Roads.</p>	
<p>Conclusion</p> <p>The Railway line (former alignment and remnants) including the Railway Bridge has considerable cultural heritage significance (Historical and Scientific values).</p> <p>The Railway line (former alignment and remnants) is generally considered an historic site and therefore the Duplication Project has no effect. However, the Railway Bridge will very likely be affected due to the proposed improvement of the culvert under the railway bridge, and the widening of the road.</p>	
<p>This place requires a full Heritage Assessment including a Statement of Significance.</p>	

2.6 Forrestdale Store

Location (Lot 3) 386 Nicholson Rd, Piara Waters	Photo
	
	
<p>Aerial, 11.03.1965, Landgate Map Viewer (Note for publication, reference only).</p>	
<p>Construction Date Circa 1978</p>	
<p>HCWA Place No N/A</p>	
<p>Heritage Listings Nil</p>	
<p>History</p> <p>The 1949 Post Office Directory lists only one commercial enterprise in Forrestdale at that time. The rest of the residents (population 45) were market, poultry, dairy or pig farmers. Edward Mayhew was operating a motor garage and post master in Forrestdale, location unlisted.</p> <p>The 1953 aerial photo shows a house and a smaller building close to and facing the corner, which may have been the original Forrestdale store. At Lot 2, 390 Armadale Road, it is now a petrol station, developed c1978. The current store, adjacent on the north side, was also built in c1978.</p> <p>The store was previously considered for inclusion in the 2006 City of Armadale MHI Review but the consultants excluded it. It was considered below threshold and/or there being a lack of supporting evidence to add the place by reason of aesthetic, historical, scientific or social value.³</p>	

³ City of Armadale MHI <https://www.armadale.wa.gov.au/municipal-heritage-inventory>

Physical Description

Forrestdale Store is a c1978 flat roofed brick and iron utilitarian building facing Nicholson Road. There is a c1978 petrol station built to the south and a newly built (2012) liquor store to the north. Access to the store is via Nicholson Road.

After reference to the study area and the lot boundaries of this place it is clear that the store, as well as the adjacent petrol station (possible location of earlier store) is outside of the road reserve boundary.



Conclusion

Forrestdale Store has little cultural heritage significance.



Forrestdale Store is outside of the Study Area.

No further assessment required.

2.7 Forrestdale Sports Association



<p>Location (Lot 8) 748 Armadale Rd, Forrestdale (Lot 421) 760-766, Forrestdale</p> 	<p>Photo</p> 
<p>Construction Date Circa 1970</p>	
<p>HCWA Place No N/A</p>	
<p>Heritage Listings Nil</p>	
<p>History</p> <p>Aerial photos show the grounds were developed between 1965 and 1974. The place is a hub for the growing community, providing facilities for various sports and community clubs.</p> <p>Pavilions and club room facilities are of no aesthetic or historical significance.</p>	
<p>Physical Description</p> <p>The west side (Lot 8) comprises the Armadale Soccer Club, a soccer field, grassed tennis courts and Arthur Skeet Pavillion. The east side comprises the Sports Association's main club rooms, Ian Pratt Pavillion and the William Skeet Oval (football/cricket oval). There are more tennis courts to the east and the Forrestdale Hall on the east boundary. Each lot has driveway access from Armadale Road, with car parking bays along the north side of the lots.</p> <p>After reference to the study area and the lot boundaries of this place it is clear that while the main intersection is being improved the hall is outside of the road reserve boundary.</p>	
<p>Conclusion</p> <p>Forrestdale Sports Association has some cultural heritage significance (Social value).</p> <p>Forrestdale Sports Association is outside of the Study Area.</p>	
<p>No further assessment required.</p>	

2.8 Forrestdale Hall

Location (Lot 352) 3 Weld St, Forrestdale	Photo
	
Construction Date Circa 1962	
HCWA Place No N/A	
Heritage Listings Nil	
<p>History</p> <p>Aerial photos show that the community hall was built between 1959 and 1965. The place is regularly used by after school dance classes, playgroups and community group get togethers.⁴</p>	
<p>Physical Description</p> <p>Forrestdale Hall is a 1960s single storey brick and iron community hall set on an urban lot. Its main entrance faces Weld Street and there are parking bays to the north side. It is situated adjacent to the Forrestdale Sports Asscaition and playing fields on the west side. The Forrestdale Community Kindergarten is based in the same complex on the south side.</p> <p>After reference to the study area and the lot boundaries of this place it is clear that while the main intersection is being improved the hall is outside of the road reserve boundary.</p>	
<p>Conclusion</p> <p>Forrestdale Hall has some cultural heritage significance (Social value).</p> <p>Forrestdale Hall is outside of the Study Area.</p>	
<p>No further assessment required.</p>	

⁴ <https://www.armadale.wa.gov.au/forrestdale-hall>; also for photograph.

2.9 Forrestdale Lake and Wetlands

<p>Location Lot 459, Forrestdale Road, Forrestdale Reserve Number A24781</p>	<p>Photo</p>
	
<p>Construction Date N/A</p>	
<p>HCWA Place No 4403</p>	
<p>Heritage Listings MHI Category A - Worthy of the highest level of protection - recommended for entry in the State Register of Heritage Places. Development would require consultation with the City of Armadale. Maximum encouragement to the owner should be provided under the City of Armadale's Town Planning Scheme to conserve the significance of the place. A Heritage Assessment and Impact Statement should be undertaken before approval is given for any major redevelopment. Incentives to promote heritage conservation should also be considered.</p>	
<p>History ⁵</p> <p>This body of water (around 200ha in area) is of historical-mythological significance to Aboriginal people, and was known as the 'place of the whistling kite' (Jandakot). Forrestdale Lake and Wetlands is protected as an A Class Nature Reserve. It is also protected by the Ramsar Convention⁶ as a wetland of international significance.</p> <p>The lake is an important feeding and resting place for various long-range migratory species of bird. Lake Forrestdale is also protected as an 'A' Class Nature Reserve. In addition, for some years from 1957, the Lake Jandakot Sailing Club was based here. This was originally a Rotary Club community service project, part of which involved the transportation of the old Bedfordale Primary School to the lakeside, where it was reassembled as a clubhouse. As the yachting season opened earlier on the lake than elsewhere, it was well supported by metropolitan sailing clubs, even, at one time, being used as a practice venue by Rolly tasker when training for the Flying Dutchman Class Olympic events. Sundays were a particularly popular time at the Lake, when the water was filled with craft of various classes, including 14-footers, Veejays and Rainbows, as well as providing a safe course for young sailers in their 'pram' dinghies. Unfortunately two dry years (with a resulting low water level) and the demolition of the clubhouse by strong winds, led to the demise of the club after four or five years.</p>	
<p>Physical Description</p> <p>Forrestdale Lake and Wetlands is a nature reserve immediately south of the suburb of Forrestdale 10kms west of Armadale, with access off Commercial Road, which bounds its perimeter. It is a still largely natural wetland, with some adjoining native vegetation, surrounded by land developed for</p>	

⁵ City of Armadale MHI <https://www.armadale.wa.gov.au/municipal-heritage-inventory>; also for photograph.

⁶ Forrestdale Lake Nature Reserve Management Plan, 2005, Dept of Conservation and Land Management, WA; [http://www.ramsar.org/wetland/australia Site No 481](http://www.ramsar.org/wetland/australia/Site%20No%20481).

housing and agriculture. The wetlands regularly supports large numbers of shore and water birds. The lake covers an area up to 198ha of open water, and is surrounded by sedgeland and a low forrest of swamp paperbarks and banksia woodlands. The lake is approximately 2m in depth, depending on rainfall.

