GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 7533/1
Permit Holder:	Commissioner of Main Roads
Duration of Permit:	From 16 June 2019 to 16 June 2039

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

ADVICE NOTE:
The funds referred to in condition 9 of this Permit are intended for the purchase of at least 242 hectares of native vegetation for conservation that contains:

- at least 226 hectares of Carnaby's cockatoo foraging habitat;
- at least 91 hectares of the Banksia Woodlands of the Swan Coastal Plain threatened ecological community;
- at least 17 hectares of vegetation significant as a remnant in an area that has been extensively cleared; and
- at least 16 hectares of significant wetlands.

1. Purpose for which clearing may be done

Clearing for the purpose of road construction and upgrades including associated activities.

2. Land on which clearing is to be done

Brand Highway road reserve (PIN 1358753), Hill River
Brand Highway road reserve (PIN 1358743), Badgingarra
Lot 4180 on Plan 215549, Badgingarra
Brand Highway road reserve (PIN 1358737), Badgingarra
Brand Highway road reserve (PIN 11674695), Badgingarra
Brand Highway road reserve (PIN 11674696), Badgingarra
Lot 4255 on Plan 209084, Badgingarra
Brand Highway road reserve (PIN 11579146), Cooljarloo
Brand Highway road reserve (PIN 11674269), Cooljarloo
Brand Highway road reserve (PIN 11674270), Cataby
Brand Highway road reserve (PIN 1226149), Cataby
Brand Highway road reserve (PIN 1226168), Yathroo
Brand Highway road reserve (PIN 1226171), Regans Ford
Brand Highway road reserve (PIN 1226192), Red Gully
Brand Highway road reserve (PIN 1188398), Orange Springs
Lot 13800 on Plan 206476, Red Gully
Lot 14246 on Plan 27746, Red Gully
Brand Highway road reserve (PIN 11674225), Granville

3. Area of clearing

(a) The Permit Holder must not clear more than 1.3 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1a.

(b) The Permit Holder must not clear more than 2.2 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1b.

(c) The Permit Holder must not clear more than 2.7 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1c.

(d) The Permit Holder must not clear more than 1.8 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1d.

(e) The Permit Holder must not clear more than 1.6 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1e.

(f) The Permit Holder must not clear more than 2.1 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1f.

(g) The Permit Holder must not clear more than 2.6 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1g.

(h) The Permit Holder must not clear more than 2.2 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1h.

(i) The Permit Holder must not clear more than 2.2 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1i.

(j) The Permit Holder must not clear more than 6 hectares of native vegetation within the combined area cross-hatched yellow on attached Plan 7533/1j, Plan 7533/1k and Plan 7533/1l.

(k) The Permit Holder must not clear more than 2.5 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1m.

(l) The Permit Holder must not clear more than 4.6 hectares of native vegetation within the combined area cross-hatched yellow on attached Plan 7533/1n, Plan 7533/1o and Plan 7533/1p.

(m) The Permit Holder must not clear more than 6 hectares of native vegetation within the area cross-hatched yellow on attached Plan 7533/1q.

4. Application

This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

5. Type of clearing authorised

This Permit authorises the Permit Holder to clear native vegetation for the activities described in condition 1 of this Permit to the extent that the Permit Holder has the power to carry out works involving clearing for those activities under the *Main Roads Act 1930* or any other written law.

6. Avoid, minimise and reduce the impacts and extent of clearing

In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference:

(a) avoid the clearing of native vegetation;
(b) minimise the amount of native vegetation to be cleared; and
(c) reduce the impact of clearing on any environmental value.

7. Dieback and weed management

(a) The Permit Holder must conduct a *dieback* survey of each of the areas cross-hatched yellow on attached Plan 7533/1a, Plan 7533/1b, Plan 7533/1c, Plan 7533/1d, Plan 7533/1e, Plan 7533/1f, Plan 7533/1g, Plan 7533/1h, Plan 7533/1i, Plan 7533/1j, Plan 7533/1k, Plan 7533/1l, Plan 7533/1m, Plan 7533/1n, Plan 7533/1o, Plan 7533/1p and Plan 7533/1q, undertaken by a *dieback specialist*, to map the presence of *dieback*.

(b) Each *dieback* survey undertaken in accordance with condition 7(a) of this Permit must be undertaken prior to, but no greater than 12 months from, commencing clearing within the related area cross-hatched yellow on attached Plan 7533/1a, Plan 7533/1b, Plan 7533/1c, Plan 7533/1d, Plan 7533/1e, Plan 7533/1f, Plan 7533/1g, Plan 7533/1h, Plan 7533/1i, Plan 7533/1j, Plan 7533/1k, Plan 7533/1l, Plan 7533/1m, Plan 7533/1n, Plan 7533/1o, Plan 7533/1p and Plan 7533/1q.

(c) The Permit Holder must prepare a Dieback and Weed Management Plan for each of the areas cross-hatched yellow on attached Plan 7533/1a, Plan 7533/1b, Plan 7533/1c, Plan 7533/1d, Plan 7533/1e, Plan 7533/1f, Plan 7533/1g, Plan 7533/1h, Plan 7533/1i, Plan 7533/1j, Plan 7533/1k, Plan 7533/1l, Plan 7533/1m, Plan 7533/1n, Plan 7533/1o, Plan 7533/1p and Plan 7533/1q, for minimising the spread and/or introduction of *dieback* and *weeds*.

(d) Once the Permit Holder has developed a Dieback and Weed Management Plan, the Permit Holder must provide that Dieback and Weed Management Plan to the *CEO* for the *CEO's* approval, prior to undertaking any clearing of any area to which the Dieback and Weed Management Plan is related, and prior to implementing the Dieback and Weed Management Plan.

(e) If it is necessary to modify a Dieback and Weed Management Plan approved by the *CEO*, then the Permit Holder must provide that modified Dieback and Weed Management Plan to the *CEO* for the *CEO's* approval prior to implementing the modified Dieback and Weed Management Plan.

(f) The Permit Holder shall implement the latest version of each Dieback and Weed Management Plan approved by the *CEO*.

8. Fauna management

(a) Up to one week prior to undertaking clearing of any of the areas cross-hatched yellow on attached Plan 7533/1b, Plan 7533/1c, Plan 7533/1d, Plan 7533/1e, Plan 7533/1f and Plan 7533/1g, that area shall be inspected by a *fauna specialist* to identify chuditch (*Dasyurus geoffroii*) dens and individuals.

(b) Where a chuditch (*Dasyurus geoffroii*) individual(s) is identified in accordance with condition 8(a) of this Permit, clearing shall only occur within that area after the individual has either:
  (i) moved on to adjacent suitable habitat of its own accord; or
  (ii) has been relocated to adjacent suitable habitat by a *fauna specialist*.

(c) Where a chuditch (*Dasyurus geoffroii*) den(s) is identified in accordance with condition 8(a) of this Permit, clearing shall only occur within that area after an equivalent replacement chuditch (*Dasyurus geoffroii*) den(s) has been installed in adjacent suitable habitat.

(d) The Permit Holder is not required to comply with conditions 8(a), (b) and (c) of this Permit if the clearing of that area is undertaken during the period 1 January to 31 August.

(e) The Permit Holder shall conduct clearing in a slow progressive manner towards adjacent remnant vegetation to allow fauna to escape the clearing activity.

9. Offsets

(a) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1j, Plan 7533/1k, Plan 7533/1l, Plan 7533/1n, Plan 7533/1o or attached Plan 7533/1p, and no later than 16 June 2038, the Permit Holder shall provide funding of $162,450 to the Department for the purpose of establishing or maintaining native vegetation.

(b) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1b or attached Plan 7533/1d, and no later than 16 June 2038, the Permit Holder shall provide funding of $51,750 to the Department for the purpose of establishing or maintaining native vegetation.

(c) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1e or attached Plan 7533/1g, and no later than 16 June 2038, the Permit Holder shall provide funding of $50,700 to the Department for the purpose of establishing or maintaining native vegetation.

(d) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1a, and no later than 16 June 2038, the Permit Holder shall provide funding of $6,210 to the Department for the purpose of establishing or maintaining native vegetation.

(e) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1c, and no later than 16 June 2038, the Permit Holder shall provide funding of $35,190 to the Department for the purpose of establishing or maintaining native vegetation.

(f) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1f, and no later than 16 June 2038, the Permit Holder shall provide funding of $21,450 to the Department for the purpose of establishing or maintaining native vegetation.

(g) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1h or attached Plan 7533/1i, and no later than 16 June 2038, the Permit Holder shall provide funding of $44,850 to the Department for the purpose of establishing or maintaining native vegetation.

(h) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1q, and no later than 16 June 2038, the Permit Holder shall provide funding of $173,850 to the Department for the purpose of establishing or maintaining native vegetation.

(i) Prior to undertaking any clearing within the area cross-hatched yellow on attached Plan 7533/1m, and no later than 16 June 2038, the Permit Holder shall provide funding of $29,250 to the Department for the purpose of establishing or maintaining native vegetation.

10. Record keeping

The Permit Holder must maintain the following records:

(a) In relation to the clearing of native vegetation authorised under this Permit:
  (i) the boundaries of clearing undertaken on each date, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  (ii) the size of the area cleared (in hectares); and
  (iii) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 7 of this Permit.

(b) In relation to dieback and weed management pursuant to condition 7 of this Permit:
  (i) a copy of each dieback survey report; and
  (ii) actions taken in implementing each approved Dieback and Weed Management Plan.

(c) In relation to fauna management pursuant to condition 8 of this Permit:
  (i) the date(s) of inspection(s) by the *fauna specialist*;
  (ii) a description of the *fauna specialist* inspection methodology employed;
  (iii) the location of each chuditch (*Dasyurus geoffroii*) individual identified, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  (iv) the date each chuditch (*Dasyurus geoffroii*) individual was identified;
  (v) the date(s) each identified chuditch (*Dasyurus geoffroii*) individual moved on to adjacent suitable habitat or was relocated to adjacent suitable habitat and a description of the adjacent suitable habitat;
  (vi) the location of each chuditch (*Dasyurus geoffroii*) den identified, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  (vii) the date each chuditch (*Dasyurus geoffroii*) den was identified;
  (viii) a photo and description of each chuditch (*Dasyurus geoffroii*) den identified;
  (ix) the location of each replacement chuditch (*Dasyurus geoffroii*) den installed, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  (x) the date each replacement chuditch (*Dasyurus geoffroii*) den was installed; and
  (xi) a photo and description of each replacement chuditch (*Dasyurus geoffroii*) den installed and the surrounding suitable habitat.

(d) In relation to offsets pursuant to condition 9 of this Permit:
  (i) the date(s) that the funds were provided.

11. Reporting

(a) The Permit Holder must provide to the *CEO* on or before 30 June of each year, a written report:
  (i) of records required under condition 10 of this Permit; and
  (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.

(b) If no clearing authorised under this Permit has been undertaken, a written report confirming that no clearing under this Permit has been undertaken, must be provided to the *CEO* on or before 30 June of each year.

(c) Prior to 15 March 2039, the Permit Holder must provide to the *CEO* a written report of records required under condition 10 of this Permit where these records have not already been provided under condition 11(a) of this Permit.

Definitions

The following meanings are given to terms used in this Permit:

CEO means the Chief Executive Officer of the Department responsible for the administration of the clearing provisions under the *Environmental Protection Act 1986*;

dieback means the effect of *Phytophthora* species on native vegetation;

dieback specialist: means a person who is registered as a dieback interpreter with the Department of Biodiversity, Conservation and Attractions, or who is approved by the *CEO* as a suitable dieback specialist;

fauna specialist: means a person who holds a tertiary qualification specializing in environmental science or equivalent, and has a minimum of 2 years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the *CEO* as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the *Biodiversity Conservation Act 2016*;

weed/s means any plant -

(a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or
(b) published in a Department of Biodiversity, Conservation and Attractions species-led ecological impact and invasiveness ranking summary, regardless of ranking; or
(c) not indigenous to the area concerned.

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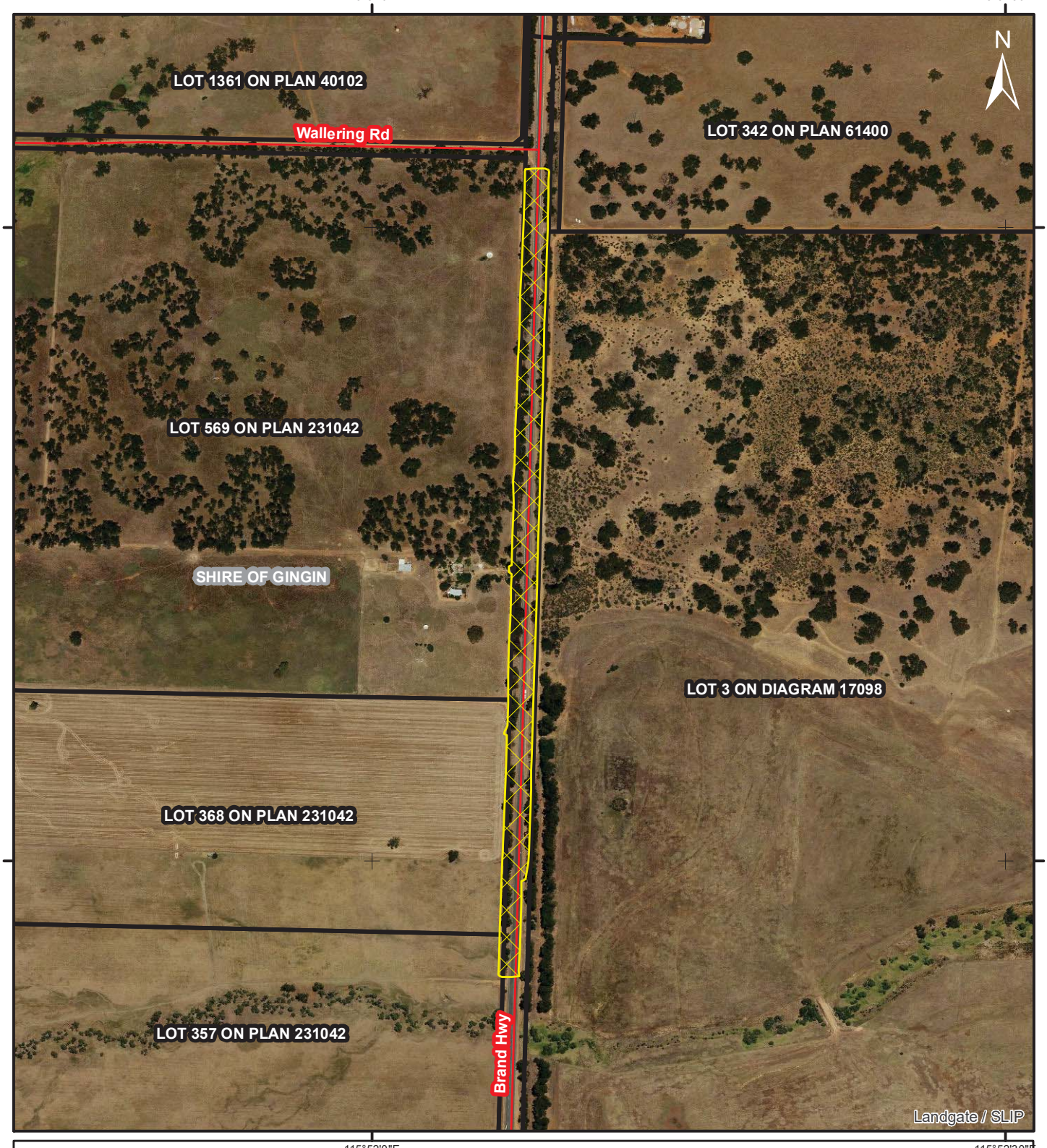
Mathew Gannaway
SENIOR MANAGER
NATIVE VEGETATION REGULATION

Officer delegated under section 20
of the *Environmental Protection Act 1986*

17 May 2019

Plan 7533/1a



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- Local Government Authorities

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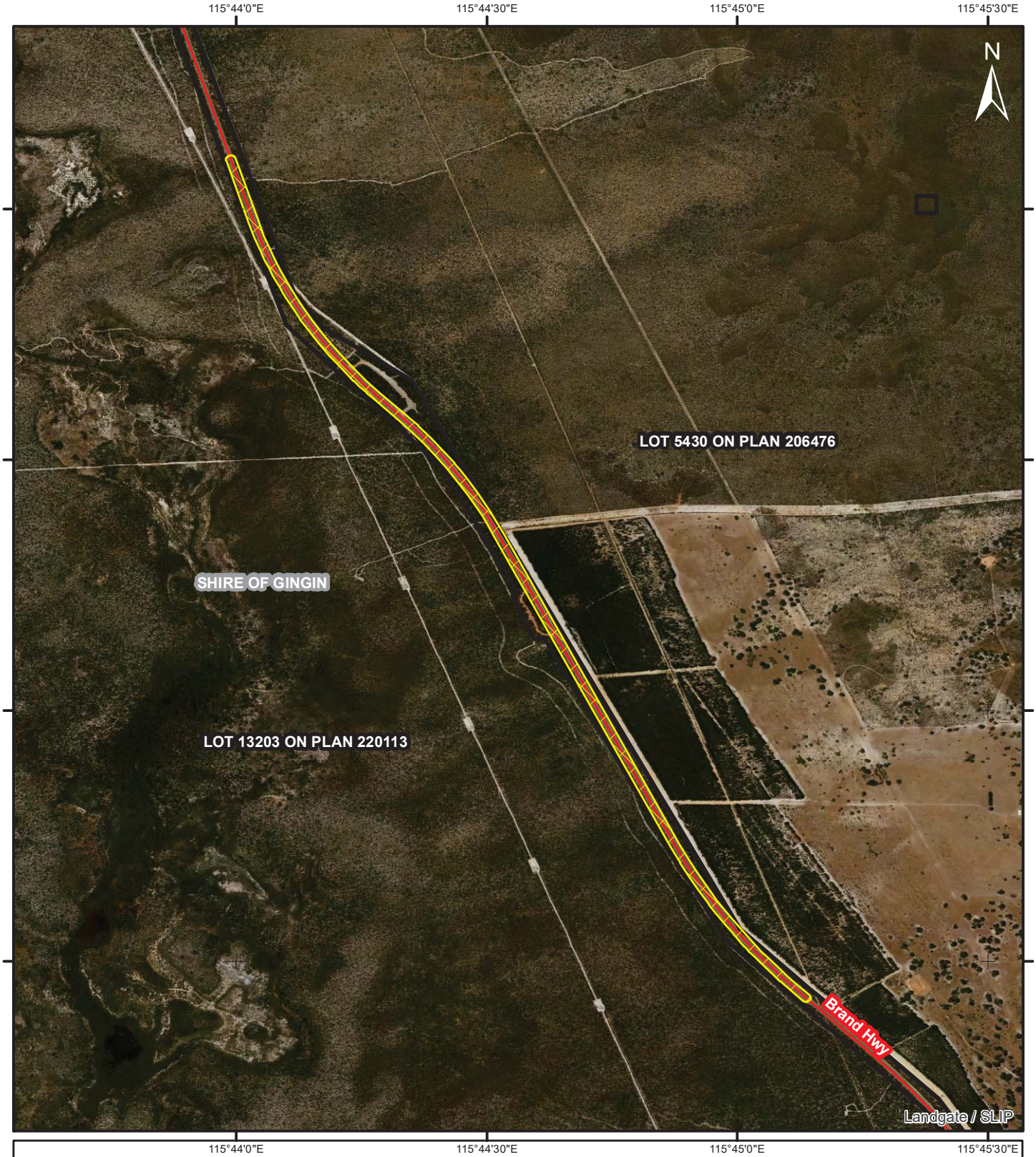
GOVERNMENT OF WESTERN AUSTRALIA

Plan 7533/1b



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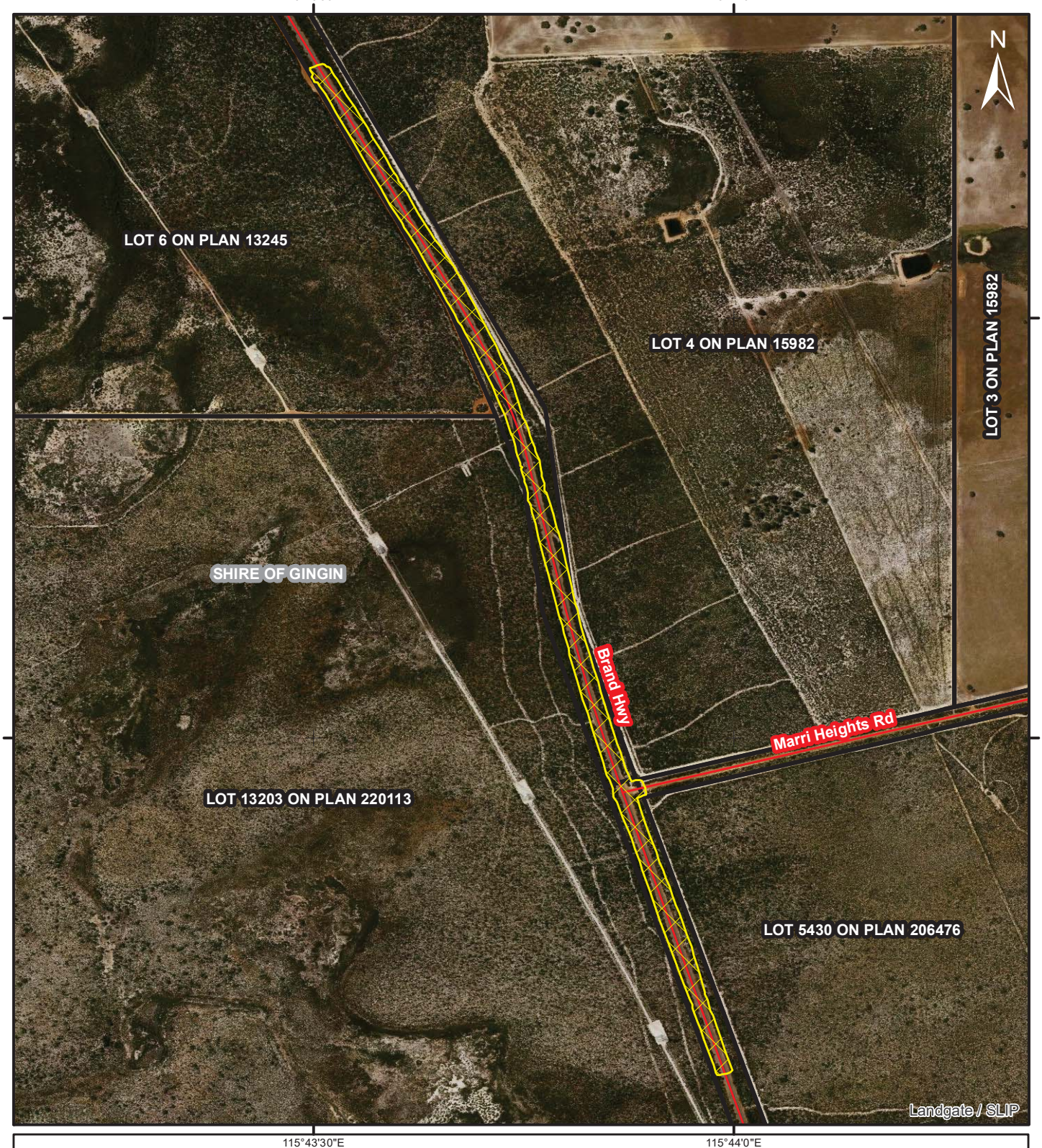

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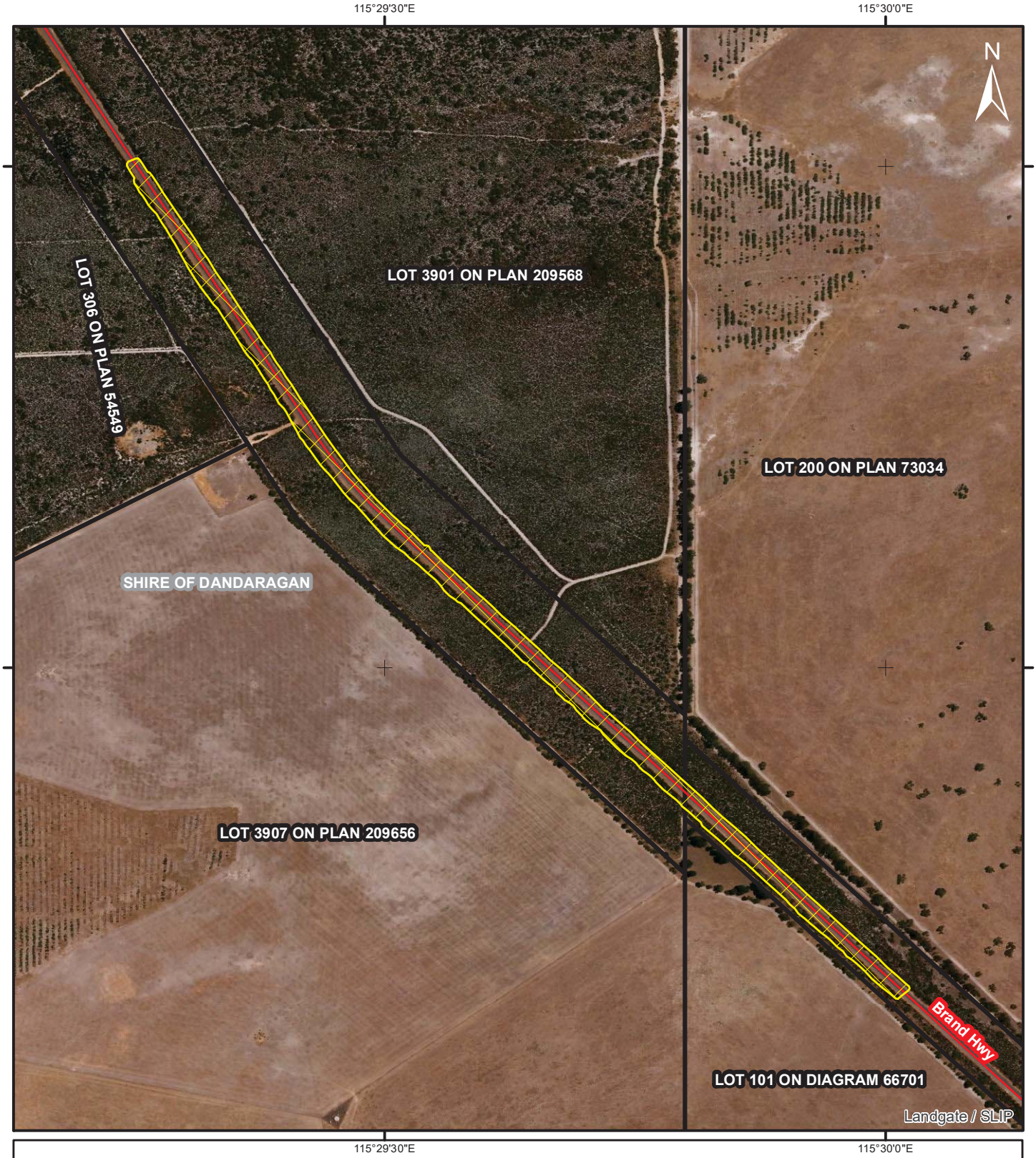

