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Native Vegetation Clearing Permit Application [Purpose Permit] - Supporting Documentation

Capricorn Yanchep Foreshore Reserve

Prepared for
Acumen Development Solutions
by Strategen

October 2017

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Native Vegetation Clearing Permit Application [Purpose Permit] - Supporting Documentation

Capricorn Yanchep Foreshore Reserve

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October 2017

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Client: Acumen Development Solutions

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
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1. Introduction

Capricorn Village Joint Venture (CVJV) is developing the Capricorn Coastal Village and Coastal Node Precinct, located in Yanchep, within the City of Wanneroo. The CVJV is proposing to clear an area of 2.3 ha (the clearing footprint) including 1.72 ha of native vegetation within the foreshore reserve to create the Capricorn Coastal Node Public Open Space (POS) (Figure 1). The Coastal Node and POS area is classified as a 'District/Potential Future Regional Beach' adjacent to a 'Coastal Tourist Activity Centre' in the Yanchep -Two Rocks District Structure Plan (2009). The purpose permit application is provided in Appendix 1.

The CVJV has prepared a Foreshore Management Plan (FMP) (Appendix 2) for the Capricorn Foreshore Reserve area (as shown in Figure 1) in accordance with condition 25 of WAPC Approval 138089, which provides for future management and enhancement of the foreshore reserve. The Capricorn Foreshore Reserve provides a link between the Indian Ocean and urban development and as such provides opportunity for both conservation and public beach access purposes.

This document has been prepared to support the granting of a Native Vegetation Clearing Permit under s 51 E of the *Environmental Protection Act 1986* (EP Act). The application 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 following environmental assessments have been conducted for the site to inform this purpose permit application:

- *Flora and vegetation survey–Capricorn foreshore reserve* (Strategen 2016; 2017)
- *Capricorn Coastal Reserve Fauna Assessment* (Bamford 2017).

1.1 Location, ownership and tenure

The Project is located approximately 51 km north-northwest of the Perth Central Business District (CBD) (Figure 1). The proposed clearing area comprises 1.72 ha within:

- Lot 8024 Capricorn Esplanade, Yanchep
- Lot 8999 Two Rocks Road, Yanchep
- Lot 15452 Two Rocks Road, Two Rocks.

Site identification details for the proposed clearing area are provided in Table 1, Table 2 and Table 3.

Table 1: Site identification details for Lot 15452 Two Rocks Road, Two Rocks

Subject	Detail
Lot address (street number)	Lot 15452 (340L) on Plan 40341
Common name of site	340L Two Rocks Road, Two Rocks 6037
Reserve	Foreshore Reserve (R 20561)
Current certificate of title	LR3133-577
Current site owner	State of Western Australia
Local Government Authority	City of Wanneroo
Current MRS zoning	Parks and Recreation
Current DPS2 Zoning	Regional Parks & Recreation

Table 2: Site identification details for Lot 8024 Capricorn Esplanade, Yanchep

Subject	Detail
Lot address (street number)	Lot 8024 On Plan 49302
Common name of site	160 Capricorn Esplanade, Yanchep 6035
Reserve	Foreshore Management (R 48603)
Current certificate of title	LR3138-305
Current site owner	State of Western Australia
Local Government Authority	City of Wanneroo
Current MRS zoning	Parks and Recreation
Current DPS2 Zoning	Regional Parks & Recreation

Table 3: Site identification details for Lot 8999 Two Rocks Road, Yanchep

Subject	Detail
Lot address (street number)	Lot 8999 On Plan 10424
Common name of site	510L Two Rocks Road, Yanchep 6035
Reserve	Foreshore–Club Capricorn (R 32510)
Current certificate of title	LR3047-62
Current site owner	State of Western Australia
Local Government Authority	City of Wanneroo
Current MRS zoning	Parks and Recreation
Current DPS2 Zoning	Regional Parks & Recreation

Figure 1: Clearing footprint

Scale 1:5,000 at A4

0 50 100 150 m

N

Legend

- Clearing footprint (2.3ha)
- Existing cadastre
- Capricorn Foreshore Reserve

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 10/10/2017
Author: JCrute
Source: Aerial image: nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Path: Q:\Consult\2016\ADS\ADS16184\ArcMap_documents\ADS16184_G004_RevC.mxd

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2. Overview of existing environment

The following key investigations have been undertaken including the extent of the proposed clearing area:

- *Flora and vegetation survey–Capricorn foreshore reserve* (Strategen 2016; Strategen 2017)
- *Capricorn Coastal Reserve Fauna Assessment* (Bamford 2017).

2.1 Geology, landform and soils

2.1.1 Geology

The Capricorn Foreshore Reserve is located on the Swan Coastal Plain, which is characterised by a low-lying coastal plain, mainly covered with woodlands. 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 surface geology of the Capricorn Foreshore Reserve is dominated by Safety Bay sand overlying Tamala Limestone. Safety Bay sand is comprised of a mixture of coastal dune sand and shallow marine eolian sands with its distribution aligning with the Quindalup Dunal System. Safety Bay sand is still productively accumulating along the coastline. Tamala Limestone is a unit of friable to hard, medium grained eolian calcarenite composed of wind-blown shell fragments with variable amounts of quartz sand.

2.1.2 Topography

The Capricorn Foreshore Reserve is characterised by an undulating dunal system running discontinuously parallel to the coast which consists primarily of a large primary dune fronted by a reasonably sized foredune. The clearing footprint ranges from 4 mAHD in the south-west (at the beach terminus of the access tracks) to a high point of approximately 16 mAHD in the east of the site based on regional topographic contour data.

2.1.3 Soils

The surface soils of the proposed clearing footprint were assessed using the geological spatial dataset mapping at 1:50 000 on geological units for Two Rocks region of Western Australia (GSWA 2013). Soils relating to the proposed clearing area are described as calcareous sand, specifically:

- S_2: Calcareous Sand – white, fine to medium grained, sub-rounded quartz and shell debris, of eolian origin.

2.1.4 Karst risk

A karst risk desktop study was undertaken by Galt Geotechnics (Galt 2016) in accordance with *Local Planning Policy 4.13: Caves and Karstic Features* (CoW 2016c) to support the Capricorn Yanchep Foreshore Management Plan (Appendix 2). The objectives of the study were to:

- conduct a karst risk desk study along the Capricorn Foreshore Reserve, in line with City of Wanneroo planning requirements, including a map showing areas of karst risk
- provide advice on further geotechnical investigations (if required) to support a Karst Risk Management Plan.

The CoW karst risk mapping identifies the Capricorn Foreshore Reserve as occurring within a 'low karst risk' zone (Galt 2016). The study concluded that a Karstic Features Management Plan is not required to support the proposed development, however notes that geotechnical studies will be required within the clearing footprint area where structures, such as changerooms, toilet facilities etc are proposed to certify that the land is capable of development (Galt 2016). The requirement for a geotechnical investigation is not specifically related to karst risk, but is required as part of standard pre-development requirements (Galt 2016).

2.1.5 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 maps (Landgate 2017) indicates that there is no mapped risk of ASS occurring within 3 m of natural soil surface within the clearing footprint area.

2.2 Hydrology

2.2.1 Surface water

The clearing footprint is located immediately east of Indian Ocean within the Capricorn Foreshore Reserve. Based on the DoW Geographic Data Atlas mapping, the site is not located within the DoW 100-year ARI floodplain mapping of rivers and major watercourses (DoW 2017).

Surface water runoff is not expected due to the sandy nature of onsite soils and their infiltration capacity. However, in high intensity rainfall events, runoff may occur in a west-southwest direction towards the Indian Ocean following the natural topography of the site.

No wetlands are located within or adjacent to the proposed clearing footprint, with the nearest wetland located approximately 5 km east.

2.2.2 Groundwater

Groundwater is estimated to be encountered approximately 1.0 mAHD based on review of the DoW Perth Groundwater Atlas (DoW 2016). Groundwater flows in a westerly direction, towards the Indian Ocean.

2.3 Vegetation and flora

Strategen undertook a Level 2 flora and vegetation survey (Strategen 2016; Strategen 2017; Appendix 3) of the proposed foreshore disturbance area and balance of the foreshore reserve. The survey was undertaken on 25 November 2016, in accordance with Level 2 survey requirements of Guidance Statement 51 Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia and Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2004a). Supplementary surveys were undertaken on 23 May 2017 and 3 October 2017. A summary of the findings of the survey are detailed in the following sections.

The surveys included a desktop assessment using Florabase, Parks and Wildlife, Department of the Environment (DEE) databases and available literature to identify the possible occurrence of Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs), Threatened and Priority (P) flora and vegetation communities potentially occurring within the site (the survey area) (Strategen 2016; Strategen 2017).

The field survey involved systematic flora and vegetation sampling at each quadrat and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site, the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum.

For each vascular plant species, the average height, number of plants and percent cover were recorded.

All plant specimens collected during the field surveys were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

Regional vegetation

Beard (1990) Botanical Subdistrict

The proposed clearing area occurs within the Drummond Botanical Subdistrict which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils (Beard 1990).

IBRA subregion

The proposed clearing area occurs within the Swan Coastal Plain 2 IBRA subregion which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

System 6 and vegetation association mapping

The proposed clearing area occurs within the Quindalup Complex which is described as:

Quindalup Complex: *Coastal dune complex consisting mainly of two alliances–the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of M. Lanceolata–Callitris preissii and the closed scrub of Acacia rostellifera.*

The proposed clearing area likely[1] falls within the Guilderton 1007 vegetation system association of the Quindalup Complex (i.e. Mosaic: Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath / Shrublands; *Acacia rostellifera* and *Acacia cyclops* thicket) as defined in Government of Western Australia (2017).

Vegetation statistics for the Guilderton 1007 vegetation system association are displayed in Table 4.

Table 4: Pre-European and current extent of Guilderton 1007 vegetation system association

Vegetation system association	Pre-European extent (ha)	Current extent (ha)	% remaining	Amount proposed to be cleared (ha)	% Current Extent Protected for Conservation
1007	25,383.97	17,431.62	68.67	1.72	5.25

This vegetation association is very well represented locally and regionally, and currently extends over 68.67% of its pre-European area (Government of Western Australia 2015).

Native flora

A total of 176 native vascular plant taxa from 66 plant families (predominately *Asteraceae* and *Fabaceae* families) have the potential to occur within the broader survey area based on a desktop database search (Strategen 2016; Strategen 2017).

A total of 34 native vascular plant taxa from 28 plant genera and 15 plant families were recorded Capricorn Foreshore Reserve during the Level 2 flora and vegetation assessment (Strategen 2016; Strategen 2017). The majority of taxa were recorded within the *Myrtacea*e, *Chenopodiaceae* and *Fabaceae* families. The relatively low number of plant genera recorded reflects the disturbed nature of the survey area.

[1] The proposed clearing area falls outside of the extent mapped by Government of Western Australia (2017). This is likely attributable to a georeferencing error associated with the mapped dataset and as such, the system association within the proposed clearing area has been inferred through a comparison of vegetation descriptions and location in the landscape.

Threatened and Priority flora

One Threatened flora and three Priority flora species have been recorded in the regional area based on desktop database searches; of these, no Threatened flora species and two Priority flora species were considered to have the potential to occur within the survey area based on specific habitat requirements:

- *Leucopogon maritimus* (P1)
- *Leucopogon sp. Yanchep* (P3).

Table 3 shows the Threatened and Priority flora potentially occurring within the survey area.