Conclusion

Statement of Significance (Extracted from MHI)

- The place is an attractive and prominent landscape feature that makes a significant contribution to the character of the area.
- The place is significant for its association with the Lake Jandakot Sailing Club, who ran a yacht club here for several years from 1957.
- The place is valued by the community as a popular educational site and for bushwalking and bird-watching.
- The place is valued by local aboriginal communities as it is of historical-mythological significance, and was known as the 'place of the whistling kite' (Jandakot).
- The place has a forestation of a variety of flora and is home to 72 species of bird and also to the long-range migratory birds, and is a wetland of international importance.

Forrestdale Lake and Wetlands is outside of the Study Area.

No further assessment required.

3.0 HERITAGE ASSESSMENT – BANJUP MEMORIAL PARK

Figure 3 – Banjup Memorial Park



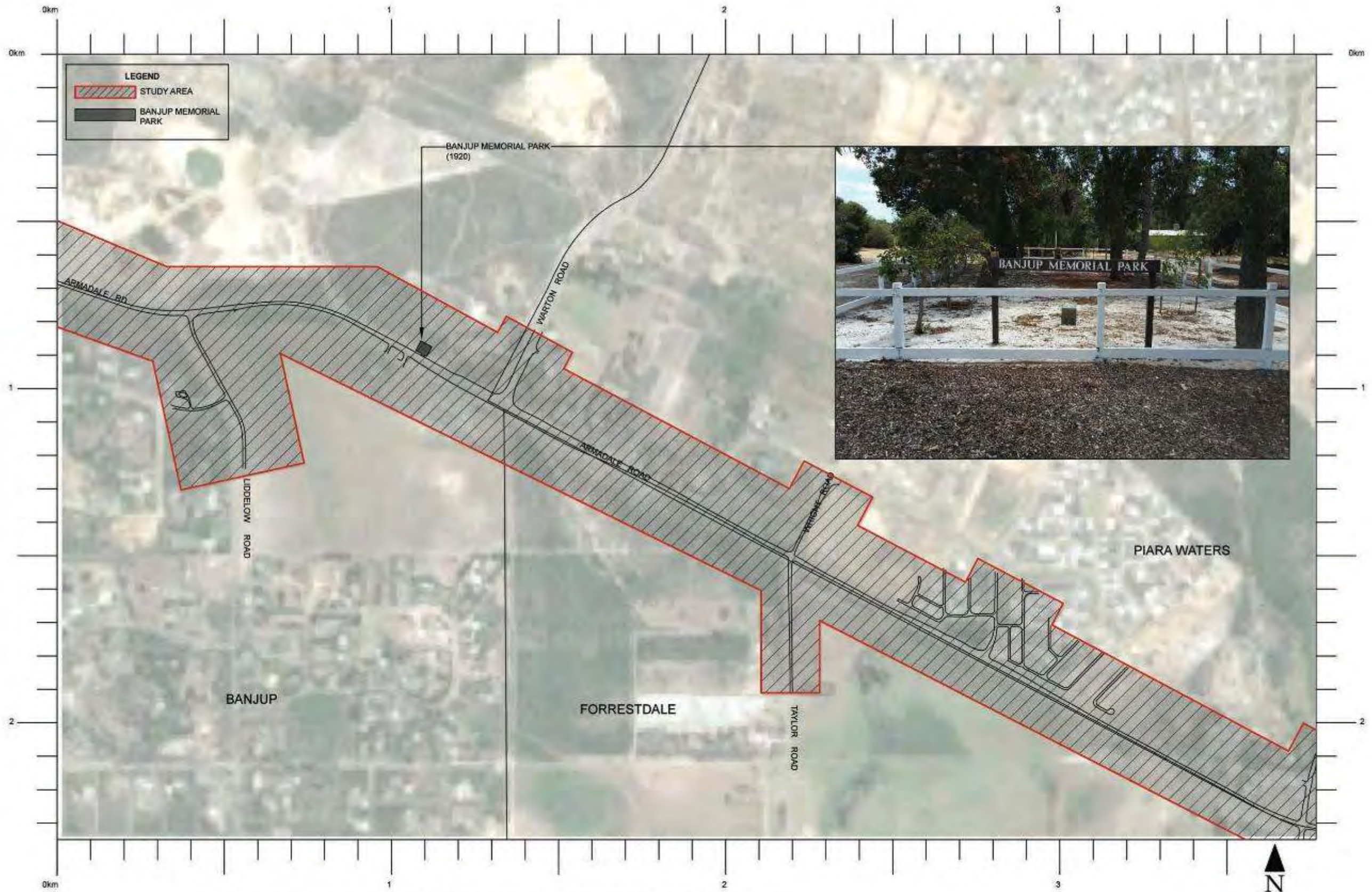


FIGURE 3 - PLACES REQUIRING HERITAGE ASSESSMENT AND HERITAGE IMPACT STATEMENT
- BANJUP MEMORIAL PARK

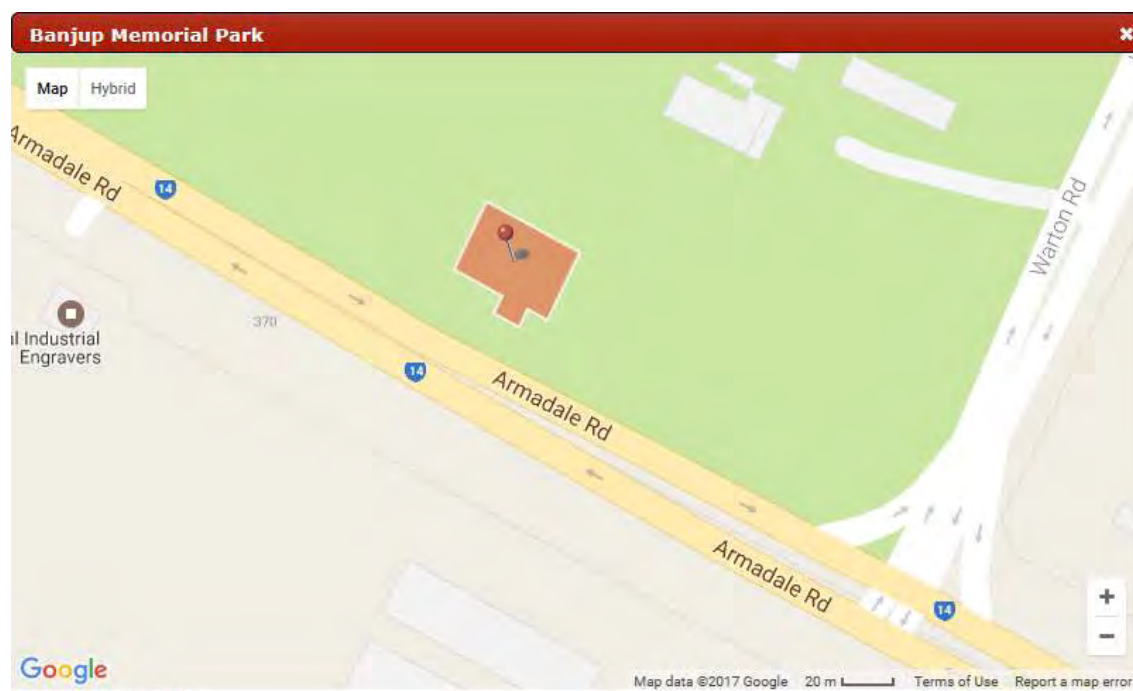
SCALE 1:10,000 0 200m 500m 1km

HCWA Place Number

10162

Location

Reserve 38912, Armadale Road (west of Warton Road intersection), Banjup.



Construction Date

1919 (Original memorial plaque)

1920 (14 trees; some of which may remain)

2013 (New memorial stone, some trees)

Statement of Significance

Banjup Memorial Park has cultural heritage significance for the following reasons:

it is a war memorial and park dedicated to those men from the district who enlisted in World War I, and dates from 1919;

it has social significance for the Returned Services League and the descendants of those men commemorated, as well as to the local community who attend Anzac day services there;

it is historically significant as a representation of war memorials and for its continued use as such; and,

it has aesthetic value as a designed small park set within a natural bush setting.

