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Lot 15 Barfield Road, Hammond Park

Native Vegetation Clearing Permit
supporting documentation

FINAL

Prepared for
Richard Noble
by Strategen

April 2019

Lot 15 Barfield Road, Hammond Park

**Native Vegetation Clearing Permit
supporting documentation**

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April 2019

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Client: Richard Noble

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1. Introduction

Gold Estates Holdings Pty Ltd are proposing to develop Lot 15 Barfield Road, Hammond Park (proposed clearing area). The proposed clearing area is located approximately 28 km from the Perth Central Business District, within the City of Cockburn (Figure 1).

The proposed clearing will enable a consolidation of their bulk earthworks strategy to facilitate residential development consistent with the local planning framework. This will necessitate the clearing of a small area of native vegetation (0.96 ha) within the proposed clearing area (Figure 1). Clearing of this vegetation will require a Native Vegetation Clearing Permit (NVCP) to facilitate lawful clearing of native vegetation. The area permit application form (form C1) is provided in Appendix 1.

This supporting document has been prepared to support the granting of a NVCP under s 51 E of the *Environmental Protection Act 1986* (EP Act). The supporting document includes the following information:

- an overview of the existing environmental conditions of the site
- an evaluation of potential impacts of the vegetation clearing
- an evaluation of compliance of the proposed clearing against the ten clearing principles listed under Schedule 5 of the EP Act
- environmental approvals and management requirements.

The information provided within this supporting document is based on surveys conducted in the proposed clearing area as documented in:

- *Lot 15 Barfield Road, Hammond Park Flora and Vegetation Survey* (PVG Environmental 2018, see Appendix 2)
- *Level 1 Fauna Risk Assessment and Black Cockatoo Habitat Assessment for Lot 15 Barfield Road, Hammond Park* (Terrestrial Ecosystems 2016, see appendix 3)

An Ecologist from Strategen attended the site in March 2019 to confirm the environmental values previously identified in the surveys (Strategen survey).

1.1 Location, ownership and tenure

The proposed clearing area is located at Lot 15 Barfield Road, Hammond Park. Site identification details for the proposed clearing area are provided in Table 1.

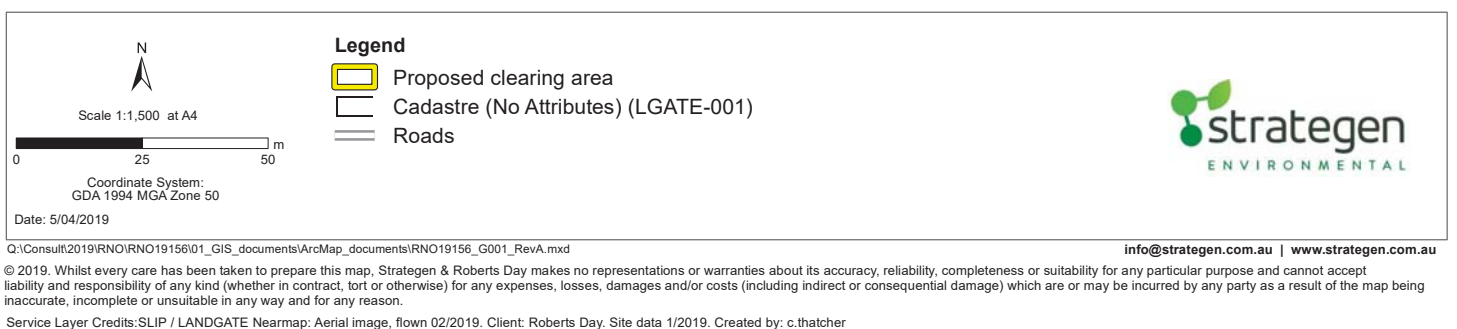
The current zoning under the current Local Planning Scheme, Development, reflects the degraded nature of the proposed clearing area with historic partial clearing evident. As such, a large proportion of the site is cleared.

Table 1: Site identification details

Subject	Detail
Lot address	Lot 15 on Deposited Plan 30747
Street address	171 Barfield Rd, Hammond Park 6164
Current site owner	Gold Estates Holdings Pty Ltd
Local Government Authority	City of Cockburn
Current MRS zoning	Urban



Figure 1: Proposed clearing area



2. Overview of existing environment

2.1 Topography

The proposed clearing area slopes gently from a high around 35 m Australian Height Datum (AHD) in the south-east corner down to 28m AHD in the flatter north-west part (WALGA 2018).

2.2 Landform and Geology

The proposed clearing area is located within the Swan Coastal Plain bioregion (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell *et al.* 2002). The Swan Coastal Plain comprises five major geomorphologic systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson *et al.* 1994). Each major system is composed of further subdivisions in the form of detailed geomorphologic units (Churchward & McArthur 1980; Semeniuk 1990; Gibson *et al.* 1994). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils. The proposed clearing area is situated within the Bassendean Dunes formation.

2.3 Soils

Regional geological mapping identified one geological unit within the proposed clearing area; namely, Bassendean Sand (Qdcb) which is characterised by 'basal conglomerate overlain by dune quartz sand with heavy mineral concentrations' (Geoscience Australia 2008).