Table 5: Threatened and Priority flora potentially occurring within the survey area

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Eucalyptus argutifolia (Wabling Hill Mallee)	**Threatened** – Vulnerable	Threatened	Mallee to 4 m tall with smooth bark. Flowers are white and visible March to April. Habitat for this species occurs within shallow soils over limestone, on slopes or gullies of limestone ridges and outcrops (Western Australian Herbarium 1998-).	**Unlikely –** Preferred soil type/habitat does not occur within the survey area.
Leucopogon maritimus (Coast Beard-heath)	Not listed	Priority 1	A low, spreading shrubs to 40 cm tall and 60 cm wide, often multi-stemmed close to the base but single-stemmed at ground level with a fire-sensitive rootstock. *Leucopogon maritimus* is restricted to near-coastal Quindalup dunes, from a small area of coastline about 40–70 km north of Perth. It occurs in deep, calcareous sands, on the mid to upper slopes of dunes or in shallow sand over limestone, but avoiding the thicker vegetation of the swales. It grows in low heathland communities often dominated by *Melaleuca systena, Acanthocarpus preissii, Acacia lasiocarpa and Olearia axillaris*, sometimes in close proximity to the common coastal epacrids *Leucopogon parviflorus* and *L. Insularis* (Strategen 2016).	**Possible** – Preferred habitat exists within the survey area.
Leucopogon sp. Yanchep	Not listed	Priority 3	An erect shrub, 0.15–1 m tall, to 0.6 m wide. Flowers are white/pink, occurring from April to June or September. This species occurs in light grey-yellow sand, brown loam, limestone, laterite or granite on coastal plain, breakaways, valley slopes or low hills (Western Australian Herbarium 1998-).	**Unlikely –** Preferred soil type/habitat does not occur within the survey area.
Stylidium maritimum	Not listed	Priority 3	Caespitose perennial herb to 70 cm tall. Leaves tufted, linear to narrowly oblanceolate. Flowers are white or purple and visible September to November. Habitat for this species is sandy soils over limestone on dune slopes and flats, typically growing within coastal heath and shrubland or open Banksia woodland (Western Australian Herbarium 1998-).	**Possible** – Preferred habitat exists within the survey area.

No Threatened or priority flora species were recorded within the survey area at the time of Level 2 flora and vegetation assessment (Strategen 2016; Strategen 2017). The surveys were conducted during the prime flowering time for conservation significant species, which is the optimum time for correct identification Therefore, the combined survey effort is considered to adequately assess flora and vegetation values of the site.

Introduced (exotic) taxa

A total of 17 introduced (exotic) taxa were recorded within the survey area during the Level 2 flora and vegetation assessment (Strategen 2016; Strategen 2017), however, none of these species are Declared Plant species in Western Australia pursuant to s.22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) (Strategen 2016).

Vegetation type and condition

Four native vegetation types (VT) were identified within the clearing footprint. Native vegetation types, description and areas are provided in Table 6.

Table 6: Vegetation type, description and area within the clearing footprint

Vegetation type	Description	Area (ha)	% clearing footprint
VT1	*Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima* and **Thinopyrum distichum* low shrubland on sandy soils	0.10	4
VT2	*Olearia axillaris, Acacia rostellifera, Rhagodia baccata* and *Scaevola crassifolia* heath over *Spinifex longifolius, Acanthocarpus preissii, Cassytha flava*, **Pelargonium capitatum* and exotic grasses including on sandy soils	0.21	9
VT3	*Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils	1.29	57
VT4	*Olearia axillaris, Scaevola crassifolia, Acacia rostellifera* and *Acacia truncata* heath with emergent *Agonis flexuosa* over *Acanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum,* and exotic grasses on sandy soils	0.10	4
Planted	Planted palms (**Phoenix* sp.) and Japanese Pepper (**Schinus terebinthifolius)*	0.01	<1
Cleared	Cleared areas	0.55	24
TOTAL (native only)		1.70	74

The clearing footprint area shows signs of having been degraded for a long period of time due to the widespread extent of weeds and human disturbance (e.g. trampling dune vegetation for access to the beach). Vegetation condition within the clearing footprint area ranged from 'Completely Degraded' to 'Very Good' (Keighery 1994), with majority of the survey area mapped to be in 'Very Good' condition.

A summary of the vegetation condition within the clearing footprint area is provided in Table 7.

Table 7: Vegetation condition within the clearing footprint

Vegetation Condition	Area (ha)	Percentage of the site
Very Good	1.15	50
Good to Very Good	0.30	13
Good	0.27	12
Completely degraded	0.56	25
Total	**2.28**	**100**

Threatened and Priority Ecological Communities

Desktop database searches identified three TECs and one PEC within 5 km of the Capricorn Foreshore Reserve.

- *Banksia dominated woodlands of the Swan Coastal Plain Bioregion* (Endangered – EPBC Act[2]; Priority 3 PEC)

[2] This community was identified during the database search and is also recognised as the recently listed TEC – *Banksia woodlands of the Swan Coastal Plain* (Endangered – EPBC Act). There has not been sufficient time since the listing of the EPBC Act TEC to update State records to reflect the new community name and conservation status.

- SCP01: *Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain* (Endangered – EPBC Act, Critically Endangered – WC Act)
- Floristic community type (FCT) 26a: *Melaleuca huegelii - Melaleuca acerosa* (currently *M. systena*) shrublands on limestone ridges (Endangered – WC Act)
- FCT19b: Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (Endangered – EPBC Act, Critically Endangered – WC Act).

The closest known occurrences of TECs are the following:

- SCP01 - *Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain* (Critically Endangered under the EPBC Act and WC Act) located approximately 1 km from the survey area
- *Banksia dominated woodlands of the Swan Coastal Plain Bioregion* (Priority 3; now EPBC Act listed TEC), located approximately 3 km from the survey area.

The vegetation within the survey area did not resemble a known TEC; however, the vegetation within VT 2 and VT 3 may resemble two Priority 3 PECs:

- FCT 29a (Coastal Shrublands on shallow sands)
- FCT 29b (*Acacia* Shrublands on taller dunes).

These FCTs were recorded in the previous vegetation surveys within the region (ATA 2007). FCT 29 is largely restricted to the Quindalup System and contains two distinct subgroups. FCT 29a comprises mostly heaths on shallow sands over limestone close to the coast and occurs between Seabird and Garden Island. FCT 29a does not have a single dominant species but important species include *Spyridium globulosum, Rhagodia baccata* and *Olearia axillaris*. FCT 29b is dominated by *Acacia* Shrublands or mixed heaths of the larger dunes and ranges from Seabird to south of Mandurah. There is no consistent dominant species in FCT 29b, however species such as *Acacia rostellifera, Acacia lasiocarpa* and *Melaleuca systena* are important.

FCT 29a is inferred to potentially occur within VT 2 based on the dominant species recorded during the survey (e.g. *Rhagodia baccata* and *Olearia axillaris*) while VT 3 may represent FCT 29b as it comprises *Acacia rostellifera* and *Melaleuca systena*. These FCTs are also restricted to the Quindalup complex within which the survey area occurs (GoWA 2000).

Therefore, it is expected that FCT 29a and FCT 29b occur within the survey area based on previous survey results (ATA 2007), the known vegetation complex within the survey area and dominant taxa recorded. Whilst the PECs may occur in the survey area, these FCTs are very well represented within surrounding Bush Forever Site 397: *Coastal Strip from Wilbinga to Mindarie* which is under existing protection. Furthermore, these VTs will be retained within the larger foreshore reserve, subject to protection and management measures detailed in the Capricorn Yanchep Foreshore Management Plan (Strategen 2016; Strategen 2017).

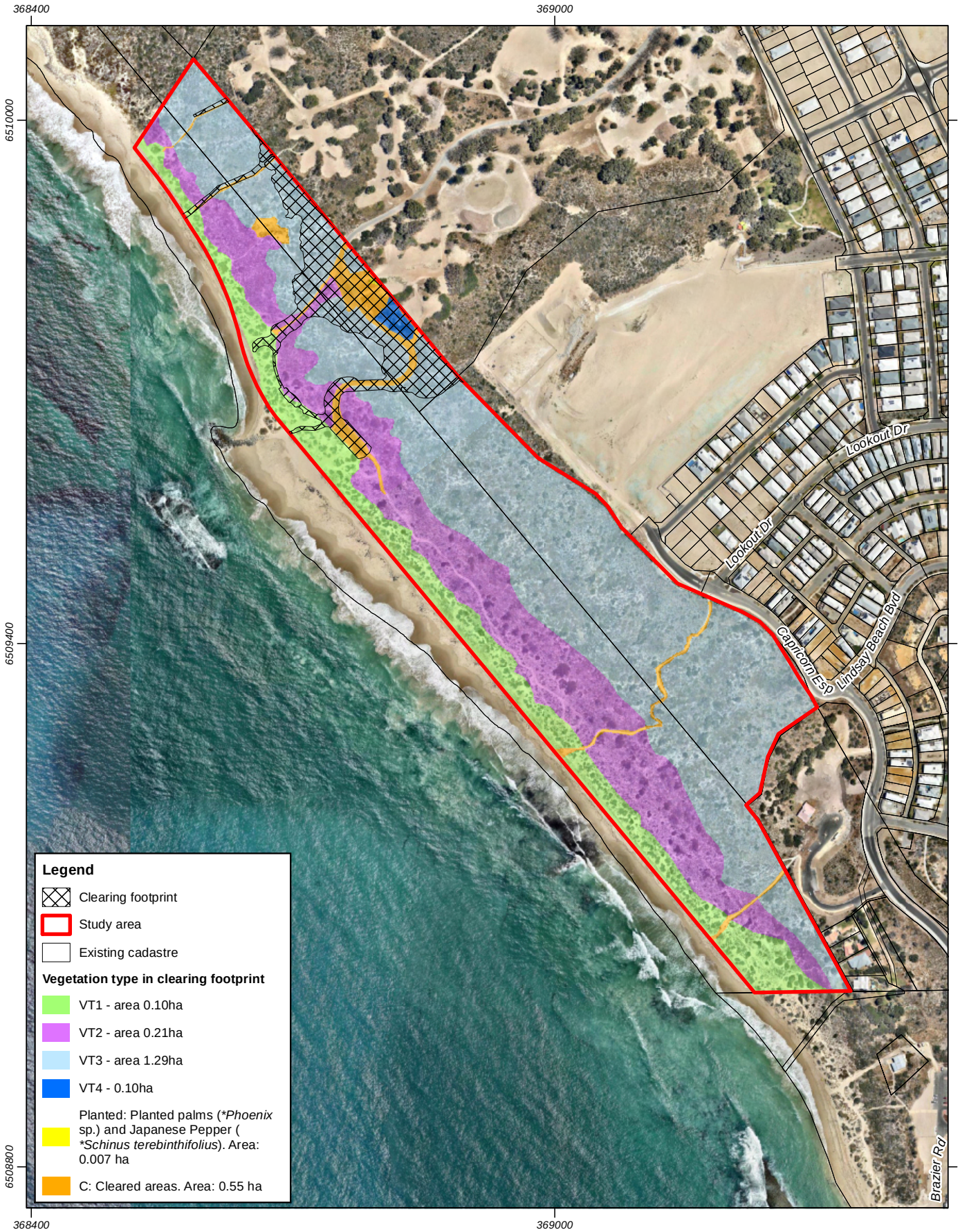

Figure 2: Vegetation types mapped within the survey area

Scale 1:6,000 at A4

0 50 100 150 200 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 2/10/2017
Author: JCrute
Source: Aerial image: Nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Path: Q:\Consult\2016\ADS\ADS16184\ArcMap_documents\ADS16184_G002_RevB.mxd

Vegetation type	Area in hectare
VT1	0.1
VT2	0.21
VT3	129
VT4	0.1
Planted	0.007
Cleared	0.55