Physical Description

The Banjup Memorial Park is located in Rose Shanks Reserve near the intersection of Armadale and Warton Roads.

It stands in a bush setting accessed from Armadale Road and is surrounded by a white timber post and rail fence 10.2 metres wide by 33.9 metres in length.

The boundary of the lot extends 19.8m to the north west, and 8m to the south east. The area on the north side is used for parking, at occasions where visitors gather (eg Anzac Day).



A small memorial plaque is located at the front of the park, and an avenue of trees (14 in number to represent the 14 men listed on the memorial plaque) guides visitors to a newer granite memorial. There is a flag pole at the north end of the park and a bench seat is supplied nearby for visitors.

History

The monument was dedicated in 1919.

The Banjup Memorial Park was established in 1920 and initially comprised an avenue of 14 trees. A memorial plaque that reads 'Banjup Memorial Reserve' was dedicated to those men from Banjup who had enlisted in World War One indicating whether they had died or were wounded. This Memorial has the dubious honour of recording the highest 'Killed in Action' and 'Wounded' on a percentage basis, than any other War Memorial in Western Australia.

A gum tree was planted for each of the fourteen men from the district who had enlisted. If any of the trees dies, another is planted in its place. As a number of trees have required replacement over the years, there is an assortment of tree species at varying ages, including Jarrah (*Eucalyptus marginata*), Tuart (*Eucalyptus gomphocephala*), Grevillea and Red Flowering Gum (*Corymbia ficifolia*)

A plaque naming the men is displayed at the park and another is held at the Azelia Ley Homestead. The plaque names the men who returned safely as well as those who were wounded or killed. Cockburn RSL maintains Banjup Memorial Park.

In 2012, the proposed widening of Armadale Road to dual carriageway resulted in a reconsideration of the park's location. The Cockburn RSL and the City of Cockburn considered that it is within the community's interest to use the widening of Armadale Road as an opportunity to improve the memorial thereby endorsing its significance in Banjup.

Griffiths Architects were engaged by the City of Cockburn in 2012 to undertake a Heritage Assessment in preparation for the road widening, as the memorial land protruded into the

Armadale Road Reserve. The report recommended some modifications, which were undertaken in 2013. A summary is below:⁷

- The whole memorial was relocated approximately 5.1 metres north from the current position. When the dedication plaque was relocated to the rear of the lot, the RSL upgraded it to a more substantial form of a new large granite block engraved with a commemorative inscription, which was derived from consultation with the RSL.
- Removal of the two trees located at the front of the memorial and planting of two new trees in the re-vested land at the rear.
- Choice of a much better and safer location for the plaque, as it would encourage people to assemble away from the road.
- A designated pull up zone for cars to be used as a 'drop-off' point during services and a temporary pull up for patrons on other days.
- The existing bench which was located within the park was relocated closer to the rear so that it is further away from the disturbances of the road.
- The RSL have suggested that the supply of a flagpole to the rear of the lot would serve to maintain the integrity of the place and also benefit the community by ensuring that the memorial can be fully utilized during services such as Anzac Day. The flagpole was erected in a location so that it would not obscure or be obscured by tree canopies; located between the two newly planted trees at the rear so that the trees "stand guard" and enhance the presence of the flagpole.

⁷ Griffiths Architects, Banjup Memorial Park Report, May 2012 for City of Cockburn.

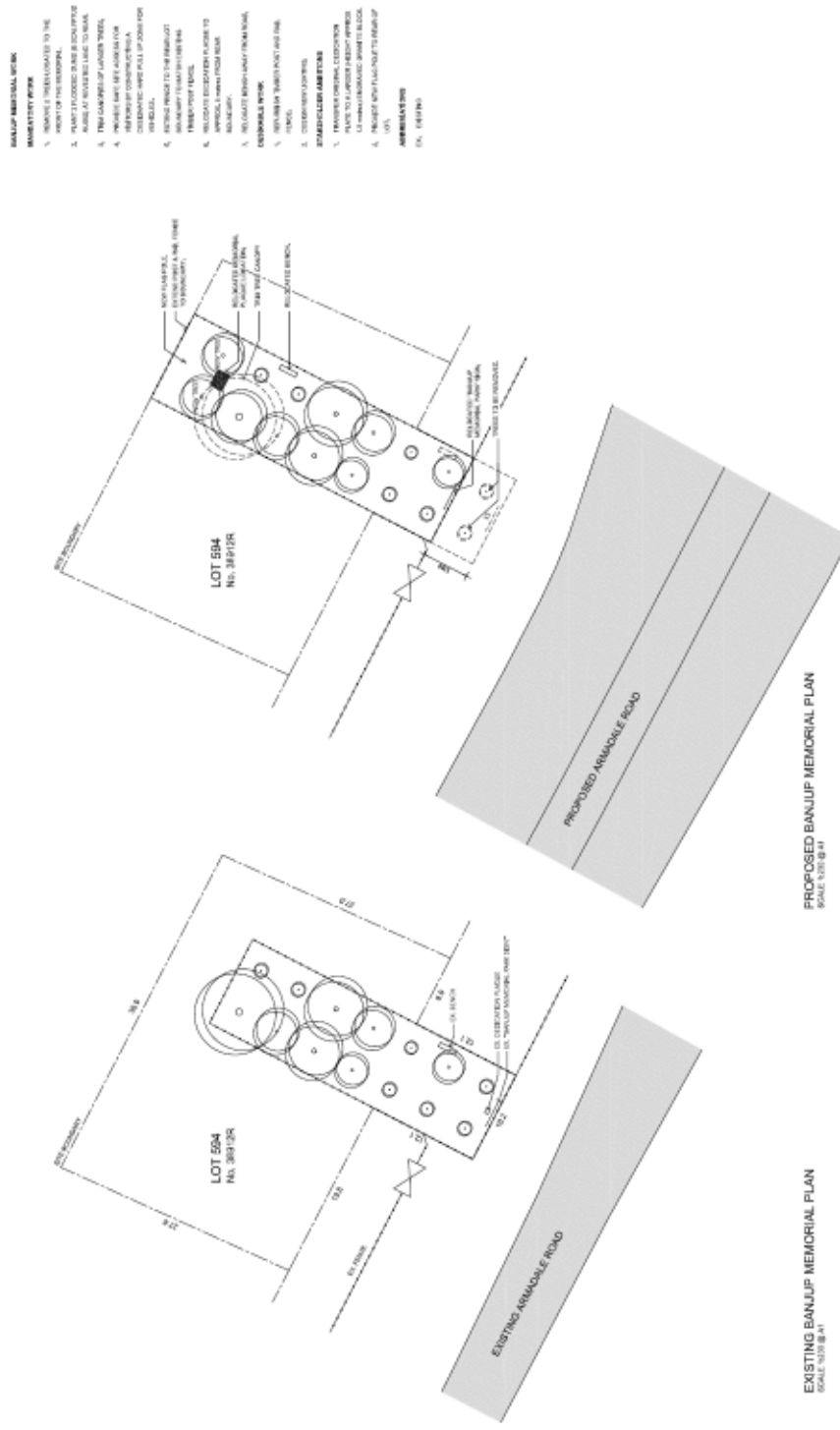


Figure extracted from Griffiths Architects, Banjup Memorial Park Report, May 2012 for City of Cockburn.

Integrity/Authenticity

Moderate degree of Integrity (original intent clear, current use compatible, high long term sustainability). Some trees have been replaced, and some appear to need replacement at some point in the future.

High degree of authenticity (original fabric remaining). Plaque and some trees date from 1919.

Condition

Good

MHI Management Category

MHI Category B

Considerable significance Very important to the heritage of the locality. Conservation of the place is highly desirable. Any alterations or extensions should be sympathetic to the heritage values of the place.