2.4 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring, iron-sulphide rich soils, sediments or organic substrates, formed under waterlogged conditions. If exposed to air, these sulphides can oxidise and release sulphuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

A search of the Swan Coastal Plain ASS risk mapping (WALGA 2017) indicates that there is a 'moderate to low' potential of soil within the proposed clearing area containing ASS.

2.5 Hydrology

2.5.1 Surface water

No surface water features have been identified within the proposed clearing area. The flora and vegetation survey undertaken by PVG Environmental confirmed the absence of wetlands in the proposed clearing area.

The Geomorphic Wetlands, Swan Coastal Plain mapping (DBCA 2015) identifies one Conservation Category Wetland (CCW) within 1 km of the proposed clearing area; namely UFI14104, approximately 1 km to the northwest of the proposed clearing area.

2.5.2 Groundwater

Groundwater contours within the proposed clearing area indicate that depth to groundwater across the proposed clearing area is estimated at 5 – 12 m below ground level (WALGA 2018).

2.6 Vegetation and flora

PGV undertook a flora and vegetation assessment of the proposed clearing area in September 2014. Subsequent to this assessment, an Ecologist from Strategen Environmental undertook a site visit in March 2019 to confirm the flora and vegetation values outlined by PGV Environmental (Strategen survey). The results of the assessments are detailed under the following sub-sections and a copy of the report is provided in Appendix 2.

2.6.1 Regional vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1: 1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981); System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia) for Western Australia (DEE 2019a).

The proposed clearing area is situated within vegetation association Bassendean 1001 – Medium very sparse woodland; jarrah, with low woodland; *Banksia* & *Casuarina* (Beard 1990).

Based on regional vegetation complex mapping (Heddle et al. 1980) the proposed clearing area contains the Bassendean Central and South vegetation complex, described as ranging from woodland of *Eucalyptus marginata* - *Allocasuarina fraseriana* - *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites, and includes the transition of *Eucalyptus marginata* to *Eucalyptus tottiana* near Perth.

Vegetation statistics for the above vegetation system association and complex are displayed in Table 2. The proposed clearing area contains 0.28 ha of remnant vegetation in Good condition and 0.12 ha of vegetation in Degraded condition which is potentially representative of Pre-European vegetation associations and complexes.

Table 2: Pre-European and current extent vegetation system association and complexes
(Government of Western Australia 2017; 2016)

Vegetation system association/ complex	Pre-European extent (ha)	Current extent (ha)	% remaining	% Current Extent Protected for Conservation
1001	57 410	12 704	22.13	2.8
Bassendean Central and South	87 476	23 533	26.9	1.86

2.6.2 Native flora

A total of 43 native vascular plant taxa from 23 plant families were recorded within the proposed clearing area. The majority of taxa were recorded within the Fabaceae and Asparagaceae families (see Appendix 2).

2.6.3 Threatened and Priority flora

The desktop assessment conducted by PGV Environmental (2014) (Appendix 2) identified four Threatened flora and 11 Priority flora species that have been recorded in the regional area. NatureMap (Parks and Wildlife 2019) and EPBC Protected Matters Tool (PMST) (DEE 2019b) searches were also undertaken in April 2019 by Strategen to inform other possible Threatened or Priority flora species occurring in the proposed clearing area. These searches identified a further three Threatened flora and three Priority flora species that have subsequently been recorded in the regional area.

One species, *Eremaea asterocarpa* subsp. *brachyclada* was identified by PGV Environmental (2014) as possibly occurring, however this species is no longer listed as a conservation significant species (Western Australian Herbarium 1998-).

Table 3 presents the combined results of the Threatened and Priority flora potentially occurring within the proposed clearing area, based on the desktop assessment.

Based on site observations, it was determined that preferred or potential habitat for the following Threatened and Priority flora taxa is potentially present:

- *Caladenia huegelii* (T, Endangered)
- *Dodonaea hackettiana* (P4)
- *Thysanotus glaucus* (P4).

As the flora survey was undertaken in September, the timing of the survey was within the usual flowering period for these *Caladenia huegelii* and *Dodonaea hackettiana*.

While outside the usual flowering period for *Thysanotus glaucus*, this species would be identifiable throughout the year, even without reproductive characteristics (flowers or fruit) present, and none were recorded within the proposed clearing area during the survey.

Preferred habitat for *C. huegelii* is mixed woodland of *Eucalyptus marginata*, *Banksia attenuata* and other *Banksia* species with scattered *Allocasuarina fraseriana* and *Corymbia calophylla* over a dense understorey, which was not present within the proposed clearing area. Remnant vegetation types, containing potential habitat in the proposed clearing area, are likely to be too degraded for this species to be present given the species tends to favour vegetation with dense undergrowth (DEC 2009).

No flora species listed as Threatened under the *Biodiversity and Conservation Act 2016* (BC Act) or Priority Flora species as listed by the DBCA were recorded during the field survey.