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GOVERNMENT OF WESTERN AUSTRALIA

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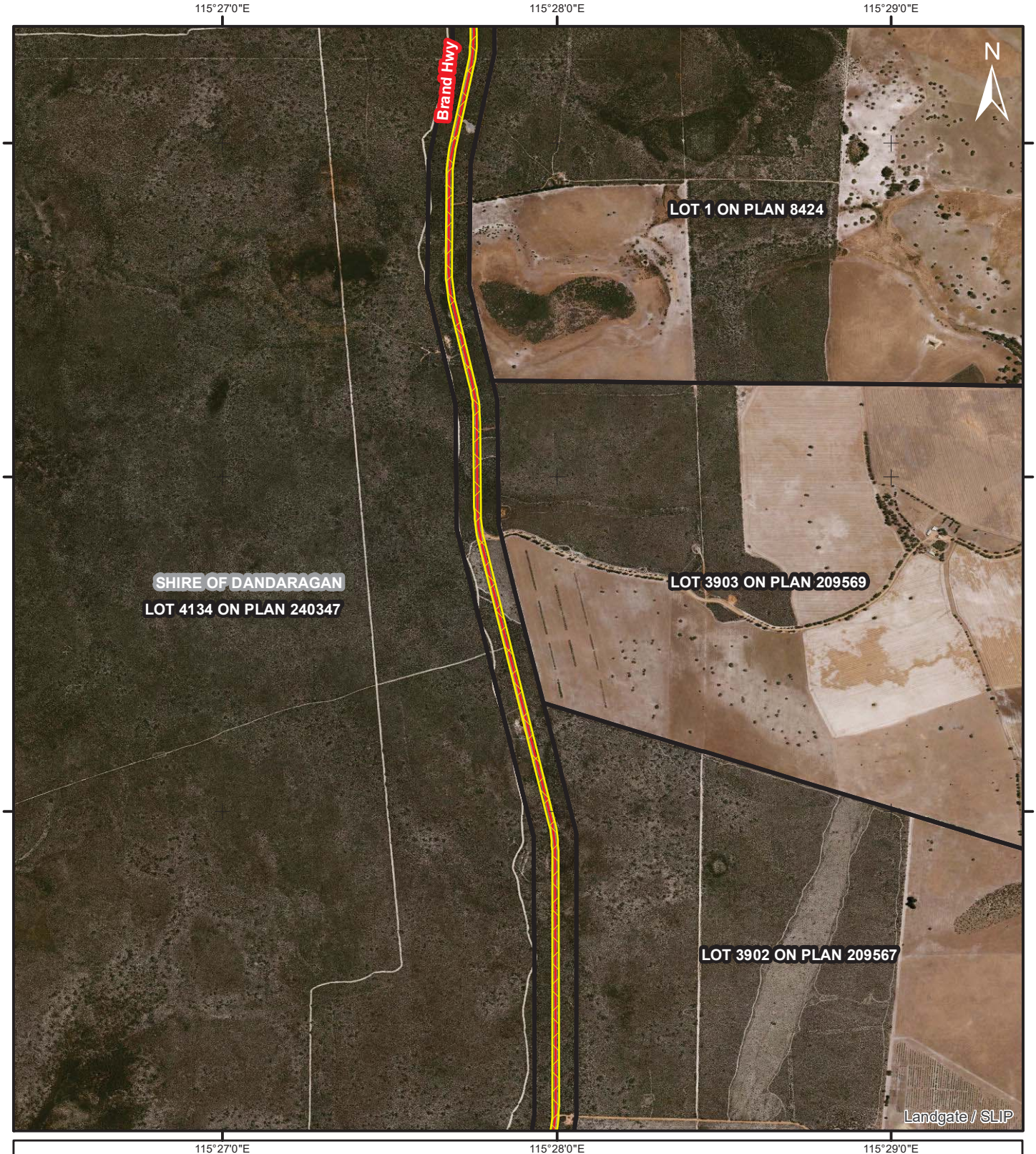

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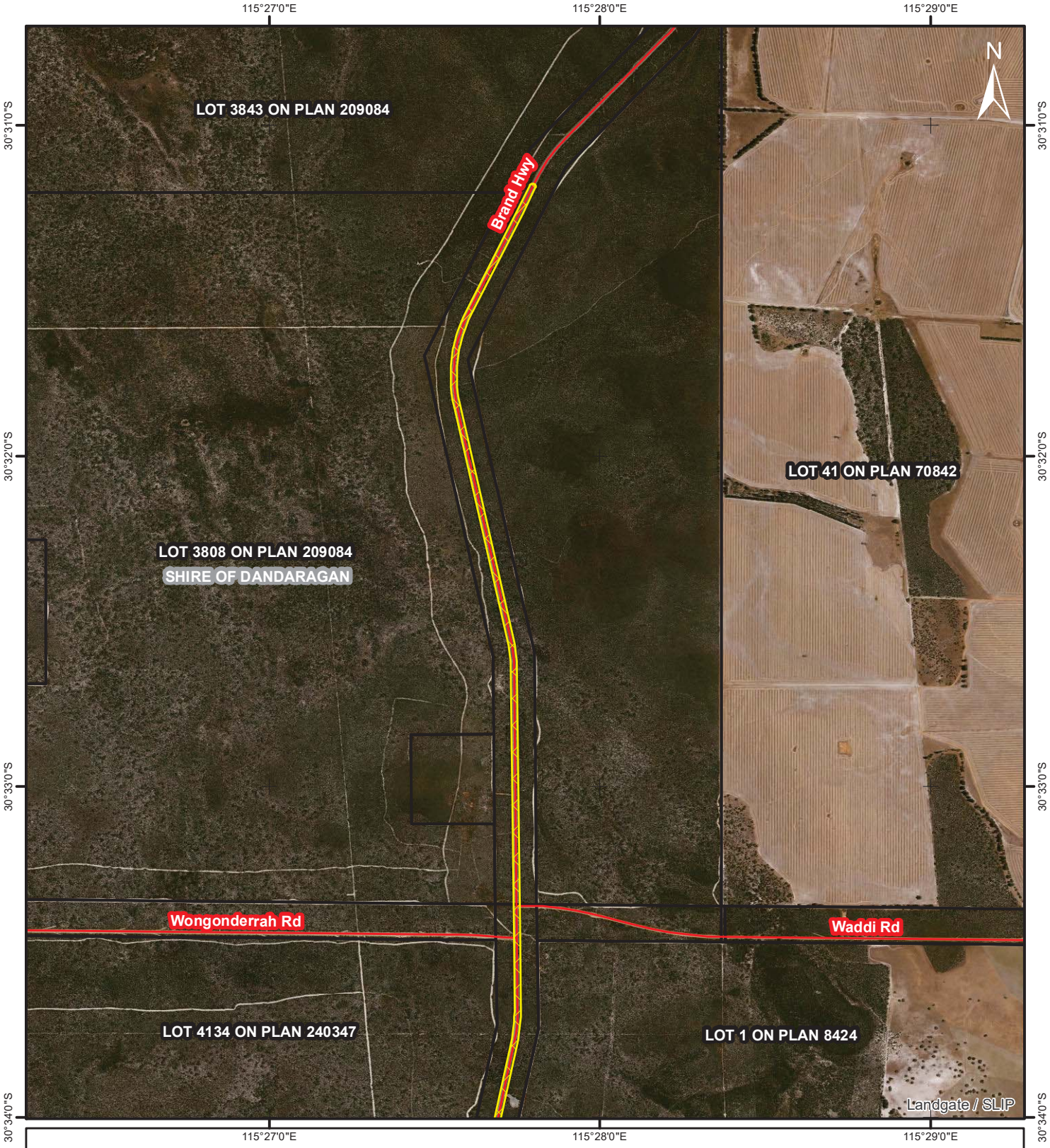

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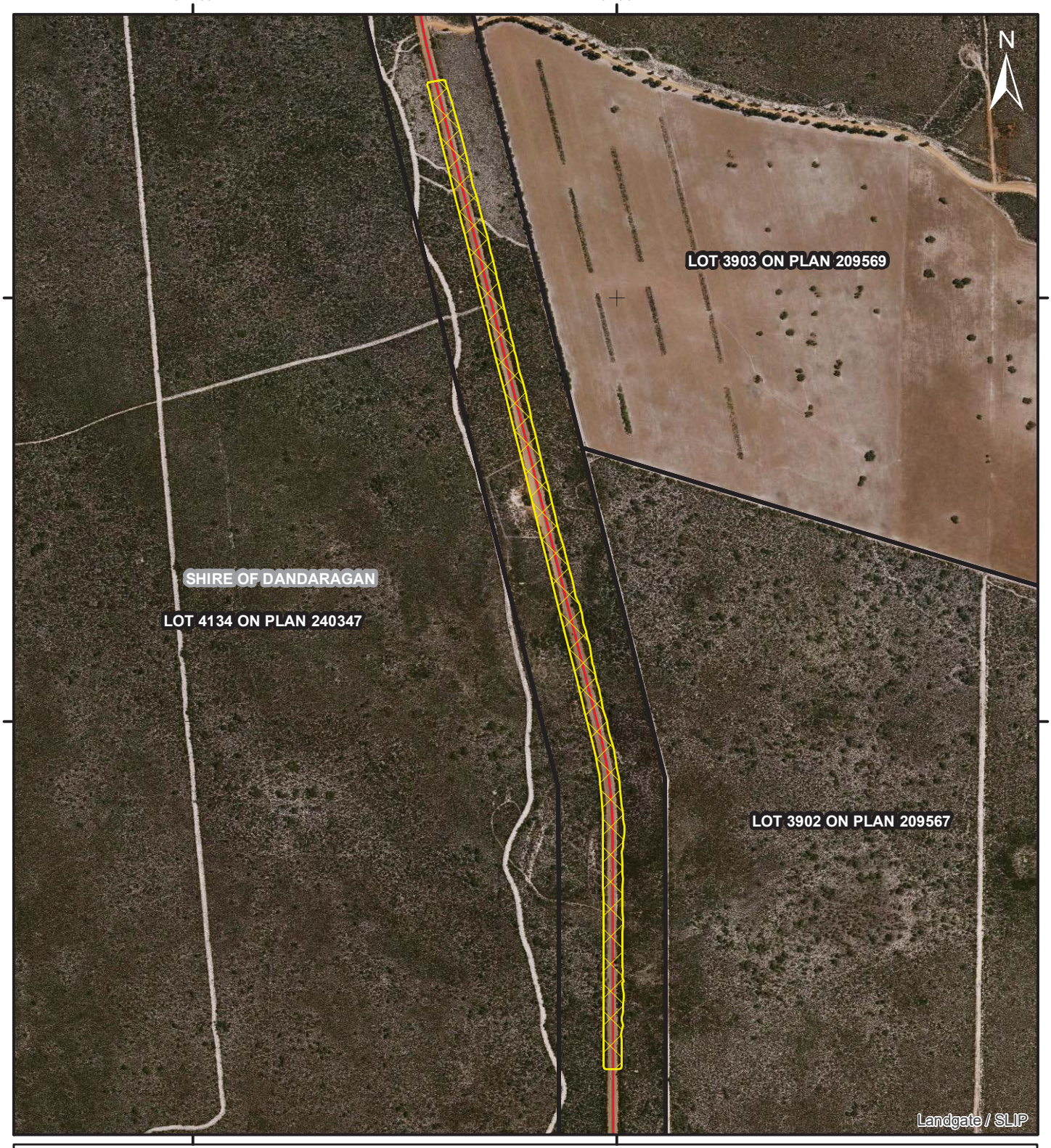

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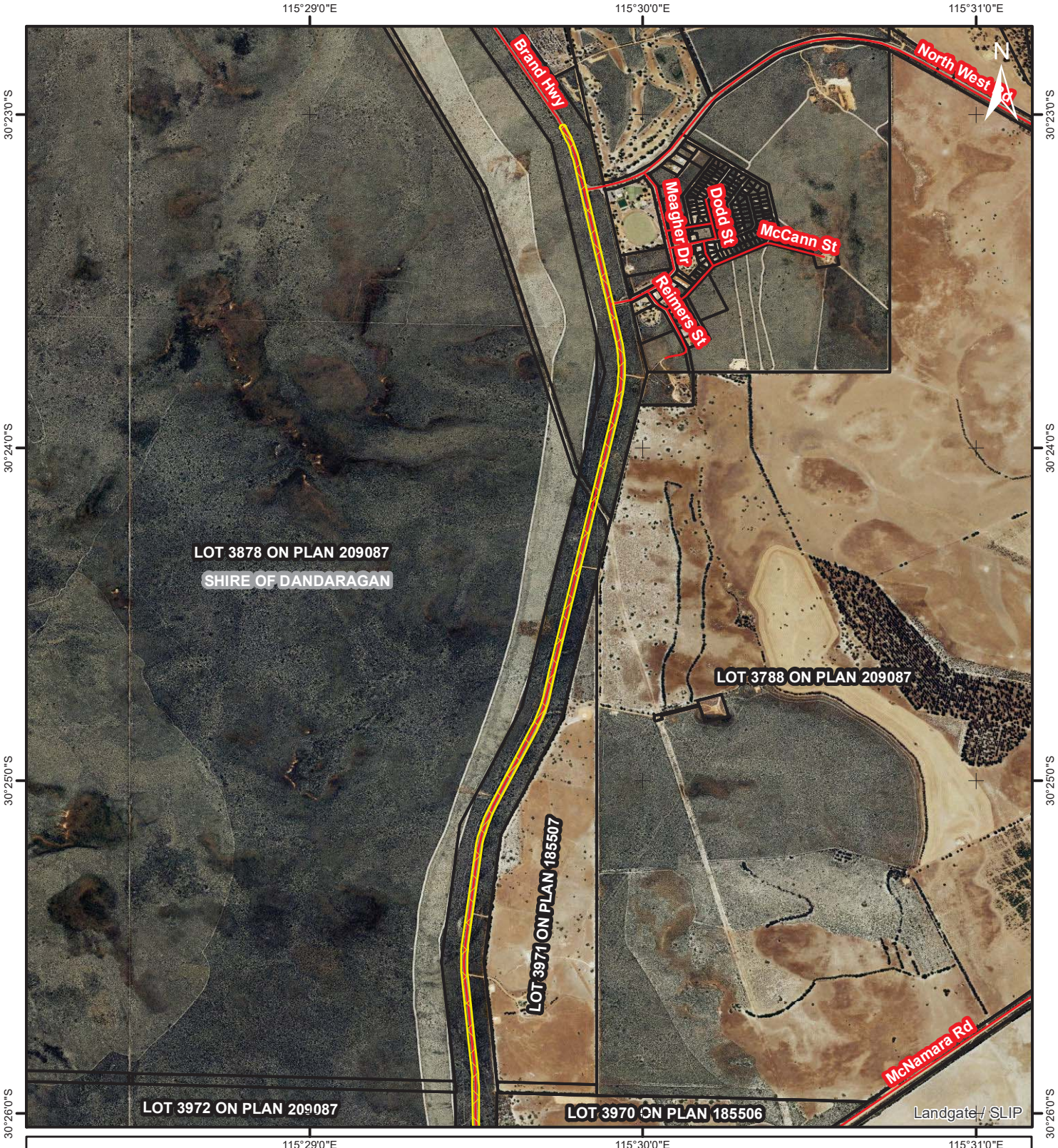

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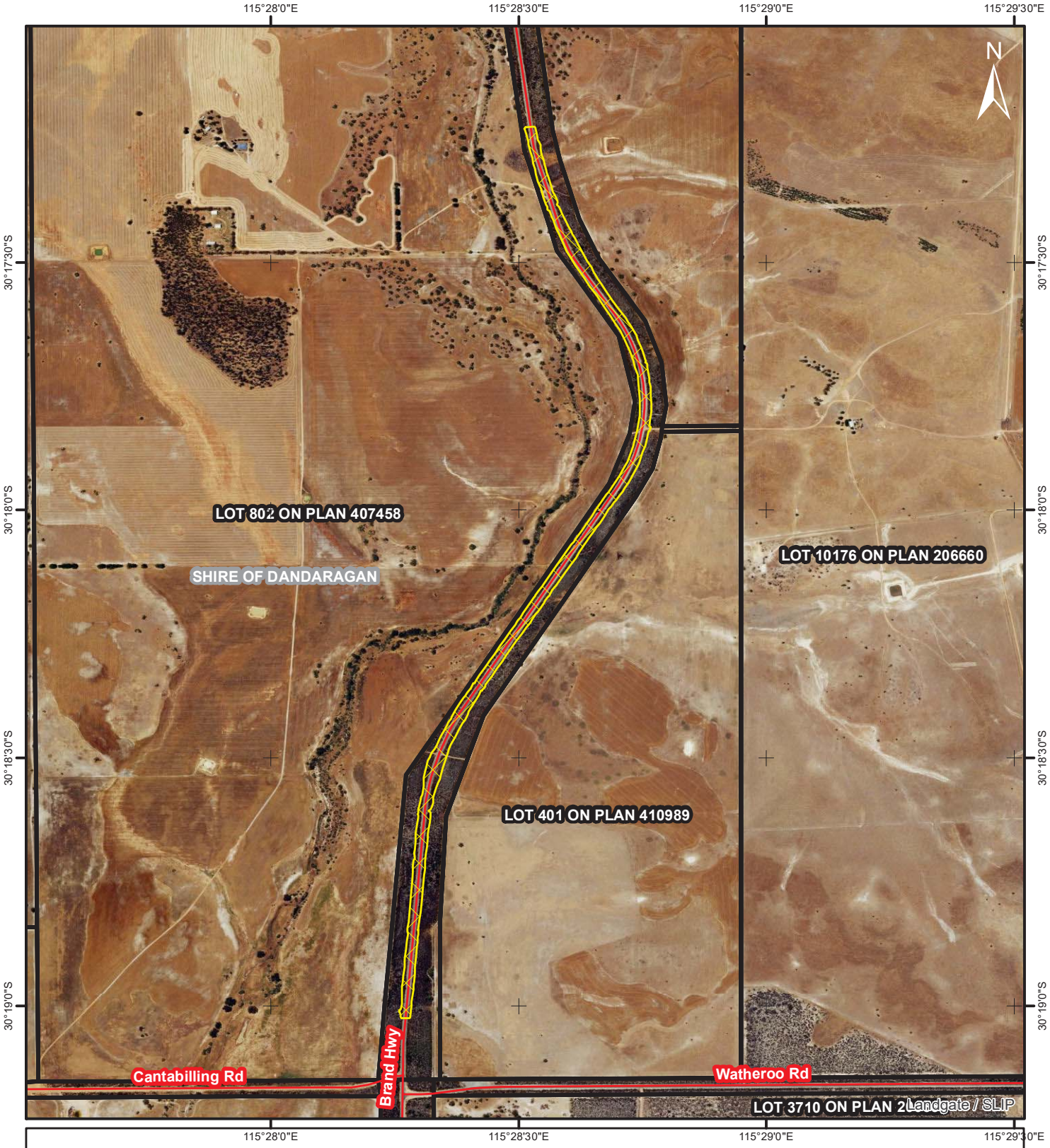

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GOVERNMENT OF WESTERN AUSTRALIA

This report has been prepared to fulfil the requirements of an accredited environmental assessment process between the Commonwealth and State governments, pursuant to a bilateral agreement established under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This report is set out in four parts:

- Part 1: Application details;
- Part 2: Assessment against matters of national environmental significance (pursuant to the EPBC Act);
- Part 3: Assessment against the clearing principles (pursuant to the Western Australian *Environmental Protection Act 1986* (EP Act)); and
- Part 4: References.

Part 1: Application details

1. Application

1.1 Applicant details

Applicant:	Commissioner of Main Roads Western Australia

1.2 Property details

Properties:	Brand Highway road reserve (PIN 1358753), Hill River Brand Highway road reserve (PIN 1358743), Badgingarra Lot 4180 on Plan 215549, Badgingarra Brand Highway road reserve (PIN 1358737), Badgingarra Brand Highway road reserve (PIN 11674695), Badgingarra Brand Highway road reserve (PIN 11674696), Badgingarra Lot 4255 on Plan 209084, Badgingarra Brand Highway road reserve (PIN 11579146), Cooljarloo Brand Highway road reserve (PIN 11674269), Cooljarloo Brand Highway road reserve (PIN 11674270), Cataby Brand Highway road reserve (PIN 1226149), Cataby Brand Highway road reserve (PIN 1226168), Yathroo Brand Highway road reserve (PIN 1226171), Regans Ford Brand Highway road reserve (PIN 1226192), Red Gully Brand Highway road reserve (PIN 1188398), Orange Springs Lot 13800 on Plan 206476, Red Gully Lot 14246 on Plan 27746, Red Gully Brand Highway road reserve (PIN 11674225), Granville
Local Government Authorities:	Shire of Gingin Shire of Dandaragan

1.3 EPBC Act details

Reference No.:	EPBC 2017/7864
Referral date:	23 January 2017
Proposed action:	To upgrade Brand Highway 34.83-164.3 SLK, involving the widening of six existing sections and the construction of an additional eight passing lanes, within the Shires of Dandaragan and Gingin, Western Australia
Controlled action decision date:	16 March 2017
Relevant controlling provisions:	Listed threatened species and communities (sections 18 & 18A of EPBC Act)

1.4 EP Act details

Reference No.:	CPS 7533/1
Clearing permit application type:	Purpose Permit
Application date:	22 March 2017
Clearing area (hectares):	37.8
No. trees:	N/A
Method of clearing:	Mechanical Removal
Purpose category:	Road construction or upgrades

1.5 EP Act decision on application

Decision on permit application:	Granted
Decision date:	17 May 2019

Reasons for decision:

The clearing permit application has been assessed against the clearing principles, planning instruments and other matters in accordance with section 51O of the EP Act. It has been concluded that the proposed clearing is at variance to principles (a), (b), (d), (e) and (f), may be at variance to principle (h), and is not likely to be at variance to the remaining principles.

The Delegated Officer considered that the proposed clearing has the potential to result in death of/injury to chuditch and woma if present within the application area. It is considered that impacts to chuditch can be mitigated through permit conditions requiring directional clearing, and restricting clearing between September and December, pre-clearing inspections for dens, relocation of individuals occupying identified dens, and replacement/relocation of confirmed dens in adjoining habitat. It is considered that impacts to woma can be mitigated through permit conditions requiring directional clearing.

The Delegated Officer also considered that the proposed clearing has the potential to result in the spread/introduction of dieback and weeds. It is considered that this risk can be adequately mitigated through the imposition of dieback and weed hygiene clearing permit conditions. Noting the staged nature of the proposed clearing, this includes the requirement for staged dieback surveys (i.e. within 12 months prior to clearing) and later development of site specific dieback management plans informed by those surveys.

After consideration of all avoidance and mitigation measures, the Delegated Officer considered that the following significant residual impacts will occur:

- loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat;
- loss of up to 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC;
- loss of up to 3.7 hectares of Beard vegetation association 1035; and
- loss of up to 2.8 hectares of significant wetlands.

It is considered that the acquisition for conservation of at least 242 hectares of native vegetation with similar environmental values to those of the vegetation being lost will adequately counterbalance the significant residual impacts of the proposed clearing consistent with the *WA Environmental Offsets Policy, September 2011*.

The Delegated Officer also took into consideration that upgrades to the road will provide a public benefit including improved road safety.

Given the above, the Delegated Officer decided to grant a clearing permit subject to avoid and minimise, fauna management, dieback and weed management, reporting and offset conditions.

2. Application area

The application is to clear up to 37.8 hectares of native vegetation along Brand Highway between Straight Line Kilometre (SLK) 34.83 (near Dewar Road) and 163.4 (near Boothendarra Road) in the Shires of Gingin and Dandaragan. The proposed clearing is for the construction of eight passing lanes and the widening of six sections of the highway. The application area is made up of 13 different areas (Table 1 and Figure 1) which together measure approximately 170 hectares. It is noted that Area 10 and Area 11 overlap with the application area for Area 11 being approximately seven metres wider. The works are proposed to be undertaken in stages over a period of 8 years, however, some of the works are yet to be funded and therefore scheduling may change.