Protected under the Town Planning Scheme of the City of Cockburn.

References

- <http://monumentaustralia.org.au/display/60069-banjup-memorial-park>
 - City of Cockburn MHI
http://www.cockburn.wa.gov.au/Council_Services/City_Development/Heritage
-

Historic and/or Aerial Photographs ⁸



Photo: Aerial, 11.03.1965 showing park well defined by tree plantings.



Photo: Aerial, 30.08.1981 showing Pistol Club being developed to the north.

⁸ Source: Landgate Map Viewer (Note: not for publication; reference only)



Photo: Aerial, 23.03.2011 showing park boundary projecting south.



Photo: Aerial, 16.11.2013 showing park boundary relocated back from the road, and extended to the north, with new trees planted.



Photo: Aerial, 09.01.2015



View of park looking north from Armadale Road. Original plaque at front.



Original Plaque



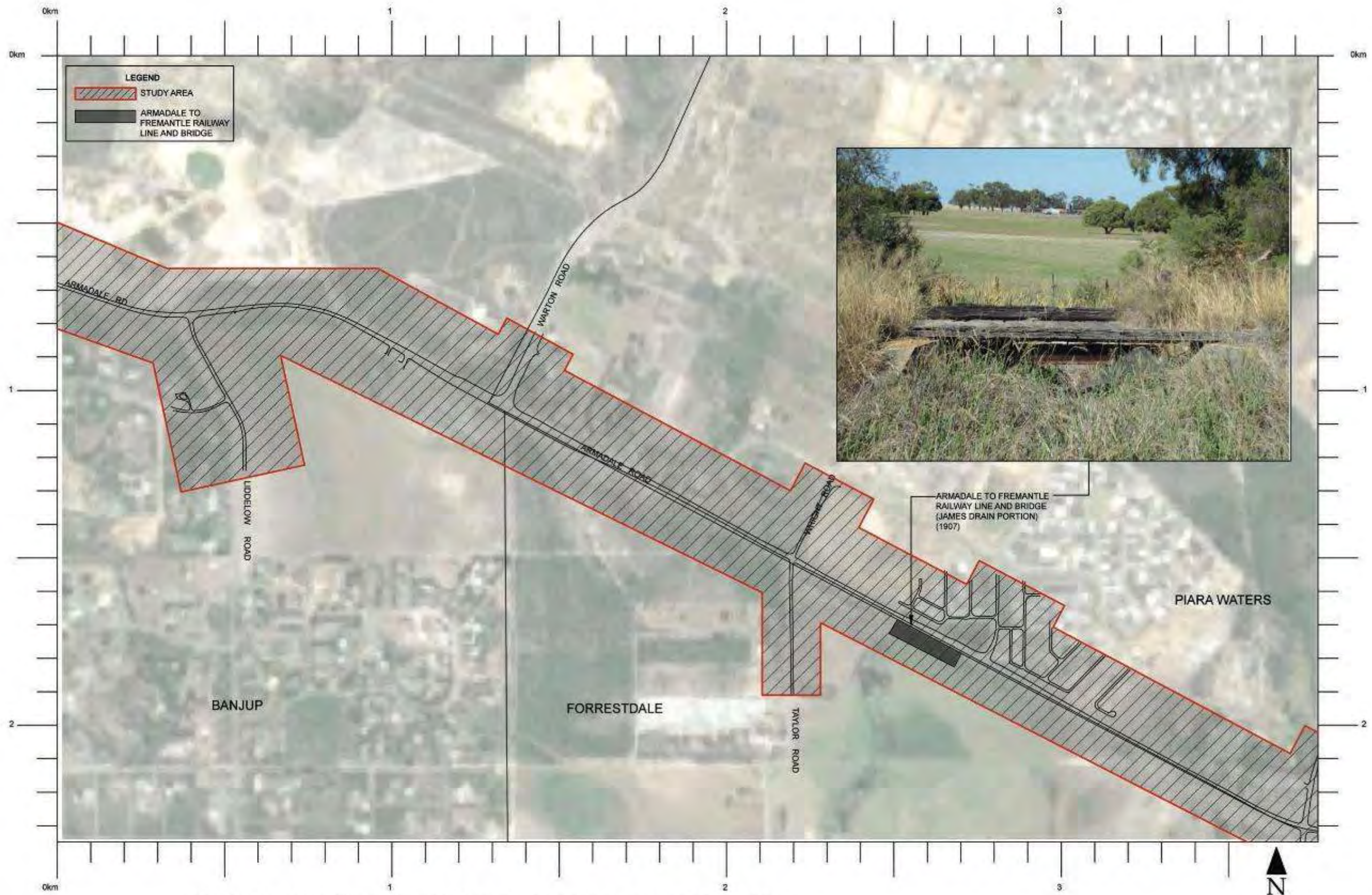
New (2013) granite memorial.



Avenue of trees leading to memorial, with flagpole behind.

4.0 HERITAGE ASSESSMENT – ARMADALE TO FREMANTLE RAILWAY LINE REMNANTS

Figure 4 – James Drain Portion of Armadale to Fremantle Railway Line



**FIGURE 4 - PLACES REQUIRING HERITAGE ASSESSMENT AND HERITAGE IMPACT STATEMENT
- ARMADALE TO FREMANTLE RAILWAY LINE AND BRIDGE (JAMES DRAIN PORTION)**

SCALE 1:10,000

HCWA Place Number

24580 (Parent entry for 24004, 24581, 24582)

Location

24580: Remnants - Runs along the south side of Armadale Road between Liddelow Rd and the Armadale Railway Line.

The entry comprises three separate curtilage areas as surveyed by the Heritage Council of WA:

<p>Armadale/Fremantle Rail Armadale Road to Cockburn</p>	<p>24582</p> <p>Armadale Road to Cockburn - Runs along the south side of Armadale Road between Liddelow Road and Armadale Road. Excludes portion between Nicholson & Taylor Rds.</p>
<p>Armadale/Fremantle Rail Line Nicholson to Taylor Rds</p>	<p>24004</p> <p>Nicholson to Taylor Rds - Runs along the south side of Armadale Rd from Nicholson Rd to Taylor Rd excluding that portion for 100 metres east and west of James Drain</p>



Note: James Drain originates from the Taylor Road wetlands and Bangup Swamp, and flows through adjacent farmlands into Forrestdale Lake.⁹



Aerial view of location of James Drain portion. Waterway underneath Armadale Road, water pipeline and railway bridge.

⁹ Forrestdale Lake Nature Reserve Management Plan, 2005, Dept of Conservation and Land Management, WA.



Aerial view of James Drain portion of railway line, with bridge over waterway which runs underneath Armadale Road.

Construction Date

1907

Statement of Significance

The Armadale to Fremantle Railway Line remnants has cultural heritage significance for the following reasons:

it has historic value as representing the opening of the railway from Perth to Armadale, which had a large impact on the elevation of Armadale to municipal prominence;

it has historic value as its construction opened the district to the transport of its agricultural and timber products and the movement of passengers along the Armadale-Fremantle route; and,

it has scientific value as an archaeological research and teaching site that has the potential to reveal wider information about railway works associated with the construction of railways in Western Australia at the start of the 20th Century.

Physical Description

In the 1970s the alignment of this railway was largely intact and the location of the sidings readily visible. The two railway bridges at Armadale (Neerigen Brook) and Westfield (Wungong Brook) were also still in situ. The construction of Armadale Road along the railway reserve has eliminated much of this formation.

There are the remains of a bridge over the James Drain in Forrestdale between Nicholson and Taylor Roads.