Table 3: Threatened and Priority flora potentially occurring within the proposed clearing area

Species	Conservation status		Description	Potential to occur
	BC Act / DBCA listing	EPBC Act		
<i>Andersonia gracilis</i>	T	Endangered	Slender erect or open straggly shrub, 0.1 to 0.5 m high. Flowers are white, pink or purple. Flowers from September to November. Occurs on white/grey sand, sandy clay, gravelly loam on winter-wet areas, near swamps (Western Australian Herbarium 1998-).	Unlikely due to the absence of preferred habitat.
<i>Caladenia huegelii</i>	T	Endangered	A slender orchid 30 to 50 cm tall. One or two striking flowers characterised by a greenish-cream lower petal with a maroon tip. Other petals are cream with red or pink suffusions. Habitat for this species occurs within well-drained, deep sandy soils in low mixed Banksia, Allocasuarina and Jarrah woodlands (Western Australian Herbarium 1998-, DEE 2018b).	Possible due to the presence of potential habitat.
<i>Diuris micrantha</i>	T	Vulnerable	A slender orchid to 60 cm tall. Flowers are yellow with reddish-brown markings and visible from September to October. Habitat for this species occurs within clay-loam substrates in winter-wet depressions or swamps (DEE 2018b).	Unlikely due to absence of preferred habitat.
<i>Diuris purdiei</i>	T	Endangered	A slender orchid to 0.35 m tall. Flowers are yellow and visible from September to October. Habitat for this species is grey-black sand substrates in winter-wet swamps which have high moisture (Western Australian Herbarium 1998-). <i>Diuris purdiei</i> occurs from Perth south to near the Whicher Range, within the Swan (Western Australia) Natural Resource Management Region. It grows on sand to sandy clay soils, in areas subject to winter inundation, and amongst native sedges and dense heath with scattered emergent <i>Melaleuca preissiana</i> , <i>Corymbia calophylla</i> , <i>E. marginata</i> and <i>Nuytsia floribunda</i> (DEE 2018b).	Unlikely due to absence of preferred habitat.
<i>Drakaea elastica</i>	T	Endangered	A slender orchid to 30 cm tall with a prostrate, round to heart shaped leaf. Singular, bright green, glossy flower. Habitat for this species is within bare patches of white sand over dark sandy loams on damp areas mostly in <i>Kunzea glabrescens</i> thickets (DotE 2015d).	Unlikely due to absence of preferred habitat.

Species	Conservation status		Description	Potential to occur
	BC Act / DBCA listing	EPBC Act		
<i>Eleocharis keigheryi</i>	T	Vulnerable	A rhizomatous, clumped perennial grass-like herb to 40 cm tall. Flowers are green and visible from August to November. Habitat for this species occurs in clay or sandy loam in freshwater creeks and claypans (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat.
<i>Lepidosperma rostratum</i>	T	Endangered	A rhizomatous, tufted perennial, grass-like or herb (sedge), 50 cm tall. Flowers are brown and flowering occurs from May to June. Habitat for this species occurs in peaty sand or clay and within seasonally wet swamps (Western Australian Herbarium 1998-, DoE 2015d).	Unlikely due to absence of preferred habitat.
<i>Poranthera moorokatta</i>	P2	-	Monococious, erect annual. Flowering and fruit recorded for later September to early November. Known only from two populations at Kings Park and Ellenbrook in Banksia woodland, damp land (Barret 2012)	Unlikely due to absence of preferred habitat.
<i>Cyathochaeta teretifolia</i>	P3	-	Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high to 1 m wide. Flowers are brown. Habitat for this species includes grey sand, sandy clay, preferring swamps and creek edges (Western Australian Herbarium 1998-).	Unlikely due to the absence of preferred habitat.
<i>Eryngium pinnatifidum</i> subsp. <i>palustre</i>	P3	-	An erect perennial, herb, 0.15 to 0.5 m high. Flowers are white and blue, flowering from October to November. Habitat for this species includes clay, sandy clay soils. It occurs on claypans, seasonally wet flats (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat
<i>Jacksonia gracillima</i>	P3	-	A decumbent shrub, to 0.20 m high and 0.50 m wide. Flowers are orange, yellow. Occurs on winter-wet flats (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat
<i>Pimelea calcicola</i>	P3	-	Erect to spreading shrub, 0.2 to 1 m high. Flowers are pink, flowering from September to November. Preferred habitat includes coastal limestone ridges on sand (Western Australian Herbarium 1998-).	Unlikely due to absence of preferred habitat
<i>Pithocarpa corymbulosa</i>	P3	-	Erect to scrambling perennial herb, 0.5 to 1 m high. Flowers are white, flowering from January to April. Occurs on gravelly or sandy loam, amongst granite outcrops.	Unlikely due to absence of suitable habitat