Table 1. Application area description

Area ID	Plan	Project type	SLK start	SLK finish	Shire	Clearing size (ha)
Area 1	7533/1a	Northbound passing lane	34.83	36	Gingin	1.3
Area 2	7533/1b	Widening	65	68.63	Gingin	2.2
Area 3	7533/1c	Southbound passing lane	68.63	71.02	Gingin	2.7
Area 4	7533/1d	Widening	71.02	74	Gingin	1.8
Area 5	7533/1e	Widening	77.3	79.84	Dandaragan	1.6
Area 6	7533/1f	Northbound passing lane	79.84	81.71	Dandaragan	2.1
Area 7	7533/1g	Widening	81.71	86	Dandaragan	2.6
Area 8	7533/1h	Southbound passing lane	111.08	112.9	Dandaragan	2.2
Area 9	7533/1i	Northbound passing lane	114.1	116.1	Dandaragan	2.2
Area 10	7533/1j to 7533/1l	Widening	120	136	Dandaragan	6
Area 11	7533/1m	Southbound passing lane	126.2	128.38	Dandaragan	2.5
Area 12	7533/1n to 7533/1p	Widening	139	152	Dandaragan	4.6
Area 13	7533/1q	Northbound passing lane	160.1	163.6	Dandaragan	6
		Southbound passing lane	160.1	163.4	Dandaragan	
					TOTAL	**37.8**

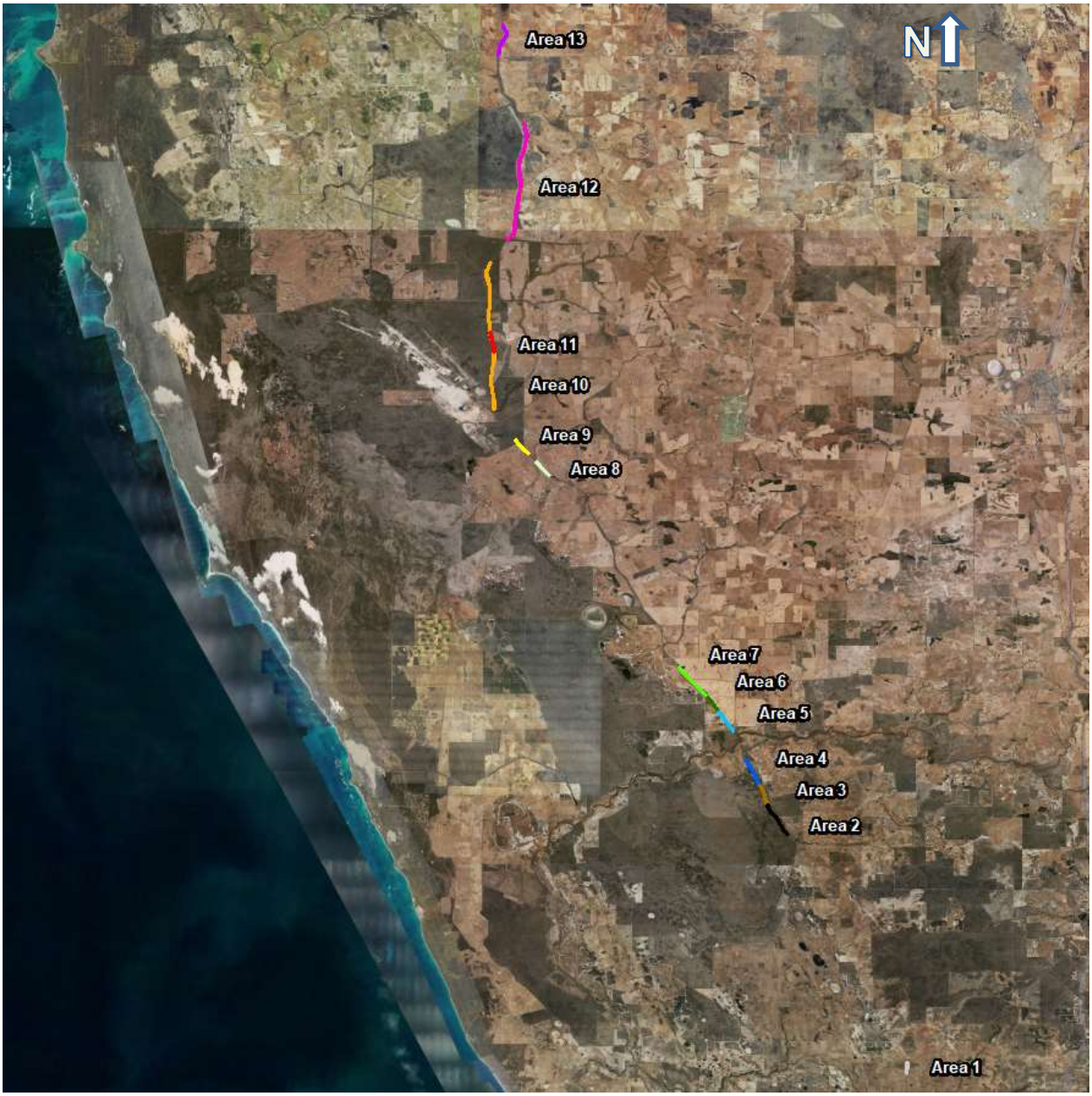

Figure 1. Application area map

3. Vegetation description and surveys undertaken

Beard vegetation associations

The application area intersects eight mapped Beard vegetation associations (4, 7, 949, 999, 1015, 1030, 1031 and 1035) across two Interim Biogeographic Regionalisation for Australia (IBRA) bioregions (Swan Coastal Plain and Geraldton Sandplains) (Table 2).

Table 2. Beard vegetation associations intersected by the application area

Area ID	Beard vegetation association	Beard vegetation association description (Shepherd et al., 2001)	Bioregion
Area 1	999	Medium woodland; marri	Swan Coastal Plain
Area 2	949 1015	Low woodland; banksia Mosaic: Mixed scrub-heath / Shrublands; dryandra thicket	Swan Coastal Plain
Area 3	949	Low woodland; banksia	Swan Coastal Plain
Area 4	4 949	Medium woodland; marri & wandoo Low woodland; banksia	Swan Coastal Plain
Area 5	1030 1035	Low woodland; *Banksia attenuata* & *B. menziesii* Mosaic: Medium open woodland; marri / Shrublands; dryandra heath	Swan Coastal Plain
Area 6	1030 1035	Low woodland; *Banksia attenuata* & *B. menziesii* Mosaic: Medium open woodland; marri / Shrublands; dryandra heath	Swan Coastal Plain
Area 7	1030 1031	Low woodland; *Banksia attenuata* & *B. menziesii* Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath	Swan Coastal Plain
Area 8	1030	Low woodland; *Banksia attenuata* & *B. menziesii*	Swan Coastal Plain
Area 9	1030 1031	Low woodland; *Banksia attenuata* & *B. menziesii* Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath	Swan Coastal Plain
Area 10	7 1030 1031	Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo Low woodland; *Banksia attenuata* & *B. menziesii* Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath	Geraldton Sandplains
Area 11	1031	Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath	Geraldton Sandplains
Area 12	1031	Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath	Geraldton Sandplains
Area 13	1031	Mosaic: Shrublands; hakea scrub-heath / Shrublands; dryandra heath	Geraldton Sandplains

Surveys undertaken

The applicant commissioned a range of terrestrial flora, vegetation and fauna surveys to support the application. A summary of these surveys (i.e. Surveys 1 to 6 and 9) is provided in Table 3. The applicant also previously commissioned two surveys for adjacent areas for the Brand Highway SLK 51.2 to 77.5 widening project approved under clearing permit CPS 818/12 on 20 December 2016. The details of these surveys are also included in Table 3 (i.e. Surveys 7 & 8). It should be noted that the survey locations listed are approximate only and a wider footprint than the application area may have been utilised. Therefore the results of the surveys may relate to a larger area than the application area.

Table 3. Surveys commissioned for the application.

Survey	Title	Survey location	Survey dates	Field work	Comment
Survey 1	Main Roads Western Australia Brand Highway Passing Lanes Biological Assessment, May 2016 (GHD, 2016a)	Was commissioned for Areas 1, 3, 6, 8, 9, 11 and 13 (i.e. the eight passing lanes). Buffer areas were also surveyed meaning the northern half of Area 2, the southern 500m of Area 4, the northern 500m of Area 5, the southern 400m of Area 7 and 1.6 kilometres of Area 10 were also included.	Flora & Vegetation 15-19 September 2014 (all but Area 1) 30 March 2015 (Area 1 only) 7-13 September 2015 (all but Area 1) 23 January 2016 (Area 1 only) Fauna 15-19 September 2014 (all but Area 1) 30 March 2015 (Area 1 only) 23 January 2016 (Area 1 only)	A total 38 quadrats (10x10m) were surveyed. Breakdown of quadrats by area is as follows: • Area 1 = 0 • Area 2 = 2 • Area 3 = 2 • Area 4 = 1 • Area 5 = 1 • Area 6 = 3 • Area 7 = 1 • Area 8 = 3 • Area 9 = 3 • Area 10 = 2 • Area 11 = 3 • Area 13 = 9 At least one transect on either side of the road was walked across the entire length of the survey area except for the survey area for Area 1.	665 flora taxa recorded (562 native). No threatened flora species recorded. 13 priority flora species recorded. 56 fauna species recorded (53 native). Carnaby's cockatoo recorded. Chuditch and western brush wallaby considered likely to occur. 195 potential habitat trees for Carnaby's cockatoo recorded but none had suitably sized breeding hollows.
Survey 2	Main Roads Western Australia Brand Highway, Western Australia – Various Sections: SLK 74 to 150 Biological Survey, April 2016 (GHD, 2016b)	Majority of Areas 5, 10 and 12	Flora & Vegetation 29 September to 2 October 2015 Fauna 29 September to 2 October 2015	A total of 25 quadrats (10x10m) were surveyed. Breakdown of quadrats by area is as follows: • Area 5 = 5 • Area 10 = 12 • Area 12 = 8	440 flora taxa recorded (375 native). No threatened flora species recorded. 13 priority flora species recorded. 45 fauna species recorded. Carnaby's cockatoo recorded. Chuditch, woma, black-striped snake and western brush wallaby considered likely to occur. Four potential habitat trees for Carnaby's cockatoo recorded but none contained hollows.

Survey	Title	Survey location	Survey dates	Field work	Comment
Survey 3	Brand Highway, Regans Ford Biological Survey, September 2016 (Astron, 2016)	Majority of Areas 4 and 7 and the southern half of Area 2	Flora & Vegetation 18-23 September 2016 Fauna 18-23 September 2016	A total of 19 quadrats (10x10m) were surveyed. Breakdown of quadrats by area is as follows: • Area 2 = 2 • Area 4 = 9 • Area 7 = 8	234 flora taxa recorded. A further 19 records were made that could not be identified to species level of which some are likely to represent additional taxa. Approximately 82 per cent of the flora recorded were native taxa. No threatened flora species recorded. One priority flora species recorded. 32 fauna species recorded. Carnaby's cockatoo recorded. Chuditch considered likely to occur. Five potential habitat trees for Carnaby's cockatoo recorded with four of these containing suitable nest hollows but none showed signs of use.
Survey 4	Assessment Report and Vegetation Management Plan Brand Highway Widening and Passing Lane Package 2016/2017, February 2017 (MRWA, 2017a)	Southern 800m of Area 10, central 1.1 kilometre portion of Area 10 and 1.9 kilometre portion of Area 12	15 July 2016	Site visit to extrapolate vegetation type, vegetation condition and fauna habitat mapping from Surveys 1 and 2 for unsurveyed portions of Areas 10 and 12. Targeted flora search also undertaken.	No threatened flora species recorded. Three priority flora species recorded. Suitable Carnaby's cockatoo foraging habitat present. No potential habitat trees for Carnaby's cockatoo recorded.
Survey 5	Brand Highway Passing Lanes Survey for Listed Threatened and Priority Flora Taxa, December 2017 (Woodman Environmental, 2017)	All (Areas 1 to 13)	6-10 November 2017	Targeted survey for conservation significant flora taxa. Both sides of the road searched on foot for the entire length of the application area.	No threatened flora species recorded. 22 priority flora species recorded.
Survey 6	Main Roads Western Australia Brand Highway Passing Lanes Banksia Woodlands TEC Assessment, April 2018 (Ecologia, 2018a)	All (Areas 1 to 13)	7-11 November 2017	A total of 31 quadrats (10x10m) were surveyed for the presence of the Banksia Woodlands of the Swan Coastal Plain EPBC Act listed threatened ecological community (TEC). Note: Data compiled for the 82 quadrats established by Surveys 1 to 3 was also assessed for the presence of the TEC.	40 of the total 113 quadrats were considered to be representative of the Banksia Woodlands of the Swan Coastal Plain TEC. The same quadrats were also considered to broadly correspond to the priority ecological community (PEC) Swan Coastal Plain *Banksia attenuata – Banksia menziesii* woodlands floristic community type (FCT) 23b listed by the Department of Biodiversity, Conservation and Attractions (DBCA) as Priority 3 (P3).

Survey	Title	Survey location	Survey dates	Field work	Comment
Survey 7	Main Roads WA Midwest Region Brand Highway Upgrade SLK 51.3 to SLK 65 Biological Survey, March 2016 (GHD, 2016c)	An approximately 14 kilometre section of Brand Highway extending south from the southern end of Area 2 (not within current application area).	Flora & Vegetation 8-10 September 2015 Fauna 19 January 2016	A total of 6 quadrats (10x10m) were surveyed. Majority of survey area traversed on foot and opportunistic observations made.	188 flora taxa recorded (156 native). No threatened or priority flora species recorded. Carnaby's cockatoo recorded. Chuditch, black-striped snake, western brush wallaby and water rat may occur within/utilise the survey area. 22 potential habitat trees for Carnaby's cockatoo recorded but none had suitably sized breeding hollows.
Survey 8	Main Roads Western Australia Brand Highway Realignment: Regan's Ford Biological Survey, May 2016 (GHD, 2016d)	Section between Areas 4 and 5 (not within current application area)	Flora & Vegetation 21-23 September 2015 Fauna 21-23 September 2015	A total of 20 quadrats (10x10m) were surveyed. Majority of survey area traversed on foot and opportunistic observations made.	327 flora taxa recorded (267 native). No threatened flora species recorded. Two priority flora species recorded. A third priority flora species may also have been recorded (flowering material required for identification was not able to be collected during the survey). Carnaby's cockatoo recorded. Chuditch and western brush wallaby considered likely to occur. Two observations made of nesting Carnaby's cockatoos. Chicks were heard at one of the nesting trees and nesting behaviour observed at the other. 730 potential habitat trees for Carnaby's cockatoo recorded with 31 containing suitably sized breeding hollows. Note: The area approved to clear under CPS 818/12 did not include the two nesting trees.
Survey 9	Main Roads Australia Brand Highway Widening and Passing Lanes SLK 120 to 136 and SLK 139 to 152 Regional Targeted Flora Survey, December 2018 (Ecologia, 2018b)	Areas of road reserve and conservation estate near Area 12 and the northern 3.5 kilometre section of Area 10 (i.e. areas outside of the application area)	12-16 November 2018 Additional survey for *Comesperma rhadinocarpum* was also undertaken 17-18 December 2018	Targeted grid searching on foot of potentially suitable habitat at approximately 10 to 20 metre intervals for the following priority flora species: • *Catacolea enodis* (P2); • *Desmocladus microcarpus* (P2); • *Hypocalymma serrulatum* (P2); • *Comesperma rhadinocarpum* (P3); • *Jacksonia anthoclada* (P3); • *Tetratheca angulata* (P3); and • *Grevillea rudis* (P4).	All seven targeted priority flora species recorded. Numbers recorded were as follows: • *C. enodis* – 109 plants from 53 point locations; • *D. microcarpus* – 31 plants from 11 point locations; • *H. serrulatum* – 700 plants from 70 point locations; • *C. rhadinocarpum* – 199 plants from 107 point locations; • *J. anthoclada* – 908 plants from 154 point locations; • *T. angulata* – 188 plants from 63 point locations; and • *G. rudis* – 254 plants from 63 point locations.

Vegetation types

Surveys 1 to 4 recorded a total of 30 different vegetation types across the application area (Table 4). This does not include areas where native vegetation was absent or largely absent. Such areas were recorded in all survey areas for Surveys 1 to 3 and were described as follows:

- Survey 1 – Highly modified (HM) – Includes areas that have been predominantly cleared but which still contain either scattered natives or introduced species. These include bulldozed firebreaks that contain seed and which may support occasional native species.
- Survey 2 – Cleared/Degraded – Includes existing clearing road reserve, gravel pits, tracks and firebreaks. Often comprises Scattered Shrubs over Scattered Bunch introduced grass and Scattered Herbs.
- Survey 3 – Cleared – remnant vegetation has been removed.

Table 4. Vegetation types recorded in the application area.

Area ID	Survey	Vegetation Type	Description
Area 1	Survey 1	Parkland cleared (PC)	Woodland of *Corymbia calophylla* over weed grassland of **Ehrharta calycina*, **E. longiflora* and **Avena* spp. with occasional *Banksia prionotes*, *Xanthorrhoea preissii* and *Grevillea vestita*, and occasional trees of *Eucalyptus rudis* in low-lying areas.
Area 2	Survey 1	*Banksia attenuata* and *B. menziesii* woodland (BaBmW)	Woodland of *Banksia menziesii* and *B. attenuata* over sparse tall shrubland of *Adenanthos cygnorum, Jacksonia floribunda* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Eremaea pauciflora, Stirlingia latifolia* and open sedgeland of *Lyginia barbata, Alexgeorgea nitens* and *Mesomelaena pseudostygia* over sparse herbland of *Haemodorum* sp., *Drosera erythrorhiza* and *Dampiera linearis*.
	Survey 3	PI01	*Banksia attenuata* and *Banksia menziesii* low woodland over *Adenanthos cygnorum* subsp. *cygnorum* and *Eremaea pauciflora* var. *pauciflora* open shrubland over *Stirlingia latifolia* low open shrubland over *Mesomelaena pseudostygia* very open sedgeland.
Area 3	Survey 1	*Banksia attenuata* and *B. menziesii* woodland (BaBmW)	Woodland of *Banksia menziesii* and *B. attenuata* over sparse tall shrubland of *Adenanthos cygnorum, Jacksonia floribunda* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Eremaea pauciflora, Stirlingia latifolia* and open sedgeland of *Lyginia barbata, Alexgeorgea nitens* and *Mesomelaena pseudostygia* over sparse herbland of *Haemodorum* sp., *Drosera erythrorhiza* and *Dampiera linearis*.
Area 4	Survey 1	*Banksia attenuata* and *B. menziesii* woodland (BaBmW)	Woodland of *Banksia menziesii* and *B. attenuata* over sparse tall shrubland of *Adenanthos cygnorum, Jacksonia floribunda* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Eremaea pauciflora, Stirlingia latifolia* and open sedgeland of *Lyginia barbata, Alexgeorgea nitens* and *Mesomelaena pseudostygia* over sparse herbland of *Haemodorum* sp., *Drosera erythrorhiza* and *Dampiera linearis*.
	Survey 1	*Melaleuca preissiana* Woodland (MpW)	Woodland of *Melaleuca preissiana* over tall shrubland of *M. incana* subsp. *incana, Hypocalymma angustifolium, Gastrolobium obovatum* over closed sedgeland of *Gahnia trifida, Juncus kraussii* subsp. *australiensis, Schoenus caespititius* over sparse herbland of *Laxmannia ramosa* subsp. *ramosa, Drosera erythrorhiza, Isotropis cuneifolia* subsp. *cuneifolia*.
	Survey 3	PI01	*Banksia attenuata* and *Banksia menziesii* low woodland over *Adenanthos cygnorum* subsp. *cygnorum* and *Eremaea pauciflora* var. *pauciflora* open shrubland over *Stirlingia latifolia* low open shrubland over *Mesomelaena pseudostygia* very open sedgeland.
	Survey 3	PI04	*Eucalyptus todtiana*, *Banksia attenuata* and *Banksia menziesii* low open woodland over *Xanthorrhoea preissii* open shrubland over *Hibbertia crassifolia*, *Eremaea pauciflora* var. *pauciflora* and *Allocasuarina humilis* low shrubland over *Mesomelaena pseudostygia* and *Tetraria octandra* very open sedgeland.
	Survey 3	PI05	*Corymbia calophylla* low open forest over *Xanthorrhoea preissii* and *Hakea trifurcata* open shrubland over *Bossiaea eriocarpa* and *Jacksonia sternbergiana* low shrubland over *Mesomelaena pseudostygia* and *Caustis dioica* open sedgeland.

Area ID	Survey	Vegetation Type	Description
Area 5	Survey 1	*Banksia attenuata* and *B. menziesii* woodland (BaBmW)	Woodland of *Banksia menziesii* and *B. attenuata* over sparse tall shrubland of *Adenanthos cygnorum, Jacksonia floribunda* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Eremaea pauciflora, Stirlingia latifolia* and open sedgeland of *Lyginia barbata, Alexgeorgea nitens* and *Mesomelaena pseudostygia* over sparse herbland of *Haemodorum* sp., *Drosera erythrorhiza* and *Dampiera linearis*.
	Survey 2	*Banksia* Woodland on White Sand	Low Open Woodland dominated by *Banksia attenuata, B. menziesii* with *Eucalyptus todtiana* over Scattered Shrubs of *B. attenuata, Jacksonia floribunda* over Low Shrubland to Open Shrubland of *Melaleuca urceolaris* and *Eremaea pauciflora* over Sedgeland of *Desmocladus subterranea, Xanthorrhoea preissii* over herbs *Trachymene pilosa, Podotheca angustifolia, Burchardia congesta, Pterostylis dilatata* on White Sand.
	Survey 2	Geomorphic Wetland	Trees of *Corymbia calophylla, Melaleuca preissiana* over Shrubs of *M. preissiana, M. incana, Hypocalymma angustifolium* over Sedgeland of *Lepidosperma squamatum, *Cyperus congestus*.
	Survey 2	Marri *Banksia* Woodland	Woodland of *Corymbia calophylla* over Low Woodland of *Banksia attenuata, Banksia prionotes* over High Open Shrubland of *Allocasuarina humilis, Nuytsia floribunda* over Scattered Shrubs of *Jacksonia horrida, Hibbertia hypericoides* over Low Shrubland of *Calothamnus sanguineus, Acacia pulchella* var. *glaberrima, Banksia nivea* over Open Sedgeland of *Caustis dioica, Mesomelaena pseudostygia* over Scattered Herbs of *Cassytha flava, Haemodorum brevisepalum*.
	Survey 2	Heath and Emergents	Scattered Low Trees of *Banksia attenuata, Eucalyptus todtiana* over Scattered Heath of *Leucopogon oldfieldii, Astroloma xerophyllum, Hibbertia aurea, Hakea obliqua, H. ruscifolia, Melaleuca trichophylla* over Low Shrubland of *Conostylis, Calothamnus sanguineus* over Very Open Sedgeland of *Mesomelaena pseudostygia, Desmocladus subterranea, Lyginia barbata* over Scattered Herbs of *Drosera spp.* and *Burchardia congesta.*
Area 6	Survey 1	*Banksia attenuata* and *B. menziesii* woodland (BaBmW)	Woodland of *Banksia menziesii* and *B. attenuata* over sparse tall shrubland of *Adenanthos cygnorum, Jacksonia floribunda* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Eremaea pauciflora, Stirlingia latifolia* and open sedgeland of *Lyginia barbata, Alexgeorgea nitens* and *Mesomelaena pseudostygia* over sparse herbland of *Haemodorum* sp., *Drosera erythrorhiza* and *Dampiera linearis*.
	Survey 1	Tall Mixed Shrubland (TMS)	Tall shrubland of *Xanthorrhoea preissii, Hakea trifurcata* and *Jacksonia sternbergiana* over shrubland of *Hibbertia hypericoides, Petrophile macrostachya* and *Calothamnus quadrifidus* subsp. *quadrifidus* and grassland of *Austrostipa elegantissima, *Ehrharta longiflora, Neurachne alopecuroides* over open herbland of *Drosera erythrorhiza, Hypochaeris glabra, *Ursinia anthemoides*.

Area ID	Survey	Vegetation Type	Description
Area 7	Survey 1	*Banksia attenuata* and *B. menziesii* woodland (BaBmW)	Woodland of *Banksia menziesii* and *B. attenuata* over sparse tall shrubland of *Adenanthos cygnorum, Jacksonia floribunda* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Eremaea pauciflora, Stirlingia latifolia* and open sedgeland of *Lyginia barbata, Alexgeorgea nitens* and *Mesomelaena pseudostygia* over sparse herbland of *Haemodorum* sp.*, Drosera erythrorhiza* and *Dampiera linearis*.
	Survey 3	PI01	*Banksia attenuata* and *Banksia menziesii* low woodland over *Adenanthos cygnorum* subsp. *cygnorum* and *Eremaea pauciflora* var. *pauciflora* open shrubland over *Stirlingia latifolia* low open shrubland over *Mesomelaena pseudostygia* very open sedgeland.
	Survey 3	PI02	*Grevillea eriostachya* and *Allocasuarina humilis* tall open shrubland over *Xanthorrhoea preissii* and *Eremaea pauciflora* var. *pauciflora* open shrubland over *Austrostipa elegantissima* and *Amphipogon turbinatus* very open tussock grassland over *Mesomelaena pseudostygia* very open sedgeland.
	Survey 3	PI03	*Calothamnus quadrifidus* subsp. *quadrifidus*, *Allocasuarina humilis* and *Jacksonia floribunda* tall shrubland over *Eremaea pauciflora* var. *pauciflora* and *Xanthorrhoea preissii* shrubland over *Hibbertia crassifolia* low open shrubland over *Tetraria octandra*, *Mesomelaena pseudostygia* open sedgeland.
	Survey 3	PI04	*Eucalyptus todtiana*, *Banksia attenuata* and *Banksia menziesii* low open woodland over *Xanthorrhoea preissii* open shrubland over *Hibbertia crassifolia*, *Eremaea pauciflora* var. *pauciflora* and *Allocasuarina humilis* low shrubland over *Mesomelaena pseudostygia* and *Tetraria octandra* very open sedgeland.
	Survey 3	W01	*Banksia prionotes* and *Melaleuca rhaphiophylla* tall shrubland over *Acacia saligna* subsp. *saligna* open shrubland over *Juncus kraussii* subsp. *australiensis* low open shrubland over **Ehrharta calycina* very open tussock grassland.
Area 8	Survey 1	*Banksia attenuata* and *B. menziesii* woodland over mixed shrubland and sedgeland (BaBmWMS)	Woodland of B*anksia menziesii* and *B. attenuata* over sparse tall shrubland of *Allocasuarina humilis, Jacksonia sternbergiana* and *Xanthorrhoea preissii* over low shrubland of *Bossiaea eriocarpa, Hibbertia hypericoides* and *Hypocalymma xanthopetalum* over mixed grassland and sedgeland of *Mesomelaena pseudostygia, *Ehrharta spp.* and **Briza maxima*.
	Survey 1	Low, mixed heath (LMH)	Sparse shrubland of *Allocasuarina humilis, Leptospermum erubescens* and *Conospermum stoechadis* over sedgeland of *Ecdeiocolea monostachya* over low shrubland of *Calothamnus sanguineus, Hibbertia hypericoides and Daviesia nudiflora* over mixed sedgeland and grassland of *Neurachne alopecuroidea, Desmocladus* spp. and *Mesomelaena pseudostygia, Schoenus* spp. and sparse herbland of *Trachymene pilosa, Drosera* spp. and *Poranthera microphylla*.
	Survey 1	*Eucalyptus rudis – Melaleuca rhaphiophylla* woodland (ErMrW)	*Eucalyptus rudis – Melaleuca rhaphiophylla* woodland over weedy grasses, including **Ehrharta* spp. and **Eragrostis curvula.*
Area 9	Survey 1	Low, mixed heath (LMH)	Sparse shrubland of *Allocasuarina humilis, Leptospermum erubescens* and *Conospermum stoechadis* over sedgeland of *Ecdeiocolea monostachya* over low shrubland of *Calothamnus sanguineus, Hibbertia hypericoides and Daviesia nudiflora* over mixed sedgeland and grassland of *Neurachne alopecuroidea, Desmocladus* spp. and *Mesomelaena pseudostygia, Schoenus* spp. and sparse herbland of *Trachymene pilosa, Drosera* spp. and *Poranthera microphylla*.
	Survey 1	*Eucalyptus todtiana* and *Banksia attenuata* very open woodland (BaEtOW)	Open woodland of *Banksia attenuata, B. menziesii* and *Eucalyptus todtiana* over open shrubland of *Hakea ruscifolia, Xanthorrhoea preissii* and *Allocasuarina humilis* over low shrubland of *Petrophile macrostachya, Eremaea pauciflora* and *Hakea incrassata* and grassland of **Ehrharta* spp.*, *Eragrostis curvifolia* and **Bromus diandrus*