History

The Jandakot-Armadale Railway was constructed by the Railway Construction Branch, Public Works Department (PWD). Work commenced at Jandakot on 20 February 1907 and after a month the forming up of the track bed and clearing were well advanced. About 80 men were employed and 1 mile of rails had been laid. Jandakot had been the terminus of the railway since the section from Robb's Jetty opened on 1 April 1906. This railway was built to serve the settlers along its route but it was also a short cut for goods, timber and coal to the port of Fremantle. Because of this heavy goods traffic, the line was built new with heavy rails. The 58lb per yard steel rails were made by Cockerill Ougrée in Liège, Belgium. By the end of April 1907 the rails had been laid for 3½ miles. The rails were connected with the South Western Railway at Armadale in mid June and it was reported that the PWD had already hauled 100 tons of local goods using their construction locomotive.

The railway was opened for goods and passenger traffic from 15 July 1907, while the official opening was performed by the Minister for Works, James Price, on 22 July 1907. A special train was run for the occasion from Fremantle through to Armadale. At the time of the opening there were only two intermediate sidings; No.1 Siding (later Banjupp) and No.2 Siding (later Forrestdale).

There were a number of sidings and stopping places from Fremantle heading towards Armadale along the route of the railway over the years from 1907 to 1964. These included:

- Jandakot : opened with the railway from Robb's Jetty on 1 April 1906. It was renamed Yangebupp on 1 April 1908, but renamed Jandakot on 14 September 1908. It was still open when the railway closed in 1964. It appears that this siding was about 8.9km, as the crow flies, west from the Banjup siding (*Outside of Study Area*).
- Banjup : opened with the railway on 15 July 1907 and was known as No.1 Siding. It was named Banjupp on 1 April 1908 but renamed Banjup in August 1915. It had a public siding, shelter shed and loading ramp. The public siding was removed in April 1952 but the location remained open as a passenger stopping place until eliminated in January 1961. (*This siding was located just west of the intersection of Armadale and Liddelow Roads, Banjup.*)
- Taylor's Crossing: this was a passenger stopping place only, and opened sometime prior to 1922. It was originally called Skeet's Crossing and was renamed Taylor's Crossing in June 1934. It appears to have been mainly used by school children. It was eliminated in January 1961. (*This locality was about 500 metres east of the intersection of Armadale and Taylor Roads*).
- Pine Tree Crossing : this was also a passenger stopping place only (mainly school children) and opened about 1936-38. It was eliminated in January 1961. (*This location is about the intersection of Armadale and Nicholson Roads*).
- Forrestdale: opened with the railway on 15 July 1907 and was known as No.2 Siding. It was named Jandakot on 1 April 1908, but renamed East Jandakot on 14 September 1908. It was renamed Forrestdale in August 1915. It had a public siding, shelter shed and loading ramp. It was still open when the railway closed in 1964.

(This siding was located about the intersection of Armadale and Wirin Roads, Forrestdale). (*Outside of Study Area*)

- Westfield: this public siding was opened in August 1911 and named Murphy's Crossing. It was renamed Westfield in May 1916. The public siding was removed for a time but was reinstalled in October 1923. A shelter shed was provided for passengers and goods. It was still open when the railway closed in 1964. (This siding was just west of the current intersection of Armadale and Lake Roads). (*Outside of Study Area*)

In the early 1960s a new bauxite railway was proposed by Alcoa to run from Mundijong to the Darling Ranges. A new direct route for the bauxite was planned from Mundijong to Kwinana and this eliminated the need to maintain a parallel railway from Armadale to Robbs Jetty. Train services from Bibra Lake to Armadale were therefore suspended from 23 January 1964.

The last train to run on this line was an Australian Railway Historical Society tour to Armadale on 23 February 1964. This tour was also a farewell tour for the 'DS' class of steam locomotives, when DS 371 hauled this train.

Development of industries and redevelopment of Armadale Road along the railway reserve since the 1980s has gradually eliminated much of the railway line formation.

Integrity/Authenticity

Moderate degree of Integrity (original intent clear).

Moderate degree of authenticity (some original fabric remaining).

Condition

Poor

MHI Management Category

Management Category A

Place No 24581 James Drain Portion (for the bridge over the James Drain and the formed railway bed 100 metres to the east and west of the bridge)

Worthy of the highest level of protection - recommended for entry in the State Register of Heritage Places. Development would require consultation with the City of Armadale. Maximum encouragement to the owner should be provided under the City of Armadale's Town Planning Scheme to conserve the significance of the place. A Heritage Assessment and Impact Statement should be undertaken before approval is given for any major redevelopment. Incentives to promote heritage conservation should also be considered.

Management Category D

Place No 24004 Nicholson to Taylor Rds

Significant, but not essential to an understanding of the history of the district. Record the place photographically prior to demolition.

Management Category E

Place No 24582 (the remainder of the former railway line alignment between the intersection of the Armadale Perth railway on Armadale Road to the border with the City of Cockburn).

Historic site with little or no built features - Recognise (for example, with a plaque, place name, or acknowledge in new urban or architectural design)

References

City of Armadale MHI <https://www.armadale.wa.gov.au/municipal-heritage-inventory>

Historic and/or Aerial Photographs ¹⁰

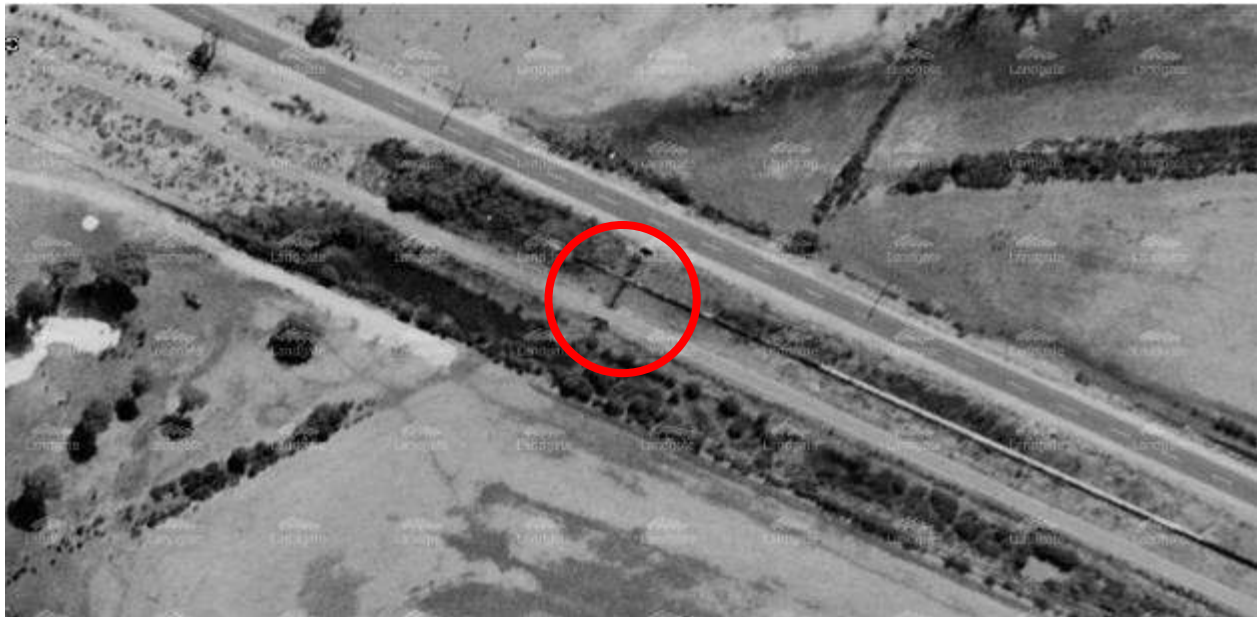


Photo: Aerial, 11.03.1965. Focus on bridge at James Drain.

¹⁰ Source: Landgate Map Viewer (Note: not for publication; reference only)



Photo: Aerial, 19.06.1985.



Photo: Aerial, 15.09.2012.



Photo: Bridge at James Drain, Feb 2017.



Photo: Water pipeline and bridge at James Drain, Feb 2017.