Species	Conservation status		Description	Potential to occur
	BC Act / DBCA listing	EPBC Act		
<i>Stylidium paludicola</i>	P3	-	Reed-like perennial, herb 0.35 m to 1 m high. Leaves are tufted, linear or subulate or narrowly oblanceolate. Flowers are pink, flowering from October to December. Peaty sand over clay, winter wet habitat. Marri and Melaleuca woodland, Melaleuca shrubland (Western Australian Herbarium 1998-).	Unlikely due to absence of suitable habitat
<i>Dodonaea hackettiana</i>	P4	-	An erect shrub or tree, 100 to 500 cm tall. Flowers are yellow to green/red and occur mainly from July to October. Habitat for this species occurs in sand and outcropping limestone (Western Australian Herbarium 1998-).	Possible due to presence of potential habitat.
<i>Kennedia beckxiana</i>	P4	-	Prostrate or twining shrub or climber. Flowers are red, flowering from September to December. Occurs on sand, loam on granite hills and outcrops (Western Australian Herbarium 1998-).	Unlikely due to absence of suitable habitat
<i>Ornduffia submersa</i>	P4	-	Aquatic species, occurring in wetland areas (Western Australian Herbarium 1998-).	Unlikely due to absence of suitable habitat
<i>Thysanotus glaucus</i>	P4	-	Caespitose, glaucous perennial, herb, 0.1 to 0.2 m high, flowers are purple, flowering from October to December or January to March. Occurs on white, grey or yellow sand, sandy, sandy gravel (Western Australian Herbarium 1998-).	Possible due to presence of potential habitat.
<i>Tripterococcus</i> sp. <i>Brachylobus</i> (A.S George 14234)	P4	-	Grey, black or peaty sand. Winter-wet flats.	Unlikely due to absence of suitable habitat.
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	-	An erect shrub, 0.2 m to 0.75 m high. Flowers are pink, flowering in May or November to December or January. Occurs in winter-wet depressions on sand, sandy clay (Western Australian Herbarium 1998-).	Unlikely due to absence of suitable habitat.

2.6.4 Vegetation types

Three vegetation types were recorded within the proposed clearing area (Table 4; Figure 2). The dominant native vegetation type was 'EmBaBm' which can be described as *Eucalyptus marginata*, *Banksia attenuata* and *Banksia menziesii* low woodland over weeds. This vegetation type completely lacks native understorey.

Table 4: Vegetation type within proposed clearing area

Vegetation type	Description	Area (ha)	Percentage of proposed clearing area
BaBm	<i>Banksia attenuata</i> , <i>B. menziesii</i> Low Open Woodland over <i>Xanthorrhoea preissii</i> Open Shrubland.	0.28	15%
Xp	<i>Xanthorrhoea preissii</i> Open Shrubland	0.12	6%
EmBaBm	<i>Eucalyptus marginata</i> , <i>B. attenuata</i> , <i>B. menziesii</i> Low Woodland over weeds	0.46	25%
CL	Cleared areas including tracks / firebreaks	0.99	54%
Total			

2.6.5 Vegetation condition

Vegetation condition was rated using the scale of Keighery (1994) for the South West Botanical Province (Table 5). The proposed clearing area has been subject to historical disturbance including clearing. As such, the majority of the site is in Completely Degraded condition (1.38 ha; 74%). The remainder of the vegetation was rated as Degraded to Good (Table 6, Figure 3).

Table 5: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Table 6: Vegetation condition within proposed clearing area

Condition	Area (ha)	Percentage of proposed clearing area
Good	0.28	15%
Degraded	0.12	6%
Completely Degraded	1.47	79%
Total	1.87	100

2.6.6 Threatened and Priority Ecological Communities

Banksia woodland TEC

FCT analysis conducted by PVG Environmental (2014) identified that the small area of Banksia woodland (BmBa) in the north-east corner of the proposed clearing area is representative of the FCT 21a – Central *Banksia attenuata* - *Eucalyptus marginata* woodlands, which forms part of the *Banksia Woodlands of the Swan Coastal Plain* federally listed Threatened Ecological Community (Banksia Woodland TEC). This FCT is also a state listed (P3) Priority Ecological Community (PEC).

The EPBC PMST search identified the Banksia woodland TEC as potentially occurring in the proposed clearing area.

Vegetation within BmBa (0.28 ha) has retained Banksia woodland structure, but with limited native understorey (PGV Environmental 2014), which was confirmed by the Strategen survey. TSSC (2016) states that to be considered a part of the Banksia Woodlands TEC, a patch should be in at least 'Good' condition, 2 ha in size or above. As such, on its own, this patch would not meet the requirements due to its small size and condition. However, as this VT forms part of a broader area of Banksia woodland vegetation (within the private lots to the north), this small area of vegetation should be considered to form part of the Banksia woodland TEC, listed as Endangered under the EPBC Act.

Vegetation within EmBaBm is completely lacking native understory vegetation and is in 'Completely Degraded' condition. TSSC (2016) states that to be considered a part of the Banksia Woodlands TEC, the structure of the patch should include a highly species rich understorey. As such, EmBaBm has not been considered to form part of the Banksia woodland TEC.

No other PECs or TECs were considered to be represented by the vegetation within the proposed clearing area.

An assessment of BmBa against the diagnostic criteria provided in the approved conservation advice for the Banksia woodland TEC is shown in Table 7.