Area ID	Survey	Vegetation Type	Description
Area 10	Survey 1	Low mixed heath (LMH)	Sparse shrubland of *Allocasuarina humilis, Leptospermum erubescens* and *Conospermum stoechadis* over sedgeland of *Ecdeiocolea monostachya* over low shrubland of *Calothamnus sanguineus, Hibbertia hypericoides and Daviesia nudiflora* over mixed sedgeland and grassland of *Neurachne alopecuroidea, Desmocladus* spp. and *Mesomelaena pseudostygia, Schoenus* spp. and sparse herbland of *Trachymene pilosa, Drosera* spp. and *Poranthera microphylla*.
	Survey 1	Mixed Tall shrubland (MTS)	Sparse woodland of *Banksia attenuata* over tall shrubland of *Adenanthos cygnorum, Allocasuarina humilis, Jacksonia nutans* over mixed, low shrubland of *Jacksonia floribunda, Hibbertia hypericoides* and *Eremaea asterocarpa* over sedgeland of *Alexgeorgea nitens, Lyginia barbata* and *Mesomelaena pseudostygia*.
	Survey 1 and 4	Tall *Adenanthos* and *Allocasuarina* Shrubland (AcAhS)	Tall shrubland of *Adenanthos cygnorum, Allocasuarina humilis* and *Leptospermum erubescens* over mixed, low shrubland of *Jacksonia floribunda, Hibbertia hypericoides* and *Daviesia podophylla* over herbland of *Dampiera linearis, Dampiera linearis* and *Conostylis teretifolia*.
	Survey 2	Heath and Emergents	Scattered Low Trees of *Banksia attenuata, Eucalyptus todtiana* over Scattered Heath of *Leucopogon oldfieldii, Astroloma xerophyllum, Hibbertia aurea, Hakea obliqua, H. ruscifolia, Melaleuca trichophylla* over Low Shrubland of *Conostylis, Calothamnus sanguineus* over Very Open Sedgeland of *Mesomelaena pseudostygia, Desmocladus subterranea, Lyginia barbata* over Scattered Herbs of *Drosera spp.* and *Burchardia congesta.*
	Survey 2	Mixed Heath on White Sand (with Laterite)	Open Heathland of *Leucopogon oldfieldii, Calothamnus sanguineus*, *Hibbertia hypericoides, H. subvaginata, Leucopogon oldfieldii, Stirlingia incrassata* over Low Open Shrubland *Banksia shuttleworthiana, Hakea conchifolia, Jacksonia floribunda* over Sedgeland of *Dasypogon bromeliifolius, Mesomelaena pseudostygia, Xanthorrhoea preissii, Desmocladus subterranea* over Scattered Herbs of *Drosera citrina, D. bulbosa* subsp. *bulbosa, Stylidium miniatum,* on White Sand with Laterite.
	Survey 2 and 4	Low Open Banksia Woodland	Low Open Woodland of *Eucalyptus todtiana, Banksia menziesii, B. attenuata,* over Shrubland of *Hakea obliqua* over Low Open Shrubland of *Banksia shuttleworthiana, Jacksonia floribunda, Conostylis setigera* subsp. *setigera, Stirlingia latifolia, Calothamnus sanguineus, Hakea prostrata* over Open Sedgeland of *Schoenus rigens, Dasypogon bromeliifolius, Desmocladus subterranea, Lyginia barbata, Mesomelaena pseudostygia* over Very Open Herbs of *Phyllangium divergens, Burchardia congesta, Drosera citrina, Stylidium miniatum.*
	Survey 4	Fine mosaic of Banksia Woodland and Low Heath	A very open woodland of *Banksia prionotes* with occasional emergent *Eucalyptus todtiana* and *Adenanthos cygnorum* over *Hakea varia*, *Petrophile macrostachya*, *Conospermum crassinervium*, *Acacia pulchella*, *Leptospermum erubescens*, shrubland over *Ecdeiocolea monostachya*, *Conostylis setigera*, *Scaevola phlebopetala*, *Lechenaultia linearis*, *Opercularia vaginata*, *Hibbertia huegelii*.
	Survey 4	Geomorphic Dampland	Low heath of *Melaleuca* species with twiners of *Cassytha glabella* over a seasonal ephemeral layer of *Drosera* and *Asteraceae* species.
	Survey 4	Geomorphic Wetland	Trees of *Corymbia calophylla, Melaleuca preissiana* over Shrubs of *M. preissiana, M. incana, Hypocalymma angustifolium* over Sedgeland of *Lepidosperma squamatum, *Cyperus congestus*.
	Survey 4	Mixed heath (MH)	Sedgeland of *Ecdeiocolea monostachya* over heathland of *Allocasuarina microstachya, Banksia* spp. and *Petrophile* spp. over herbland of *Dampiera spicigera, Pterochaeta paniculata* and *Drosera* spp.

Area ID	Survey	Vegetation Type	Description
Area 11	Survey 1	Low mixed heath (LMH)	Sparse shrubland of *Allocasuarina humilis, Leptospermum erubescens* and *Conospermum stoechadis* over sedgeland of *Ecdeiocolea monostachya* over low shrubland of *Calothamnus sanguineus, Hibbertia hypericoides and Daviesia nudiflora* over mixed sedgeland and grassland of *Neurachne alopecuroidea, Desmocladus* spp. and *Mesomelaena pseudostygia, Schoenus* spp. and sparse herbland of *Trachymene pilosa, Drosera* spp. and *Poranthera microphylla*.
	Survey 1	Mixed Tall shrubland (MTS)	Sparse woodland of *Banksia attenuata* over tall shrubland of *Adenanthos cygnorum, Allocasuarina humilis, Jacksonia nutans* over mixed, low shrubland of *Jacksonia floribunda, Hibbertia hypericoides* and *Eremaea asterocarpa* over sedgeland of *Alexgeorgea nitens, Lyginia barbata* and *Mesomelaena pseudostygia*.
	Survey 1	Tall *Adenanthos* and *Allocasuarina* Shrubland (AcAhS)	Tall shrubland of *Adenanthos cygnorum, Allocasuarina humilis* and *Leptospermum erubescens* over mixed, low shrubland of *Jacksonia floribunda, Hibbertia hypericoides* and *Daviesia podophylla* over herbland of *Dampiera linearis, Dampiera linearis* and *Conostylis teretifolia*.
	Survey 1	Low *Calothamnus* heath (CqS)	Closed shrubland of *Calothamnus* species over herbland of *Drosera* spp., *Hypochaeris* sp. and *Stylidium* sp.
Area 12	Survey 2 and 4	Mixed Heath on White Sand (with Laterite)	Open Heathland of *Leucopogon oldfieldii, Calothamnus sanguineus*, *Hibbertia hypericoides, H. subvaginata, Leucopogon oldfieldii, Stirlingia incrassata* over Low Open Shrubland *Banksia shuttleworthiana, Hakea conchifolia, Jacksonia floribunda* over Sedgeland of *Dasypogon bromeliifolius, Mesomelaena pseudostygia, Xanthorrhoea preissii, Desmocladus subterranea* over Scattered Herbs of *Drosera citrina, D. bulbosa* subsp. *bulbosa, Stylidium miniatum,* on White Sand with Laterite.
	Survey 2	Low Open *Banksia* Woodland	Low Open Woodland of *Eucalyptus todtiana, Banksia menziesii, B. attenuata,* over Shrubland of *Hakea obliqua* over Low Open Shrubland of *Banksia shuttleworthiana, Jacksonia floribunda, Conostylis setigera* subsp. *setigera, Stirlingia latifolia, Calothamnus sanguineus, Hakea prostrata* over Open Sedgeland of *Schoenus rigens, Dasypogon bromeliifolius, Desmocladus subterranea, Lyginia barbata, Mesomelaena pseudostygia* over Very Open Herbs of *Phyllangium divergens, Burchardia congesta, Drosera citrina, Stylidium miniatum.*
	Survey 2	Heath on Gravel	Scattered Shrubs of *Petrophile macrostachya, Allocasuarina humilis* over Low Open Heath of *Leucopogon oldfieldii, Gastrolobium polystachyum, Eremaea pauciflora, Astroloma glaucescens* over Sedgeland of *Mesomelaena tetragona* over Scattered Herbs of *Stylidium cygnorum, Drosera porrecta.*
Area 13	Survey 1	Northern *Banksia* woodland (BW)	Sparse woodland of *Banksia attenuata* and *B. menziesii* over shrubland of *Melaleuca seriata, M. leuropoma* and *Acacia pulchella* over mixed grassland and sedgeland of *Lyginia* spp., *Desmocladus* spp. and **Ehrharta calycina* over herbland of *Burchardia congesta, *Ursinia anthemoides* and *Conostylis aculeata* subsp. *aculeata.*
	Survey 1	Mixed tall shrubland (TS)	Sparse tall shrubland of *Adenanthos cygnorum* and *Hakea trifurcata* over shrubland of *Melaleuca* spp., *Hypocalymma xanthopetalum* and *Banksia* spp. and grassland of *Neurachne alopecuroidea, *Avena barbata* and **Briza maxima.*
	Survey 1	Mixed heath (MH)	Sedgeland of *Ecdeiocolea monostachya* over heathland of *Allocasuarina microstachya, Banksia* spp. and *Petrophile* spp. over herbland of *Dampiera spicigera, Pterochaeta paniculata* and *Drosera* spp.
	Survey 1	*Calothamnus* shrubland and *Meeboldina* sedgeland (CtSMcS)	Low shrubland of *Calothamnus hirsutus, Thryptomene mucronulata* and *Verticordia* spp. over mixed sedgeland of *Meeboldina coangustata, Schoenus insolitus* and *Centrolepis* spp. and herbland of *Tribonanthes australis*, *Stylidium flagellum* and *Drosera gigantea* subsp. *gigantea*.

Vegetation condition

Vegetation condition recorded across the application area ranges from Completely Degraded to Pristine using the Keighery (1994) scale (Table 5). Vegetation condition of two short sections within Area 10/Area 11 was not interpretable at the time of survey due to having been burnt. The majority (i.e. 46 per cent) of the vegetation within the application area was recorded to be in Excellent condition.

Vegetation condition ratings are defined as follows:

- Pristine: Pristine or nearly so, no obvious signs of disturbance (Keighery, 1994).
- Excellent: Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species (Keighery, 1994).
- Very Good: Vegetation structure altered; obvious signs of disturbance (Keighery, 1994).
- Good: Vegetation structure significantly altered by very obvious signs of multiple disturbance; retains basic structure or ability to regenerate (Keighery 1994).
- Degraded: Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching Good condition without intensive management (Keighery 1994).
- Completely Degraded: The structure of the vegetation is no longer intact and the area is completely or almost completely without native species (Keighery, 1994).

Table 5. Vegetation condition recorded in the application area.

Area ID	Survey	SLK Start	SLK End	Side of road	Distance (m)	Vegetation condition
Area 1	Survey 1	34.83	36	West	1170	Completely Degraded to Degraded
				East	1170	Completely Degraded to Degraded
Area 2	Survey 7	65	65.1	West	100	Excellent
				East	100	Excellent
	Survey 3	65.1	66.6	West	1500	Excellent
				East	1500	Good
	Survey 1	66.6	68.63	West	2030	Very Good
				East	2030	Very Good
Area 3	Survey 1	68.63	71.02	West	2390	Very Good
				East	2390	Very Good to Excellent
Area 4	Survey 1	71.02	71.5	West	480	Very Good
				East	480	Very Good
	Survey 3	71.5	74	West	2500	Excellent
				East	2060	Excellent
					170	Very Good
					270	Good
Area 5	Survey 8	77.3	77.54	West	240	Very Good
				East	240	Good to Very Good
	Survey 2	77.54	79.7	West	810	Very Good to Excellent
					880	Very Good
					470	Good to Very Good
				East	1200	Very Good to Excellent
					330	Very Good
					630	Good
	Survey 1	79.7	79.84	West	140	Good to Very Good
				East	140	Good to Very Good
Area 6	Survey 1	79.84	81.71	West	1180	Excellent
					690	Good to Very Good
				East	1690	Good to Very Good
					180	Degraded to Good

Area ID	Survey	SLK Start	SLK End	Side of road	Distance (m)	Vegetation condition
Area 7	Survey 1	81.71	82.1	West	390	Good to Very Good
				East	390	Good to Very Good
	Survey 3	82.1	86.0	West	1040	Excellent
					2240	Very Good
					360	Degraded
					260	Completely Degraded
				East	330	Excellent
					1230	Very Good
					860	Good
					130	Degraded
					1350	Completely Degraded
Area 8	Survey 1	111.08	112.9	West	50	Very Good to Excellent
					1620	Good to Very Good
					150	Good
				East	1820	Very Good to Excellent
Area 9	Survey 1	114.1	116.1	West	1260	Very Good
					740	Good to Very Good
				East	750	Excellent
					1250	Good to Very Good
Area 10	Survey 4	120	120.8	West	800	Excellent
				East	800	Excellent
	Survey 2	120.8	125.13	West	1100	Excellent to Pristine
					3230	Excellent
				East	4330	Excellent
	Survey 1	125.13	126.2	West	1070	Good to Very Good
				East	1070	Good to Very Good
	Survey 1	126.2	128.38	Refer Area 11	Refer Area 11	Refer Area 11
	Survey 1	128.38	129	West	500	Good to Very Good
					120	Uninterpretable
				East	500	Good to Very Good
					120	Uninterpretable
	Survey 4	129	130.1	West	1100	Excellent
				East	1100	Excellent
	Survey 2	130.1	136	West	2600	Excellent
					3300	Very Good to Excellent
				East	2600	Excellent
					3300	Very Good to Excellent
Area 11	Survey 1	126.2	128.38	West	1820	Very Good to Excellent
					180	Degraded
					180	Uninterpretable
				East	2000	Very Good to Excellent
					180	Uninterpretable

Area ID	Survey	SLK Start	SLK End	Side of road	Distance (m)	Vegetation condition
Area 12	Survey 2	139	146.9	West	7900	Excellent
				East	7900	Excellent
	Survey 4	146.9	148.8	West	1900	Excellent
				East	1900	Excellent
	Survey 2	148.8	152	West	3200	Excellent
				East	1600	Excellent
					1600	Very Good
Area 13	Survey 1	160.1	163.6	West	300	Excellent
					2610	Very Good to Excellent
					460	Good to Very Good
					130	Degraded to Good
				East	420	Excellent to Pristine
					80	Excellent
					2430	Very Good to Excellent
					440	Good to Very Good
					130	Degraded to Good
				TOTAL	1520 (1%)	Excellent to Pristine
					50900 (46%)	Excellent
					21730 (20%)	Very Good to Excellent
					15360 (14%)	Very Good
					11800 (11%)	Good to Very Good
					3410 (3%)	Good
					440 (0%)	Degraded to Good
					670 (1%)	Degraded
					2340 (2%)	Completely Degraded to Degraded
					1610 (1%)	Completely Degraded
					600 (1%)	Uninterpretable
					110380 (100%)	

Part 2: Assessment against matters of national environmental significance

4. Description of controlling provision(s)

The proposed action to upgrade Brand Highway 34.83-164.3 SLK, involving the widening of six existing sections and the construction of an additional eight passing lanes, within the Shires of Dandaragan and Gingin, Western Australia was determined to be a controlled action on 16 March 2017. Based on the information available in the referral, the Commonwealth Department of the Environment and Energy (DotEE) considered that the proposed action is likely to have a significant impact on Carnaby's cockatoo (*Calyptorhynchus latirostris*) listed as Endangered under the EPBC Act. DotEE also considered that the proposed action may have a significant impact on the following species and ecological communities listed under the EPBC Act:

- chuditch (*Dasyurus geoffroii*) (Vulnerable);
- glossy-leafed hammer orchid (*Drakaea elastica*) (Endangered);
- Badgingarra box (*Eucalyptus absita*) (Endangered);
- sandplain duck orchid (*Paracaleana dixonii*) (Endangered);
- dwarf pea (*Ptychosema pusillum*) (Vulnerable); and
- Banksia Woodlands of the Swan Coastal Plain (Endangered).

Note: The referral identified the potential loss of up to 34.3 hectares of Carnaby's cockatoo foraging habitat. As outlined in Section 5, during the assessment DWER determined that the proposed action could result in the loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat.

Carnaby's cockatoo

Carnaby's cockatoo is endemic to the southwest of Western Australia. Breeding takes place between late July and December and occurs mostly in the inland wheatbelt region of its distribution, in areas receiving between 300 and 750 millimetres of annual average rainfall (Saunders, 1974). During the non-breeding season (January to July) the majority of the birds move to the higher rainfall coastal regions of their range including the midwest coast, Swan Coastal Plain and south coast (Saunders, 1980; Saunders, 1990; Berry, 2008; Johnstone *et al*., 2011). There has been an apparent expansion in the breeding range to include areas further west and south since the middle of last century with a more rapid increase into the jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) forests of the southwest (Johnstone and Storr, 1998; Johnstone *et al*., 2011). This expansion in breeding range is due to threatening processes such as clearing of breeding habitat and competition for suitable breeding hollows.

Carnaby's cockatoo preferred habitat is remnant native eucalypt woodlands, especially those of salmon gum (*Eucalyptus salmonophloia*) and wandoo (*Eucalyptus wandoo*), and in shrubland or kwongkan heathland dominated by plants of the Proteaceae family. It also occurs in forests containing marri, jarrah, karri (*Eucalyptus diversicolor*) and tuart (*Eucalyptus gomphocephala*) (Department of Parks and Wildlife, 2013).

Carnaby's cockatoo forages on the seeds, flowers and nectar of native proteaceous plant species (e.g. *Banksia*, *Hakea* and *Grevillea* species), eucalypts and *Callistemon* species. The species also forages on seeds of introduced species (e.g. *Pinus* and *Erodium* species, canola and almonds), insects and insect larvae. Carnaby's cockatoo generally forages within six kilometres of a night roost site and, while nesting, within a 12 kilometres radius of their nest site (Commonwealth of Australia, 2012).

Carnaby's cockatoo nests in large hollows in tall, living or dead eucalypts. It nests most commonly in smooth-barked wandoo and salmon gum, but has also been recorded breeding in red morrel (*Eucalyptus longicornis*), York gum (*Eucalyptus loxophleba*), tuart, flooded gum (*Eucalyptus rudis*), swamp yate (*Eucalyptus occidentalis*), gimlet (*Eucalyptus salubris*) and marri, and are said to nest in any species of eucalypt with a suitable hollow (Department of Parks and Wildlife, 2013).

Currently, the overall population trend for Carnaby's cockatoo is one of decline due to the loss and fragmentation of habitat as a result of clearing of native vegetation (Saunders, 1990; Johnstone and Storr, 1998; Saunders and Ingram, 1998; Garnett *et al*., 2011).

The Carnaby's cockatoo recovery plan summarises habitat critical to the survival of Carnaby's cockatoos as:

- the eucalypt woodlands that provide nest hollows used for breeding, together with nearby vegetation that provides feeding, roosting and watering habitat that supports successful breeding;
- woodland sites known to have supported breeding in the past and which could be used in the future, provided adequate nearby food and/or water resources are available or are re-established; and
- in the non-breeding season the vegetation that provides food resources as well as the sites for nearby watering and night roosting that enable the cockatoos to effectively utilise the available food resources.
  (Department of Parks and Wildlife, 2013)

The recovery plan also states that success in breeding is dependent on the quality and proximity of feeding habitat within 12 kilometres of nesting sites. Along with the trees that provide nest hollows, the protection, management and increase of this feeding habitat that supports the breeding of Carnaby's cockatoo is a critical requirement for the conservation of the species (Department of Parks and Wildlife, 2013).

Chuditch

The chuditch, or western quoll, is the largest carnivorous marsupial occurring in Western Australia. At the time of European settlement, chuditch were present in all mainland Australian States and the Northern Territory. The chuditch is now largely restricted to southwest Western Australia. Historically the species inhabited a wide range of habitats but today it survives mostly in jarrah forests and woodlands, mallee shrublands and heathlands (DBCA, 2017a).

Chuditch are solitary animals with home ranges extending up to 15 km^2 for males and 3-4 km^2 for females. Their home ranges can overlap except in core areas which contain numerous den sites. Dens are located in hollow logs, tree limbs, rocky outcrops and burrows (DBCA, 2017a).

Chuditch require adequate numbers of suitable den and refuge sites and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive. They are capable of travelling long distances, and even at their most abundant, chuditch are generally present in low numbers. For this reason they require habitats that are of a suitable size (> 20,000 hectares) and not excessively fragmented. The most dense chuditch populations have been found in riparian jarrah forest. The total chuditch population as of 2007 was estimated to be less than 10,000 individuals (Department of Environment and Conservation, 2012).

The recovery plan outlines habitats considered critical to survival and maintenance of important populations of the species as:

- areas currently occupied by chuditch;
- areas of natural vegetation in which chuditch breed;
- areas of natural vegetation in which chuditch forage;
- areas of natural vegetation that chuditch use to move from one area to another;
- areas of suitable vegetation within the recorded range in which undiscovered chuditch populations may exist;
- areas not currently occupied by chuditch due to recent fire but are capable of supporting chuditch populations when sufficiently recovered; and
- areas previously occupied and that still provide suitable habitat and into which chuditch can be reintroduced.
  (Department of Environment and Conservation, 2012)

Corridors of retained vegetation (e.g. road reserves) are also important to chuditch as links between larger reserves (Department of Environment and Conservation, 2012).

Clearing of native vegetation is particularly deleterious to the species where:

- the affected land includes or adjoins riparian habitat;
- it creates new gaps in otherwise homogenous habitat;
- it leads to progressive fragmentation of habitat; or
- it necessitates the construction of roads (especially sealed roads) through, or adjacent to, uncleared habitat.
  (Department of Environment and Conservation, 2012)

Glossy-leafed hammer orchid

Glossy-leafed hammer orchid was declared as rare flora under the Western Australian *Wildlife Conservation Act 1950* in July 1988. The species is known only from the Swan Coastal Plain over a range of approximately 350 kilometres between Cataby in the north and Busselton in the south. It grows on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps, typically in banksia (*Banksia menziesii*, *B. attenuata* and *B. ilicifolia*) woodland or spearwood (*Kunzea glabrescens*) thicket vegetation (Department of Environment and Conservation, 2009).

Forty-two populations (11 of which have subpopulations) are listed in the recovery plan for the species. Four of these are listed as extinct with another six listed as presumed extinct. Twenty-seven contain fewer than 15 plants with more than half of all known plants located in just one population (Department of Environment and Conservation, 2009).

Ten species of *Drakaea* (hammer orchids) are currently recognised and all species emit pheromones that attract male thynnid wasps as pollinators, with each orchid species pollinated by a different species of thynnid wasp. Collections have been made of the thynnid wasp responsible for pollinating glossy-leafed hammer orchid, and it is believed to be an undescribed species. These wasps are known to require an abundant source of nectar on which to feed, and the presence of a particular scarab beetle that they parasitise to complete their life cycle. The size of the area of vegetation required to support a viable population of this pollinating wasp is unknown (Department of Environment and Conservation, 2009).

The recovery plan describes habitat critical to the survival of glossy-leafed hammer orchid as:

- the area of occupancy of important populations (all wild and translocated populations are considered important populations);
- areas of similar habitat surrounding important populations (i.e. low-lying areas of deep sand supporting banksia woodland or spearwood thicket) – these areas provide potential habitat for natural range extension and are likely to be necessary to support the pollinating wasp and allow pollinators to move between populations; and
- additional occurrences of similar habitat that may contain important populations of the species or be suitable for future translocations or other recovery actions intended to create important populations.
  (Department of Environment and Conservation, 2009)

Badgingarra box

Badgingarra box was declared as rare flora under the Western Australian *Wildlife Conservation Act 1950* in July 1989. It is a mallee to 10 metres tall, although commonly only reaches 4 metres tall. The species is known from a narrow 15 kilometre range near Badgingarra in the Shire of Dandaragan. Populations occur between 24 kilometres and 27 kilometres west of a fault line that runs north-north west to south-south east and between elevations of 210 metres and 290 metres above sea level. The populations seem to be associated with minor drainage lines flowing downhill from upper catchment areas (Department of Environment and Conservation, 2008).

In 2008 the species was known from eight populations with a combined total of less than 50 mature individuals, however, due to the clumping habit of the species it is often difficult to ascertain the true number of individuals and there may be up to 100. The recovery plan outlines habitat critical to the survival of the species as comprising:

- the area of occupancy of important populations (all populations are considered important populations);

- areas of similar habitat surrounding important populations (i.e. white sands with some lateritic gravel and on clayey sand on sandy flats where they are lower in the landscape); and
- additional occurrences of similar habitat that do not currently contain the species but may have done so in the past and may be suitable for translocations – these areas are also important where they provide potential habitat for natural range extension and/or for allowing pollinators or biota essential to the continued existence of the species to move between populations.
  (Department of Environment and Conservation, 2008)

Sandplain duck orchid

Sandplain duck orchid is endemic to Western Australia and grows in deep sand in open areas beneath dense tall shrubs with scattered banksias, or in heathland in shallow sand over laterite (Department of the Environment, Water, Heritage and the Arts, 2008a).

In December 2008 the species was known from eight populations from Arrowsmith, Eneabba and south to the Jurien Bay area. Five of the eight populations occur on nature reserves that have active mining leases and an adjacent railway reserve, two others occur in national parks and the other is in private property. There are another 11 populations previously recorded throughout this area, but plants have not been seen at these locations since the early 1990s. These populations were on a mixture of road verges, unallocated Crown land and national parks. There is estimated to be 57 mature plants in the eight populations, with an extent of occurrence of approximately 539.9 km^2. When including the other 11 populations, the extent of occurrence is estimated to be 1169.82 km^2 (Department of the Environment, Water, Heritage and the Arts, 2008a).

As of July 2018, DBCA's threatened and priority flora (TPFL) dataset listed 30 populations of this species suggesting at least 11 new populations have been recorded since December 2008.

The main identified threats to sandplain duck orchid are fire, land clearing for mining activities, road works and railway and power line maintenance activities. The susceptibility of the species to dieback is unknown but thought to be low (Department of the Environment, Water, Heritage and the Arts, 2008a).