5.0 HERITAGE IMPACT STATEMENT - BANJUP MEMORIAL PARK

Note: This report and the Heritage Assessment (Section 3.0) forms the first part of a Heritage Impact Statement and acts as supporting information.

The following aspects of the proposal respect or enhance the heritage significance of the place or area, for the following reasons:

The project creates the opportunity for the addition of improved access and parking for the Banjup Memorial Park.

Whilst the project will require some modification to the park, similar modifications have previously been undertaken without the loss of significance of the place.

The majority of the key elements of the park have previously been located/relocated to the rear section of the site thus reducing the impact of the road on the functions of the place.

The possible removal of trees in the park closest to the road is acceptable as these are later replacement trees, and can be either transplanted, or replacement trees introduced of the same species in a different location.

The following aspects of the proposal could detrimentally impact on heritage significance. the reasons are explained as well as the measures to be taken to minimise impacts

The widening of the road will likely lead to the need to move the front fence of the park back some metres. Whilst this will change the boundary of the park it is considered that the front boundary has already undergone change and therefore the current alignment does not have historical reference. Further, with the key elements of the park having been previously located/relocated to the rear of the park the impact on the significance of the place is minimal.

Conclusion

The cultural heritage significance of the place will not be lost or significantly affected by the proposed works.

The opportunity for the addition of improved access and parking for the Banjup Memorial Park could be investigated.

6.0 HERITAGE IMPACT STATEMENT - ARMADALE TO FREMANTLE RAILWAY LINE REMNANTS

Note: This report and the Heritage Assessment (Section 4.0) forms the first part of a Heritage Impact Statement and acts as supporting information.

The following aspects of the proposal respect or enhance the heritage significance of the place or area, for the following reasons:

The road widening project will have an impact on the Armadale to Fremantle Railline Remnants, however the impact is largely confined to those parts of the place that have already undergone significant change.

The project creates the opportunity to provide interpretation for the former Railway Line. This would give the opportunity for future generations to recognise and understand the existence and significance of the former Armadale to Fremantle Railway Line. Currently no interpretation exists.

The following aspects of the proposal could detrimentally impact on heritage significance. the reasons are explained as well as the measures to be taken to minimise impacts

The road widening will impact on the former rail alignment however this site has already undergone so much disturbance and alteration in the past that little now remains. It is considered that, through interpretation, the significance of the former railway line can be conveyed.

Attempts should be made to retain the remnants of the bridge at James Drain. This is a clear and tangible element of the former railway line which provokes thought about the site. If retention of the bridge remnants is not possible then Interpretation of this element would enhance an understanding of the place. The remaining elements of the bridge could be utilised in the interpretation response.

Much of the significance of the Armadale to Fremantle Railway Line Remnants lies in its historic values which can be retained through interpretation means.

Conclusion

Much of the signifiacne of the Armadale to Fremantle Railway Line Remnants lies in its historic values which can be retained through interpretation means. The key remaining physical feature is the bridge at James Drain which should be retained if possible and interpreted. If retention is not possible then meaningful interpretation utilising remnants of the bridge should be created.

7.0 RECOMMENDATIONS

Management categories for the assessed places provides guidance as to the way forward:

- Place No 24581 James Drain Portion (for the bridge over the James Drain and the formed railway bed 100 metres to the east and west of the bridge) Management Category **A**
A Heritage Assessment and Impact Statement should be undertaken before approval is given for any major redevelopment.
- Place No 24004 Nicholson to Taylor Rds Management Category **D**
Record the place photographically prior to demolition.
- Place No 24582 (the remainder of the former railway line alignment between the intersection of the Armadale Perth railway on Armadale Road to the border with the City of Cockburn). Management Category **E**
Recognise (for example, with a plaque, place name, or acknowledge in new urban or architectural design)
- Place No 10162 Banjup Memorial Park, MHI Category **B**
Conservation of the place is highly desirable. Any alterations or extensions should be sympathetic to the heritage values of the place.

The Banjup Memorial Park is being retained as part of this project, and previous alterations (relocation further away from the road reserve) have been sympathetic.

The railway line will be impacted upon, however much of its significance lies in its historic value which, through interpretation, can be retained. While the Heritage Assessments and Impact Statements form part of this report, Main Roads can also consider including interpretation into the proposed works to negate the impact the Duplication Project will have on the railway line remnants.

7.1 Interpretation

Interpretation is a means of communicating ideas and feelings about a place and its stories in order to help people understand more about the place, its people and its environment. In accordance with the definition and explanatory note in the *Burra Charter 2013* (Article 1.17):

Interpretation means all the ways of presenting the cultural significance of a place. Interpretation may be a combination of the treatment of the fabric (e.g. maintenance, restoration, reconstruction); the use of and activities at the place; and the use of introduced explanatory material.

A useful reference which clearly sets out the principles for the interpretation of heritage sites is the Australia ICOMOS *Practice Note – Interpretation* <http://australia.icomos.org/publications/charters> .

The alignment of the railway line could be interpreted in the Duplication Project. (Refer to historical aerial photographs accessed from Landgate.)

Similarly the existence and location of former railway sidings along the railway line (Banjup, Taylor's Crossing and Pine Tree Crossing) could be interpreted in the Duplication Project. (Refer to historical information in Section 6.0 of this report.)

Possible ways in which the Railway Line remnants could be interpreted include:

- Aligning the cycle way/pedestrian path with the former railway line
- Signage to note the location of the former bridge
- Marking the particular locations along Armadale Road with signage, e.g. "James Drain Bridge," or "Taylor's Crossing" etc
- Re-use of the railway bridge and any railway line timbers in pedestrian shelter/sign at former location of the bridge and sidings
- Signage including historical information under such shelters with seating, water fountain, etc

7.2 The Government Heritage Property Disposal Process

The purpose of the Government Heritage Property Disposal Process (GHPDP) policy, adopted in 1994, is to identify and assess the heritage value of government property under consideration for disposal, and to provide relevant protection where appropriate.

"Disposal" includes the sale, transfer or lease of a property outside the State Government sector (where transfer or lease is for a duration of at least 10 years), and includes the demolition of places.

The policy applies to all State Government agencies and to all statutory authorities as listed in Schedule 1 of the Financial Management Act 2006.

Buildings and structures will generally need to be considered as part of this process if they:

- Are more than 60 years old
- Are already listed on an existing heritage list such as a local government inventory (Municipal Inventory)
- Display other evidence of potential significance in terms of aesthetic, historic, social or scientific value

The Armadale to Fremantle Railway Line Remnants should be referred to the State Heritage Office under the Government Heritage Property Disposal Process (GHPDP). The relevant form is attached.

8.0 REFERENCES

- Apperly, R., Irving, R., Reynolds, P. *A Pictorial Guide to Identifying Australian Architecture. Styles and Terms from 1788 to the Present*, Angus and Robertson, North Ryde, 1989.
- *The Burra Charter* (The Australia ICOMOS Charter for Places of Cultural Significance, 1999): <http://australia.icomos.org/publications/charters/>.
- City of Armadale Intramaps <http://maps.armadale.wa.gov.au/intramaps80/>
- City of Cockburn Intramaps <http://maps.cockburn.wa.gov.au/Public80/>
http://www.cockburn.wa.gov.au/Council_Services/City_Development/Heritage/
- City of Armadale MHI <https://www.armadale.wa.gov.au/municipal-heritage-inventory>
- City of Cockburn MHI
http://www.cockburn.wa.gov.au/Council_Services/City_Development/Heritage/
- Convention of Wetlands, <http://www.ramsar.org/wetland/australia>
- Forrestdale Lake Nature Reserve Management Plan, 2005, Dept of Conservation and Land Management, WA.
- Griffiths Architects, *Banjup Memorial Park Report*, May 2012 for City of Cockburn.
- ‘Heritage Impact Statement: A guide’ State Heritage Office, Nov 2012, at http://www.stateheritage.wa.gov.au/docs/conservation-and-development/heritageimpactstatementaguide_nov2012int.pdf?sfvrsn=0
- Landgate Aerial Photographs, via Mapviewer, www.landgate.wa.gov.au/mapviewer
- Monuments Australia www.monumentaustralia.org.au/display/60069-banjup-memorial-park
- National Library of Australia, digitized newspapers; ‘Trove’
<http://trove.nla.gov.au/newspaper/result?q=>
- State Heritage Office, inHerit database <http://inherit.stateheritage.wa.gov.au/public>
- ‘Interpretation: A guide to making Interpretation easy to understand, plan and deliver,’ State Heritage Office, March 2012, at http://stateheritage.wa.gov.au/docs/heritage-tourism/interpretaion_2012.pdf?sfvrsn=4
- Wise’s Post Office Directories 1893-1949, State Library of WA <http://slwa.wa.gov.au/explore-discover/wa-heritage/post-office-directories>