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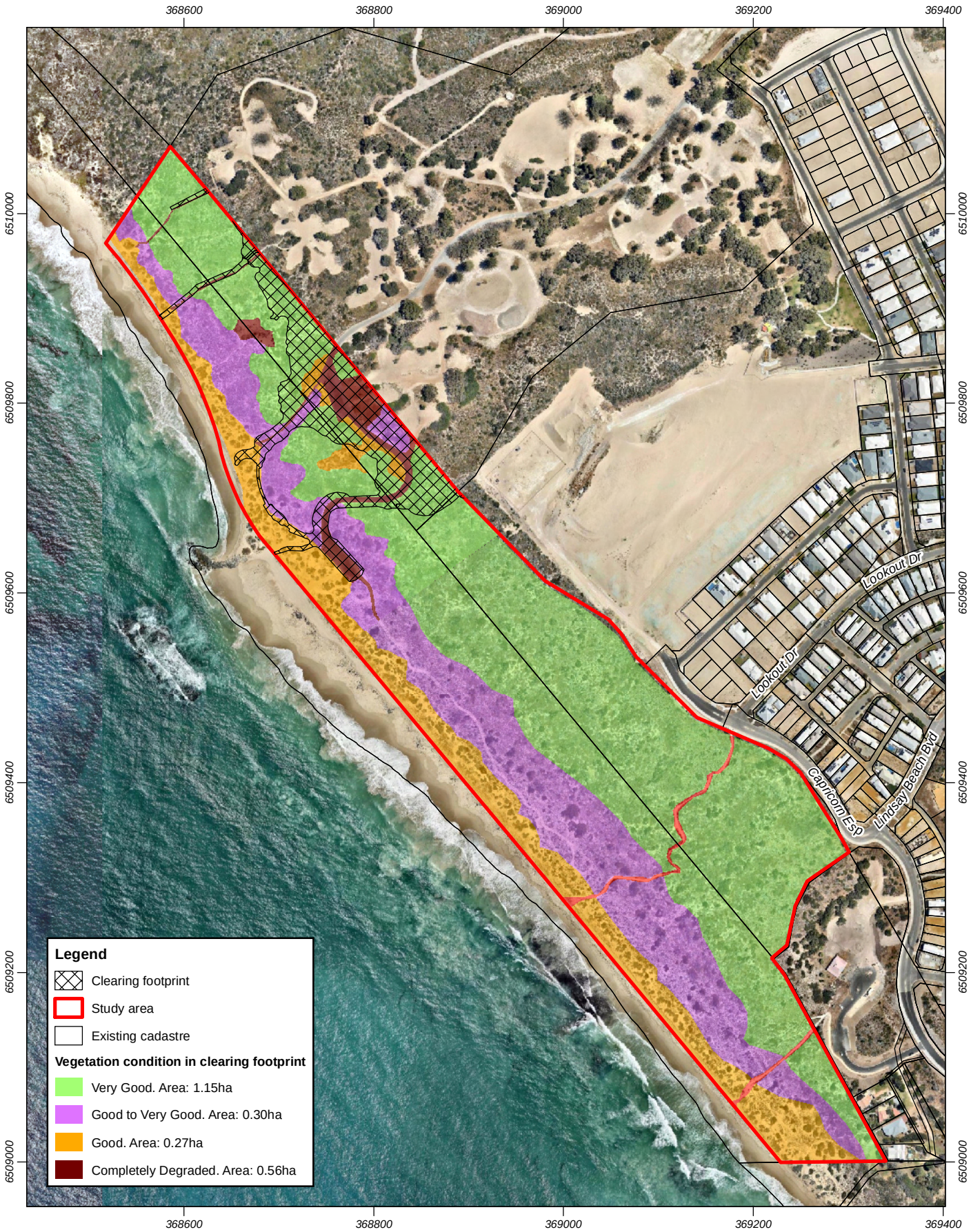

Figure 3: Vegetation condition mapped within the survey area

Scale 1:5,500 at A4

0 50 100 150 200 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 2/10/2017
Author: JCrute
Source: Aerial image: Nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Path: Q:\Consult\2016\ADS\ADS16184\ArcMap_documents\ADS16184_G003_RevB.mxd

Vegetation condition	Area in hectare
Very Good	1.15
Good to Very Good	0.30
Good	0.27
Completely Degraded	0.56

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2.4 Terrestrial fauna

Bamford Consulting Ecologists (Bamford) was commissioned to undertake a Level 1 fauna survey of the Study area in accordance with EPA *Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b; Appendix 4). The field component of the survey was undertaken in December 2016 and focussed on a 'values and impacts' approach to impact assessment with respect to fauna (Bamford 2017).

2.4.1 Desktop assessment

The desktop study identified 166 vertebrate fauna species as potentially occurring in the site: four frogs, 53 reptiles, 92 birds, 12 native and five introduced mammals (Bamford 2017).

The vertebrate assemblage includes up to 38 species of conservation significance (CS). Some species have been excluded from the assemblage as they are almost certainly locally extinct. A further three CS invertebrate species were identified from the desktop assessment (Bamford 2017).

Overall, the fauna assemblage may consist of up to 166 vertebrate species, but all these are unlikely to occur due to the limited range of environments present in the site (Bamford 2017).

Conservation significant fauna species

Based on the likely fauna assemblage of the site, a total of 38 species of conservation significance were considered to potentially occur in the Capricorn Foreshore Reserve. Species of conservation significance have been divided into three categories including:

1. Conservation significance (CS) 1 - listed under legislation (EPBC Act; WC Act).
2. Conservation significance (CS) 2 - listed as Priority by Department of Biodiversity, conservation and Attractions.
3. Conservation significance (CS) 3 - locally significant or otherwise of note in the area.

The overall list of significant species includes six CS1 species, three CS2 species and 29 CS3 species. Numbers and classes of significant species broken down by major taxonomic group and still expected to be present are listed in Table 8.

Table 8: Conservation significant vertebrate species expected in the survey area.

Taxon	CS1	CS2	CS3	Total
Frogs	-	-	-	-
Reptiles	-	1	1	2
Birds	6	-	26	32
Mammals*	-	2	2	4
Total	**6**	**3**	**29**	**38**

Key species of conservation significance (CS 1 and CS 2) with the potential to occur in the survey area are discussed further in Table 9.

Table 9: Conservation significant fauna species with the potential to occur on site

Common Name	Conservation Status		Expected status in Study area	Fauna assessment
	CS1	**CS2**		
Reptiles				
Black-striped Snake *Neelaps calonotos*		P3	Resident	The Black-striped Snake is restricted to the west coast from just north of Lancelin to Mandurah and, although locally common in some environments on the Swan Coastal Plain, its persistence is threatened by continuing loss of habitat due to urban development throughout its range. The species may be locally extinct at Capricorn and Yanchep due to habitat fragmentation. It was not recorded during the Level 1 fauna assessment (Bamford 2017).
Birds				
Eastern Osprey *Pandion cristatus*	Mar S5		Irregular visitor	Several other species listed as Migratory until recently have also been removed from the EPBC list, including the Eastern Osprey and White-bellied Sea-Eagle. These are likely to be infrequent visitors to the area. Both Ospreys and White-bellied Sea-Eagles are known to nest in Tuart trees around the Peel Inlet. They nest on the ground or on the tops of high dunes on islands, but are unlikely to nest on the mainland (Bamford 2017).
Peregrine Falcon *Falco peregrinus*	S7		Irregular visitor	This species is known to occur over a wide range of environments across Australia. Preferred nesting locations include a range of elevated locations with steep topography such as rocky hills, breakaways, cliffs and high artificial structures. It will also nest in very large, horizontally-aligned tree hollows, and in old Raven nests in tall trees (Bamford 2017). The Peregrine Falcon may be a regular foraging visitor to the site, but the area would represent a very small proportion of a pair's range.
Carnaby's Black-Cockatoo (CBC) *Calyptorhynchus latirostris*	E S2		Visitor	The species is likely to be an irregular non-breeding visitor to the Capricorn area; it is common and with some pairs breeding slightly inland around Yanchep National Park. It is known to feed on seeding Banksia and Eucalyptus as well as proteaceous heaths, which does not occur in the site (Bamford 2017). The coastal heathland present at the site provides minimal foraging value for the species, with only five of the 51 species recorded in the broader survey area considered habitat for Carnaby's Black-Cockatoo in accordance with *Plants Used by Carnaby's Black Cockatoo* (Groom 2011). Of the five species recorded which are utilised by CBC, all are foraging species only, with the exception of *Eucalyptus gomphocelphala* which potentially provides roosting and breeding habitat. No evidence of roosting or nesting was recorded during the Level 1 fauna assessment (Bamford 2017), and based on the lack of suitable habitat is unlikely to occur. Several known roosting sites occur to the east of the site at Yanchep National Park (approximately 5 km from the site), Carabooda and Nowergup (Department of Planning Western Australia 2011). Data from Birdlife Australia's Great Cocky Count survey indicate that a single roost site located east of Yanchep had a count of 4,897 Carnaby's Black-Cockatoos and accounted for 45% of all of the Carnaby's recorded on the Perth-Peel Coastal Plain (Bamford 2017). Breeding is known to occur further inland, east of the site (Bamford 2017). There are several small resident populations on the northern Swan Coastal Plain at Yanchep National Park, Boonanarring and Mooliabeenee. Birds at these sites are known to forage in remnant bushland and in adjacent pine plantations (Bamford 2017). Carnaby's Black-Cockatoo was recorded foraging at Burns Beach by and flying over the site at South Yanchep in previous fauna investigations (Bamford 2017).

Common Name	Conservation Status		Expected status in Study area	Fauna assessment
Fork-tailed Swift *Apus pacificus*	Mig S5		Migrant, occasional visitor	This species occurs is a spring to autumn, non-breeding migrant to Australia, and is widespread but infrequently observed in coastal and subcoastal areas between Augusta and Carnarvon, including nearshore and offshore islands (DoEE 2017b). This species was not recorded during the survey but may occur occasionally on site, although it is a largely aerial species mostly independent of terrestrial ecosystems.
Rainbow Bee-eater *Merops ornatus*	Mar S5		Migrant, occasional visitor	Rainbow Bee-eater was not recorded during the Level 1 fauna assessment in December 2016, but is likely to nest in the area during spring and was recorded at Burns Beach in previous investigations (Bamford 2017). The species will often construct its burrows on slopes that are sparsely vegetated, including slopes around construction sites.
Mammals				
Quenda, Southern Brown Bandicoot *Isoodon obesculus fusciventer*		P5	Resident	This species is commonly associated with dense, low vegetation, so may be present in heathland habitats within the site. No evidence (diggings or tracks) of the species was recorded, during the Level 1 fauna assessment however the species has been recorded at South Yanchep, approximately 3 km to the south in previous investigations (Bamford 2017).
Brush Wallaby *Notamacropus irma*		P4	Resident	The Brush Wallaby occurs in a range of shrublands and woodlands across much of the south-west of Western Australia. This species has been recorded previously in the Neerabup National Park however was not recorded during the Level 1 fauna assessment in the site (Bamford 2017).

EPBC Act listed species: V = Vulnerable, E = Endangered, C = Critically Endangered, Mig = Migratory, Mar = Marine.
WC Act listed species: S1 – S7 = Schedule 1 - 7; DPaW Priority Species: P1 - P5 = Priority 1 - 5.

2.4.2 Fauna values present within the site

Fauna assemblage

The assemblage is typical of heathland on coastal dunes, located throughout the Swan Coastal Plain Bioregion. The likely composition of the major taxonomic groups is described in Table 10.

Table 10: Fauna assemblage

Taxonomic group	Anticipated species numbers
Frogs	Four species of frog may occur in the Study area. Frog species are likely to be locally common, regionally widespread and can be expected to breed in seasonal wetlands in the region.
Reptiles	53 species of reptile are known from the general area. The majority of reptile species that may occur in the area are common and regionally widespread on the coastal plain north of Perth.
Birds	92 species of bird may occur in the Study area, however species that may occur include species that fly over the Study area occasionally and therefore do not strictly use the survey area.
Mammals	17 mammal species could be present in the Study area, including five introduced species and several species are considered to be locally extinct. Approximately half of the native species potentially occurring in the Study area are bats, known from the general region north of Perth.
Invertebrates	Some species of conservation significance are known from the region.

Vegetation and Substrate Associations (VSAs)

The coastal heath on calcareous sand can be considered a single VSA that is well-represented to the north and south. It also tends to be the coastal strip of native vegetation that is retained during urban development. Vegetation includes a mix of low shrubs comprising, *Acacia rostellifera*, *Olearia axillaris* and *Scaevola* sp. over coastal sand dunes.