Dwarf pea

Dwarf pea is endemic to Western Australia and is the only Western Australian representative of its genus. It inhabits low, open woodland of slender banksia (*Banksia attenuata*), firewood banksia (*B. menziesii*) and *Eucalyptus todtiana* over scrub with common woollybush (*Adenanthos cygnorum*) and yellow buttercups (*Hibbertia hypericoides*) (Department of the Environment, Water, Heritage and the Arts, 2008b).

In December 2008 the species was known from three populations, all located on private property. Two populations are located near Gingin, with another further north, near Regans Ford. The northern population occurs on the upper slopes of a high sand ridge. Near Gingin, one population occurs adjacent to a paperbark swamp and the other is found throughout open vegetation and firebreaks (Department of the Environment, Water, Heritage and the Arts, 2008b).

As of July 2018, DBCA's TPFL dataset listed four populations of this species suggesting at least one new population has been recorded since December 2008.

The main potential threats to dwarf pea include grazing, weeds, inappropriate fire regimes, changes in hydrology, firebreak and power line maintenance and dieback (Department of the Environment, Water, Heritage and the Arts, 2008b).

Banksia Woodlands of the Swan Coastal Plain

The Banksia Woodlands of the Swan Coastal Plain TEC is located in the southwest of Western Australia and is largely restricted to the Perth and Dandaragan subregions of the Swan Coastal Plain IBRA bioregion, from around Jurien Bay in the north to Dunsborough in the south. The TEC also extends into immediately adjacent areas on the Whicher and Darling escarpments (which lie within the Jarrah Forest IBRA bioregion), to the south and east, where pockets of banksia woodlands may also occur (Threatened Species Scientific Committee, 2016).

The canopy of the TEC is most commonly dominated or co-dominated by *Banksia attenuata* and/or *B. menziesii*. Other *Banksia* species that dominate in some examples of the ecological community are acorn banksia (*B. prionotes*) or holly-leaved banksia (*B. ilicifolia*). The TEC is characterised by a high species richness and high species geographic turnover in the shrub and herbaceous layers. Many understorey species are locally endemic and most do not occur across the full range of the TEC (Threatened Species Scientific Committee, 2016).

The TEC typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands. It is also common on sandy colluvium and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau. Other less common soil and landform scenarios are described further in the approved conservation advice (incorporating listing advice) for the TEC (Threatened Species Scientific Committee, 2016).

The areas considered critical to the survival of the TEC cover all patches that meet the key diagnostic characteristics and condition thresholds, plus the buffer zones, particularly where this comprises surrounding native vegetation. Additional areas that do not meet the minimum condition thresholds may also be critical to the survival of the TEC depending on factors such as size and shape, landscape linkages to other patches and landscape position, because they could retain some biodiversity or habitat values (Threatened Species Scientific Committee, 2016).

The estimated pre-European extent of the TEC is 706,000 to 708,000 hectares. The estimated extent remaining in 2015 was about 336,000 to 337,000 hectares indicating an overall decline of about 52 per cent. Approximately 81,800 hectares or 24 per cent of the remaining extent of the TEC is estimated to be protected in reserves. Based on available mapping, over 12,000

patches of the TEC occur with the median patch size being 1.6 hectares. Approximately 22 per cent of the extent remaining is comprised of patches less than 100 hectares in size (Threatened Species Scientific Committee, 2016).

5. Summary of impacts

Carnaby's cockatoo

The application area occurs within the modelled distribution of Carnaby's cockatoo (Commonwealth of Australia 2012). Individuals/flocks of Carnaby's cockatoo were recorded at Area 2 (Survey 7), Area 3 (Survey 1), Area 4 (Survey 3), Area 6 (Survey 1), Area 8 (Survey 1), Area 10/11 (Survey 1, Survey 2) and Area 12 (Survey 2). Survey 1 regularly recorded Carnaby's cockatoo foraging evidence across the survey area, most commonly on the seeds and flowers of *Banksia* species. No breeding activity was recorded within the application area, however, Survey 8 recorded two breeding events at Regan's Ford in September 2015. The nesting trees were recorded approximately 1 kilometre southeast of Area 5. Noting the modelled distribution and the results of the surveys it is considered that Carnaby's cockatoo occurs across the application area.

Nesting/breeding habitat

Surveys 1 to 4 recorded a total of 204 Carnaby's cockatoo habitat trees (i.e. trees with a diameter at breast height of 500 millimetres or greater, or 300 millimetres or greater for salmon gum and wandoo). Four of these trees were observed to contain suitable nesting hollows but none showed signs of current or historic use by Carnaby's cockatoo (Astron, 2016). The four trees are located outside the application area near Area 4 approximately 2 kilometres south of the confirmed breeding locations at Regan's Ford.

The majority of the remaining 204 habitat trees were recorded within Area 1 or outside the application area between Areas 8 and 9 at the Minyulo Brook crossing. A total of 53 habitat trees were recorded within Area 1 all being marri. Given the relatively small number of habitat trees recorded within an application area of approximately 170 hectares, and the absence of currently suitable nest hollows, the proposed clearing is not likely to result in significant impacts to Carnaby's cockatoo nesting habitat.

Roosting habitat

Survey 2 recorded a total of 3.3 hectares of potential roosting habitat for Carnaby's cockatoo at Area 5 although no evidence of roosting by the species was recorded (GHD, 2016b). The vast majority of this potential habitat occurs outside Area 5. Survey 3 did not record any signs of current or historic roosting at the five habitat trees recorded by the survey (Astron, 2016). Survey 1 did not record any roosting evidence or habitat (GHD, 2018). According to available datasets, the closest confirmed roost site to the application area is located approximately 1 kilometre east of Area 5. The next closest confirmed roost site is located approximately 5 kilometres southeast of Area 1. Given the lack of confirmed roosting habitat within the application area and that the majority of the potential habitat recorded occurs outside the application area, the proposed clearing is not likely to result in significant impacts to Carnaby's cockatoo roosting habitat.

Foraging habitat

Surveys 1 to 3 report that the majority of the vegetation types recorded contain quality foraging habitat for Carnaby's cockatoo. The main exception is Area 13 where the 'Calothamnus shrubland and Meeboldina sedgeland' vegetation type recorded by Survey 1 is described as providing fewer preferred foraging species (GHD, 2016a). Area 1 also contains substantial areas described as 'Highly modified' which are unlikely to provide substantial foraging habitat resources for Carnaby's cockatoo.

The vegetation types mapped within Area 13 that are considered to contain the most foraging habitat for Carnaby's cockatoo measure 5.03 hectares. The vegetation types mapped within Area 1 that are considered to contain the most foraging habitat for Carnaby's cockatoo measure 0.96 hectares. A total of 30.5 hectares of native vegetation is proposed to be cleared from Areas 2 to 12. Therefore it is considered that the proposed clearing will result in the loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat.

The record of nesting from Survey 8 is located within 12 kilometres of Areas 2, 3, 4, 5, 6 and 7. According to available datasets, confirmed Carnaby's cockatoo nesting sites also occur within 12 kilometres of Areas 8, 9, 10 (southern half), 11 and 13 (northern half).

The proposed clearing will result in the loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat, the majority of which occurs within 12 kilometres of confirmed nesting locations. The loss of this habitat would increase the risk of further declines in breeding success and population size. The proposed clearing may be inconsistent with the recovery plan (Department of Parks and Wildlife, 2013) for the species.

Whilst the proposed clearing may be inconsistent with the recovery plan, approximately 125,000 hectares of remnant native vegetation remains within a 12 kilometre radius of the application area. It is also considered that substantial areas of similar vegetation with similar values in same and/or better condition likely remains within 12 kilometres of confirmed nesting sites and the proposed loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat may be approved subject to the implementation of an offset.

There is no approved conservation advice for the species and no threat abatement plan has been identified as being relevant for the species.

Chuditch

Surveys 1, 2, 3, 7 and 8 did not record the presence of chuditch but considered that the species was likely to occur in the area. Five historical records of chuditch occur within the local area (20 kilometre radius) (Department of Parks and Wildlife, 2007 –). Three of these records occur near Area 1 which is unlikely to provide suitable habitat for the species given the vegetation type recorded (i.e. parkland cleared). The other two records occur near Areas 2 to 7 located at the estimated northern limit of the species distribution. One of the records is of a deceased chuditch found on the side of Brand Highway near Regan's Ford in 2001. The second record is of a juvenile (presumed based on size) observed on farmland in 1987 approximately 500 metres

east of Brand Highway near Salt Lake Road. Given there are no historical records of the chuditch in the vicinity of Areas 8 to 13, it is considered that the species is not likely to occur in those areas.

The two records near Areas 2 to 7 occur within the vicinity of watercourses and lakes. The 2001 record is located near Moore River and the 1987 record is located near a series of lakes (including Guraga Lake and Namming Lake) and an associated watercourse. This is consistent with the apparent greater abundance of the species near riparian vegetation.

Areas 2 to 7 occur on the edge of a large (approximately 60,000 hectares) remnant of native vegetation to the west that is predominantly comprised of Namming Nature Reserve, Moore River National Park, Moore River Nature Reserve and unallocated Crown land. The remnant is intersected by Moore River and also contains several lakes and numerous other wetlands. The remnant is considered likely to contain the necessary habitat requirements and be of a sufficient size to support a population of chuditch.

Chuditch may utilise Areas 2 to 7 and therefore the proposed clearing of these areas may be inconsistent with the recovery plan (Department of Environment and Conservation, 2012) for the species. However, the proposed clearing is not expected to be particularly deleterious given the following:

- Areas 2 to 7 do not form part of any obvious links between reserves. A number of reserves occur to the east of the large western remnant but these are separated from the application area by cleared farmland. Based on aerial imagery the main link between the large western remnant and the reserves to the east is associated with remnant vegetation along Moore River located outside of the application area.
- A total of 13 hectares of native vegetation is proposed to be cleared from Areas 2 to 7. A combined total of 0.4 hectares of wetland vegetation occurs within Areas 2 to 7 across three different wetlands (refer assessment against clearing principle (f) for further information). It is considered that the proposed clearing does not include substantial areas of riparian habitat.
- Areas 2 to 7 occur on the edge of the large western remnant and therefore the proposed clearing is not expected to create new gaps in otherwise homogenous habitat or lead to progressive fragmentation of the remnant.
- The proposed clearing is for the widening of an existing road and not the construction of a new road through, or adjacent to, uncleared chuditch habitat.
- The majority of the large western remnant is secured on lands managed by DBCA for conservation.

Impacts to chuditch may also be mitigated through pre-clearing inspections for dens, relocation of individuals occupying identified dens, and replacement/relocation of confirmed dens in adjoining habitat. Advice from DBCA outlines that the main period when young are most likely to be in a den is September to December and dependent young in dens will not be mobile (DBCA, 2019b). It is considered that the aforementioned actions should only be required during this period. Directional clearing (i.e. clearing towards adjacent remnant vegetation to allow chuditch to escape to that vegetation) is expected to be sufficient as mitigation during the remainder of the year when young should be mobile.

There is no approved conservation advice for the species. There are three threat abatement plans relevant for the species:

- *Threat abatement plan for predation by feral cats* (Department of the Environment, 2015);
- *Threat abatement plan for competition and land degradation by rabbits* (Department of the Environment and Energy, 2016); and
- *Threat abatement plan for predation by the European red fox* (Department of the Environment, Water, Heritage and the Arts, 2008c).

It is considered that the proposed clearing is not likely to result in an increase in predation of chuditch by feral cats or the European red fox. It is also considered that the proposed clearing is not likely to result in an increase in rabbit abundance. Therefore the proposed clearing is not likely to be inconsistent with any of the three threat abatement plans.

Glossy-leafed hammer orchid

No individuals of glossy-leafed hammer orchid were recorded in Surveys 1 to 5. The species flowers between late September and early November but the best time to identify plants is in July and August when the distinctive leaves are relatively conspicuous (Department of Environment and Conservation, 2009). Most of the surveys were undertaken during the flowering period. Survey 4 was undertaken during July/August but only covered a small portion of the application area.

Despite the timing of the surveys, Survey 5 reports that the species is unlikely to occur in the application area due to the absence of suitable habitat (Woodman Environmental, 2017).

Areas 1 to 7 occur at the northern end of the known range of the species with Areas 8 to 13 outside the current known range. The closest known record to the application area occurs approximately 2 kilometres south of Area 2.

Given that no individuals were recorded, and the separation distance to the closest known location, it is considered that the proposed clearing is not likely to result in significant impacts to glossy-leafed hammer orchid. The proposed clearing is not likely to be inconsistent with the recovery plan (Department of Environment and Conservation, 2009) for the species. There is no approved conservation advice for the species.

The *Threat abatement plan for competition and land degradation by rabbits* (Department of the Environment and Energy, 2016) is relevant for the species. The proposed clearing is not likely to result in an increase in rabbit abundance and therefore the proposed clearing is not likely to be inconsistent with the threat abatement plan.

Badgingarra box

No individuals of Badgingarra box were recorded in Surveys 1 to 5. Survey 1 outlines that one mallee was recorded with insufficient material (fruits/buds) to enable identification. No location details were provided for this individual. Survey 5 was

undertaken after Survey 1 and involved a targeted search for this species across all portions of the application area (i.e. Areas 1 to 13). Given the level of survey effort undertaken for Survey 5, it is considered that no individuals are likely to occur within the application area.

According to DBCA datasets, the closest known records of the species occur approximately two to three kilometres from Areas 12 and 13. This includes one record located east of the southern end of Area 12, two records located north of the northern end of Area 12, and one record located southwest of the southern end of Area 13.

Survey 2 reports that the 'Mixed Heath on White Sand (with Laterite)' vegetation type recorded in the north-eastern 350 metre portion of Area 12 forms part of a tract of vegetation associated with known Badgingarra box records (GHD, 2016b). Given this, the north-eastern 350 metre portion of Area 12 may form part of a larger area of vegetation that meets the definition of habitat critical to the survival of the species as outlined in the recovery plan. The proposed clearing may be inconsistent with the recovery plan for the species.

It is identified that a total of 4.6 hectares of native vegetation is proposed to be cleared from Area 12. Area 12 is 13 kilometres long and occurs within an approximately 200 metre wide road reserve. Approximately 80 metres of remnant vegetation occurs in the road reserve outside of Area 12 on both sides. The area proposed to be cleared is a narrow portion of vegetation adjacent to an existing road and substantial areas of similar habitat for Badgingarra box will remain in adjoining areas. Given the scale of impacts proposed, it is considered that the proposed clearing will not result in significant impacts to an area of vegetation that may be critical to the survival of Badgingarra box.

There is no approved conservation advice for the species and no threat abatement plan has been identified as being relevant for the species.

Sandplain duck orchid

No individuals of sandplain duck orchid were recorded in Surveys 1 to 5. The species flowers between October and November which is when surveys for this species should be conducted (DBCA, 2017b). Surveys 1 to 4 were not conducted at an appropriate time for detection of this species but Survey 5 was. The survey area for Survey 5 encompassed all portions of the application area (i.e. Areas 1 to 13) and therefore it is considered unlikely that any individuals occur within the application area.

All but two of the 30 populations of this species recorded in DBCA's TPFL dataset occur at least 10 kilometres north/northeast of the application area. The exceptions are Population 30 which occurs approximately 4.5 kilometres southwest of the southern end of Area 10 and Population 2 which occurs approximately 350 metres west of Area 3.

Given that no individuals were recorded, and the separation distance to the closest known location, it is considered that the proposed clearing is not likely to result in significant impacts to sandplain duck orchid. The proposed clearing is not likely to be inconsistent with the approved conservation advice (Department of the Environment, Water, Heritage and the Arts, 2008a) for the species. There is no adopted or made recovery plan for the species and no threat abatement plan has been identified as being relevant for the species.

Dwarf pea

No individuals of dwarf pea were recorded in Surveys 1 to 5. The species flowers from August to November. Given the level of survey effort undertaken during the flowering period for this species, it is considered that no individuals are likely to occur within the application area.

The closest DBCA TPFL dataset record of this species occurs approximately eight kilometres from the application area. The closest DBCA WA Herbarium dataset record of this species plots approximately 850 metres north of Area 12 but the locality description of the record is "near Badgingarra". No date is recorded against this record. Based on the above, this record is considered to be unreliable.

Given that no individuals were recorded, and the separation distance to the closest known location, and the unreliable nature of that record, it is considered that the proposed clearing is not likely to result in significant impacts to dwarf pea. The proposed clearing is not likely to be inconsistent with the approved conservation advice (Department of the Environment, Water, Heritage and the Arts, 2008b) for the species. There is no adopted or made recovery plan for the species and no threat abatement plan has been identified as being relevant for the species.

Banksia Woodlands of the Swan Coastal Plain

Survey 6 determined that 40 of the total 113 quadrats surveyed by Surveys 1, 2, 3 and 6 were representative of the Banksia Woodlands of the Swan Coastal Plain TEC. A total of 294.3 hectares of the TEC was mapped comprising 10 patches in Good or better condition ranging in size from 0.56 to 178 hectares. The areas of the TEC recorded were characterised by dominant *B. attenuata*, *B. menziesii* or *B. prionotes* in the upper canopy layer together with a highly diverse understorey of shrubs and herbs. Emergent marri and *Eucalyptus todtiana* were present in many examples of the TEC. A total of 352 plant taxa were recorded across the quadrats aligning with the TEC with a mean species richness of 41.7 taxa. Only 16 species were recorded in 50 per cent or more of the quadrats aligning with the TEC indicating a high species turnover (Ecologia, 2018a).

The patches of the TEC recorded are also considered to broadly correspond to the Swan Coastal Plain *Banksia attenuata – Banksia menziesii* woodlands floristic community type (FCT) 23b (Ecologia, 2018a). FCT 23b is currently known from 91 point locations from Regans Ford to Malaga, a distance of approximately 100km. The boundaries of the PEC have not been mapped, therefore it is not possible to determine the likely impacts of the proposed clearing on the regional distribution of the FCT, however, it is considered unlikely that the clearing will have significant impacts on FCT 23b overall (Department of Parks and Wildlife, 2017).

Nine of the 10 patches of the TEC recorded occur over the vast majority of Areas 2 to 8 and adjoining areas. A total of 15.2 hectares of native vegetation is proposed to be cleared from Areas 2 to 8. The tenth patch recorded occurs at Area 9 of which 0.04 hectares occurs within Area 9. Therefore the proposed clearing will result in the loss of up to 15.24 hectares of the TEC.

The proportion of each patch of the TEC proposed to be cleared is not of a scale that would likely result in any patch no longer meeting the key diagnostic characteristics and condition thresholds for the TEC. This is due to the linear nature of the application area. The size of each patch will be reduced but no significant additional fragmentation is considered likely given the clearing will occur on the edge of an existing road which already fragments most patches.

The proposed clearing of up to 15.24 hectares of the TEC represents a relatively small proportion of its current extent, however, cumulative impacts to the TEC are considered significant, incremental and ongoing. The proposed clearing may be inconsistent with the approved conservation advice (Threatened Species Scientific Committee, 2016) for the TEC. The proposed loss of up to 15.24 hectares of the TEC may be approved subject to the implementation of an offset.

There is no adopted or made recovery plan for the TEC. The *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi* (Department of the Environment and Energy, 2018) is relevant for the TEC. Advice received from DBCA's Moora District indicates that there are confirmed *Phytophthora* dieback records from the application area. This includes several records from the area covering Areas 5, 6, 7, 8 and 9 (DBCA, 2017b; DBCA, 2018a).

Given dieback infestations are known from the application area where the TEC is also known to occur, there is a risk that the proposed clearing will result in the spread/introduction of dieback to adjacent areas of the TEC. Therefore the proposed clearing may be inconsistent with the threat abatement plan. It is considered that the risk of spread/introduction of dieback can be adequately mitigated through the imposition of dieback hygiene conditions.

6. Public consultation

The applicant has advised that no stakeholder consultation was considered to be required (MRWA, 2017b; MRWA, 2018a). It was advised that Brand Highway is a MRWA asset and the designs are restricted to the road reserve thus eliminating the impact to local stakeholders. During the contract phase updates on traffic impacts will be provided to the public and nearby landholders (MRWA, 2018c).

The proposed action was advertised for public comment in the *West Australian* newspaper by the former Department of Environment Regulation on 24 April 2017. No public submissions were received.

7. Avoidance, mitigation and offsets

The applicant has advised that there are no feasible alternatives to taking the proposed action, other than not upgrading the existing road (MRWA, 2017b). The applicant has also advised that further reduction of the size of clearing is not feasible (MRWA, 2018c).

The applicant has advised that the project has been designed with consideration for:

- feasibility of alignment and need to meet Australian standards;
- increasing road safety through passing lanes and widening;
- allowing adequate site distance for passing lanes; and
- cost versus environmental constraints.

(MRWA, 2018a).

The applicant has also advised:

- during the development phase, environmental matters were considered in selecting the design;
- during the design phase, the design was rationalised to reduce the amount of clearing whilst providing a safe and compliant design;
- the site office, materials storage areas, construction vehicles/machinery and access tracks will be located on previously disturbed or cleared areas; and
- the clearing line will be pegged prior to clearing commencing and where possible vegetation will be pruned rather than removed.

(MRWA, 2017b)

In relation to specific design/management measures implemented/considered the applicant has advised:

- the design was tailored from the standard for safety and functionality to provide steepened batters to reduce the footprint;
- based on the geometry of the road, the installation of safety barriers would not provide a reduction in the clearing footprint as the area of deflection behind the barrier required for safety would be two to five metres of clearing in selected areas which is greater than the three metre average currently held;
- widening on only one side of the road would lead to an unsafe location of the centreline/crown of the road as you would have changes in the angle under the wheel path – the centreline/crown cannot be adjusted without full reconstruction of the road which would involve clearing of up to four metres which is greater than the current clearing requirements;
- passing lanes could not be located on the side containing more degraded vegetation as directional passing lanes are required (either north or south) which limits options – other alignments were ruled out based on safety constraints and vertical geometry and land acquisition would be required if the road was relocated which may prove prohibitive;
- installation of a kerb on a rural road where the speed limit is 110 km/hr is a safety concern due to the potential hazards caused by road runoff, as such this was not a viable option;
- the upgrade of the highway to include passing lanes has been selected as they provide the optimal place to provide a safe overtaking opportunity for vehicles – the passing lanes mostly occur north or south of major intersections where slow vehicles may have entered the highway;

- no drainage modification was feasible as the current standard is already the smallest possible footprint to allow successful drainage to occur – altering the drainage would prohibit the drains from performing, causing scour and pavement failures; and
- on the opposite side to the passing lanes clearing has been limited to an average of three metres where the design footprint should be ten metres to provide optimal drainage and safety considerations.
  (MRWA, 2018c)

The applicant has advised that an Environmental Management Plan (EMP) and a Vegetation Management Plan (VMP) will be prepared and implemented with the objective of minimising and managing the onsite environmental impacts. Key aspects that the EMP/VMP will include are:

- the clearing area will be demarcated prior to the commencement of project activities and prior to the commencement of native vegetation clearing;
- the clearing area demarcation will be checked and approved by the Environment Officer or Project Manager prior to clearing;
- an environmental specialist will remain on site during the clearing to ensure compliance;
- clearing will be limited to the smallest possible area and mature trees especially shall be conserved as far as practicable;
- previously disturbed areas will be cleared rather than good condition vegetation where possible;
- clearing shall not occur for such temporary works as side tracks, access tracks, temporary storage areas, campsites, spoil areas or site offices;
- spoil and laydown areas will not be stored within 50 metres of waterways;
- refuelling will be undertaken in accordance with the Safety Health and Environment Work Method Statement or equivalent;
- regular vehicle servicing will be undertaken at designated areas, at least 100 metres away from watercourses;
- bulk fuel and hazardous material storage areas will be bunded and managed in compliance with applicable Australian Standards;
- spill kits will be present on site and all staff trained in their use;
- movement of machines and other vehicles will be restricted to the limits of the areas cleared;
- Declared Pests in the project area will be removed prior to works by the contractor;
- earth moving machinery will be cleaned of soil and vegetation prior to entry to project areas adjacent to conservation areas;
- vehicle and equipment wash down areas will be located away from environmentally sensitive areas, reserves and at least 50 metres from waterways;
- in project areas adjacent to conservation areas a post construction check will be completed and any weeds identified will be added into the annual weed program to monitor and remove the weeds; and
- all waste materials from the project area will be removed from the site to a suitable licenced facility upon completion of the project and to the satisfaction of the Project Manager or Site Superintendent.
  (MRWA, 2017b; MRWA, 2018a)

In relation to the management of dieback the applicant has advised:

- dieback management surveys and management plans will be undertaken during the scheduling of works as the works are to be rolled out over a number of years;
- due to the changing nature of dieback, surveys undertaken now will not remain current; and
- where dieback surveys and management plans are required to protect key assets such as adjacent conservation estate or reserves, DBCA will be engaged for dieback services.
  (MRWA, 2017c)

The applicant has advised that mitigation measures proposed to be implemented to minimise clearing impacts to fauna include:

- undertaking pre-clearing inspections by an environmental specialist;
- conducting clearing progressively in one direction to allow fauna to move to uncleared areas; and
- turning on machinery several minutes before clearing starts to encourage fauna to move from the area.
  (MRWA, 2018b)

To offset significant residual impacts to Carnaby's cockatoo foraging habitat and the Banksia Woodlands of the Swan Coastal Plain TEC the applicant proposes to make a monetary contribution to DWER of $923,100 for the acquisition of 192 hectares of suitable remnant vegetation for conservation. The monetary contribution is proposed to be provided in stages prior to clearing commencing for each package outlined in Table 6. This is due to the staged works schedule and associated timing of grants being received by the applicant to construct each package.

Table 6. Proposed offset package

Package	Area	Clearing size (ha)	Significant residual impacts proposed to be offset	Monetary contribution	Hectares to be acquired
1	Area 10 Area 12	10.6	10.6 hectares of Carnaby's cockatoo foraging habitat	$62,700	19
2a	Area 2 Area 4	4	4 hectares of Carnaby's cockatoo foraging habitat 4 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	$240,500	25
2b	Area 5 Area 7	4.2	4.2 hectares of Carnaby's cockatoo foraging habitat 4.2 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	$46,400	8
3	Area 1	1.3	0.96 hectares of Carnaby's cockatoo foraging habitat	$50,730	3
4a	Area 3	2.7	2.7 hectares of Carnaby's cockatoo foraging habitat 2.7 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	$211,640	22

Package	Area	Clearing size (ha)	Significant residual impacts proposed to be offset	Monetary contribution	Hectares to be acquired
4b	Area 6	2.1	2.1 hectares of Carnaby's cockatoo foraging habitat 2.1 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	$56,100	17
5	Area 8 Area 9	4.4	4.4 hectares of Carnaby's cockatoo foraging habitat 2.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	$115,500	35
6	Area 13	6	5.03 hectares of Carnaby's cockatoo foraging habitat	$73,530	43
7	Area 11	2.5	2.5 hectares of Carnaby's cockatoo foraging habitat	$66,000	20
TOTAL		37.8	36.49 hectares of Carnaby's cockatoo foraging habitat 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	$923,100	192

As outlined in Section 11, DWER has undertaken an assessment of the proposed offset package. It is considered that the acquisition for conservation of at least 226 hectares of Carnaby's cockatoo foraging habitat, at least 91 hectares of which is representative of the Banksia Woodlands of the Swan Coastal Plain TEC, will adequately counterbalance the significant residual impacts of the proposed clearing consistent with the *EPBC Act Environmental Offsets Policy, October 2012*.