Appendix 4
Armadale Road Duplication
Environmental Management Plan



intelligent outcomes | respected experience

Armadale Road Duplication - Tapper Road to Anstey Road

Environmental Management Plan

DRAFT

Prepared for
Main Roads Western Australia
by Strategen

April 2017

Armadale Road Duplication - Tapper Road to Anstey Road

Environmental Management Plan

DRAFT

Strategen is a trading name of
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April 2017

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Main Roads Western Australia

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	A	Client review	E Payne	Electronic	26 April 2017

Filename: MRO16249_01 R004 Rev A - 26 April 2017

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1. Introduction

Main Roads Western Australia (MRWA) is proposing to duplicate approximately 7 km of Armadale Road, between Tapper Road in Atwell and Anstey Road in Forrestdale (the Project). MRWA proposes to duplicate this section of Armadale Road to support increased traffic volumes in the City of Cockburn and City of Armadale local government areas.

As part of the road duplication, upgrades and/or improvements to a number of intersections along Armadale Road and within the development envelope are proposed and associated works including lighting, service relocations and drainage. The Project construction is anticipated to commence in 2017.

The Project is located within the suburbs of Atwell and Banjup in the City of Cockburn and Piara Waters and Forrestdale in the City of Armadale (the Development envelope).

1.1 Purpose and scope

The purpose of this Environmental Management Plan (EMP) is to manage impacts associated with the proposed duplication as well as identify areas of responsibilities required for the implementation of management strategies. This EMP has been developed to support the Environmental Impact Assessment (EIA) prepared to assess impacts of the modified concept design for the Project and addresses specific issues identified as part of the EIA.

1.2 Communication Plan

Environmental issues specific to the project will be communicated through the avenues described in Table 1.

Table 1: Communication plan

Method	Frequency	Participants	Reference	Responsibility
<i>Project Site</i>				
Contract requirements	Prior to Work	MRWA appointed contractors and Contractor Project Manager	EMP and Contractor Environmental Policy	Contractor
Induction	Prior to Work	All personnel and subcontractors	EMP and Contractor Environmental Policy	Contractor
Toolbox Meetings	Weekly	Project Personnel	Contractor Safety Plan	Contractor
<i>Agency consultation</i>				
Department of Parks and Wildlife	Prior to construction	MRWA Project Manager and Contractor Project Manager	-	MRWA
Department of Aboriginal Affairs	Prior to construction	MRWA Project Manager and Contractor Project Manager	-	MRWA
Department of Water	Prior to construction	MRWA Project Manager and Contractor Project Manager	-	MRWA
<i>Audit</i>				
1st party compliance audit	3 monthly	Required contractors , project personnel and MRWA	EMP	Contractor
2nd party compliance audits	As required	Required contractors , project personnel and MRWA	EMP	MRWA

1.2.1 External Communication and Complaints

A complaints register will be maintained by the contractor. All complaints received will be forwarded to the Main Roads' Project Manager for action. Serious complaints will be investigated within 24 hours of the complaint being received.

Table 2: Environmental Management Plan

Project component	Management action	Monitoring/maintenance program	Responsible person	Timeframe
<i>Standard recorded keeping management</i>				
Record keeping – Vegetation clearing	Maintain the following records for the area of clearing: <ul style="list-style-type: none"> a copy of the EIA & EMP a map showing the location where the clearing occurred, recorded in an ESRI Shapefile the size of the area cleared (in hectares) the dates on which the clearing was undertaken. 	Pre-construction and post-construction record maintenance.	Contractor	Within 4 weeks of clearing completion.
Record keeping - Revegetation	Maintain on site a copy of the approved Revegetation Plan (if required) Maintain the following records for the area revegetated and rehabilitated: <ul style="list-style-type: none"> a map and an ESRI Shapefile showing the location of the areas revegetated and rehabilitated a description of the revegetation and rehabilitation activities undertaken (including dates of actions) the size of the area revegetated and rehabilitated (in hectares). 	Post-construction record maintenance.	Contractor	Within 4 weeks of successful completion of revegetation.
Record keeping – Offset Proposal (OP)	Maintain on site a copy of the OP (if required). Maintain the following records for the offset area: <ul style="list-style-type: none"> a map and an ESRI Shapefile showing the location of areas that have had offset actions implemented a description of the offset actions implemented (include the dates of actions) the size of the area where offset actions were undertaken (in hectares). 	Post-construction record maintenance.	MRWA	In accordance with approval conditions.
Record keeping – EMP	Maintain on site a copy of the EMP. Maintain the following records for the Study area during construction: <ul style="list-style-type: none"> the location of the area to which the EMP has had action applied an ESRI Shapefile showing the locations of the areas of clearing for project activities a description of the management actions implemented the size of the area to which the management actions were applied (in hectares). 	Post-construction record maintenance.	Contractor	Within 4 weeks of all management plan actions being completed during construction.
Record keeping – Hygiene	All earth moving machinery to be clean of soil and vegetation prior to entry. Ensure no weed affected soil; mulch; fill or other material is brought into the area cleared during construction. Restrict movement of machines and other vehicles to the limits of the areas cleared. Maintain a copy of the Hygiene Management Strategy on site.	Construction monitoring/Post-construction record maintenance.	Contractor	Within 4 weeks of all management plan actions being completed during construction.

Project component	Management action	Monitoring/maintenance program	Responsible person	Timeframe
	Maintain the following records for the Study area: <ul style="list-style-type: none"> advice from the environmental specialist regarding any pathogen other than dieback for any pathogen other than dieback, the appropriate steps taken to minimise the risk of the pathogen. 			
Record keeping - European heritage	Maintain the following records for the Study area: <ul style="list-style-type: none"> the location of the Banjup Memorial Park an ESRI Shapefile showing the location of the Banjup Memorial Park. 	Construction monitoring/Post-construction record maintenance.	Contractor	Ongoing.
<i>Project specific aspects</i>				
Clearing of native vegetation	Provide clear drawings indicating areas approved to be cleared (as defined in the EIA) to the clearing contractor at pre-start meetings.	Pre-construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.
	Demarcate vegetation onsite proposed to be cleared ahead of clearing activities. Ensure vegetation to be retained is clearly demarcated.	Pre-construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.
	Minimise vegetation clearing and the area of disturbance by utilising existing cleared areas where possible.	Pre-construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.
	Clearing of vegetation shall not exceed the limits of clearing and mature trees will be conserved as far as practicable, and will not be disturbed for such temporary works as side tracks, access tracks, temporary storage areas, spoil areas or site offices.	Construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.
	Damage caused (beyond the extent of approvals) during the construction to vegetation, landforms, or fauna habitat shall be rehabilitated to the pre-clearing condition.	Post-construction surveillance.	Contractor	As soon as possible.
	Cleared vegetation will be used during any rehabilitation activities and either mulched or respread.	Post-construction surveillance.	Contractor	During construction.
Avoid and manage impacts to fauna.	Minimise impacts on areas of vegetation where significant fauna have been recorded or may potentially occur.	Pre-construction/ construction surveillance.	Contractor	Project lifespan/ ongoing.
	No pets, traps or firearms are allowed within the Study area.	Pre-construction/ construction surveillance.	Contractor	Project lifespan/ ongoing.
	Fauna are not to be fed or intentionally harmed or killed.	Pre-construction/ construction surveillance.	Contractor	Project lifespan/ ongoing.
	In the event that sick, injured or orphaned native wildlife are located on the project site, the WILDCARE Helpline ((08) 9474 9055) will be contacted for assistance.	Pre-construction/ construction surveillance.	Contractor	Project lifespan/ ongoing.
	Manage direct fauna impacts through implementation of a fauna relocation program (to nearby vegetation areas) prior to clearing commencing.	Pre-construction surveillance monitoring.	Contractor	Prior to clearing commencing.
	Offset cleared areas through revegetation/rehabilitation in accordance with the approved offset proposal.	Post-construction surveillance.	MRWA	Within 4 weeks of successful completion of offset proposal.
Wetlands and surface water	Minimises clearing activities near open surface water bodies to reduce the potential for sedimentation and adverse environmental harm.	Pre-construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.