Sedgelands of *Lepidosperma gladiatum* sometimes form a distinct VSA in some locations (i.e. in deep swales) but are also mixed with other vegetation types across the site. The lack of variety in VSAs with the separation of the coastal heaths from more inland VSAs such as shrublands and woodlands will slightly reduce the number of species present. This is because some species will move between vegetation types seasonally but this opportunity has been lost with development nearby. This VSA type is widespread in the local area, particularly to the north of the site (Bamford 2017).

Summary of fauna values

Overall, the fauna assemblage is constrained by the limited range of environments present in the survey area and the adjacent development areas (Bamford 2017). Few species of conservation significance are anticipated to be present, however locally significant birds and mammals may utilise the site. The fauna assemblage is affected by the long, narrow shape of the survey area and its relationship to areas of protected native vegetation to the north and south.

3. Assessment against the ten clearing principles

An assessment of the proposed clearing against the ten clearing principles is provided in Table 11. 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, formerly Department of Environment Regulation guidelines (DER 2014).

This assessment demonstrates that the proposed removal of 1.72 ha of native vegetation is not at variance with the any of the clearing principles. On this basis, CVJV anticipates that the proposed clearing of 1.72 ha of native vegetation can be permitted to occur.

Table 11: 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.	The clearing is to occur with the site covers an area of approximately 1.72 ha. A total of 34 native flora species were identified in the Level 2 flora assessment (Strategen 2016; Strategen 2017). The species recorded is likely to be representative of the true diversity of the site given that the survey was conducted in November (i.e. spring) the optimal survey timing for the Swan Coastal Plain, with an additional survey completed in autumn. Vegetation within VT 2 and VT 3 may resemble two Priority 3 PECs; FCT 29a and FCT29b, of which 0.21 ha and 1.29 ha will be cleared. These FCTs however are well represented within surrounding Bush Forever Site 397 which is under existing protection, as well as within the Capricorn Foreshore Reserve area. These VTs will be retained within the larger foreshore reserve, subject to protection and management measures detailed in the Capricorn Yanchep Foreshore Management Plan. The clearing footprint shows signs of degradation over a long period of time due to the widespread extent of weeds and human disturbance (e.g. trampling dune vegetation for access to the beach). As such, vegetation condition within the survey area ranged from 'Completely Degraded' to 'Very Good'. Vegetation is also uniform in nature. Results indicate a relatively low floristic diversity for the proposed clearing area; therefore, biological diversity within the proposed clearing area is not expected to be significantly affected, due to the proportionally small area of clearing proposed. In addition, the proposed clearing area encompasses previously disturbed areas, further reducing impacts on native vegetation. Clearing is not expected to be at variance to this principle.	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.	The proposed clearing area shows signs of being degraded by clearing, human disturbance and invasive weeds, reducing the value of the site for significant fauna. The proposed clearing area is located within the larger foreshore reserve, representing 7.45% of the foreshore reserve. Furthermore, the fauna habitat within the foreshore reserve is consistent with extensive areas of foreshore reserve spanning the coastline. The proposed clearing area is not considered to represent habitat critical for fauna species, therefore the nature and scale of vegetation to be cleared is not considered to be significant at a local or regional scale in regard to indigenous fauna habitat.	Not at variance.
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No rare flora was recorded in the proposed clearing area during the flora and vegetation assessments (Strategen 2016, 2017). No Threatened flora species as listed under s 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the site. Given that the site was conducted during the prime flowering time for majority of the conservation significant species potentially occurring within the site, it is not expected that occurrences of conservation significant species are present within the site. Therefore, the Project is not at a variance with this principal.	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.	The vegetation identified within the Strategen (2016) survey area did not resemble a known TEC. As a result the proposed clearing will be at variance with this principle.	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.	A total 1.72 ha of vegetation, representing 7.45% of the foreshore reserve is proposed to be cleared. Vegetation to be cleared has been historically disturbed by human trampling, invasive weeds and clearing, and is surrounded by residential areas and roads. Notwithstanding this, the vegetation of the foreshore reserve is not considered to be a significant remnant. 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, and highly degraded and uniform nature of vegetation. Furthermore, the proposed clearing area encompasses previously disturbed areas, further reducing impacts on native vegetation. The balance of the foreshore reserve, comprising 20.74 ha (92.55% of the foreshore reserve) will be retained and protected.	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.	The proposed clearing will not occur near a watercourse or wetland. The closest wetland is located approximately 2 km east of the proposed clearing area (Wetland UFI: 8010; Conservation Category Wetland) therefore the proposed clearing is not at variance to this principle.	Not at variance.
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The proposed clearing will affect a small amount of vegetation (1.72 ha; 7.45%) within the foreshore reserve. In consideration of the above, the clearing is not likely to cause appreciable land degradation due to: • the small area of total proposed clearing • the large extent of vegetation that would remain within the local and regional areas.	Not at variance.

Clearing principle	Assessment	Outcome
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.	The proposed clearing area occurs within the mapped extent of Bush Forever Site 397: *Coastal Strip from Wilbinga to Mindarie*. Bush Forever Site 397 corresponds to the existing coastal foreshore reserve between Mindarie and Wilbinga and is therefore identified in Bush Forever as a 'Site with some Existing Protection'. Bush Forever Site 397 comprises part of the Yanchep foreshore reserve. The foreshore reserve boundary was determined in 1996 as part of MRS Amendment 975/33 and is based on the Coastal Planning Strategy prepared for the Yanchep-Two Rocks area (Alan Tingay & Associates, 1993). As outlined in State Planning Policy 2.8 *Bushland Policy for the Perth Metropolitan Region* (SPP 2.8) mitigation and offset measures are required for direct impacts to Bush Forever sites. Appendix 4 of SPP2.8 requires (for areas of low conservation significance) a net outcome of at least 1 x the calculated loss in habitat hectares with the possibility of reducing with consideration of gains achieved in vegetation/habitat of a higher significance than the vegetation lost. Given that 25% of the clearing footprint is 'completely degraded' and no conservation significant flora or threatened communities have been identified within the clearing footprint, the vegetation to be cleared has been considered 'low conservation significance' In addition, Bush Forever Site 397 is widespread, and only 1.72 ha of the Bush Forever Site is proposed to be cleared with the balance retained, ensuring ecological connectivity to the Bush Forever Site to the north and south is maintained. Selective revegetation will be undertaken within the foreshore reserve in accordance with any requirements of the Foreshore Management Plan (to be endorsed by CoW and WAPC). In addition, the proposed development will include formalising access-ways and the construction of conservation fencing which will provide additional protection to foreshore vegetation. The draft FMP also proposes a targeted weed control programme for the broader foreshore reserve thus enhancing the existing vegetation within the surrounding Bush Forever area. Weed control will be informed by the high level weed mapping within the FMP. The indicative revegetation areas are shown in Figure 9 of the FMP (Appendix 2) totalling 1.05 ha. Given the above information, including the management and revegetation provisions in the FMP, the proposal is not considered to be at variance to principle h.	Not at variance.
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.	The amount of vegetation proposed to be cleared is minimal and is not expected to affect surface or underground water quality.	Not at variance.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The proposed clearing will affect a small amount of vegetation and is not part of, or associated with, a flood management zone, a drainage basin or creek line, therefore the proposed clearing is not at variance with this principle.	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
- Development Application in accordance with City of Wanneroo requirements, including an associated Foreshore Management Plan and Bushfire Management Plan.

The assessment against the 10 clearing principles concluded that the proposed clearing, whilst resulting in some reduction in vegetation within Bush Forever Site 397 and two Priority 3 PECs (FCT 29a and FCT 29b) will not result in a significant impact to any flora or fauna species, or threatened ecological communities particularly with consideration of the proposed mitigation and management measures outlined below and detailed in the Foreshore Management Plan (currently under review by CoW and DoPLH).

4.2 Environmental mitigation and management

The location of the proposed clearing area has been selected with consideration of the existing environment and quality of native vegetation. As such, the development has been located in a degraded area (Figure 3), particularly in comparison to the large areas of 'very good quality' vegetation within the foreshore reserve.

In order to manage potential impacts associated with the proposed clearing on Bush Forever, CVJV will implement a range of environmental management measures detailed in the Capricorn Yanchep Foreshore Management Plan (Appendix 2), focussing on key aspects and potential impacts, including the following:

- selective rehabilitation of degraded areas (as shown indicatively in Figure 9 of Appendix 2)
- measures to avoid the spread of weeds and pathogens, including:
  - site inductions
  - establishing clearing boundaries through use of GPS and on-ground demarcation
  - ensure vehicles are clean of entry
  - targeted weed control within the foreshore reserve based on weed mapping
  - weed monitoring
- measures to minimise vegetation clearing and avoid significant vegetation where required:
  - site inductions
  - establishing clearing boundaries through use of GPs and on-ground demarcation
  - ensure vehicles are clean of entry

  provision of signage in areas of know wildlife activity
- measures to protect fauna and fauna habitat:
  - site inductions
  - establishing clearing boundaries through use of GPs and flagging
  - fauna inspections, trapping and translocation program
  - Feral animals control

5. References

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Appendix 1
Purpose permit

GOVERNMENT OF WESTERN AUSTRALIA

Department of Water and Environmental Regulation – Department of Mines, Industry Regulation and Safety

Application for a clearing permit (purpose permit)

Environmental Protection Act 1986 s 51E

FORM C2

Clearing of native vegetation is prohibited in Western Australia except where a clearing permit has been granted or an exemption applies. A person who causes or allows unauthorised clearing commits an offence.

CPS No.
Date stamp

Part 1 Assessment under the EPBC bilateral agreement

The native vegetation clearing processes under Part V of the *Environmental Protection Act 1986* (EP Act) have been accredited by the Commonwealth of Australia under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and can be assessed under an assessment bilateral agreement.

To be assessed under the assessment bilateral agreement, the proposed clearing action must be referred to the Commonwealth under the EPBC Act prior to submitting this application form and Annex C7 must also be completed.

For further information see Annex C7 and *A guide to native vegetation clearing processes under the assessment bilateral agreement* available at www.dwer.wa.gov.au.

Do you want your proposed clearing action assessed in accordance with, or under, an EPBC Act Accredited Process such as the assessment bilateral agreement?

☐ Yes ☑ No Proceed to Part 2

Has the proposed clearing action been referred to the Commonwealth of Australia under the EPBC Act?

☐ Yes EPBC Number

☐ No It cannot be assessed under an Accredited Process until it has been referred to the Commonwealth. Proceed to Part 2.

Has a decision been made under the EPBC Act as to whether or not the proposed clearing action is a controlled action?

☐ Yes ☐ No Proceed to Part 2

Is the proposed clearing action a controlled action under the EPBC Act?

☐ No It cannot be assessed under an Accredited Process, proceed to Part 2

☐ Yes Complete and attach the requirements of Annex C7 to this completed form

List the controlling provisions identified in the notification of the controlled action decision

☐ Annex C7 is complete and the required supporting information is attached

Part 2 Land details

The location of the land where clearing is proposed must be accurately described.

FILE REFERENCE

Land description: volume and folio number, lot or location number(s), Crown lease or reserve number, pastoral lease number or mining tenement number of all properties.

Lot 15452 (340L) on Plan 40341
340L Two Rocks Road, Two Rocks 6037
Foreshore Reserve (R 20561)
LR3133-577

Lot 8024 On Plan 49302
160 Capricorn Esplanade, Yanchep 6035
Foreshore Management (R 48603)
LR3138-305

Lot 8999 On Plan 10424
510L Two Rocks Road, Yanchep 6035
Foreshore–Club Capricorn (R 32510)
LR3047-62

Local government area

City of Wanneroo

Part 3 Proposal

An aerial photograph or map with a north arrow must be attached, clearly marking the area proposed to be cleared
or
if you have the facilities, a digital map on CDROM of the area to clear as an ESRI shapefile with the following properties:

- Geometry type: polygon shape
- Coordinate system: GDA 1994 (Geographic latitude/longitude)
- Datum: GDA 1994 (Geocentric Datum of Australia 1994).