Table 7: Characteristics of the Banksia woodland within the proposed clearing area compared to the key diagnostic criteria as per TSSC (2016)

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

Key diagnostic criteria (TSSC 2016)	Banksia woodlands within the proposed clearing area
<u>Composition:</u> Contains at least one of the following species: <ul style="list-style-type: none"> • <i>Banksia attenuata</i> • <i>Banksia menziesii</i> • <i>Banksia prionotes</i> • <i>Banksia ilicifolia</i>. 	Yes. Banksia woodlands within BmBa contain <i>Banksia attenuata</i> and <i>B. menziesii</i> .
<u>Condition (Keighery 1994):</u> 'Pristine': no minimum patch size 'Excellent': 0.5 ha 'Very Good': 1 ha 'Good': 2 ha.	Banksia woodlands in BmBa covering 0.28 ha within the proposed clearing area in Good condition does not meet the patch size and condition criteria. However, the patch is contiguous with a broader patch of Banksia woodland directly to the north and east of the proposed clearing area, which would bring the overall patch size to >2 ha.

2.7 Terrestrial fauna

Terrestrial Ecology (2016) undertook a Level 1 fauna assessment of the proposed clearing area consisting of a desktop investigation and a 'targeted' reconnaissance field survey for conservation significant fauna and fauna habitat. The results of the assessment are detailed under the following sub-sections and a copy of the reports is provided in Appendix 3.

Subsequent to this assessment, an Ecologist from Strategen Environmental undertook a site visit in March 2019 to confirm the fauna values outlined by PGV Environmental (Strategen survey).

A Fauna Management and Relocation Plan was also prepared in consultation with the City of Cockburn and Department of Biodiversity Conservation and Attractions (DBCA) by Endplan Environmental (2016) (Appendix 4). The purpose of the plan was to identify the potential direct and indirect impacts of the proposed clearing of the site on vertebrate fauna.

2.7.1 Desktop assessment

Database searches of *NatureMap* and the DEE Protected Matters Database were undertaken as part of the fauna habitat survey undertaken by Terrestrial Ecosystems (2016) with a 10 km buffer of the proposed clearing area. These databases were used in conjunction with the vegetation and consequently the habitat present to determine the likelihood of any Threatened or Priority fauna species occurring in the proposed clearing area and in the nearby surrounds (where habitat is similar) (Appendix 3).

Fauna habitat present in the proposed clearing area has been mapped by Terrestrial Ecosystems (2016) as being either highly degraded or disturbed and therefore of very low value for fauna, particularly for conservation significant species.

It is important to note that the databases returned fauna species that are unlikely to occur in the proposed clearing area or nearby because of the following:

- specific habitat is not present within the proposed clearing area such as the ocean for marine mammals, or coastal shore habitat for shorebirds and wading birds or wetlands for waterbirds
- some species have a limited or patchy distribution
- species that have become locally extinct, or
- species that have been erroneously identified in previous surveys.

The database searches were examined and species were excluded if they met the above criteria, because they are then not expected to occur in the proposed clearing area.

Below provides a summary of species excluded from the conservation significant fauna records.

Waterbirds

Several shorebirds and wetland bird species were returned in the database searches. Wetland birds such as Egrets and wading birds including Plovers, Stints and Sandpipers inhabit estuaries, mudflats, saltmarshes, sandflats and beaches, where they feed on invertebrates such as worms, molluscs, insects and crustaceans (Garnett *et al.* 2011). There is no wetland in the proposed clearing area and therefore no habitat for these species. The wading birds returned from the database searches are excluded from any further discussion in this report.

Several coastal birds were returned from the database searches. Coastal birds such as White-bellied Sea-eagle and Osprey require coasts and near-coastal wetland habitat, where they feed mainly on fish, sea snakes and nesting seabirds (Johnstone & Storr 1998). There is no such habitat present in the proposed clearing area. As such, these species have also been excluded from any further discussion in this report.

Now Regionally Extinct

Several species returned in the database searches are also known to be historical records of species now regionally/locally extinct, for example the Malleefowl, Numbat and Western Ringtail Possum. These species have been excluded from any further discussion in this report.

Database Errors and Anomalies

Occasionally species appear in only the EPBC database searches, for example the Grey Wagtail and the Fork-tailed Swift. This database also considers broader information, for example bioclimatic distribution models, so can be less accurate at the local level. These species have also been omitted from any further discussion.

In addition, many fauna species are not distributed evenly across the landscape, are more abundant in some places than others are, and consequently more detectable (Currie 2007). Furthermore, some small, common ground-dwelling reptile and mammal species tend to be habitat specific, and many bird species can occur as regular migrants, occasional visitors or vagrants.

Conservation significant fauna

The likelihood of conservation significant species occurring in the proposed clearing area is outlined below in Table 9 and is based on the following criteria:

- Recorded: Recorded during the field survey or site reconnaissance
- Likely: Suitable habitat is present in the proposed clearing area and the proposed clearing area is in the species' known distribution
- Possible: Limited or no suitable habitat is present in proposed clearing area, but is nearby. The species has good dispersal abilities and is known from the general area
- Unlikely: No suitable habitat is present in proposed clearing area but is nearby, the species has poor dispersal abilities but is known from the general area or suitable habitat is present, however, the proposed clearing area is outside of the species' known distribution.

A total of eight conservation significant species (including Priority species) identified by the database searches have been considered here, with that being based on database records and suitable habitat in the proposed clearing area. These eight species are comprised of three reptile species, four birds and one mammal species.