Project component	Management action	Monitoring/maintenance program	Responsible person	Timeframe
	Manage potential stormwater drainage into wetlands through the construction of drainage structures.	Project planning/Pre-construction.	Contractor	Project planning.
	Minimise clearing of vegetation associated with wetland buffers.	Pre-construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.
	Stage clearing activities to reduce the likelihood of impacts to surface water areas, where practicable.	Pre-construction/ vegetation clearance monitoring.	Contractor	Prior to clearing commencing.
Groundwater	Ensure the Project is undertaken in consideration of the following DoW Water Quality Protection Notes: <ul style="list-style-type: none"> • WQPN 10: Contaminant spills - emergency response • WQPN 25: Land use compatibility tables for PDWSAs • WQPN 44: Roads near sensitive water resources • WQPN 60: Tanks for mobile fuel storage in PDWSAs • WQPN 83: Infrastructure corridors near sensitive water resources • WQPN 84: Rehabilitation of disturbed land in PDWSAs. 	Pre-construction/ construction surveillance.	Contractor	Project lifespan/ ongoing.
Acid Sulfate Soils	An ASS Management Plan will be prepared and implemented to manage ground-disturbance that may have the potential to disturb ASS (excavation below ground water level).	Pre-construction/ construction surveillance.	Contractor	Project lifespan/ ongoing.
Reserves / Conservation areas	Avoid vegetation clearing within Bush Forever sites where possible.	Pre-construction/ construction surveillance.	Contractor	Prior to clearing commencing.
	Implement weed hygiene and control measures to prevent new weed infestations and the spread of existing weeds from occurring within the Study area.	Pre-construction/ construction surveillance.	Contractor	Ongoing.
Environmentally Sensitive Areas	Avoid vegetation clearing within ESAs sites where possible.	Pre-construction/ construction surveillance.	Contractor	Prior to clearing commencing.
Dust	Attend to dust complaints as soon as possible.	Pre-construction/ construction surveillance.	Contractor	Ongoing.
	Apply water for dust suppression to protect loose surfaces.	Pre-construction/ construction surveillance.	Contractor	Ongoing.
	Prepare and implement a Dust Management Plan for construction activities.	Pre-construction/ construction surveillance.	Contractor	Within 4 weeks of the completion of construction.
Noise and vibration	Prepare and implement a Noise and Vibration Plan to manage potential impacts during construction.	Pre-construction/ construction surveillance.	Contractor	Within 4 weeks of the completion of construction.
	Assess traffic noise anticipated during operation of the Project.	Pre-construction/project planning.	Contractor	Prior to road operation.
Visual amenity	Ensure that the road is consistent with the surrounding environment.	Pre-construction/project planning.	Contractor	Prior to construction.
Aboriginal heritage	Ensure the Project will not result in any disturbance to sites of Aboriginal heritage significance.	Pre-construction/project planning.	Contractor	Prior to construction.

Project component	Management action	Monitoring/maintenance program	Responsible person	Timeframe
European heritage	Ensure the Project does not disturb the Banjup Memorial Park.	Pre-construction/ construction surveillance.	Contractor	Within 4 weeks of the completion of construction.
Hazardous materials	Vehicle servicing should be undertaken within designated servicing areas, including spill trays and spill response equipment if required to be serviced within the Study area.	Construction/post construction surveillance.	Contractor	Ongoing.
	Dumping or temporary storage of road materials, such as bitumen, asphalt, concrete or aggregate materials and refuelling, storage of fuel and chemicals (bunding) should be undertaken at designated depots or hardstand areas only.	Construction/post construction surveillance.	Contractor	Ongoing.
Fire	Manage potential fire risk associated with construction through use of a water tanker as required.	Construction/post construction surveillance.	Contractor	Ongoing.
Monitoring	Monitor compliance with: <ul style="list-style-type: none"> • Offset proposal implementation • Hygiene Management Plan • Acid Sulfate Soil (ASS) Management Plan (if required) • Dust Management Plan • Noise and Vibration Plan. 	Construction monitoring/Post-construction record maintenance.	Contractor and/or MRWA	During construction of Project.

Appendix 5
EPBC protected matters search



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: 23/03/17 19:24:13

[Summary](#)

[Details](#)

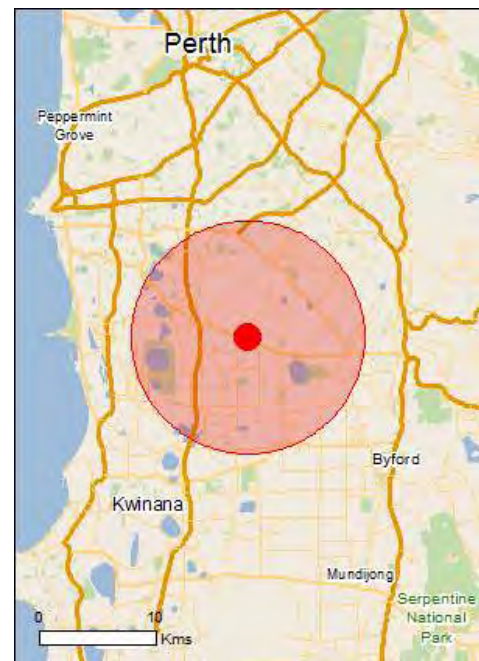
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	30
Listed Migratory Species:	19

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	29
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	11
Regional Forest Agreements:	None
Invasive Species:	44
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Forrestdale and thomsons lakes	Within Ramsar site
Peel-yalgorup system	30 - 40km upstream

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area

Listed Threatened Species	[Resource Information]
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Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
Insects		
Leioproctus douglasiellus a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
Neopasiphae simplicior A native bee [66821]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
Bettongia penicillata Brush-tailed Bettong, Woylie [213]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngor, Ngoolangit [25911]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leafed Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D.Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area

Name	Threatened	Type of Presence
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

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

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

Name
Commonwealth Land -

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

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Balannup Lake	WA
Forrestdale Lake	WA
Gibbs Road	WA
Harry Waring Marsupial Reserve	WA
Modong	WA
Piara	WA
Thomsons Lake	WA
Unnamed WA48291	WA
Unnamed WA49299	WA
Unnamed WA49561	WA
Wandi	WA

Invasive Species [\[Resource Information \]](#)

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

Name	Status	Type of Presence
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
Turdus merula Common Blackbird, Eurasian Blackbird [596]		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
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 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

Name	Status	Type of Presence area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		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 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
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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

Nationally Important Wetlands		[Resource Information]
Name		State
Forrestdale Lake		WA
Gibbs Road Swamp System		WA
Thomsons Lake		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

-32.13614 115.89733

Acknowledgements

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

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

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

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