Total area of clearing proposed (hectares)

2.3 ha (1.72 ha native vegetation)

Proposed method of clearing or final land use

mechanical

Period within which clearing is proposed to be undertaken, e.g. May 2018– June 2023

Q4 2017 – Q4 2020

Purpose of clearing

To facilitate development of the Capricorn Coastal node public open space and associated beach access points.

Has this clearing application or any related matter been referred to the Environmental Protection Authority (EPA) ☐ Yes ☐ No

Part 4 Applicant

To apply for a permit you must either be:

- the landowner
  or
- have the authority of the landowner to access the land and undertake the clearing.

Are you applying as an individual, a company or an incorporated body? Enter details for one only (please print).

Capricorn village joint Venture (Yanchep Sun City Pty Ltd ACN 008 768 278 and Capricorn Investment group Pty Ltd ACN 108 508 265).

Ownership of land

A landowner can be:

- a person who holds the certificate of title
- a person who is the lessee of Crown land
  or
- a public authority that is responsible for care of the land.

Form of ownership:

☐ Certificate of title (please attach a copy of the certificate and all associated encumbrances with the application, available from the Western Australian Land Information Authority – Landgate)

☐ Pastoral lease (please attach a copy of the lease and all associated encumbrances with the application)

☐ Mining lease

☒ Public authority that has care, control or management of the land

☐ Other form of lease, land tenure or specific arrangement. Please state:

Authority to access land

Please specify the applicant's authority to access land to be cleared. For example, a letter from Department of Planning, a statutory power or letter of authority from the landowner.

Note: the letter of authority must explicitly state the applicant has authority to clear on the said land.

State nature of authority to access land (please attach copy of authority)

City of Wanneroo, please see attached letter of authorisation.

Proposed permit holder details

Given names, family name and title Position title/Company

Contact details

☐ Contact details are the same as above **or:**

Person with whom the Department of Water and Environmental Regulation or Department of Mines, Industry Regulation and Safety should liaise concerning the clearing application.

*If applying as a company or incorporated body, please also supply the registered business office address.

Given names, family name and title (Mr, Mrs, Ms, etc.)
Mr Tim Bowra

Position title/Company
General Manager / Strategen Environmental

Postal/Business address*
Postal address:
Level 150 Subiaco Square Road
SUBIACO WA 2904

Business address:
Strategen Environmental
PO Box 243
SUBIACO WA 2904

Fixed telephone number
08 9380 3100

Mobile telephone number
0417 957002

Fax number
08 9380 4606

Email address
t.bowra@strategen.com.au

Part 5 Declaration and signature

For your application to be accepted, it must be signed either on behalf of the company or as an individual.

By signing this form you are declaring that the statements on this form are true and correct.

The department in accepting this form accepts you are a person duly authorised to sign for and on behalf of the body corporate in applying for and in holding a permit.

Knowingly providing false or misleading information is an offence under section 112 of the *Environmental Protection Act 1986* and may incur a penalty of up to $50,000.

Please indicate if you are signing as an individual or a company:

☐ **An individual**. If an individual landowner is applying, **all landowners** must sign this form.

☑ **A company**. A person duly authorised to sign for and on behalf of the body corporate must sign this form. A company must be a legal entity and provide an Australian Company Number (ACN). Please note Australian Business Number (ABN) is not sufficient.

☐ **Other entity formed at law**. Provide details:

Signature(s)

Date
31/7/2017

Print name(s)
Ian Charles Benness

Common seal (if used)

Position (e.g. director, CEO etc.)
Attorney for Yanchep Sun City Pty Ltd and Capricorn Investment Group Pty Ltd under Power of Attorney M651359 dated 8 April 2014

Company name/ACN or other entity (incorporation etc.)
Yanchep Sun City Pty Ltd ACN 008 768 278 and Capricorn Investment Group Pty Ltd ACN 108 508 265 trading as Capricorn Village Joint Venture

Part 6 Prescribed fee

*If applying as a company or incorporated body, please also supply the registered business office address.

(Mr, Mrs, Ms, etc.)

Mr Ian Benness

General Manager (Finance)

Postal/Business address* (for future correspondence)

PO Box 266
West Perth, WA 6872 AUSTRALIA

Fixed telephone number

08 6336 8250

Mobile telephone number

0419 912 091

Fax number

Email address

Ian@capricornproject.com.au

Make cheques or money orders payable to:

Department of Water and Environmental Regulation
(for all clearing purposes other than mining and petroleum activities)
or
Department of Mines, Industry Regulation and Safety
(for mining and petroleum clearing activities under the Mining Act, various Petroleum Acts or State Agreement Acts).

To make payment with a credit card, please complete Form C3 and attach to this form.

Do not send cash in the mail.

A **$200** fee is required for all purpose permit applications.

OFFICE USE ONLY

Payment method (tick applicable box):

☐ Cheque ☐ Money order ☑ Credit card (please complete Form C3 and attach)

Part 7 Application checklist and documentation summary

Additional information to assist in the assessment of your proposal may be attached to this application—e.g. reports on salinity, fauna or flora studies or other environmental reports conducted for the site could be included in electronic format and submitted on CDROM.

Please ensure you have included the following as part of your application:

REQUIRED

☐ A completed application form that is signed and dated by all landowners, or the applicant acting on behalf of or likely to become the landowner.

☐ Payment.

☐ An aerial photograph or map with a north arrow clearly identifying the areas of vegetation proposed to be cleared or ESRI shapefile. An ERSI shapefile must be provided if the application requires an assessment under an EPBC Act Accredited process.

☐ Written authority from the landowner to access the land and undertake the clearing.

☐ I have read and understood the 'Confidential or commercially sensitive information' section at the bottom of this form.

REQURED IF APPLICABLE

☐ Copy of the certificate of title or pastoral lease.

☐ Form C3 if fee is to be paid by credit card.

☐ Annex C7 if the clearing applied for is also to be assessed under an EPBC Act Accredited Process.

Please provide a summary of all attached documentation.

NVCP Application Supporting documentation
Letter of Authority – City of Wanneroo
Copy of Power of Attorney

Part 8 Lodgement

Send by email or post original applications for all clearing purposes (other than mining and petroleum activities) to:

Department of Water and Environmental Regulation
Locked Bag 33, CLOISTERS SQUARE
PERTH WA 6850
Email: info-der@dwer.wa.gov.au

Telephone: 6364 7000

For more information: www.dwer.wa.gov.au

Send original applications related to mining and petroleum clearing activities (under delegation) to:

Department of Mines, Industry Regulation and Safety
Environment Division
Mineral House
100 Plain St
EAST PERTH WA 6004

Telephone: 9222 3333

For more information: www.dmp.wa.gov.au

Please retain a copy of this form for your records.
Incomplete applications will be declined in accordance with section 51E (3) of the *Environmental Protection Act 1986*.

CONFIDENTIAL OR COMMERCIALLY SENSITIVE INFORMATION

Information submitted as part of this application may be made publicly available. If you wish to submit information that you believe to be commercially sensitive or otherwise confidential, then you should submit that information in an appendix to this application, with a written

statement of reasons why you request that each item of information be kept confidential. The department will take reasonable steps to protect confidential or commercially sensitive information. Please note in particular that all submitted information may be the subject of an application for release under the *Freedom of Information Act 1992*. If you have any enquiries regarding the provision of relevant information as part of this application contact either the Department of Water and Environmental Regulation or the Department of Mines, Industry Regulation and Safety.

If there is insufficient space on any part of this form, please continue on a separate sheet of paper and attach to this form.

City of Wanneroo

File Ref: DA2017/1021
Our Ref: 17/302013
Enquiries: Mitchell Hoad (9405 5544)

29 September 2017

Strategen Environmental
P.O. Box 243
SUBIACO WA 6904

Attn: Tim Bowra

LETTER OF CONSENT – APPLICATION FOR NATIVE VEGETATION CLEARING (PURPOSE PERMIT) APPLICATION WITHIN YANCHEP FORESHORE RESERVE

I refer to your correspondence on 2 August 2017, in relation to an application for a Native Vegetation Clearing (Purpose Permit) Application and advise as follows.

The City grants Strategen Environmental its consent to submit an application for a Native Vegetation Clearing (Purpose Permit) Application within the following lots managed by the City:

- Lot 15452 (340K) Two Rocks Road, Yanchep, Reserve Number 20561;
- Lot 8999 (510L) Two Rocks Road, Yanchep, Reserve Number 32510; and
- Lot 8024 (160) Capricorn Esplanade, Yanchep, Reserve Number 48603.

The purpose of this clearing is to be in accordance with any future development approval issued by the Western Australian Planning Commission with respect to the development of the Capricorn Yanchep foreshore area.

Please be advised that the City's consent for this Application to be lodged with the Department of Water and Environmental Regulation (DWER) should not be construed as its support for the development application currently being considered, or for its support to the DWER for the Application to be granted.

Should you have any further queries on this matter, please do not hesitate to contact Mitchell Hoad on 9405 5544.

Yours faithfully,

Debbie Terelinck
ACTING CHIEF EXECUTIVE OFFICER
City of Wanneroo

POWER OF ATTORNEY

This Power of Attorney is granted this 8th **day of** April **2014**

1. Interpretation

Unless the contrary intention appears, the following words have these meanings:

Appointors:	**Capricorn Investment Group Pty Ltd ACN 108 508 265** and **Yanchep Sun City Pty Ltd ACN 008 768 278**, both of Level 1, 682 Murray Street, West Perth, Western Australia.
Attorneys:	**Tian Tian Liu** of 45 Campbell Street, East Cannington, Accountant.
	Ian Charles Benness of 95 Tate Street, West Leederville, Finance and Administration Manager.
Deed:	this Power of Attorney
Land:	any land jointly owned by the Appointers in Western Australia

In this Deed, the singular implies the plural and vice versa.

2. Appointment

Each Appointor appoints the Attorneys to be its attorney, acting jointly and severally for all powers referred to in this Deed.

3. Ratification and Indemnity

(a) The Appointors agree to ratify all acts lawfully performed by the Attorneys pursuant to this Deed.

(b) The Appointors indemnify the Attorneys against any claim, demand, cost, charge, damage, loss or expense suffered or incurred by the Attorneys in respect of the lawful exercise of the powers granted pursuant to this Deed.

4. Sale of Land

The Attorneys may sell or dispose of any Land (in whole or part) which is jointly owned by the Appointors to any person provided it is less than 4,000m^2 in area and may execute any contracts for sale of land, transfers of land and deeds of covenant in respect of such sales and contracts.

5. Subdivision of Land

The Attorneys may grant or dedicate roads, create easements, subdivide or amalgamate any Land or any part of such Land which is owned by the Appointors and execute all applications and any documents incidental to subdivision or amalgamation of Land.

6. Caveats

The Attorneys may lodge or withdraw (in whole or part) caveats over any land on behalf of the Appointors.

7. Easements and Restrictive Covenants

The Attorneys may create, consent to, complete, execute and register at Landgate any easement or deed of restrictive covenant over or against any Land or any part of the Land which is owned by the Appointors.

8. Execution of Documents Generally

The Attorneys may complete and execute any documents required by, or ancillary and incidental to, the enactment of all the powers conferred by this Deed, including any instrument or document to be registered at Landgate pursuant to or in accordance with the Transfer of Land Act 1893, as amended.

9. Notices

The Attorneys may give all notices and engage in all action which they deem desirable or necessary to protect or enforce the Appointors rights and interests in connection with the Land.

10. Registration

The Attorneys may register this Deed at Landgate and anywhere else they deem to be necessary or desirable.

11. Governing Law

This Deed is governed by the laws of Western Australia.

Executed by **Capricorn Investment Group Pty Ltd ACN 108 508 265** in accordance with section 127 of the *Corporations Act* by or in the presence of:

Signature of Director

NORMAN A. SMORGON

Full Name of Director

Signature of Director/~~Secretary~~

RICHARD G. MIDWOOD

Full name of Director/~~Secretary~~

Executed by **Yanchep Sun City Pty Ltd ACN 008 768 278** in accordance with section 127 of the *Corporations Act* by or in the presence of:

Signature of Director

TORU SHIBATA

Full Name of Director
(please print)

Signature of ~~Director~~/Secretary

John Poroch
Company Secretary

Full name of Director/Secretary
(please print)

Signed sealed and delivered by **Ian Charles Benness** in the presence of:

Signature of Witness

Angela Tomadon.