Table 8: Threatened and priority fauna potentially occurring within the proposed clearing area

Species	Conservation status		Relevant Ecology	Likelihood of Occurrence
	BC Act / DBCA listing	EPBC Act		
<i>Calyptrorhynchus banksii naso</i> (Forest Red-tailed Black-Cockatoo [FRTBC])	T	Vulnerable	This species is relatively common in the Perth metropolitan area. The FRTBC feeds primarily on Marri and Jarrah fruit, but also Tuart and to a lesser extent on Blackbutt (<i>Eucalyptus patens</i>), Albany Blackbutt (<i>E. staeri</i>), Karri (<i>Eucalyptus diversicolor</i>), Sheoak (<i>Allocasuarina fraseriana</i>) and Shottygobble (<i>Persoonia longifolia</i>) (Johnstone et al. 2013). The FRTBC can obtain energy faster when feeding on Marri and Jarrah than other food sources (Cooper et al. 2002), and these two-plant species make up most of their diet (Johnstone et al. 2013). The proposed clearing area has none of the FRTBC foraging species present.	Likely
<i>Calyptrorhynchus baudinii</i> (Baudin's Black Cockatoo)	T	Endangered	This species occurs in the humid and sub-humid forests of Western Australia. Its range extends from Giddegannup and Clackline in the north to about 50 km east of Albany and all the forest to the south-west coast (Chapman 2007).	Possible
<i>Calyptrorhynchus latirostris</i> (Carnaby's Cockatoo)	T	Endangered	This species as with the FTRBC is relatively common in the Perth metropolitan area. Carnaby's Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include a variety of Banksia species, for example the Slender Banksia (<i>Banksia attenuata</i>) and Firewood Banksia (<i>Banksia menziesii</i>), Eucalyptus species, such as Marri, Jarrah, Blackbutt, Coastal Blackbutt, Salmon Gum (<i>Eucalyptus salmophloia</i>), as well as Pine trees (<i>Pinus sp.</i>), Grevillea, Allocasuarina, and Hakea species (Shah 2006, Johnstone et al. 2011). The seeds from a variety of Banksia species and the cones of Pine trees provide the highest energetic yield (Cooper et al. 2002). The proposed clearing area has food items such as the Slender Banksia, Firewood Banksia and Coastal Blackbutt that Carnaby's Cockatoo is known to eat.	Likely
<i>Merops ornatus</i> (Rainbow Bee-eater)	T	Marine	The Rainbow Bee-eater is often seen in the Perth metropolitan area. This species is one of the most common and widespread birds in Australia with a distribution that covers the majority of Australia (Barrett et al. 2003). The Rainbow Bee-eater is also a common and widespread species in WA, except the drier interior of the State and the far south-west. It occurs in lightly wooded, often sandy country, preferring areas near water. It feeds on airborne insects and nests throughout its range in WA in burrows excavated in sandy ground or banks, often at the margins of roads and tracks (Johnstone & Storr 1998). In WA, this bird can occur as a 'resident, breeding visitor, postnuptial nomad, passage migrant and winter visitor' (Johnstone & Storr 1998).	Possible

Species	Conservation status		Relevant Ecology	Likelihood of Occurrence
	BC Act / DBCA listing	EPBC Act		
<i>Ctenotus gemmula</i> (Jewelled South-west Ctenotus)	P3		There are three geographic populations for this species. One is on the sand plain north of Perth, one is on the sand plain around the greater metropolitan area and the largest geographic distribution is along the south coast of Western Australia. Its habitat includes white sand plains, mainly in semi-arid and sub-humid zones (Storr et al. 1999)	Possible
<i>Neelaps calonotos</i> (Black-striped Snake)	P3		This species occurs on dunes and sand-plains vegetated with heaths and Eucalypt/Banksia woodlands. It feeds largely on skinks and its distribution is restricted by urban development. In its natural state, the proposed clearing area would have been typical habitat for the Black-striped snake, but not since the proposed clearing area has been historically cleared.	Possible
<i>Lerista lineata</i> (Lined Skink)	P3		This species is restricted to the south of the Swan River, where it inhabits sandy coastal heath and shrubland, this includes Banksia / Eucalypt woodlands (Wilson and Swan 2017). The proposed clearing area does have habitat that would be considered suitable for this species i.e. Banksia Woodland, however, the site has previously been cleared. The species is also likely to have poor dispersal ability.	Possible
<i>Isododon obesulus fusciventer</i> (Quenda, Southwestern Brown Bandicoot)	P4		This species occurs from Guilderton southwards on the SCP, including the Perth Metropolitan area, in Jarrah and Karri forests and adjacent coastal vegetation complexes. The species inhabits scrubby, often swampy, vegetation with dense cover up to about 1 m high. It feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. The Southern Brown Bandicoot is patchily distributed in suitable habitat, with populations inhabiting Jarrah and Wandoo forests usually associated with watercourses. On the Swan Coastal Plain it is often associated with wetlands with dense vegetation where they feed on fruit, seeds, insects and fungi (Woinarski et al. 2012). The proposed clearing area has some limited suitable habitat in the form of relatively dense vegetation cover in the understorey.	Possible

2.7.2 Black Cockatoo habitat

Foraging habitat

There is limited suitable habitat for Black Cockatoo species (Carnaby's Cockatoo, FRTBC and Baudin's Black Cockatoo) that have known distributions that include the proposed clearing area (Appendix 6).