8. Other relevant considerations

The applicant has an environmental policy statement as follows:

> *Main Roads manages the State's road network to provide safe and efficient road access that will enhance community lifestyles and support economic prosperity. Main Roads seeks to achieve balanced and sustainable outcomes for the community. Responsible environmental stewardship in developing and maintaining the road network is critical to the success of Main Roads* (MRWA, 2017b).

The applicant has advised that they are committed to:

- protecting and enhancing the environmental values of road reserves;
- minimising the impact on the natural environment of roads and road use; and
- conserving natural resources and minimising energy consumption and waste.
  (MRWA, 2017b)

The applicant has advised that they have a corporate Environmental Management System (EMS) which facilitates management of environmental risks and performance improvement. The EMS is reported to be independently certified and audited against the requirements of ISO 14001:2004 and integrated into all key processes including planning, delivery, maintenance, network operations and supporting services (MRWA, 2017b).

The applicant has advised that a passing lane strategy has been adopted to provide safe passing opportunities at regular intervals, ideally every 20 kilometres in rural areas. By constructing the eight proposed passing lanes, north and south passing lanes will be provided every 20 kilometres in line with this strategy. Safety reductions from head on crashes is significant (MRWA, 2018c).

The applicant has advised that economic benefits will be achieved based on time savings and crash reductions over the length of the journey. Capital investment is approximately $24 milllion based on current market conditions with an additional $2 million to be spent in preconstruction development and approvals. Passing lane construction typically employs a steady crew of 15 contractors for three months with a peak crew of 25+ during sealing works. Widening typically employs a similar crew for 20+ weeks. In addition, a team of three to four MRWA staff will be assigned for approximately six months (MRWA, 2018c).

Part 3: Assessment against the clearing principles

9. Assessment against clearing principles

(a) Native vegetation should not be cleared if it comprises a high level of biodiversity.

Proposed clearing is at variance to this principle

As outlined in Section 3, a total of 30 different vegetation types were recorded across the application area with vegetation condition ranging from Completely Degraded to Pristine. The majority (i.e. 46 per cent) of the vegetation within the application area was recorded to be in Excellent condition.

The vegetation type '*Calothamnus* shrubland and *Meeboldina* sedgeland' recorded in Area 13 by Survey 1 is described as being restricted in extent and containing an assemblage of flora species not found elsewhere in the survey area (GHD, 2016a). Based on this information, it is considered that the vegetation type represents an area of high biodiversity. A total of 8.8 hectares of this vegetation type was recorded, approximately 2.5 hectares of which occurs inside Area 13.

The weed Victorian teatree (**Leptospermum laevigatum*) was recorded in Area 13 by Survey 1. DBCA's Moora District also advises that the weed **Verbesina encelioides* has recently been identified within Area 13 and is of particular concern (DBCA, 2017b; DBCA, 2018a). There is a risk that the proposed clearing may result in an increased abundance and distribution of Victorian teatree and **Verbesina encelioides* within/near Area 13. This may result in an ongoing decline in biodiversity of the remaining portion of the '*Calothamnus* shrubland and *Meeboldina* sedgeland' vegetation type. Weed management practices will aid in mitigating impacts to this vegetation type.

As outlined under principle (f), the '*Calothamnus* shrubland and *Meeboldina* sedgeland' vegetation type is considered to represent a significant wetland. Portions of two other significant wetlands are also proposed to be cleared totalling 0.3 hectares.

As outlined in Section 5, the proposed clearing will result in the loss of up to 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC. The proposed clearing of up to 15.24 hectares of the TEC represents a relatively small proportion of its current extent, however, cumulative impacts to the TEC are considered significant, incremental and ongoing.

The patches of the Banksia Woodlands of the Swan Coastal Plain TEC recorded are also considered to broadly correspond to the Priority Ecological Community (PEC) Swan Coastal Plain *Banksia attenuata* – *Banksia menziesii* woodlands floristic community type (FCT) 23b listed by DBCA as P3 (Ecologia, 2018a). This PEC is noted to be a component of the TEC.

FCT 23b is currently known from 91 point locations from Regans Ford to Malaga, a distance of approximately 100km. The boundaries of the PEC have not been mapped, therefore it is not possible to determine the likely impacts of the proposed clearing on the regional distribution of the FCT, however, it is considered unlikely that the clearing will have significant impacts on the PEC overall (Department of Parks and Wildlife, 2017).

Survey 6 reports that an additional 20 quadrats surveyed floristically correspond to the Banksia Woodlands of the Swan Coastal Plain TEC and the FCT 23b PEC. However these quadrats were recorded from the Geraldton Sandplains IBRA bioregion hence they do not meet the criteria to qualify as the TEC/PEC.

As outlined under principle (e), Beard vegetation association 1035 is mapped over the majority of Areas 5 and 6. Only 493 hectares of Beard vegetation association 1035 remains and therefore the remaining extent of the vegetation association is considered to represent an area of high biodiversity.

As outlined in Section 5, the proposed clearing will result in the loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat, the majority of which occurs within 12 kilometres of confirmed nesting locations. The loss of this habitat would increase the risk of further declines in breeding success and population size.

As outlined under principle (c), no individuals of threatened flora were recorded by Surveys 1 to 5. Given this and the separation distances between the application area and known DBCA records, no significant impacts to threatened flora are expected from the proposed clearing.

A total of 32 priority flora species were recorded by Surveys 1 to 5 (Table 7). Of these, Survey 5 confirmed that the records from Surveys 1, 2 and 4 of *Banksia dallanneyi* subsp. *pollosta, Grevillea makinsonii*, *Hypocalymma gardneri*, *Diuris recurva, Hibbertia helianthemoides* and *Hypolaena robusta* were misidentified, although *Hypolaena robusta* was recorded elsewhere by Survey 5. Therefore the corrected total of priority flora species recorded is 27. As outlined in Table 7, it is considered that the proposed clearing is unlikely to result in significant impacts to any of the priority flora species recorded.

The application area is considered to contain:

- a vegetation type described as being restricted in extent and containing an assemblage of flora species not found elsewhere in the survey area;
- portions of significant wetlands;
- portions of ten patches of the Banksia Woodlands of the Swan Coastal Plain TEC/FCT 23b PEC;
- portions of Beard vegetation association 1035 of which only 493 hectares remains; and
- Carnaby's cockatoo foraging habitat.

Given the above, the application area is considered to comprise a high level of biodiversity and the proposed clearing is at variance to this principle.

Table 7. Assessment of priority flora recorded by Surveys 1 to 5 and 9

Species	Status	Survey	Area	DBCA Advice	Assessment
Grevillea synapheae subsp. *minyulo*	Priority 1	Survey 1	Area 8	No specific advice provided.	Survey 1 recorded this species approximately 600 metres south of Area 8. No significant impacts to this species are expected from the proposed clearing given the separation distance and that no individuals occur within the application area.
Lyginia excelsa	Priority 1	Survey 1 Survey 5	Area 10 Area 11 Area 10 Area 11	*Lyginia excelsa* is known from a relatively restricted range of approximately 100 kilometres north-south and 30 kilometres east-west between Eneabba and Dandaragan. The records from Surveys 1 and 5 are within the current known range. The species is known from approximately 6 locations, including from conservation estate, within Badgingarra and Tathra National Parks. This species has been recorded in higher numbers often near roads or firebreaks and it may be a disturbance opportunist (DBCA, 2018a). The majority of records from Surveys 1 and 5 occur adjacent to Badgingarra National Park and Conservation Park. Although, the proportional impacts proposed to these local populations are very high, it would seem likely that this is reflective of the level of survey effort within the application area, as opposed to outside of the application area, and that there is a reasonable likelihood of suitable habitat extending into the adjoining conservation estate. The portions of populations that would remain should the proposed clearing be implemented are within areas of continuous vegetation / habitat, some of which is within conservation estate. The proposed level of impact is unlikely to be significant to the conservation of the species at either the local or regional scale (DBCA, 2018a).	Survey 1 recorded 46 plants of this species at three main locations; one approximately 350 metres north of Area 9 (one plant) and the other two approximately 1.5 kilometres apart within/immediately adjacent to Area 10/Area 11. Survey 5 recorded over 1000 plants of this species at five main locations along Area 10/Area 11, two of which align with the locations recorded from Survey 1. At least 1038 plants were recorded outside Area 10/Area 11 by Survey 5 in areas up to approximately 80 metres away. Noting this and DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Catacolea enodis	Priority 2	Survey 5 Survey 9	Area 12 Area 12	*Catacolea enodis* is known from approximately 5 locations within a highly restricted range of approximately 50 kilometres north-south and 20 kilometres east-west, between Badgingarra and Alexander Morrison National Parks. It is known from only 12 Herbarium records, the majority of which are old, with only three collections from within the last 20 years, the most recent of which was collected by Survey 5. Six of the collections would appear to be from the same location within Alexander Morrison National Park (DBCA, 2018a). Historically the species was recorded as locally frequent in Alexander Morrison National Park, but more recent records suggest it is uncommon or only a few plants. The species is dioecious (male and female reproductive organs are in separate individuals of the species). The Herbarium record received for Survey 5 indicates that only a few male plants were observed (DBCA, 2018a). On the basis of available information, it would appear likely that the majority, if not all of the plants recorded by Survey 5 would fall within the application area or a 10 metre buffer area. The only recent Herbarium record south of this location is from 2004, also on Brand Highway, but no population size information was included with that record (DBCA, 2018a). The population recorded in Survey 5, in the southern extent of the range of the species, is potentially significant. Given the highly restricted range of the species, small number of known locations, lack of recent collections, and lack of available information on population size and viability, both the direct and indirect impacts of the proposed clearing are potentially significant to the conservation of the species at both the local and regional scale (DBCA, 2018a). It is recommended that targeted searches be undertaken within Badgingarra National Park to confirm whether secure populations can be recorded in this locality. If other viable and secure populations are recorded in the southern extent of the species range, then this would reduce the conservation significance of the populations recorded within and in close proximity to the application area (DBCA, 2018a).	Survey 5 recorded five individuals within Area 12 with an additional three plants recorded outside. All eight plants recorded occur on the same side of the road over a distance of approximately 100 metres. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to *Catacolea enodis* were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 109 plants at the same location but on both sides of the road and over an extended distance of approximately 200 metres. All of the additional 109 plants recorded occur outside the application area (plants recorded up to 50 metres away). The applicant also advised that two of the five plants recorded within the application area can be avoided (MRWA, 2018c). Given the substantially reduced proportional impact, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.
Chordifex reseminans	Priority 2	Survey 1	Area 13	This species is represented in the local area, including Badgingarra National Park, and has been recorded in large populations. If present in the application area it is unlikely that the proportional impact to the population would be considered significant to the species (DBCA, 2017b).	Survey 1 recorded one plant of this species. Survey 1 noted that this species closely resembles the more common *Chordifex sinuosus* and that the two species can be difficult to distinguish without sufficient rootstock material (GHD, 2016a). The species was not re-recorded at Area 13 by Survey 5. Area 13 is centrally located within the known range of the species. Noting this and the DBCA advice received, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Desmocladus microcarpus	Priority 2	Survey 2 Survey 5 Survey 9	Area 12 Area 12 Area 12	*Desmocladus microcarpus* is known from 5 locations and a highly restricted range of approximately 70 kilometres north-south and 40 kilometres east-west between Badgingarra and Wannamal. The records from Surveys 2 and 5 are at the northern extent of the known range (DBCA, 2018a). The species has been recorded in Crown Reserve 47808 and Badgingarra National Park. The species is known from 7 collections at the Herbarium, all but two of which are 38 or more years old. The most recent Herbarium collection is the collection from Survey 5 and the next most recent collection is from 2006 at Crown Reserve 47808. There is little information on population sizes, but the little information available suggests that it is rare and occurs in small populations. The species is dioecious (male and female reproductive organs are in separate individuals of the species). No specimen appears to have been submitted to the Herbarium with respect to Survey 2 to confirm the identity (DBCA, 2018a). The next closest Herbarium record is from 1981 and occurs approximately 700 metres to the southwest within Badgingarra National Park, possibly on the Dampier to Perth pipeline easement, so it is unclear whether this record is within conservation estate or within a clearing/maintenance zone for the pipeline. No information on frequency or population size was supplied with this record (DBCA, 2018a). Given the restricted range of the species, small number of known locations, lack of recent collections, lack of available information on population size and viability, and that the records from Surveys 2 and 5 currently represent the northern extent of the known range, the direct impacts of the proposed clearing are potentially significant to the conservation of this species at both the local and regional scale (DBCA, 2018a). It is recommended that targeted searches be undertaken within Badgingarra National Park to confirm whether viable and secure populations can be recorded in this locality. If other viable and secure populations are recorded in the northern extent of its range, then this would reduce the conservation significance of the plants recorded (DBCA, 2018a).	Surveys 2 and 5 each recorded one plant of this species. The two plants were recorded approximately 130 metres apart. One of the plants was recorded within Area 12 with the other recorded approximately 15 metres from Area 12. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to *Desmocladus microcarpus* were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 31 plants at the same location. All were recorded outside the application area with 19 of the plants recorded within Badgingarra National Park approximately 100 metres to the west. Given the substantially reduced proportional impact, and that more than half of the plants occur within conservation estate, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.

Species	Status	Survey	Area	DBCA Advice	Assessment
Hypocalymma serrulatum	Priority 2	Survey 2 Survey 5 Survey 9	Area 10 Area 12 Area 10 Area 10	*Hypocalymma serrulatum* is known from a highly restricted range of approximately 65 kilometres north-south, centred on Badgingarra National Park. The single record near Regan's Ford in the southern extent of its distribution is old (1967). Extensive surveys in Tiwest tenements have only recorded a couple of plants. The records from Surveys 2 and 5 are within the current known range adjacent to Badgingarra National Park (DBCA, 2018a). The largest population previously recorded was around 1000 plants, near Wongonderra Road. The size of the population recorded within the application area is potentially significant at the local and regional scale. The information provided by the applicant indicates that 1294 individuals occur within the application area and 511 individuals were recorded outside. Most of the individuals recorded outside the application area occur within a 10 metre buffer area and would potentially be subject to indirect impacts (DBCA, 2018a). This is potentially a significant population. It is noted that this species occurs along drainage lines, and it is possible that the altered roadside drainage may be creating preferred habitat for the species (DBCA, 2018a). Further information is required to clarify the significance of the impact. It is recommended that targeted searches be undertaken in the adjacent habitat within Badgingarra National Park to confirm whether the populations extend into the National Park or are restricted to the roadside. If the populations are restricted to the roadside, it may be due to altered hydrology due to roadside drainage in this location (DBCA, 2018a).	All the plants recorded by Survey 5 are located along the northern 3.5 kilometre section of Area 10. Survey 2 recorded two plants within the same section of Area 10 as well as a single plant approximately 20 metres from Area 12. Survey 5 does not include comments regarding the Area 12 location. It is likely that the plant recorded in Survey 2 occurs outside the area surveyed for Survey 5. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to *Hypocalymma serrulatum* were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 700 plants on both sides of the road adjacent to an approximately 500 metre portion of the 3.5 kilometre section of Area 10. All were recorded outside the application area with approximately 200 of the plants recorded within the adjacent Badgingarra National Park (also on both sides of the road approximately 80 to 150 metres away). In relation to the Survey 9 results, DBCA advised that the 500 metre length is probably sufficient to indicate that the species isn't restricted to areas of disturbance or altered hydrology along the roadside (DBCA, 2018b). Given the substantially reduced proportional impact, and that the population extends to within conservation estate, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.
Persoonia filiformis	Priority 2	Survey 5	Area 12	*Persoonia filiformis* is known from numerous locations within a relatively restricted range of approximately 130 kilometres north-south and 40 kilometres east-west between Port Denison and Dandaragan. The records within the application area are within the current known range. The species has been recorded in South Eneabba Nature Reserve, Lesueur National Park and Coomallo Nature Reserve (DBCA, 2018a). The species is known from 21 collections in the WA Herbarium and these records indicate that it has often been recorded as single plants or small populations. However, there are numerous Threatened and Priority Flora Report Forms (TPRFs) submitted by consultants undertaking surveys for development proposals with respect to this species. Larger populations have been recorded during surveys for mining and petroleum projects (in particular survey for Origin's Redback tenements recorded almost 14,000 individuals). A review of this species may indicate that it warrants downgrading to Priority 3 (DBCA, 2018a). Six individuals were recorded across four locations within the application area. The recorded locations were adjacent to Badgingarra National Park. No plants were recorded outside of the application area. Based on currently available data in this locality, the loss of these six plants may have the potential to be significant locally, but not regionally. However, it would seem likely that suitable habitat extends into the adjacent Badgingarra National Park (DBCA, 2018a).	Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Allocasuarina ramosissima	Priority 3	Survey 2	Area 12	No specific advice provided.	A single plant of this species was recorded approximately 30 metres from Area 12. Area 12 is centrally located within the known range of the species. No significant impacts to this species are expected from the proposed clearing.
Arnocrinum gracillimum	Priority 3	Survey 5	Area 10	*Arnocrinum gracillimum* is known from a restricted range of approximately 90 kilometres north-south and 40 kilometres east-west between Eneabba and Dandaragan. The records from Survey 5 are within the current known range. The species has been recorded from numerous locations within the known range, although many of the Herbarium records are quite old. It has been recorded within Coomallo Nature Reserve (DBCA, 2018a). A single individual was recorded inside the application area, while 47 plants were recorded outside of the application area, representing an impact of two per cent to the local population. A total eight individuals fall within the application area and a 10 metre buffer area, representing 17 per cent of the local population. There is a reasonable likelihood of suitable habitat extending into the Conservation Park to the west and local government reserve to the east of the recorded plants, so should the proposed clearing be implemented, the remaining habitat is unlikely to be isolated. The proposed level of impact is unlikely to be significant to the conservation of the species at either the local or regional scale (DBCA, 2018a).	Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Banksia dallanneyi subsp. *pollosta*	Priority 3	Survey 1 Survey 2	Area 2 Area 5	No specific advice provided.	The record from Survey 1 for this species plots approximately three metres from Area 2. The number of plants recorded is not specified. Two records of the species were provided in the spatial data for Survey 2 submitted by the applicant. However, the report for Survey 2 states that the species was not identified. The two records are approximately 400 metres apart with one occurring approximately 50 metres from Area 5 and the other occurring approximately four metres from Area 5. The number of plants recorded is not specified. Survey 5 made several collections of *Banksia dallanneyi* in an area encompassing Areas 2, 3, 4 and 5 including from the vicinity of the records provided by the applicant for Survey 2. The report outlines that: • all collections had leaves broader than 3mm and most leaves had less than 60 lobes (occasional leaves had more than 60); • it is more appropriate to refer to the collections made as the common *Banksia dallanneyi* subsp. *dallanneyi* as *Banksia dallanneyi* subsp. *pollosta* has leaves 2-3mm wide with 60-80 lobes; • it is possible that the specimens with some leaves with more than 60 lobes may be intergrades between the two subspecies; • further study of *Banksia dallanneyi* appears to be required to resolve whether *Banksia dallanneyi* subsp. *pollosta* should be maintained as a discrete taxon; and • based on the collections made by Survey 5, it is considered that *Banksia dallanneyi* subsp. *pollosta* does not occur in the survey area. (Woodman Environmental, 2017) Given the findings from Survey 5 it is considered that the proposed clearing is unlikely to result in significant impacts to *Banksia dallanneyi* subsp. *pollosta*.
Beaufortia bicolor	Priority 3	Survey 5	Area 10 Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 5 recorded this species regularly over the northern 5 kilometres of Area 10 and over the majority of the length of Area 12. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Comesperma rhadinocarpum	Priority 3	Survey 5 Survey 9	Area 10 Area 12 Area 10 Area 12	*Comesperma rhadinocarpum* is known from more than 10 locations and a broad range of approximately 450 kilometres north-south and 500 kilometres east-west between Kenwick, Koolyanobbing and Port Gregory. The records from Survey 5 are within the current known range (DBCA, 2018a). Recent survey work for this species has resulted in it being downgraded from Priority 2 to Priority 3 (DBCA, 2018b). The species has been recorded on conservation estate at Lake Logue Nature Reserve, South Eneabba Nature Reserve, Drummond Nature Reserve and Badgingarra National Park. The population in Badgingarra National Park consisted of five plants within a gravel scape (DBCA, 2018a). The species was initially thought to be extinct as it was only known from the type collection (from 1877) until it was rediscovered in 1988. At the majority of locations where the species has been recorded, it has been recorded as rare or one to few plants. It has only been recorded as common at one location southwest of Mullewa and now also within the application area (DBCA, 2018a). The description of the Mullewa population location suggests it may have also been recorded in road reserve. Noting this, the number of individuals recorded in the application area, and the record of five plants within a gravel scape, the species may be a disturbance opportunist (DBCA, 2018a). On the basis of available information, it would appear likely that all of the plants recorded would fall within the application area (over 95 per cent) or a 10 metre buffer area. Given that the populations within the application area are some of the largest recorded and the high level of direct and indirect impacts proposed, impacts from the proposed clearing are potentially significant to the conservation of the species at both the local and regional scale (DBCA, 2018a). It would appear likely that there is potential habitat for the species within the nearby Badgingarra National Park. It is recommended that targeted searches be undertaken within Badgingarra National Park to confirm whether large secure populations can be recorded in this locality (possibly along firebreaks). If other viable and secure populations are recorded in this locality, then this would reduce the conservation significance of the populations recorded (DBCA, 2018a).	144 individuals of this species were recorded from three locations in Area 10 and for the majority of the length of Area 12, with 142 within the application area. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to *Comesperma rhadinocarpum* were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 199 plants from a range of locations near/adjacent to Areas 10 and 12. All were recorded outside the application area with the majority recorded from an approximately five kilometre long firebreak installed on the eastern side of the Brand Highway road reserve where it borders Badgingarra National Park (approximately 80 metres from the application area). The identification of plants primarily from firebreaks supports the theory that the species is a disturbance opportunist. Given the substantially reduced proportional impact, and that the majority of plants recorded occur within/on the edge of Badgingarra National Park approximately 80 metres from the application area, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.
Desmocladus biformis	Priority 3	Survey 5	Area 10 Area 11 Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 5 recorded this species regularly over an approximately 700 metre long central portion of Area 12 and at another location within Area 10/Area 11. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Grevillea makinsonii	Priority 3	Survey 2	Area 10 Area 12	No specific advice required.	Survey 5 identified that the records of this species from Survey 2 were misidentified. The recorded locations were visited with only *Grevillea shuttleworthiana* subsp. *canarina* found which does not have a conservation status (Woodman Environmental, 2017). Therefore no significant impacts to this species are expected from the proposed clearing.
Guichenotia alba	Priority 3	Survey 1 Survey 5	Area 9 Area 10 Area 11 Area 10 Area 11 Area 13	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 1 recorded one plant approximately seven metres from Area 9. No plants were recorded at this location by Survey 5. Both surveys recorded plants at the same two locations for Area 10/11. Survey 5 recorded nine plants at Area 13 (three plants inside with the remaining six plants occurring within 10 metres of Area 13). Survey 1 did not record plants at this location but did record 11 plants approximately 500 metres south of Area 13. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.
Haemodorum loratum	Priority 3	Survey 3 Survey 5	Area 4 Area 4 Area 6 Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 5 recorded one plant of this species within Area 4 with Survey 3 recording two more plants nearby (one approximately 50 metres from Area 4 and one approximately 90 metres from Area 4). Survey 5 also recorded six plants within Area 6 and two plants within Area 12. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.
Hensmania stoniella	Priority 3	Survey 5	Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 5 recorded four plants of this species at three locations within Area 12. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Hypocalymma gardneri	Priority 3	Survey 4	Area 10 Area 12	No specific advice provided.	The report for Survey 5 outlines that: • the results of Survey 4 were reviewed prior to the survey; • the photograph of the species presented in the report for Survey 4 clearly represents the common taxon *Hypocalymma xanthopetalum*; • *Hypocalymma gardneri* has needle-like leaves less than 1 mm in width, with the taxon in the photograph having oblong leaves clearly wider than this; • Survey 5 did not record any *Hypocalymma gardneri* individuals at any of the locations recorded by Survey 4; • Survey 5 recorded *Hypocalymma xanthopetalum* at several of the locations where Survey 4 recorded *Hypocalymma gardneri*; • it is likely that all of the locations of *Hypocalymma gardneri* recorded by Survey 4 are erroneous; • the survey area is not within the known range of *Hypocalymma gardneri*; and • *Hypocalymma gardneri* is unlikely to occur within the application area. (Woodman Environmental, 2017) Given the findings from Survey 5 it is considered that the proposed clearing is unlikely to result in significant impacts to *Hypocalymma gardneri*.
Jacksonia anthoclada	Priority 3	Survey 5 Survey 9	Area 10 Area 10	*Jacksonia anthoclada* is known from a restricted range of approximately 75 kilometres north-south, between Eneabba and Badgingarra. The populations within the application area are within the current known range (DBCA, 2018a). There are 25 collections in the Herbarium. These records contain little information on population size, but the few records available indicate that population size ranges between 20-88 plants. One record notes that the species appears to prefer disturbed habitats. It is noted that there are records of the species in Badgingarra National Park; however, three of the four records appear likely to be of the same population as that recorded by Survey 5 based on the description, while the other is described as being on Bibby Rd and may also be within road reserve (DBCA, 2018a). The Herbarium records at the southern end of Badgingarra National Park represent the southern extent of the known distribution. If the three Herbarium records in Badgingarra National Park and the records within the application area all represent the same population, the proposed clearing is potentially significant at both the local and regional scale. Although, it would seem likely that suitable habitat extends into the adjacent Badgingarra National Park, further information is required to clarify the significance of the impact. It is recommended that targeted searches be undertaken in the adjacent habitat within Badgingarra National Park to confirm whether the populations extend into the National Park or are restricted to the roadside (DBCA, 2018a).	Survey 5 recorded 59 plants of this species over a distance of approximately 400 metres within Area 10 on both sides of the road. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to *Jacksonia anthoclada* were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 908 plants at the same location. All were recorded outside the application area with approximately 500 recorded within the adjacent Badgingarra National Park. Given the substantially reduced proportional impact, and that more than half of the plants occur within conservation estate, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.