Full name of Witness (please print)

Signature of **Ian Charles Benness**

Signed sealed and delivered by **Tian Tian Liu** in the presence of:

Signature of Witness

Angela Tomadon

Full name of Witness (please print)

Signature of **Tian Tian Liu**

INSTRUCTIONS

1. This form may be used only when a "Box Type" form is not provided or is unsuitable. It may be completed in narrative style.
2. If insufficient space hereon Additional Sheet Form B1 should be used.
3. Additional Sheets shall be numbered consecutively and bound to this document by staples along the left margin prior to execution by the parties.
4. No alteration should be made by erasure. The words rejected should be scored through and those substituted typed or written above them, the alteration being initialled by the persons signing this document and their witnesses.

NOTES

1. Insert document type.
2. A separate attestation is required for every person signing this document. Each signature should be separately witnessed by an Adult Person. The full name, address and occupation of the witness must be stated.

EXAMINED

M651359 PA
28 May 2014 09:54:34 Perth

REG $ 160.00

LODGED BY
ADDRESS CWS LAWYERS
3rd Floor
45 St Georges Tce
PERTH WA 6000
PHONE No. Phone: 6210 7070
FAX No. Fax: 9221 2264
REFERENCE No.
ISSUING BOX No. 188 (V)

PREPARED BY
ADDRESS CWS LAWYERS
3rd Floor
45 St Georges Tce
PERTH WA 6000
PHONE No. Phone: 6210 7070
FAX No. Fax: 9221 2264

INSTRUCT IF ANY DOCUMENTS ARE TO ISSUE TO OTHER THAN LODGING PARTY

TITLES, LEASES, DECLARATIONS ETC LODGED HEREWITH

1. Vol. Lot 15 (4)
2.
3.
4.
5.
6.

Received Items
Nos. 4

Receiving Clerk MK

Registered pursuant to the provisions of the *TRANSFER OF LAND ACT 1893* as amended on the day and time shown above and particulars entered in the Register.

Landgate

GOVERNMENT OF WESTERN AUSTRALIA
REGISTRAR OF TITLES
WESTERN AUSTRALIA

GOVERNMENT OF WESTERN AUSTRALIA

Department of Water and Environmental Regulation – Department of Mines, Industry Regulation and Safety

Credit card payment for clearing permit applications

Environmental Protection Act 1986 s 51E

FORM C3

Clearing of native vegetation is prohibited in Western Australia except where a clearing permit has been granted or an exemption applies. A person who causes or allows unauthorised clearing commits an offence.

CPS No.

Date stamp

Part 1 Prescribed fees

Fee to be paid:

AREA PERMIT APPLICATION (for use with Form C1)

Required for all area permit applications

- ☐ $50 for an area of less than one hectare
- ☐ $100 for an area between one hectare and 10 hectares
- ☐ $200 for an area of more than 10 hectares
- ☐ $50 for an amendment not related to the area

PURPOSE PERMIT APPLICATION (for use with Form C2)

Required for all purpose permit applications

- ☒ $200

AREA PERMIT AMENDMENT (for use with Form C4)

- ☐ $50 to alter the requirements of, or increase the area covered by an area permit by less than one hectare
- ☐ $100 to increase the area covered by an area permit by between one hectare and 10 hectares
- ☐ $200 to increase the area covered by an area permit by more than 10 hectares

PURPOSE PERMIT AMENDMENT (for use with Form C4)

- ☐ $200 to alter any requirement of a purpose permit

SURRENDER (for use with Form C6)

- ☐ $5 to surrender a clearing permit (fee non-refundable)

OFFICE USE ONLY

ADDITIONAL PAYMENT (under payments or change in application details)

- ☐ $50
- ☐ $100
- ☐ $200
- ☐ Other—please specify $

Credit card number

5586 0209 3362 7571

Card holder name

IAN C BENNETT – CARNEGIE VILLAGE JOINT VENTURE

Card type:

- ☑ MasterCard
- ☐ Visa

Applicant (person or company name)

IAN BENNETT

☐ Tick if receipt to be issued to the applicant

Expiry date

09/22

Signature

Contact phone number

0419912091

Part 2 Lodgement

Please attach Form C3 to any relevant clearing permit application form and send by email or post original applications for all clearing purposes (other than mining and petroleum activities) to: **Department of Water and Environmental Regulation** Locked Bag 33, CLOISTERS SQUARE, PERTH WA 6850 Email: info-der@dwer.wa.gov.au Telephone: 6364 7000 For more information: www.dwer.wa.gov.au	Please attach Form C3 to any relevant clearing permit application form and send original applications related to mining and petroleum clearing activities (under delegation) to: **Department of Mines, Industry Regulation and Safety** Environment Division Mineral House 100 Plain St EAST PERTH WA 6004 Telephone: 9222 3333 For more information: www.dmp.wa.gov.au

Appendix 2
Final Draft Foreshore Management Plan

intelligent outcomes | respected experience

Capricorn Yanchep

Foreshore Management Plan

Prepared for
Capricorn Village Joint Venture
by Strategen

July 2017

strategen
ENVIRONMENTAL

Capricorn Yanchep

Foreshore Management Plan

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ACN: 056 190 419

July 2017

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Capricorn Village Joint Venture

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Report	A	Client review	P Molinari / E Congear / T Bowra	Electronic	23 Dec 2016
Draft Report	B	Client review	D White / E Payne / T Bowra	Electronic	3 March 2017
Final Draft Report	C	Client review	E Payne / T Bowra	Electronic	8 March 2017
Revised Final Draft Report	0	Issue to CoW/DoP	E Payne / T Bowra	Electronic	14 March 2017
Draft Report	D	Client review	E Payne / T Bowra	Electronic	27 July 2017
Final Report	**1**	**Issue to CoW/DoP**	**E Payne / T Bowra**	**Electronic**	**31 July 2017**

Filename: ADS16184_01 R001 Rev 1 - 31 July 2017

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1. Introduction

1.1 Background

Capricorn Village Joint Venture (CVJV) is developing the Capricorn Coastal Village and Coastal Node Precinct, located in Yanchep, Western Australia, approximately 51 km north of the Perth Central Business District (CBD). The Capricorn Coastal Village and Coastal Node (the Project), incorporates Part Lot 312 and Lots 2, 303 and 304, Two Rocks Road, Yanchep, in the City of Wanneroo (CoW).

The Project will deliver approximately 2 500 dwelling units and include a primary school, shopping precinct, tourism accommodation facility and a retirement village. The *Capricorn Coastal Village Agreed Structure Plan No. 44* was adopted by the CoW and Western Australia Planning Commission (WAPC) in 2012 and development works have commenced with around 1 400 titled lots already developed.

The Capricorn foreshore area comprising the Study area, as shown in Figure 1 provides a link between the Indian Ocean and urban development and as such provides opportunity for conservation, recreation and development purposes. As the developer, CVJV are required to prepare a Foreshore Management Plan (FMP) to the satisfaction of the CoW and Department of Planning (DoP) for endorsement by the WAPC, in accordance with condition 25 of WAPC Approval 138089. The FMP will outline future development and management of the Capricorn foreshore reserve (Figure 1).

1.2 Study area

The Study area is approximately 1.3 km in length, 22.41 ha in area as shown in Figure 1 and comprises of Bush Forever Site 397 (Lot 9046), Deposited Plan 405421; that extends from Wilbinga to Mindarie and includes the following reserves as shown on Figure 3:

1. R 32510 – north-east portion of the Study area identified as ‘Parks and Recreation’ under MRS zoning and ‘Regional Parks and Recreation’ under District Planning Scheme No. 2 (DPS 2).
2. Part Lot Reserve 20561 – western boundary of the Study area identified as ‘Parks and Recreation’ under MRS zoning and ‘Regional Parks and Recreation’ under DPS 2.
3. Part Lot Reserve 48603 – Southeast portion of the Study area identified as ‘Parks and Recreation’ under MRS zoning and ‘Regional Parks and Recreation’ under DPS 2.

The Study area is bound to the east, by the 'Urban' zoned portion of the Capricorn Coastal Village and Coastal Node and the Indian Ocean to the west (Figure 2). The northern boundary of the Study area extends to the Regional Open Space (ROS) reserve 32510 boundary (comprising Lot 8999), while the southern boundary is bound by Newman Park ‘A’ Reserve, comprising Yanchep Lagoon, and excludes Lot 661, comprising the Mary Lindsay Homestead, freehold lots 132-135, Lots 8026 and 500 in reserve 4806 and Lots 501-502 in reserve 29352.

The western portion of the CVJV landholding, which is reserved for Parks and Recreation under the Metropolitan Region Scheme will be ceded to the Crown as a Foreshore Reserve at the time of subdivision of the abutting land in accordance with WAPC policy DC 2.3 (WAPC 2002). Upon the transfer of the foreshore to the Crown, the Study area will be vested with the CoW.

Figure 1: Study area

Scale 1:8,000 at A4

0 50 100 150 200 250 m

N

Legend

- Study area
- Existing cadastre

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 25/07/2017
Author: JCrute
Source: Aerial image: nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Path: Q:\Consult\2016\ADS\ADS16184\ArcMap_documents\R001\RevB\ADS16184_01_R001_RevB_F001.mxd

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info@strategen.com.au
www.strategen.com.au

Figure 2: Surrounding planning approval boundaries

Scale 1:12,000 at A4

m
0 50 100 150 200 250

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 25/07/2017
Author: JCrute
Source: Aerial image: nearma, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Legend

- Study area
- Capricorn Yanchep
- Existing cadastre

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Figure 3: Tenure of the Study area

Scale 1:8,000 at A4

0 50 100 150 200 250 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 25/07/2017
Author: JCrute

Legend

- Cadastre
- Study area
- MRS parks and recreation reserve

Source: Aerial image: nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017. Bush Forever sites: DoP, 2012.

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1.3 Purpose and scope

The purpose of this FMP is to guide the management of the coastal foreshore land fronting the Capricorn Coastal Village and Coastal Node. The FMP identifies opportunities for facilities and amenities to be developed in the foreshore reserve to allow interaction with the coastline, whilst providing a management framework to ensure the ecological features of the foreshore reserve are conserved and protected.

The FMP has specifically been prepared to fulfil the requirement of Local Structure Plan 75 (ASP 75), Local Structure Plan 44 (ASP 44) and existing subdivision approvals, as summarised in section 3.4.

This FMP provides an overview of the proposed foreshore development and outlines key management measures to be implemented to protect values of the Study area. The FMP has been set out with the following structure:

- Project overview (Section 2)
- Statutory and policy context (Section 3)
- Existing environment (Section 4)
- Coastal facilities demand (Section 5)
- Foreshore development, design and function (Section 6)
- Coastal hazard risk management (Section 7)
- Management framework and responsibilities (Section 8)
- Foreshore management considerations (Section 9)
- Reporting and review (Section 10).

1.4 Objectives

The overarching objective of this FMP is to protect and conserve the existing environmental values of the Study area whilst facilitating the development of complementary recreational facilities and providing controlled access to and within the foreshore reserve. The following key objectives underpin this FMP:

1. Foreshore reserve to be developed in accordance with relevant planning and environmental approvals, planning policies and guidelines.
2. Vegetation and habitat of high environmental value to be retained and conserved where possible.
3. Manage places of environmental and heritage significance to the satisfaction of the indigenous community and key stakeholders.
4. Introduce infrastructure and recreational facilities while ensuring ecological features of the Study area are not compromised.