There are species present in the proposed clearing area that are known to be dietary items for Carnaby's Cockatoo, such as the Slender Banksia, Firewood Banksia and Jarrah (Shah 2006, Johnstone et al. 2011). However, these species are found relatively sparsely throughout the proposed clearing area in BmBa (0.28 ha) and EmBaBm (0.46 ha) (Figure 4).

The FRTBC feeds primarily on Marri and Jarrah fruit, but also Tuart and to a lesser extent on Blackbutt, Albany Blackbutt, Karri, Sheoak and Snottygobble (Johnstone et al. 2013). The proposed clearing area has a small patch of vegetation containing sparse Jarrah, therefore there is very limited foraging habitat for the FRTBC.

Johnstone and Kirkby (2008) reported Baudin's Black Cockatoo feeding primarily on the seeds of Marri, Jarrah and mixed *Banksia* spp. (including *B. grandis*, *B. littoralis* and *B. ilicifolia*). The Baudin's Black Cockatoo may infrequently be seen foraging in the vicinity of the proposed clearing area, but it is mostly seen on the Swan Coastal Plain, closer to the Darling Scarp.

Breeding habitat

There are no tree species in the proposed clearing area that are known to be used by Carnaby's Cockatoo or FRTBC for nesting. A total of seven Jarrah trees with a diameter at breast height (DBH) of ≥ 500 mm, to be considered potential breeding trees (DSEWPac 2012) were identified within and directly adjacent to the potential clearing area (Figure 4). Only two of these trees occur within the proposed clearing area, the remaining five are located within the road reserve along Barfield Road. These five trees will be retained and will not be impacted by the proposed clearing.

None of the potential breeding trees identified had suitable hollows to be used for breeding by Black Cockatoos.

Given the limited extent of Carnaby's Cockatoo foraging habitat and the limited potential breeding habitat in the proposed clearing area, the site is considered to contain low quality habitat for Carnaby's Cockatoo.

3. Assessment against the ten clearing principles

An assessment of the proposed clearing against the ten clearing principles is provided in Table 9. The ten clearing principles are outlined in Schedule 5 of the EP Act and assessment is in accordance with Department of Water and Environmental Regulation guidelines (DER 2014).

This assessment demonstrates that the proposed removal of 0.86 ha of native vegetation is not at variance with the any of the clearing principles.

Table 9: Assessment of native vegetation clearing in accordance with the ten clearing principles

Clearing principle	Assessment	Outcome
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	<p>A total of 43 native vascular plant taxa from 23 plant families were recorded within the proposed clearing area (PGV Environmental 2014). The relatively low number of taxa recorded was attributed to the small size and the degraded nature of the proposed clearing area.</p> <p>No flora species listed as Threatened under the BC Act or Priority Flora species as listed by the DBCA were recorded during the field survey. However, the surveyed identified the potential for <i>Caladenia huegelii</i> (T) and, <i>Dodonaea hackettiana</i> (P3) and <i>Thysanotus glaucus</i> (P4) based on preferred habitat and survey timing.</p> <p>Most of the vegetation within the proposed clearing area is not considered representative of any PECs or TECs. BmBa appeared to be a remnant of the Banksia woodlands of the Swan Coastal Plain TEC. Minimal native understorey was present within this vegetation type.</p> <p>The Pre-European vegetation system association and complexes within which the proposed clearing area is mapped, each have above 20% remaining which is above the 10% threshold for 'constrained areas'.</p> <p>Given the information above, vegetation within the proposed clearing area is not considered to comprises a high level of biological diversity and as such clearing is not expected to be at variance to this principle.</p>	Not at variance.
b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	<p>The proposed clearing area is not considered to represent or be necessary for the maintenance of significant habitat critical for fauna species. Two potential breeding trees for Black Cockatoos were recorded within the proposed clearing area, none of these trees contained any potential breeding hollows. Five potential breeding trees will be retained along the road reserve adjacent to the proposed clearing area.</p> <p>Foraging habitat quality in the proposed clearing area was rated as very poor.</p> <p>Additionally, vegetation retained within the road reserve adjacent to the proposed clearing area along Barfield Road will maintain habitat connectivity between areas of vegetation to the north and south.</p> <p>Therefore, clearing of 0.86 ha of vegetation is unlikely to be at variance to this principle.</p>	Not at variance.
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	<p>No Threatened or Priority flora species were recorded in the proposed clearing area during the flora and vegetation assessment (PGV Environmental 2014).</p> <p>The field survey was undertaken within the usual flowering period of <i>Caladenia huegelii</i> (T; flowers September to October) and <i>Dodonaea hackettiana</i> (P4; flowers July to October). During the field survey, no <i>Dodonaea</i> species were observed, and vegetation within the proposed clearing area was considered to be too degraded to constitute suitable habitat for <i>C. huegelii</i>.</p> <p>While the survey was undertaken outside the usual flowering period for <i>Thysanotus glaucus</i> (P4; flowers October to December or January to March), this species would still be identifiable throughout the year and therefore at the time of the survey.</p> <p>Given that the clearing area is small and unlikely to provide favourable habitat for Threatened or Priority flora, and that no Threatened or Priority flora were recorded during the field survey or have previously been recorded in the proposed clearing area, the proposed clearing is unlikely to be at variance with this principal.</p>	Not at variance.