Species	Status	Survey	Area	DBCA Advice	Assessment
Phlebocarya pilosissima subsp. *pilosissima*	Priority 3	Survey 1 Survey 2 Survey 5	Area 3 Area 10 Area 11 Area 12 Area 10 Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 1 recorded one plant on the edge of Area 3 and one plant within Area 10/11. Survey 2 recorded one plant on the edge of Area 12 at the southern end. Survey 5 recorded one plant on the opposite side of the road at this location but inside the application area. Survey 5 recorded an additional seven plants throughout the length of Area 12. Survey 5 also recorded three plants within Area 10 over a distance of approximately 400 metres. Noting DBCA's advice and that the species has been recorded regularly over a substantial distance, no significant impacts to this species are expected from the proposed clearing.
Stylidium hymenocraspedum	Priority 3	Survey 1 Survey 2	Area 10 Area 10 Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 1 recorded four plants of this species approximately 10 metres from Area 10. Survey 2 recorded a total of 20 plants of this species from five point locations; three at Area 10 (all in close proximity but only one inside Area 10), and two at Area 12 (one inside Area 12 and one approximately 2 kilometres further south and approximately 35 metres outside Area 12). Survey 5 inspected the two locations from Survey 2 recorded as occurring inside Area 10 and Area 12. The species was not found at either location. Survey 5 reports that it is possible the previously recorded individuals had senesced as the species is likely relatively short lived. Survey 5 reports that the species was observed nearby but outside the application area and therefore it would have been visible at the time of survey (Woodman Environmental, 2017). Noting DBCA's advice and that the majority of the individuals recorded occur outside the application area, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Tetratheca angulata	Priority 3	Survey 2 Survey 5 Survey 9	Area 12 Area 12 Area 12	*Tetratheca angulata* is known from a range of approximately 70 kilometres north-south. It has been recorded in Lesueur National Park, Alexander Morrison National Park, Boothendarra Hill Reserve, and Minyulo Nature Reserve. The populations within the application area are within the current known range (DBCA, 2018a). There are 14 collections in the Herbarium, and only 5 collections have been made in the last 25 years. The available records would suggest that it is uncommon where it occurs or has been recorded in small populations, the exceptions being the location where it was recently recorded within the application area and another collection from 1979 southeast of Badgingarra, where it was recorded as common (DBCA, 2018a). The information provided by the applicant indicates that the majority of the individuals recorded occur within the application area. Given that the population recorded in the application area is the only large population recorded in the last 25 years, the high level of proposed direct and indirect impacts may potentially be significant to the conservation of the species at both the local and regional scale. Further information is required to clarify the significance of the impact. It is recommended that targeted searches be undertaken in the adjacent habitat within Badgingarra National Park to confirm whether the population extends into the National Park or is restricted to the roadside (DBCA, 2018a).	Survey 2 recorded three plants of this species; one within Area 12 near its southern end and two approximately 20 metres from Area 12 near its midpoint. The two locations are approximately 5 kilometres apart. Survey 5 recorded 114 plants of this species. The plants were recorded at the same locations as that recorded for Survey 2 although 15 of the 90 plants recorded near the midpoint of Area 12 were recorded approximately 400 metres north of the other 75 plants. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to *Tetratheca angulata* were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 188 plants at the southern end of Area 12. All were recorded outside the application area within the adjacent road reserve (both sides). The vegetated portion of the road reserve is approximately 70 metres wide on the western side and approximately 100 metres wide on the eastern side of Brand Highway at this location. Plants were recorded regularly across the entire width. Given the substantially reduced proportional impact, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.
Anigozanthos humilis subsp. *chrysanthus*	Priority 4	Survey 5	Area 2	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 5 recorded one plant of this species within Area 2 at the southern end. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.
Conostephium magnum	Priority 4	Survey 1 Survey 2 Survey 4 Survey 5	Area 10 Area 11 Area 10 Area 12 Area 10 Area 12 Area 10 Area 11 Area 13	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	This species was recorded regularly over the entire length of Area 10/Area 11 with a few records also collected within/immediately adjacent to Areas 12 and 13. A substantial proportion of the plants recorded occur outside the application area (Woodman Environmental, 2017). Given this and noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Desmocladus elongatus	Priority 4	Survey 1 Survey 2 Survey 5	Area 9 Area 10 Area 12 Area 10 Area 12 Area 13	*Desmocladus elongatus* is known from a range of approximately 100 kilometres north-south between Eneabba and Dandaragan. Records from Tiwest would suggest it is quite common near Eneabba. The records within the application area are within the known range, however, the most southern record represents a small (5 kilometre) southern extension of the known range (DBCA, 2018a). It is noted that the species appeared to be associated with disturbed areas. It is possible that this species is a disturbance opportunist (DBCA, 2018a). As this species is well represented in conservation estate, is known from a large number of records, including the Tiwest records, and it is unlikely that the individuals at the southern extent of the range are to be impacted, the proposed clearing is unlikely to impact the conservation of the species at the regional scale. However, the size of the population may be significant at the local scale. Given this and the high level of proposed direct impacts, further information is required to clarify the significance of the impact. It is recommended that targeted searches be undertaken in the adjacent habitat within Badgingarra National Park to confirm whether the populations extend into the National Park or are restricted to the roadside (DBCA, 2018a).	The most southern record of the species was recorded by Survey 1. Five clumps of the species were recorded approximately 100 metres north of Area 9. Given the separation distance, no significant impacts to this population are expected from the proposed clearing. DBCA's advice notes there is a risk of significant impacts to the species at the local scale due to the potential loss of a large population. Individuals of this species were recorded at 10 main locations over a distance of approximately 45 kilometres between Area 9 and Area 13. Approximately 30 kilometres of this was surveyed by Surveys 1 to 5. The remaining 15 kilometres was not surveyed but does not form part of the application area. It is expected that the species would be recorded within the remaining 15 kilometres if surveyed with similar population sizes. Therefore it is considered that potential impacts at the local scale are unlikely to be significant and that further targeted searches within Badgingarra National Park are unwarranted.
Diuris recurva	Priority 4	Survey 1	Area 13	Impacts to this species would not be considered to be significant (DBCA, 2017b).	The report for Survey 1 outlines that this species was recorded at the northern end of Area 13 but the plant recorded was at the end of its flowering period and the petals and sepals were starting to senesce making identification difficult (GHD, 2016a). The report for Survey 5 outlines that: • the photograph of the species presented in the report for Survey 1 is not considered to represent *Diuris recurva*; • *Diuris recurva* has very differently coloured markings on the labellum lobes compared to the taxon in the photograph (red-brown versus bright purple in the photographed taxon), and the flowers generally have a recurved appearance, particularly the lateral sepals, unlike the taxon in the photograph which has straight lateral sepals; • the photograph was taken after the usual flowering period for *Diuris recurva*; • it is considered likely that the taxon in the photograph is the common *Diuris tinkeri* based on the colouration and general shape of the flowers as well as the known flowering period and distribution of the taxon; and • it is possible that *Diuris recurva* could still occur in the area based on available habitat – *Diuris recurva* was not recorded in Survey 5 but the survey timing did not coincide with the known flowering period of this taxon. (Woodman Environmental, 2017) The application area occurs within the known range of *Diuris recurva* and given DBCA's advice no significant impacts to the species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Eucalyptus macrocarpa subsp. *elachantha*	Priority 4	Survey 2	Area 12	No specific advice provided.	Survey 2 recorded five plants of this species at three main locations near Area 12 over a distance of approximately 7 kilometres. The closest plant was recorded 15 metres from Area 12 with the furthest recorded 70 metres from Area 12. Given the separation distance, no significant impacts to this species are expected from the proposed clearing.
Grevillea rudis	Priority 4	Survey 1 Survey 2 Survey 5 Survey 9	Area 13 Area 12 Area 12 Area 13 Area 12	*Grevillea rudis* is known from a restricted range of 90 kilometres north-south (noting that the southern Herbarium records are plotting incorrectly), largely between Eneabba and Badgingarra. The records are within the known range of the species (DBCA, 2018a). There are 62 collections in the Herbarium, about half of which were collected within the last 25 years. The species is often recorded as locally frequent or abundant, in particular in the northern extent of the range near Eneabba. It has been recorded on conservation estate, in particular Coomallo Nature Reserve, Wotto Nature Reserve and Alexander Morrison National Park. It has also been recorded on South Eneabba Nature Reserve, but mostly near vegetation impacted by mining. Iluka has recorded the species frequently near Eneabba, but extensive surveys near Cooljarloo have not recorded this species (DBCA, 2018a). The southernmost record from Area 12 appears to also be the location of the southernmost Herbarium record (noting that two Herbarium records plotting south of this location are plotting incorrectly). That the species was not recorded during extensive surveys just south of Area 12 at Cooljarloo suggests that this may be the southern extent of the range of this species (DBCA, 2018a). Based on the information provided by the applicant, three plants were recorded at the southernmost Area 12 location with one of these recorded from inside Area 12. The Herbarium record indicates that there were 10 plants at this location in 2008. Impacts to this population are potentially significant at both the local and regional scale. Given this, further information is required to clarify the significance of the impact. It is recommended that targeted searches be undertaken in the adjacent roadside habitat to confirm the extent of the local population and proportional impacts (DBCA, 2018a). It is also recommended that targeted searches be undertaken within Badgingarra National Park, as although there are numerous records in the vicinity of Badgingarra and on Brand Highway, there are no records within Badgingarra National Park. Confirming the presence of secure populations within Badgingarra National Park at the southern extent of the range would reduce the significance of the proposed impacts to the southernmost population (DBCA, 2018a).	Survey 1 recorded 15 plants of this species within/near Area 13 with the majority recorded approximately 500 metres south of Area 13. Survey 2 recorded 6 plants of this species at three main locations along Area 12. Survey 5 recorded 29 plants of this species with all but one plant occurring within/immediately adjacent to a 300 metre section of Area 13. The remaining plant was recorded within Area 12 at the same location as the southernmost location recorded from Survey 2. Noting DBCA's advice, DWER invited the applicant to provide additional information demonstrating that impacts to the southernmost population were unlikely to be significant. In response, the applicant commissioned a targeted regional flora survey (Survey 9). The survey recorded an additional 254 plants at this location. All were recorded outside the application area within the adjacent road reserve (both sides). The vegetated portion of the road reserve is approximately 80 metres wide on both sides of Brand Highway at this location. Plants were recorded regularly across the entire width. Given the substantially reduced proportional impact, it is considered that the proposed clearing is unlikely to result in significant impacts to the species.

Species	Status	Survey	Area	DBCA Advice	Assessment
Grevillea saccata	Priority 4	Survey 1 Survey 5	Area 13 Area 13	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 1 recorded 22 plants of this species within and in close proximity to Area 13. Survey 5 recorded 13 plants of this species within Area 13. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.
Hibbertia helianthemoides	Priority 4	Survey 1	Area 10	*H. helianthemoides* is endemic to the Stirling Ranges. The northern variant of this species (which occurs near the application area) is now recognised as a number of other taxa (*H. sericosepala*, *H. huegelii*, *H. leucocrossa* and *H. desmophylla*), none of which have a conservation status (DBCA, 2017b).	It is considered that *H. helianthemoides* does not occur within or adjacent to the application area and instead a similar species occurs that does not have a conservation status.
Hypolaena robusta	Priority 4	Survey 2 Survey 5	Area 10 Area 12 Area 10 Area 11	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 2 recorded three plants of this species at three separate locations; two approximately 700 metres apart within the northern portion of Area 10 and one approximately 30 metres from the southern end of Area 12. The report for Survey 5 outlines that: • the photograph of the species presented in the report for Survey 2 appeared to represent a densely clumping rush taxon with short rhizomes; • it is suspected that the photograph is of the densely clumping *Lyginia excelsa*; • *Hypolaena robusta* is known to have elongated rhizomes and therefore does not form dense clumps; • two of the three locations recorded by Survey 2 were visited with *Lyginia excelsa* found at both locations; • the third unvisited location occurs in very close (within 100 metres) proximity to a known *Lyginia excelsa* location; and • it is considered likely that all of the previously recorded locations of *Hypolaena robusta* are erroneous, however, the species was recorded elsewhere by Survey 5 although not in close proximity to the previously recorded locations. (Woodman Environmental, 2017) Survey 5 recorded 123 *Hypolaena robusta* individuals over a distance of approximately 4.5 kilometres. Approximately two thirds of the individuals recorded occur within Area 10/Area 11 with the remaining one third occurring immediately adjacent. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

Species	Status	Survey	Area	DBCA Advice	Assessment
Schoenus griffinianus	Priority 4	Survey 2 Survey 4 Survey 5	Area 10 Area 12 Area 10 Area 10 Area 11 Area 12	*Beaufortia bicolor*, *Desmocladus biformis*, *Guichenotia alba*, *Haemodorum loratum*, *Hensmania stoniella*, *Phlebocarya pilosissima* subsp. *pilosissima*, *Stylidium hymenocraspedum*, *Anigozanthos humilis* subsp. *chrysanthus*, *Conostephium magnum*, *Grevillea saccata*, *Hypolaena robusta* and *Schoenus griffinianus* are known from broader distributions and more collections, some from within conservation estate, and suitable habitat is either known or considered likely to extend into conservation reserves adjacent to the application area. The recorded locations are within the known range of these taxa. Given the narrow linear nature of the application area relative to the likely extent in adjoining habitat in conservation reserves, the impacts are not likely to be significant at either the local or regional scale (DBCA, 2018a).	Survey 2 recorded three plants of this species at three different locations; one approximately 30 metres from Area 10, one approximately 50 metres from Area 10 and one approximately 50 metres from Area 12. Survey 4 recorded nine plants just outside Area 10 in the immediate vicinity of one of the same locations recorded by Survey 2. Survey 5 recorded 40 plants across multiple locations within Area 10/Area 11 and Area 12. Survey 5 also recorded five plants just outside Area 12. Noting DBCA's advice, no significant impacts to this species are expected from the proposed clearing.

(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.

Proposed clearing is at variance to this principle

Surveys 1 to 3 recorded one threatened fauna species; Carnaby's cockatoo. Chuditch, also listed as threatened, as well as three fauna species listed as priority (P) fauna by DBCA, were also considered likely to occur. The priority fauna include:

- woma (*Aspidites ramsayi*) (southwest subpopulation) (P1);
- black-striped snake (*Neelaps calonotos*) (P3); and
- western brush wallaby (*Notamacropus irma*) (P4).

Carnaby's cockatoo

As outlined in Section 5, the proposed clearing will result in the loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat, the majority of which occurs within 12 kilometres of confirmed nesting locations. The loss of this habitat would increase the risk of further declines in breeding success and population size of the species.

It is considered that substantial areas of similar vegetation with similar values likely remains within 12 kilometres of confirmed nesting sites and the proposed loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat may be approved subject to implementation of an offset.

Chuditch

As outlined in Section 5, chuditch may utilise Areas 2 to 7, however, the proposed clearing is not expected to result in significant impacts to the species. Impacts to chuditch may also be mitigated through directional clearing, and for clearing not to occur between September and December, pre-clearing inspections for dens, relocation of individuals occupying identified dens, and replacement/relocation of confirmed dens in adjoining habitat.

Woma

Woma occurs in the desert and adjacent areas of the central parts of Australia with a subpopulation in southwest Western Australia which may be isolated from the main body of the spec'es' distribution. The species is associated with desert and semi-arid areas predominantly found in sandy areas, but is also found in spinifex grassland, *Eucalyptus* and *Acacia* woodlands on clay soils, rocky areas, and other non-sandy habitats (Bruton et al., 2017).

The availability of underground burrows (generally either natural or those excavated by other species), suitable ground cover, and other shelter sites appears to have a greater influence on the species occurrence than the broad habitat type. Radio-tracking studies have found that the species can persist in cleared and regrowth landscapes so long as suitable underground shelter sites remain. Although the species appears to be resilient to changes in surface vegetation, intensive agricultural activities such as cropping or trampling by grazing animals may destroy animal burrows on which the species depends. Cropping occurs across much of southwest Western Australia which may have led to the decline in the subpopulation. The loss of native mammals may also have contributed to a suspected decline in the species as there are some indications that the species prefers native mammal burrows (e.g. as opposed to rabbit burrows). The species appears to use self-dug burrows principally as temporary shelters preferring to enlarge pre-existing burrows dug by other species (Bruton et al., 2017).

DBCA has advised that there have been a number of unconfirmed reports for woma in the general Watheroo area but nothing substantiated. Searches have been undertaken in reserves inland of Jurien Bay and Green Head without success. DBCA's advice indicates that historical records of woma in the northern Wheatbelt are from areas east of Brand Highway (DBCA, 2019a). Given this, it is considered that there is a low likelihood of the species being present within the application area and that a directional clearing permit condition (i.e. clearing towards adjacent remnant vegetation to allow woma to escape to that vegetation) is appropriate for mitigating the risk of death/injury to any individuals if present.

Black-striped snake

Black-striped snake is restricted to coastal areas in the southwest of Western Australia around Perth between Port Kennedy and the Dongara region. It is very common in parts of its range, but has been locally extirpated from areas cleared for housing development which appears to be the main threat to the species. The species inhabits sand dunes and sandplains vegetated with heaths, *Eucalyptus* and *Banksia* woodlands (Gaikhorst et al., 2017).

The application area is located near the eastern edge of the species distribution. The local area (20 kilometre radius) surrounding the application area measures approximately 610,000 hectares. Based on available datasets, approximately 260,000 hectares of remnant native vegetation remains in this area (i.e. approximately 43 per cent). The majority of this occurs to the west within the species known range and where there are substantial areas managed by DBCA for conservation such as Moore River National Park, Moore River Nature Reserve, Namming Nature Reserve and Badgingarra National Park. The application area is not located in an area where urban development is occurring. Given this and that the application area is approximately 55 kilometres in length with a relatively narrow average width of approximately 30 metres, local scale impacts are considered likely to be minimal. No significant impacts to black-striped snake are expected from the proposed clearing.

Western brush wallaby

The western brush wallaby is endemic to southwest Western Australia and has a distribution from north of Kalbarri to near Cape Arid with an estimated area of occupancy of 1300-4000 square kilometres. The species inhabits a wide range of habitats, including open forest and woodland, mallee, heathland, low open grasses, and scrubby thickets, but favour open, grassy areas and are absent in karri forests where there is a dense understorey (Woinarski and Burbidge, 2016).

Western brush wallaby is relatively common particularly where fox control is in place. The population trend as of 2016 was considered stable with the number of mature individuals estimated at 10,000-50,000. Clearance for agriculture has fragmented

the population and reduced its range, however, there are no current major threats to this species. The species has increased in abundance in areas where foxes have been controlled (Woinarski and Burbidge, 2016).

The local area (20 kilometre radius) surrounding the application area measures approximately 610,000 hectares. Based on available datasets, approximately 260,000 hectares of remnant native vegetation remains in this area (i.e. approximately 43 per cent). Substantial portions of the remaining native vegetation occur on lands managed by DBCA for conservation such as Moore River National Park, Moore River Nature Reserve, Namming Nature Reserve and Badgingarra National Park. A total of 37.8 hectares of native vegetation is proposed to be cleared over a disconnected application area approximately 55 kilometres long. The loss of vegetation from narrow linear strips is not expected to result in significant impacts to the ability of the western brush wallaby to move between nearby larger remnants. Given this and the fact that the majority of the application area does not comprise natural open grassy areas favoured by western brush wallaby, no significant impacts to the species are expected from the proposed clearing.

Ecological linkages
It is considered that the southern half of Area 12 forms part of an ecological linkage between the northern and southern portions of Badgingarra National Park. Area 12 occurs within a 200 metre wide road reserve that is mostly vegetated and directly links the two portions. A similar linkage occurs 2.8 kilometres further west but is much larger being approximately three kilometres wide.

The existing Brand Highway is located centrally within the road reserve and the proposed clearing will result in the widening of the road footprint from approximately 20 metres to 30 metres. At least 70 metres of remnant vegetation will remain on either side of the road. Noting this and the presence of a larger linkage to the west, it is considered that the proposed clearing is not of a scale that will result in the loss of significant ecological linkage values.

Summary
The proposed clearing will result in the loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat. The proposed clearing may also result in impacts to chuditch and woma, however, it is considered that these impacts are not likely to be significant and may be mitigated through fauna management conditions. The proposed clearing is at variance to this principle.

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.

Proposed clearing is not likely to be at variance to this principle
According to DBCA's TPFL and WA Herbarium datasets, records of 39 threatened flora species occur within a 20 kilometre radius of the application area. Eight of these species have records within a 2 kilometre radius; *Acacia wilsonii*, *Andersonia gracilis*, *Banksia serratuloides* subsp. *perissa*, *Drakaea elastica*, *Eucalyptus absita*, *Macarthuria keigheryi*, *Paracaleana dixonii* and *Ptychosema pusillum*.

No threatened flora species were identified by Surveys 1 to 5. The combined survey areas for Surveys 1 to 4 encompassed all portions of the application area (i.e. Areas 1 to 13). The survey area for Survey 5 also encompassed all portions of the application area.

As discussed in Section 5 it is considered that the proposed clearing is not likely to result in significant impacts to *Drakaea elastica*, *Eucalyptus absita*, *Paracaleana dixonii* or *Ptychosema pusillum*.

No DBCA records of *Acacia wilsonii*, *Andersonia gracilis*, *Banksia serratuloides* subsp. *perissa* or *Macarthuria keigheryi* occur within 500 metres of the application area. No limitations for identifying/detecting these species were noted by Survey 5 which included targeted searches for threatened flora (Woodman Environmental, 2017).

Given no individuals of threatened flora were recorded by any of the surveys, and the separation distances between the application area and known DBCA records, no significant impacts to threatened flora are expected from the proposed clearing.

The proposed clearing is not likely to be at variance to this principle.

(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.

Proposed clearing is at variance to this principle
As outlined in Section 5 the proposed clearing will result in the loss of up to 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC. The proposed clearing is therefore at variance to this principle.

Based on the results of Surveys 1 to 3, it is considered that no other TECs are likely to occur within the application area.

The proposed clearing of up to 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC represents a relatively small proportion of its current extent, however, cumulative impacts to the TEC are considered significant, incremental and ongoing.

Advice received from DBCA's Moora District indicates that there are confirmed *Phytophthora* dieback records from the application area. This includes several records from the area covering Areas 5, 6, 7, 8 and 9 (DBCA, 2017b; DBCA, 2018a). Surveys 1 to 3 recorded a range of weed species across the application area. A high concentration of weeds was recorded in Area 7 which along with Area 1 exhibits the lowest vegetation condition of the application area.

Given dieback infestations and a range of weed species are known from the application area where the TEC occurs, there is a risk that the proposed clearing will result in the spread/introduction of dieback and weeds to adjacent areas of the TEC. It is considered that the risk of spread/introduction of dieback and weeds can be adequately mitigated through the imposition of dieback and weed hygiene clearing permit conditions. Noting the staged nature of the proposed clearing, this will include the requirement for staged dieback surveys (i.e. within 12 months prior to clearing) and later development of site specific dieback management plans.

(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.

Proposed clearing is at variance to this principle

The National Objectives and Targets for Biodiversity Conservation 2001-2005 include a target to have clearing controls in place that prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750 (i.e. pre-European settlement) (Commonwealth of Australia, 2001). This is the threshold level, below which species loss appears to accelerate exponentially.

The local area (20 kilometre radius) surrounding the application area measures approximately 610,000 hectares. Based on available datasets, approximately 260,000 hectares of remnant native vegetation remains in this area (i.e. approximately 43 per cent). Most of the remnant vegetation remaining occurs west of the application area (Figure 2).

Figure 2. Remnant vegetation (green shading) remaining in the local area (black outline)

As indicated in Table 8, the current vegetation extents for the Swan Coastal Plain and Geraldton Sandplains bioregions are above the 30 per cent recommended threshold. However, the current vegetation extents for mapped Beard vegetation associations 4, 7, 999 and 1035 are below the 30 per cent recommended threshold at 27.3 per cent, 12.7 per cent, 11.3 per cent and 9.8 per cent respectively. These four Beard vegetation associations also have less than 10 per cent of their pre-European extent currently remaining in DBCA managed lands (i.e. conservation estate).

Table 8. Vegetation extent remaining statistics (Government of Western Australia, 2018)

	Pre-European extent (ha)	Current extent (ha)	Extent remaining (%)	Current extent in all DBCA managed lands (ha)	Extent remaining in all DBCA managed lands (proportion of Pre-European extent) (%)
IBRA bioregion					
Swan Coastal Plain	1,501,222	578,997	38.6	222,767	18.0
Geraldton Sandplains	3,136,038	1,404,431	44.8	568,223	18.1
Beard vegetation association					
4	1,054,280	287,301	27.3	67,766	6.4
7	179,725	22,885	12.7	1,216	0.7
	Pre-European extent (ha)	**Current extent (ha)**	**Extent remaining (%)**	**Current extent in all DBCA managed lands (ha)**	**Extent remaining in all DBCA managed lands (proportion of Pre-European extent) (%)**
949	218,194	122,966	56.4	68,743	31.5
999	115,707	13,026	11.3	3,114	2.7
1015	19,557	6,639	33.9	2,927	15.0
1030	139,013	88,950	64.0	17,117	12.3
1031	269,491	88,672	32.9	37,827	14.0
1035	5,018	493	9.8	265	5.3
Beard vegetation association in IBRA bioregion					
4 (Swan Coastal Plain)	15,897	3,003	18.9	438	2.8
7 (Geraldton Sandplains)	4,136	1,391	33.6	128	3.1
949 (Swan Coastal Plain)	209,983	120,150	57.2	67,824	32.3
999 (Swan Coastal Plain)	102,940	9,604	9.3	1,210	1.2
1015 (Swan Coastal Plain)	19,557	6,639	33.9	2,927	15.0
1030 (Swan Coastal Plain)	134,789	86,014	63.8	14,981	11.1
1030 (Geraldton Sandplains)	3,849	2,791	72.5	2,087	54.2
1031 (Swan Coastal Plain)	27,730	5,353	19.3	779	2.8
1031 (Geraldton Sandplains)	241,350	83,221	34.5	37,048	15.4
1035 (Swan Coastal Plain)	3,435	360	10.5	255	7.4

Beard vegetation association 4 is only mapped over the northern 400 metres of Area 4 which is three kilometres long (i.e. only occurs over 13 per cent of Area 4 equating to clearing of approximately 0.2 hectares). Beard vegetation association 7 is only mapped over a 500 metre portion of Area 10 which is 16 kilometres long (i.e. only occurs over 3 per cent of Area 10 equating to clearing of approximately 0.2 hectares). Beard vegetation association 999 is only mapped over Area 1 (Table 2) and this area is considered to be in Completely Degraded to Degraded condition (Table 5). Given this information and that the proposed clearing is limited to a narrow linear area adjacent to an existing road, the proposed loss of vegetation from Beard vegetation associations 4, 7 and 999 is not considered likely to be significant.