1.5 Document status

An FMP was initially prepared by ATA Environmental (now Coffey Environments) in 2004 to support the Capricorn Coastal Village Structure Plan (ASP 44). The document was then revised and updated in May 2007 by the CoW, incorporating foreshore management for the Two Rocks Yanchep area. The document was adopted by the CoW, however was not approved by the WAPC. The DoP provided comments on the *Two Rocks Yanchep FMP* in June 2010; however, despite ongoing consultation, the document was not formally updated and approved due to a number of concerns not being able to be addressed at the time.

The FMP was then updated in March 2017, following a series of discussions with DoP (held on 10 May 2016) and CoW (held on 10 May 2016; 21 September 2016; 15 March 2017). The revised FMP considered previous comments and considerations on the FMP, the latest relevant planning policies and guidelines including SPP 2.6 (WAPC 2013a) and additional environmental, planning and social investigations undertaken in support of the Capricorn development.

Following submission of the FMP a series of comments were provided by DoP and CoW on 2 May 2017 and 5 May 2017 and 9 May 2017 respectively. This version of the FMP has been prepared in consideration of all DoP and CoW comments to date, as summarised in the FMP covering letter.

2. Project overview

The proposed foreshore development comprises the Coastal Node Public Open Space (POS), which represents the key infrastructure component to be developed within the foreshore reserve. In addition to the POS, beach access points have been constructed within the foreshore area.

Structural and design elements of the POS and beach access points have been developed based on several key considerations including the following:

- demand associated with regional and local context of the site
- coastal hazard and risk management
- environmental site characteristics, including vegetation, flora, fauna, topography and landform function
- maximising previously disturbed areas
- management considerations.

The proposed Foreshore Masterplan and Foreshore Concept Plan that underpin the FMP are described in detail in the supporting Development Application. An overview of foreshore design, development and function is detailed further in Section 6.

2.1 Foreshore planning and environmental approvals

The FMP will require the approval of both CoW and the DoP/WAPC.

The proposed development works within the Study area will be subject to the following planning and environmental approvals:

5. Development Application (CoW and WAPC).
6. Engineering/landscape construction design drawings (CoW).
7. Purpose Permit clearing application approval (Department of Water and Environmental Regulation [DWER]).
8. Section 18 clearance if development is proposed within a registered Aboriginal Heritage site (Department of Aboriginal Affairs).

The Study area will be zoned as 'Parks and Recreation' reserve and vested to the Crown as agreed by CVJV and the WAPC. Upon transfer of the foreshore to the Crown, the foreshore will be vested in the CoW.

3. Statutory and policy context

Key statutory and policy documents relevant to the Project are described in detail in the following sections.

3.1 Strategic context

The requirement to prepare and implement an FMP is established by the following statutory and policy mechanisms at the Australian, State and Local government levels:

- *Environmental Protection and Biodiversity Act* (EPBC Act) *1999*
- *MRS Amendment 975/33*
- *State Coastal Planning Policy 2.6*
- *State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region*
- *Perth Coastal Planning Strategy*
- *City of Wanneroo District Planning Scheme No. 2*
- *Yanchep – Two Rocks District Structure Plan*
- *Capricorn Coastal Village Agreed Structure Plan No 44*
- *Capricorn Coastal Node Structure Plan No. 75*
- *City of Wanneroo Local Biodiversity Strategy*
- *City of Wanneroo Coastal Management Plan*
- *WAPC subdivision approval 138089* (condition 25).

These mechanisms are described in further detail below.

3.2 Commonwealth government

3.2.1 Environmental Protection and Biodiversity Act 1999

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES), require approval from the Commonwealth Minister for the Environmental (DEE 2016).

Development within the Study area will result in the clearance of approximately 1.68 ha of vegetation that comprises limited foraging habitat for Carnaby's Black Cockatoo, a MNES. The proposed clearing is not expected to result in a significant impact to Carnaby's Black Cockatoo; therefore, the proposed foreshore development will not be referred to the Department of the Environment and Energy (DEE) for assessment under the EPBC Act.

3.2.2 Green Growth Plan

The Perth and Peel Green Growth Plan is a joint initiative between the Commonwealth and State Government of Western Australia initiated in 2011 by the Western Australian Ministers for Planning and Environment and the Commonwealth Minister for the Environment. As communicated at the time and reiterated by the Department of Premier and Cabinet at the release of the PPGGP, one of the primary motivations for the State Government to undertake the Strategic Assessment was to remove the Commonwealth from decision making on small projects within the Perth and Peel regions. This was particularly relevant to projects impacting black cockatoo habitat, where, at the time, the Commonwealth were requiring referral, and in some cases assessment, of projects with as little impact as 1 ha of habitat.

The proposed foreshore development is unlikely to result in an impact to MNES and the anticipated impact to vegetation within the Study area is not considered to be significant, therefore consideration under the EPBC Act and PPGGP will not be required. In accordance with current draft PPGGP mapping, the Study area does not comprise any urban, industrial or rural residential 'classes of actions' and currently no 'broad commitments' have been identified from within the Study area boundary.

As the PPGGP is currently in draft format, the proposed foreshore development will be assessed via the current planning and environmental approvals pathways, including planning approval from CoW and WAPC and approval to clear under the provisions of the EP Act, as detailed in section 2.1.

3.3 State government

3.3.1 Metropolitan Region Scheme Amendment 975/33

In 1996, the Yanchep–Two Rocks (St Andrews) MRS Amendment 975/33 rezoned approximately 4200 ha of land owned by the Tokyu Corporation to Urban and Urban Deferred zones to facilitate future development and give effect to the Yanchep Structure Plan.

A key part or this amendment, involved reserving coastal foreshore land as PRR and the ceding of this land by Tokyu Corporation to the Crown free of charge. The foreshore reserve boundary was determined in 1996 by the Amendment and was based on the Coastal Planning Strategy prepared for the Yanchep-Two Rocks area. The Yanchep precinct and associated foreshore reserve requires the provision of well-considered and adequate coastal facilities and access, which is acknowledged in the Perth Coastal Planning Strategy (PCPS), detailed further in section 3.3.4.

The MRS text outlines a number of clauses under which reserved land owned or vested in a public authority can be developed without the written approval of the Commission. Given that the proposed foreshore area is Bush Forever, representing regionally significant vegetation, approval by the WAPC is required via a Development Application (as discussed in section 2.1).

3.3.2 State Coastal Planning Policy 2.6

State Coastal Planning Policy 2.6 (SPP 2.6; WAPC 2013b) applies to all planning proposals from broad structure planning through to detailed development proposals along the coast throughout Western Australia. The objectives of SPP 2.6 are to:

- protect, conserve and enhance coastal values, particularly in areas of landscape, nature conservation, indigenous and cultural significance
- provide for public foreshore areas and access to these on the coast
- ensure the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities
- ensure that the location of coastal facilities and development takes into account coastal processes including erosion, accretion, storm surge, tides, wave conditions, sea level change and biophysical criteria.

Coastal land is required to be set aside for public use including conservation, management, public access and recreation, in accordance with SPP 2.6. SPP 2.6 also states that coastal Foreshore Management Plans or strategies are required at the appropriate time for the reserved land and any adjacent freehold land with conservation value.

To reduce the risk of damage as a result of coastal processes, SPP 2.6 outlines the requirements in terms of the application of coastal foreshore reserves and development setbacks from coastal features or physical processes.

SPP 2.6 recognises that in some circumstances development may need to occur in areas potentially impacted by physical coastal processes within certain planning time frames. These circumstances may include:

- public recreation facilities with finite life spans
- coastally dependent and easily relocatable development
- industrial and commercial development
- coastal nodes
- surf life saving clubs.

The proposed works for the Study area are consistent with three of the circumstances listed above. Development in these cases should only be considered once adequate management and adaption planning measures have been included, which are consistent with the Avoid–Planned or managed retreat–Accommodate–Protect hierarchy.

The proposed works for the Study area have been developed consistent with the policy provisions of SPP 2.6 (WAPC 2013a), as detailed in section 6 and section 7.

3.3.3 State Planning Policy 2.8 and Bush Forever

State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region (SPP 2.8, WAPC 2010) aims to provide a policy and implementation framework that ensures bushland protection and management issues throughout the Perth Metropolitan Region are adequately addressed and integrated with broader land use planning and decision-making (WAPC 2010). The policy predominantly deals with two distinct subjects, Bush Forever areas and local bushland areas.

In accordance with SPP 2.8, proposals must recognise regionally significant bushland and outline methods by which it will avoid, minimise and offset any likely adverse impacts it will have on regionally significant bushland. Where a proposal is likely to have an unavoidable adverse impact on regionally significant bushland within a Bush Forever area, the policy provides an impact assessment process that will apply. One of the key aims of Bush Forever is to conserve, where practical, a target of at least 10% of the original extent of each vegetation complex for the Swan Coastal Plain portion of the Perth Metropolitan Region.

The entire extent of the foreshore reserve comprises Bush Forever Site No. 397, which is a continuous coastal stretch of bushland extending from Wilbinga to Mindarie.

As the Study area is contained within a Bush Forever site, the Bush Forever Policy and Practice Note 14 (Existing PRRs) must be taken into consideration when planning and implementing this FMP. Practice note 14 has the starting position that vegetation within PRRs must be regarded as regionally significant and included as a protected site; however, as not all these reserves have undergone comprehensive vegetation assessments and future recreation, servicing or community objectives may be appropriate in cleared or degraded portions land Bush Forever Sites, subject to site assessment, management planning and justification (WAPC 2000).

Bush Forever site 397 comprises the entire Study area. A total of 1.68 ha of the site will be cleared to facilitate construction of access and commercial facilities within the foreshore reserve. Opportunities to rehabilitate disturbed areas within the Study area have been identified, as discussed in section 9.4.

3.3.4 Perth Coastal Planning Strategy

The *Perth Coastal Planning Strategy* (PCPS) was developed to encourage better planning and protection of the Perth Metropolitan Coastline. The strategy promotes integrated coastal zone management and provides guidance for the location, scale and density of developments appropriate for the Perth coastline over the next 10 to 15 years.

The strategy applies to the coastal zone in the MRS from Two Rocks to Singleton, extending from 500 m offshore to the first main road running parallel to the coast. The WAPC endorsed amendments to the PCPS in January 2010 and resolved to endorse PCPS as an input into the next phase of Directions 2031, including structure planning, ensuring the centres contained within PCPS precincts are appropriate and complementary to the Directions 2031 activity centres hierarchy. The Study area is located within Precinct 5 of the PCPS and earmarked as ‘mixed use’.

3.4 Local government

3.4.1 City of Wanneroo District Planning Scheme No. 2

The *CoW District Planning Scheme* (DPS) was amended in 2000 (amendment no. 787), resulting in reclassification of the majority of the DPS land to 'Urban Development' to facilitate urban growth in an orderly and managed way. Section 48 of the *Environmental Protection Act 1986* (EP Act) required an Environmental Review to be prepared for the amendment to be assess by the EPA. The Environmental Review identified a number of management conditions to be implemented at various stages of the planning process.

Environmental conditions imposed through Amendment 787 are set out under Schedule 9 of the CoW DPS 2. DPS No. 2 describes the zoning of land within CoW, specifying where certain land uses are permitted and sets standards for development. The Study area is zoned 'Regional Parks and Recreation' in accordance with the CoW DPS No. 2. In accordance with Schedule 9 of the CoW DPS 2, a coastal foreshore management plan is required to be prepared.

3.4.2 Yanchep – Two Rocks District Structure Plan

The *Yanchep–Two Rocks District Structure Plan* (Roberts Day 2010) provides a framework for the development of urban villages, centres for education, industry, technology and enterprise, regional open spaces and city centres, all connected via a network of paths and roads.

Section 7.2 of Part 1 (Statutory Provisions) of the Yanchep – Two Rocks District Structure Plan states that:

> *The precise size, nature and location of the development nodes and coastal setback zones and the provision of recreation facilities and amenities will be address as part of the LSPs. Foreshore Management Plans will also be prepared as part of the LSP's to ensure that development adjacent to the coast provides a balance between protection of the environment and sustainable development.*

The foreshore will be developed in consideration of the Yanchep-Two Rocks DSP, including the requirement to prepare a FMP.