Clearing principle	Assessment	Outcome
d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	<p>While vegetation in BmBa is aligned with the Banksia woodlands of the Swan Coastal Plain TEC listed under the EPBC Act, this vegetation type has been heavily disturbed by historical clearing and weeds. Banksia woodland vegetation currently exists directly north of the proposed clearing area.</p> <p>For the above reasons, clearing of this area of vegetation would have limited impact on the maintenance of the overall TEC.</p> <p>As a result, the proposed clearing will not be at variance with this principle.</p>	Not at variance.
e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	<p>A total 0.86 ha of remnant vegetation will be cleared to facilitate the consolidation of their bulk earthworks. This vegetation is not considered to be a significant remnant.</p> <p>The Pre-European vegetation system association and complexes within which the proposed clearing area is mapped, each have above 20% remaining which is above the above the 10% threshold for 'constrained areas'.</p> <p>The proposed clearing is not expected to result in a significant impact at the local or regional scale due to the small scale of clearing, with larger areas of vegetation protected in the broader region, including three nature reserves / Bush Forever sites within a 2 km radius (Thomsons Lake Reserve, Harry Waring Nature Reserve, and Banksia Eucalypt Woodland Park).</p> <p>Furthermore, the proposed clearing area encompasses previously disturbed areas, further reducing impacts on intact native vegetation.</p> <p>Given the above, the proposed clearing is not expected to be at variance to this principle.</p>	Not at variance.
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	<p>The proposed clearing will not occur within or immediately adjacent to a watercourse or wetland. The closest wetland is located approximately 1 km to the northwest of the proposed clearing area.</p> <p>Therefore, the proposed clearing is not considered at variance to this principle.</p>	Not at variance.
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>The proposed clearing will be limited to a small area of vegetation (0.95 ha) in a broader area of existing urban development.</p> <p>In consideration of the above, the clearing is not likely to cause appreciable land degradation due to:</p> <ul style="list-style-type: none"> the small area of total proposed clearing the large extent of vegetation that would remain within the local and regional areas general construction environmental management measures being implemented. <p>For the above reasons, the proposed clearing is unlikely to be at variance with this principle.</p>	Not at variance.
h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	<p>The proposed clearing area occurs across a very small component of vegetation in the local area, does not occur within a conservation area and is isolated from any conservation areas. The nearest conservation areas are Thomsons Lake Nature Reserve (Bush Forever site 391), Harry Waring Marsupial Reserve (Bush Forever site 392) to the west, both of which are separated from the proposed clearing area by urban residential areas, and Banksia Eucalypt Woodland Park (Bush Forever site 492) to the east, which is separated from the proposed clearing area by residential areas and the Kwinana Freeway.</p> <p>Given the above information, the proposed clearing of vegetation within the proposed clearing area is unlikely to impact on the environmental values of any of these nearby conservation areas or be at variance to this principle.</p>	Not at variance.

Clearing principle	Assessment	Outcome
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	<p>No surface water features have been identified within the proposed clearing area, and stormwater readily filtrates through the porous, sandy soils of the Bassendean Sands.</p> <p>Earthworks within the proposed clearing area will not intersect with the water table and, as such, no disruption to the hydrological regime are expected within the proposed clearing area or in adjacent vegetation.</p> <p>Additionally, the vegetation proposed to be cleared is minimal (0.86 ha of vegetation). As such, the proposed clearing is not expected to affect surface water or groundwater quality given the remaining areas of intact native vegetation in the local area.</p> <p>Given the above information, the proposed clearing is not expected to be at variance to this principle.</p>	Not at variance.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	<p>Depth to groundwater across the proposed clearing area is estimated at 5 – 12 m below ground level. Given the porous, sandy nature of the soils within the proposed clearing area, stormwater readily infiltrates.</p> <p>In addition to the stormwater and groundwater characteristics above, the small scale of the proposed clearing, is highly unlikely to cause, or exacerbate, the incidence of flooding and therefore is not considered to be at variance to this principle.</p>	Not at variance.

4. Environmental approval and management

4.1 Environmental approvals

The key approvals identified as being required and/or potentially required to support the proposed clearing include the following:

- Native Vegetation Clearing Permit (NVCP) under s 51 E of the EP Act

4.2 Environmental mitigation and management

To manage potential impacts associated with the proposed clearing, the following actions will be undertaken:

- general construction environmental management measures will be implemented, including but not limited to clear demarcation of the clearing boundary as to not impact upon adjacent vegetation, and site inductions for all contractors to inform of construction environmental management measures
- A fauna trapping and relocation program will be conducted by a suitably qualified and experienced fauna specialist prior to clearing and commencement to avoid fauna death and injury.

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