Beard vegetation association 1035 is only mapped at two locations approximately 20 kilometres apart (Figure 3). It is mapped over the majority of Areas 5 and 6. The largest remaining remnants of this vegetation association occur in DBCA managed lands. The total amount of Beard vegetation association 1035 within the Brand Highway road reserve at Areas 5 and 6 is approximately 15 hectares. A total of 3.7 hectares of native vegetation is proposed to be cleared from Areas 5 and 6. Noting only 493 hectares of Beard vegetation association 1035 remains, the portions of this vegetation association within Areas 5 and 6 are considered to be significant as remnants in an area that has been extensively cleared. The proposed clearing is therefore at variance to this principle.

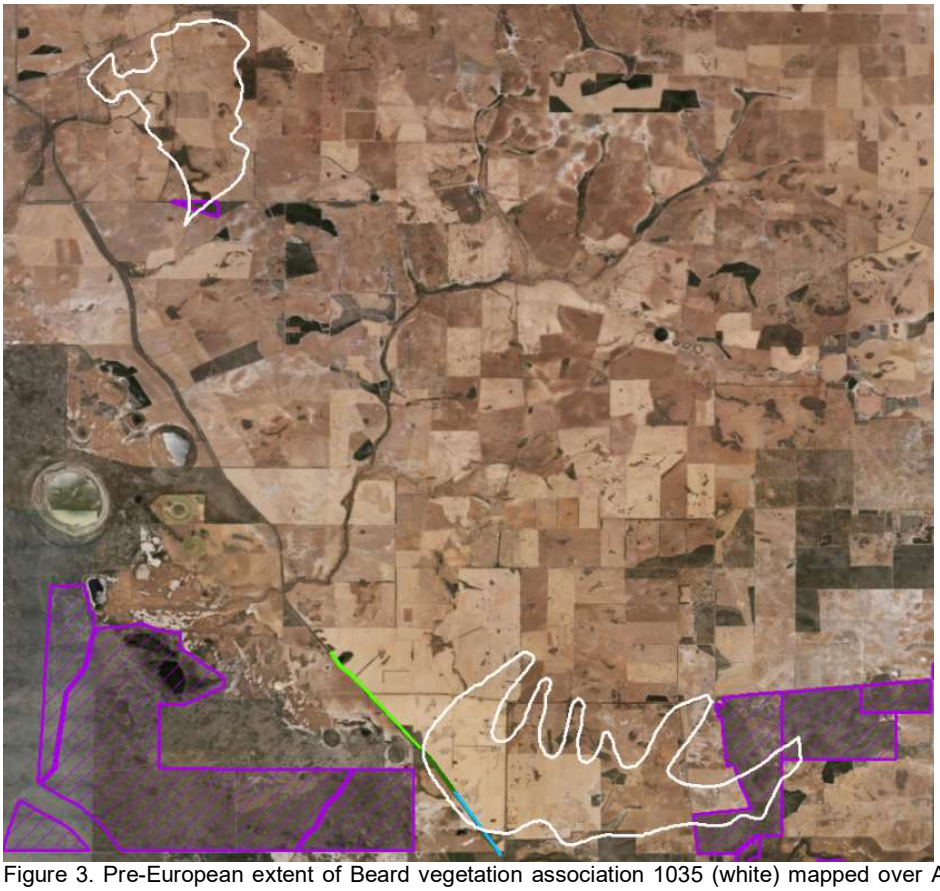

Figure 3. Pre-European extent of Beard vegetation association 1035 (white) mapped over Areas 5 (light blue) and 6 (dark green) and DBCA managed lands (purple)

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Proposed clearing is at variance to this principle

Watercourses

Survey 2 recorded two ephemeral drainage lines within Area 10. The exact locations were not identified. The report outlines that the ephemeral drainage lines were dry at the time of survey and impacted by weeds, predominantly introduced grass species (GHD, 2016b). Based on this information it is considered that the drainage lines are unlikely to represent significant watercourses.

According to available datasets, no significant watercourses intersect the application area.

Wetlands (Wetlands 1 to 11)

According to available datasets, three mapped wetlands are intersected by the application area and an additional eight wetlands are mapped within 100 metres of Areas 2, 4, 7, 10 and 13 (Table 9). Eight of the 11 wetlands are mapped in the Geomorphic Wetlands of the Swan Coastal Plain dataset (i.e. those wetlands between Areas 1 and 7).

Wetlands in the Geomorphic Wetlands of the Swan Coastal Plain dataset have been evaluated and assigned a management category (or spatially divided into multiple categories where relevant) based on their ecological values. There are three management categories:

- Conservation – wetlands which support a high level of attributes and functions;
- Resource Enhancement – wetlands which may have been partially modified but still support substantial ecological attributes and functions; and
- Multiple Use – wetlands with few remaining important attributes and functions.
  (DBCA, 2014)

Table 9. Mapped wetlands within 100 metres/intersected by the application area

ID	Area	Wetland classification	Wetland management category	Proximity	Assessment
1	Area 1	Palusplain	Multiple Use	Mapped over the southern 350 metres of Area 1	Survey 1 mapped the vegetation at this location as 'Parkland cleared' or 'Highly modified'. Vegetation condition was recorded as Completely Degraded or Completely Degraded to Degraded. It is considered that significant wetland values are not present at this location.
2	Area 2	Dampland	Conservation	60 metres west	Survey 1 did not record wetland vegetation at this location. Noting this and the separation distance to the wetland, no significant impacts to the wetland are expected from the proposed clearing.
3	Area 4	Dampland	Conservation	30 metres west	Survey 1 recorded approximately 0.1 hectares of wetland vegetation within the application area at this location. Vegetation condition was recorded to be Very Good. The vegetation within the application area forms part of a 15 metre wide strip of vegetation that is separated from the rest of the wetland by a gravel track. The mapped wetland is approximately 100 hectares in size. No significant impacts to the wetland are expected from the proposed clearing given the relatively small proportion proposed to be cleared and the fact it is already fragmented from the rest of the wetland.
4	Area 4	Sumpland	Resource Enhancement	10 metres west	Survey 3 recorded wetland vegetation approximately 20 metres west of Area 4 at this location. Approximately 0.15 hectares of Area 4 occurs within a 50 metre buffer of the wetland vegetation mapped by Survey 3. The total area of the wetland is estimated to be 15 hectares and it is surrounded by remnant vegetation on all sides. Given this, it is considered that the proposed clearing of a relatively small proportion of the wetland buffer is not likely to result in significant impacts to the wetland.
5	Area 4	Sumpland	Resource Enhancement	Mapped over a 150 metre portion of Area 4	Survey 3 did not record wetland vegetation at this location. Based on aerial imagery it is considered that the wetland occurs to the east and outside of Area 4. No significant impacts to the wetland are expected from the proposed clearing.
6	Area 4	Sumpland	Resource Enhancement	30 metres east	Survey 3 did not record wetland vegetation at this location. Based on aerial imagery it is considered that the wetland occurs further east. No significant impacts to the wetland are expected from the proposed clearing.
7	Area 5	Dampland	Not Assessed	Mapped over a 200 metre portion of Area 5	Survey 2 recorded a total of 2 hectares of wetland vegetation at this location, 0.3 hectares on the east side of the road and 1.7 hectares on the west side. Based on aerial imagery it appears that the wetland extends further to both the east and west but these areas are located on farmland virtually devoid of native vegetation. Vegetation condition of the wetland was recorded to be Good on the east side of the road and Very Good to Excellent on the west side. It is considered that the eastern 0.3 hectares does not contain significant wetland values noting it occurs as an approximately 10 metre wide isolated strip of vegetation. Approximately 0.2 hectares of the wetland vegetation mapped by Survey 2 occurs within Area 5 virtually all of which is located on the east side of the road. Given this, no significant impacts to the wetland are expected from the proposed clearing.
8	Area 7	Lake	Not Assessed	10 metres east	Survey 3 recorded a total of approximately 1.65 hectares of wetland vegetation at this location. Approximately 0.1 hectares of this occurs within Area 7, the majority of which was determined to be in Degraded condition. Based on aerial imagery the total size of the wetland is estimated to be 13 hectares. Given the relatively small proportion of the wetland proposed to be cleared and the predominantly degraded condition of the vegetation, no significant impacts to the wetland are expected.
9	Area 10	Dampland	Not Assessed	100 metres east	Survey 4 recorded approximately 3.2 hectares of wetland vegetation at this location. Wetland vegetation was recorded on both sides of the road. Vegetation condition was determined to be Excellent. It is considered that this area likely represents an extension to the wetland mapped to the east which is approximately 2.6 hectares in size. Approximately 0.2 hectares of the wetland vegetation identified occurs within Area 10. Noting the condition of the vegetation it is considered that the wetland is likely to be commensurate with a conservation category wetland.

10	Area 10	Sumpland	Not Assessed	40 metres east	Survey 4 did not record wetland vegetation at this location. Based on aerial imagery it appears that the wetland occurs further to the east. No significant impacts to the wetland are expected from the proposed clearing.
11	Area 13	Barlkarra	Not Assessed	20 metres west	Survey 1 did not record wetland vegetation at this location. Based on aerial imagery the wetland appears to occur on neighbouring farmland virtually devoid of native vegetation. No significant impacts to the wetland are expected from the proposed clearing.

Wetlands (Wetlands 12 and 13)
Two additional wetlands were recorded in the application area that are not mapped in available datasets.

Survey 4 recorded 0.8 hectares of wetland vegetation at Area 10 (Wetland 12). The vegetation was recorded on the west side of the road near Wetland 10. Approximately 0.1 hectares of the vegetation recorded occurs within Area 10. Vegetation condition at this location was determined to be Excellent. Noting the condition of the vegetation it is considered that the wetland is likely to be commensurate with a conservation category wetland.

Survey 1 recorded vegetation within and adjacent to a seasonally wet low-lying area over a distance of approximately 1.2 kilometres at Area 13 (Wetland 13). The vegetation type recorded was described as '*Calothamnus* shrubland and *Meeboldina* sedgeland' and is reported to contain a number of ephemeral wetland species and sedges and rushes (GHD, 2016a). Vegetation condition was recorded to be predominantly Very Good to Excellent. A total of 8.8 hectares of the vegetation type was recorded, approximately 2.5 hectares of which occurs inside Area 13. This vegetation type along with another recorded outside the application area are described by Survey 1 as being restricted in extent and containing an assemblage of flora species not found elsewhere in the survey area (GHD, 2016a). Based on available information, it is considered that the '*Calothamnus* shrubland and *Meeboldina* sedgeland' vegetation type represents a wetland that is likely to be commensurate with a conservation category wetland.

Summary
The application area is intersected by two ephemeral drainage lines. A total of 3.2 hectares of wetland vegetation was also recorded in the application area across six different wetlands (i.e. Wetlands 3, 7, 8, 9, 12 and 13). Native vegetation growing in, or in association with, watercourses and wetlands occurs in the application area and therefore the proposed clearing is at variance to this principle.

Clearing within the two ephemeral drainage lines is expected to be minimal noting the linear nature of the application area. No significant impacts to the drainage lines are expected. Three of the wetlands intersected by the application area are considered to be significant (i.e. Wetlands 9, 12 and 13). The proposed clearing will result in the loss of up to 2.8 hectares of significant wetland vegetation.

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Proposed clearing is not likely to be at variance to this principle
The application area is linear, approximately 55 kilometres in length with a relatively narrow average width of approximately 30 metres.

The topography of the application area generally rises steadily from south to north. Area 1 rises in elevation from approximately 90 metres Australian Height Datum (AHD) in the south to approximately 105 metres AHD in the north over a distance of 1.17 kilometres. Elevation then drops to approximately 85 metres AHD across Areas 2, 3 and 4 before rising to approximately 90 metres AHD at Area 5. Elevation rises again to approximately 100 metres AHD across Areas 6 and 7 and then approximately 110 metres AHD across Areas 8 and 9. Over Areas 10 and 11 elevation rises from approximately 110 metres AHD in the south to approximately 190 metres AHD in the north, a distance of 16 kilometres. The highest elevation for the application area is located near the midpoint of Area 12 at approximately 250 metres AHD. The northern and southern ends of Area 12 are both approximately 200 metres AHD. Elevation then drops to approximately 160 to 170 metres AHD across Area 13 which runs parallel to Boothendarra Creek located approximately 150 metres to the west.

Given the dimensions of the application area and the topography, it is considered unlikely that any significant erosion would occur as a result of clearing a wider corridor for an upgraded Brand Highway.

The application area occurs across four catchments; Moore River, Minyulo Caren Caren, Nambung River and Hill River. Noting the linear nature of the application area across four catchments, the proposed clearing is considered unlikely to result in significant changes to groundwater levels or any subsequent appreciable land degradation through salinity.

Given the dimensions of the application area and the topography, the risk of appreciable land degradation as a result of the proposed clearing is substantially reduced. The proposed clearing is not likely to be at variance to this principle.

(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.

Proposed clearing may be at variance to this principle

Four conservation areas occur adjacent to the application area; Moore River National Park, Crown Reserve 27216, an un-named Conservation Park and Badgingarra National Park.

Moore River National Park is located between 3 and 50 metres west of the length of Area 2 and between 1 and 30 metres west of the southern two thirds of Area 3.

Crown Reserve 27216 is vested in the Shire of Dandaragan for the land use purposes of 'Camping', 'Conservation', 'Protection of Flora' and 'Recreation'. It is located approximately 85 metres east of the northern two thirds of Area 9 and approximately 85 metres east of the southern 3.5 kilometres of Area 10.

The un-named Conservation Park is located approximately 85 metres west of a central 10.5 kilometre portion of Area 10 and approximately 85 metres west of Area 11.

Badgingarra National Park occurs approximately 85 metres west and east of the northern 4 kilometres of Area 10 excluding a 500 metre section on the western side where a gravel reserve occurs. It also occurs approximately 85 metres west of the northern half of Area 12.

Areas 2, 3, 9, 10, 11 and 12 are located within close proximity to conservation areas.

Advice received from DBCA's Moora District indicates that there are confirmed *Phytophthora* dieback records from the application area. This includes a major infestation within the road reserve at Area 10/11, at least one record from each of Areas 12 and 13, and several records from the area covering Areas 5, 6, 7, 8 and 9. DBCA's Moora District also advises that the weed **Verbesina encelioides* has recently been identified at the southern end of Area 10 and is of particular concern (DBCA, 2017b; DBCA, 2018a).

Surveys 1 to 3 recorded a range of weed species across the application area. A high concentration of weeds was recorded in Area 7 which along with Area 1 exhibits the lowest vegetation condition of the application area.

Given dieback infestations and a range of weed species are known from the application area, there is a risk that the proposed clearing will result in the spread/introduction of dieback and weeds to nearby conservation areas. The proposed clearing may be at variance to this principle.

It is considered that the risk of spread/introduction of dieback and weeds can be adequately mitigated through the imposition of dieback and weed hygiene clearing permit conditions. Noting the staged nature of the proposed clearing, this will include the requirement for staged dieback surveys (i.e. within 12 months prior to clearing) and later development of site specific dieback management plans.

(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.

Proposed clearing is not likely to be at variance to this principle

As discussed under principle (f), the application area is intersected by two ephemeral drainage lines, and contains a total of 3.2 hectares of wetland vegetation from six different wetlands (i.e. Wetlands 3, 7, 8, 9, 12 and 13).

The application area is linear, approximately 55 kilometres in length with a relatively narrow average width of about 30 metres. Clearing at existing crossings of the two drainage lines for road widening is not expected to be of a scale that would result in a perceptible deterioration of surface water quality.

Wetlands 3, 7 and 9 are all mapped as damplands (i.e. seasonally waterlogged basins). Wetlands 12 and 13 have not been mapped but are also expected to be seasonally waterlogged wetlands. These five wetlands are not expected to hold substantial surface water and therefore the risk of deterioration in their water quality as a result of the proposed clearing is considered low.

Wetland 8 is a lake and it is estimated that less than 1 per cent of the wetland occurs within the application area. The portion inside the application area is predominantly in Degraded condition. The proposed clearing at Wetland 8 is not expected to be of a scale that would result in a perceptible deterioration of surface water quality.

The application area occurs across four catchments; Moore River, Minyulo Caren Caren, Nambung River and Hill River. Noting the linear nature of the application area across four catchments, the proposed clearing is considered unlikely to result in significant changes to groundwater quality in the form of increased salinity.

The proposed clearing is not likely to be at variance to this principle.

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Proposed clearing is not likely to be at variance to this principle

The application area occurs across four catchments; Moore River, Minyulo Caren Caren, Nambung River and Hill River. Noting the linear nature of the application area across four catchments, it is considered that the proposed clearing is unlikely to be in a location or of a scale that would result in an increase in the incidence or intensity of flooding.

The proposed clearing is not likely to be at variance to this principle.

10. Planning instruments and other relevant matters.

The clearing permit application was advertised for public comment in the *West Australian* newspaper by the former Department of Environment Regulation on 24 April 2017. No public submissions were received.

11. Avoidance, mitigation and offsets

As outlined under Section 7, a range of avoidance and mitigation measures have been implemented/proposed. After consideration of these measures, it is considered that the following significant residual impacts remain:

- loss of up to 36.49 hectares of Carnaby's cockatoo foraging habitat;
- loss of up to 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC;
- loss of up to 3.7 hectares of Beard vegetation association 1035; and
- loss of up to 2.8 hectares of significant wetlands.

To counterbalance these significant residual impacts, the applicant proposes to make a monetary contribution of $975,900 to DWER for the acquisition of 208 hectares of similar native vegetation for conservation (Table 10). The proposed offset size was determined by calculations undertaken by the applicant using the DotEE's Offsets Assessment Guide. Properties for acquisition have not yet been identified so the assumptions applied in the calculations were that rural zoned property nearby containing vegetation in excellent condition would be purchased for inclusion in the conservation estate managed by DBCA. The applicant's monetary contributions are proposed to be made in stages to align with the staged nature of the construction works. Given this, the applicant's monetary contributions are based on land values of 10-50 hectare parcels of vegetation in order to allow DWER the flexibility to make separate acquisitions for conservation at each stage of the works. The monetary contributions proposed would also allow a separate acquisition of wetland areas as such areas may not contain Carnaby's cockatoo foraging habitat, the Banksia Woodlands of the Swan Coastal Plain TEC or Beard vegetation association 1035.

DWER has reviewed the calculations undertaken by the applicant using the DotEE's Offsets Assessment Guide and considers that higher or lower quality scores should be applied to the significant residual impacts for a number of the calculations. After applying these different scores, DWER considers that the acquisition of at least 242 hectares would be required (Table 10).

DWER has also reviewed the proposed monetary contributions and the proposed approach to purchasing native vegetation for conservation at each stage of the works. Whilst the method proposed by the applicant would provide larger contributions, it is considered impractical for DWER to purchase multiple smaller sized parcels of vegetation. It is considered that a more practical approach would be to purchase approximately three parcels of vegetation for conservation as follows:

- one parcel that contains at least 135 hectares of Carnaby's cockatoo foraging habitat;
- one parcel that contains at least 91 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC which by definition would also contain at least 91 hectares of Carnaby's cockatoo foraging habitat; and
- one parcel that contains at least 16 hectares of significant wetlands.

Based on this approach, it is considered that the monetary contributions should be based on land values of 20-100 hectare parcels of vegetation. This translates to a total contribution of $575,700 (Table 10) which reflects the cheaper cost per hectare of larger land parcels. This is also consistent with principle 3 of the *WA Environmental Offsets Policy, September 2011* which states that offsets will be cost-effective.

In relation to impacts to Beard vegetation association 1035, it is considered unlikely that a strict 'like for like' acquisition of the required 17 hectare offset size (Table 10) will be achievable. This is due to the minimal area of the association remaining (Table 8) and the low likelihood of the remaining parcels being suitable for inclusion in conservation estate. It is therefore considered that the acquisition of 17 hectares of other significant remnant vegetation in an area that has been extensively cleared would be acceptable in this case. Such vegetation is likely to be able to be acquired as part of any of the three proposed acquisitions totalling 242 hectares referenced above. Therefore no additional monetary contribution is considered required for impacts to Beard vegetation association 1035.

Given the above, it is considered that the acquisition for conservation of at least 242 hectares of native vegetation with similar environmental values to those of the vegetation being lost will adequately counterbalance the significant residual impacts of the proposed clearing consistent with the *WA Environmental Offsets Policy, September 2011*.

Table 10. Offset package assessment

Package	Area	Clearing size (ha)	Significant residual impacts proposed to be offset	Offset size proposed (ha)	Monetary contribution proposed	Offset size required (ha)	Monetary contribution required	Comment
1	10 & 12	10.6	10.6 hectares of Carnaby's cockatoo foraging habitat 0.3 hectares of significant wetlands	19 2	$62,700 $6,600	75 2	$146,250 $16,200	The $62,700 and $6,600 proposed are based on the average value obtained by the applicant of 20 hectare vegetated land parcels in the Shire of Dandaragan. The $146,250 and $16,200 required are based on the average values obtained by DWER of 100 hectare and 20 hectare vegetated land parcels in the Shire of Dandaragan, respectively.
2a	2 & 4	4	4 hectares of Carnaby's cockatoo foraging habitat 4 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	25	$240,500	25	$51,750	One offset proposed for both significant residual impacts as the TEC by nature is also Carnaby's cockatoo foraging habitat. The $240,500 proposed is based on the average value obtained by the applicant of 20 hectare vegetated land parcels in the Shire of Gingin. The $51,750 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Gingin.
2b	5 & 7	4.2	4.2 hectares of Carnaby's cockatoo foraging habitat 4.2 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC 1.6 hectares of Beard vegetation association 1035	8	$46,400	26	$50,700	One offset proposed for all three significant residual impacts as the TEC by nature is also Carnaby's cockatoo foraging habitat and both can also be significant remnant vegetation in an area that has been extensively cleared. The $46,400 proposed is based on the average value obtained by the applicant of 10 hectare vegetated land parcels in the Shire of Dandaragan. The $50,700 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Dandaragan. DWER has determined that only 8 of the required 26 hectares must contain significant remnant vegetation in an area that has been extensively cleared to counterbalance the significant residual impacts to Beard vegetation association 1035.
3	1	1.3	0.96 hectares of Carnaby's cockatoo foraging habitat	3	$50,730	3	$6,210	The $50,730 proposed is based on the average value obtained by the applicant of 10 hectare vegetated land parcels in the Shire of Gingin. The $6,210 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Gingin.
4a	3	2.7	2.7 hectares of Carnaby's cockatoo foraging habitat 2.7 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	22	$211,640	17	$35,190	One offset proposed for both significant residual impacts as the TEC by nature is also Carnaby's cockatoo foraging habitat. The $211,640 proposed is based on the average value obtained by the applicant of 20 hectare vegetated land parcels in the Shire of Gingin. The $35,190 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Gingin.

Package	Area	Clearing size (ha)	Significant residual impacts proposed to be offset	Offset size proposed (ha)	Monetary contribution proposed	Offset size required (ha)	Monetary contribution required	Comment
4b	6	2.1	2.1 hectares of Carnaby's cockatoo foraging habitat 2.1 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC 2.1 hectares of Beard vegetation association 1035	17	$56,100	11	$21,450	One offset proposed for all three significant residual impacts as the TEC by nature is also Carnaby's cockatoo foraging habitat and both can also be significant remnant vegetation in an area that has been extensively cleared. The $56,100 proposed is based on the average value obtained by the applicant of 20 hectare vegetated land parcels in the Shire of Dandaragan. The $21,450 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Dandaragan. DWER has determined that only 9 of the required 11 hectares must contain significant remnant vegetation in an area that has been extensively cleared to counterbalance the significant residual impacts to Beard vegetation association 1035. This is due to the higher IUCN statuses of Carnaby's cockatoo and the Banksia Woodlands of the Swan Coastal Plain TEC.
5	8 & 9	4.4	4.4 hectares of Carnaby's cockatoo foraging habitat 2.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC	35	$115,500	23	$44,850	One offset proposed for both significant residual impacts as the TEC by nature is also Carnaby's cockatoo foraging habitat. The $115,500 proposed is based on the average value obtained by the applicant of 20 hectare vegetated land parcels in the Shire of Dandaragan. The $44,850 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Dandaragan. DWER has determined that only 12 of the required 23 hectares must contain the Banksia Woodlands of the Swan Coastal Plain TEC.
6	13	6	5.03 hectares of Carnaby's cockatoo foraging habitat 2.5 hectares of significant wetlands	43 14	$73,530 $46,200	31 14	$60,450 $113,400	The $73,530 and $46,200 proposed are based on the average values obtained by the applicant of 50 hectare and 20 hectare vegetated land parcels in the Shire of Dandaragan, respectively.The $60,450 and $113,400 required are based on the average values obtained by DWER of 100 hectare and 20 hectare vegetated land parcels in the Shire of Dandaragan, respectively.
7	11	2.5	2.5 hectares of Carnaby's cockatoo foraging habitat	20	$66,000	15	$29,250	The $66,000 proposed is based on the average value obtained by the applicant of 20 hectare vegetated land parcels in the Shire of Dandaragan. The $29,250 required is based on the average value obtained by DWER of 100 hectare vegetated land parcels in the Shire of Dandaragan.
TOTAL		37.8	36.49 hectares of Carnaby's cockatoo foraging habitat 15.24 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC 3.7 hectares of Beard vegetation association 1035 2.8 hectares of significant wetlands	208	$975,900	242	$575,700	In summary, the 242 hectares required is for acquiring: • 226 hectares of Carnaby's cockatoo foraging habitat that also contains 91 hectares of the Banksia Woodlands of the Swan Coastal Plain TEC ($446,100); and • 16 hectares of significant wetlands ($129,600). 17 hectares of the total 242 hectares would also be required to be significant remnant vegetation in an area that has been extensively cleared.

Part 4: References

12. References

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GIS Databases:

- Species and Communities Bio Datasets
- DBCA Managed Land
- Geomorphic Wetlands of the Swan Coastal Plain
- Pre-European Vegetation
- Native Vegetation Current Extent
- IBRA Bioregions
- Hydrography
- Catchments
- Topographic Contours
- Landgate WA Now Aerial Imagery