3.4.3 Capricorn Coastal Village Agreed Structure Plan No. 44

Part 8 (special provisions) of Part 1of the *Capricorn Coastal Village Agreed Structure Plan No. 44* (CoW 2012) (ASP 44) states that:

> *Lots 303 and 304 within the Project Area are subject to Environmental Conditions which require the preparation of the following relevant Environmental Management Plans:*
>
> *Drainage, Nutrient and Water Management Plan*
>
> *Foreshore Management Plan.*

In accordance with the Structure Plan, ATA Environmental prepared a draft Foreshore Management Plan in 2004 which was updated in 2007 by the CoW. This FMP has been prepared in place of the draft FMP and will be implemented to the satisfaction of the CoW and DoP.

3.4.4 Capricorn Coastal Node Structure Plan No. 75

The *Capricorn Coastal Node Structure Plan No. 75* (TBB 2015) (ASP 75) provides the planning framework to guide subsequent detailed urban design and development of the Capricorn Coastal Node. The Structure Plan has been prepared pursuant to the CoW DPS 2. The Capricorn development occurs adjacent to the eastern boundary of the Study area, as detailed in Figure 2.

In accordance with Section 1.12 of ASP 75, a Foreshore Development Concept must be prepared as a condition of subdivision, where public access to the coastal foreshore reserve is made available, specifically:

Foreshore Management Plan – Lodgement of subdivision or development within the Mixed Use Zone where adjacent to the Coastal Foreshore Reserve.

Furthermore, ASP 75 requires an FMP as a condition of subdivision approval where public access to the Coastal Foreshore Reserve is made available. The main purpose is therefore to provide a development concept for a coastal activity node in the foreshore reserve for the use of existing and future residents (as provided for in the approved adjacent structure plans) and provide for the management of this coastal activity node, prior to public access being provided through subdivision or development adjacent to it.

ASP 75 details the type of development permissible immediately adjacent to the Study area and that it must:

- maintain public accessibility to the Study area
- maintain a visual connection to the coast from the foreshore road and in strategic locations
- be sympathetic to the coastal environment and landscape.

This FMP has been prepared to satisfy this requirement.

3.4.5 City of Wanneroo Local Biodiversity Strategy

The *CoW Local Biodiversity Strategy* (2011) was developed to guide the planning of growth within the CoW, with specific targets to reduce the loss of natural areas and improve biodiversity protection. The report sets out a number of targets and strategies for CoW to implement, guiding development and biodiversity in CoW over the years from 2011–2016. The strategy is currently being updated by the CoW.

3.4.6 City of Wanneroo Coastal Management Plan

Part 1 of the *CoW Coastal Management Plan* (CoW 2012) provides an overview of current and future coastal land use from Tamala Park to Two Rocks. The plan enables CoW to focus on research and ultimately allow for effective planning, implementation and management of recreation and conservation of coastal areas and coastal assets now and into the future (CoW 2012).

The Coastal Management Plan outlines potential future uses for the Capricorn coastal region. These include:

- two picnic/recreation areas
- dual use path parallel to the foreshore/board walk and beach access
- beach access ways including associated car parking, lookouts, signage, bins and bike racks
- investigations into proposed uses of the Lindsay Homestead
- Capricorn Boulevard extension
- proposed boardwalk and beach access
- extra access from Lindsay homestead.

Requirements detailed in Part 1 of the Coastal Management Plan have either been developed or are proposed to be constructed as detailed further in section 6 of this FMP and the supporting DA.

Part 2 of the CoW Coastal Management Plan is yet to be finalised however intends to provide additional information on the potential adaption of existing management regimes as the CoW evolves and guide future development to ensure the sustainable use of the coastline (CoW 2016b).

3.4.7 WAPC Subdivision approval

In accordance with subdivision condition 25 of WAPC 138089 (DP 57657; C/T Volume/Folio 2674/643), CVJV is required to prepare a Foreshore Management Plan whereby:

'The preparation and implementation of a Foreshore Management Plan for the foreshore reserve abutting the application area to the satisfaction of the WAPC.'

This FMP has been prepared to satisfy subdivision condition 25 and considers previous comments made on the draft FMP documents.

3.4.8 Local Planning Policy 4.2.1

The CoW *LPP 4.21 Coastal Assets Policy* (CoW 2016) is a key guiding document utilised in the preparation of this FMP and supporting DA. The policy complements SPP 2.6 and associated guidelines and has been utilised in conjunction with these documents to inform the assessment and adaptation planning for the proposed coastal assets.

The relationship between the proposed foreshore infrastructure and LPP 4.2.1 has been summarised further in section 7 and the supporting DA.

4. Existing Environment

4.1 Physical environment

4.1.1 Climate

The Yanchep locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Gingin Aero weather Station (Station No. 009178) provides average monthly climate statistics for the Yanchep locality (Figure 4). Average annual rainfall recorded at Yanchep since 1996 is 620.2 mm (BoM 2016). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between December and March, with average monthly maximums ranging from 30.6°C in December to 33.3 in February (BoM 2016). Lowest temperatures occur between June and September, with average monthly minimums ranging from 6.2°C in July and August to 7.5°C in September (BoM 2016).

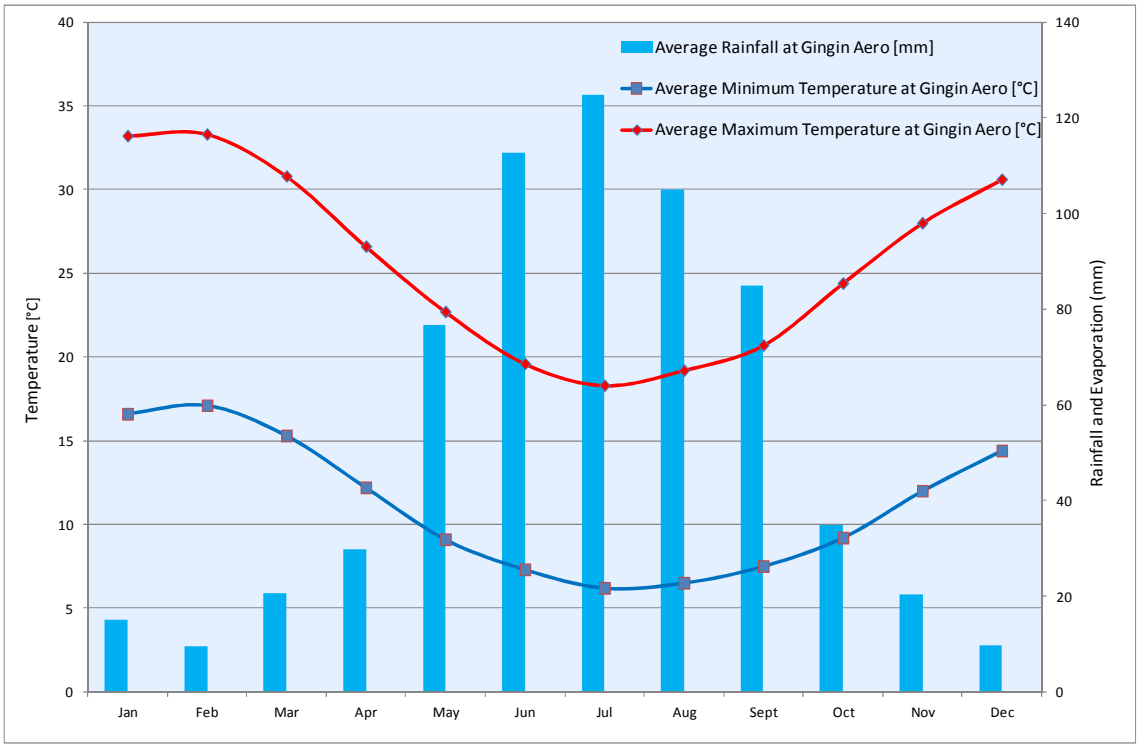

Figure 4: Mean monthly climatic data (temperature and rainfall) for Gingin Aero Centre

4.1.2 Geology, landform and soils

Geology

The Study area is located within the Perth Basin, a geological formation that spans from the southern boundary of the Carnarvon Basin in the north and Cape Leeuwin in the south and extends to approximately 10 km thick (ATA 2007).

The surface geology of the Study area is dominated by Safety Bay sand overlying Tamala Limestone (Figure 5). Safety Bay sand is comprised of a mixture of coastal dune sand and shallow marine eolian sands with its distribution aligning with the Quindalup Dunal System. Safety Bay sand is still productively accumulating along the coastline. Tamala Limestone is a unit of friable to hard, medium grained eolian calcarenite composed of wind-blown shell fragments with variable amounts of quartz sand (ATA 2007).

Landform

The Study area is characterised by an undulating dunal system running discontinuously parallel to the coast which consists primarily of a large primary dune fronted by a reasonably sized foredune. The primary dune maintains a typical elevation of 15–20 mAHD (MRA 2014). The foredune has a typical elevation of 5–6 mAHD with a maximum width of approximately 75 m in the northern boundary of the Study area, becoming narrower further south. Between the beach and tall dunal system lies a foredune areas consisting of low, narrow beach ridges and swales. Two ridges are also present running east–west from the frontal primary dune creating a broad, deep valley between them (ATA 2004).

Karst risk

A karst risk desktop study was undertaken by Galt Geotechnics (Galt 2016; Appendix 1) in accordance with *Local Planning Policy 4.13: Caves and Karstic Features* (CoW 2016c) to support the FMP. The objectives of the study were to:

- conduct a karst risk desk study along the foreshore of the Capricorn Yanchep project (area nominated on provided plans), in line with City of Wanneroo planning requirements, including a map showing areas of karst risk
- provide advice on further geotechnical investigations (if required) to support a Karst Risk Management Plan.

The CoW karst risk mapping identifies the Study area as occurring within a 'low karst risk' zone (Galt 2016). The study concluded that a Karstic Features Management Plan is not required to support the proposed development, however notes that geotechnical studies will be required within the Study area where structures, such as changerooms, toilet facilities etc are proposed to certify that the land is capable of development (Galt 2016). The requirement for a geotechnical investigation is not specifically related to karst risk, but is required as part of standard pre-development requirements (Galt 2016).

Soils

The Study area features an undulating coastal Quindalup dune system which extends from Geographe Bay in the south to Dongara in the north and features a series of large scale, elongated and coalescent parabolic dunes (ATA 2007).

Soil mapping undertaken for the Perth Metropolitan Region (Gozzard 1982), identified one soil type within the Study area:

- S_2: Calcareous Sand – white, fine to medium grained, sub-rounded quartz and shell debris, of eolian origin.

The soil mapping of the Study area is presented in (Figure 5).

Contamination risk

Strategen Environmental (Strategen) undertook an assessment of soil beneath the historic Club Capricorn infrastructure to determine if residual pesticide is present as a result of regular application of white ant treatment (Strategen 2016a).

The assessment included sampling of soil from three chalets and former kiosk area. Results of the assessment found that persistent organochlorine (OC) and organophosphate (OP) pesticides were not present in shallow samples, excluding the following in low concentrations:

- Aldrin
- Chlordane
- Dieldrin
- Heptachlor
- Oxychlordane.

The quantities of the OC/OP pesticides described above were compared to the National Environmental Protection Council (2013) *National Environmental Protection (Assessment of site contamination) Amendment Measure* (NEPM) which found that the concentrations did not exceed the guidelines. In consideration of the results, the assessment concluded that no specific contamination management was required during demolition of the buildings (Strategen 2016a).

4.1.3 Hydrology

A review of the Department of Water Perth Groundwater Mapping (2016) indicates that groundwater flows is in a westerly direction towards the coastline. Groundwater in the Study area ranges from 0 m Australian Height Datum (AHD) along the coastline to a maximum of 1 mAHD in the east of the Study area.

A search of the Swan Coastal Plain geomorphic wetlands map (Landgate 2016 [search conducted 26 August 2016]) did not identify any wetlands within the Study area. The nearest wetland is found is approximately 5 km to the east of the Study area.

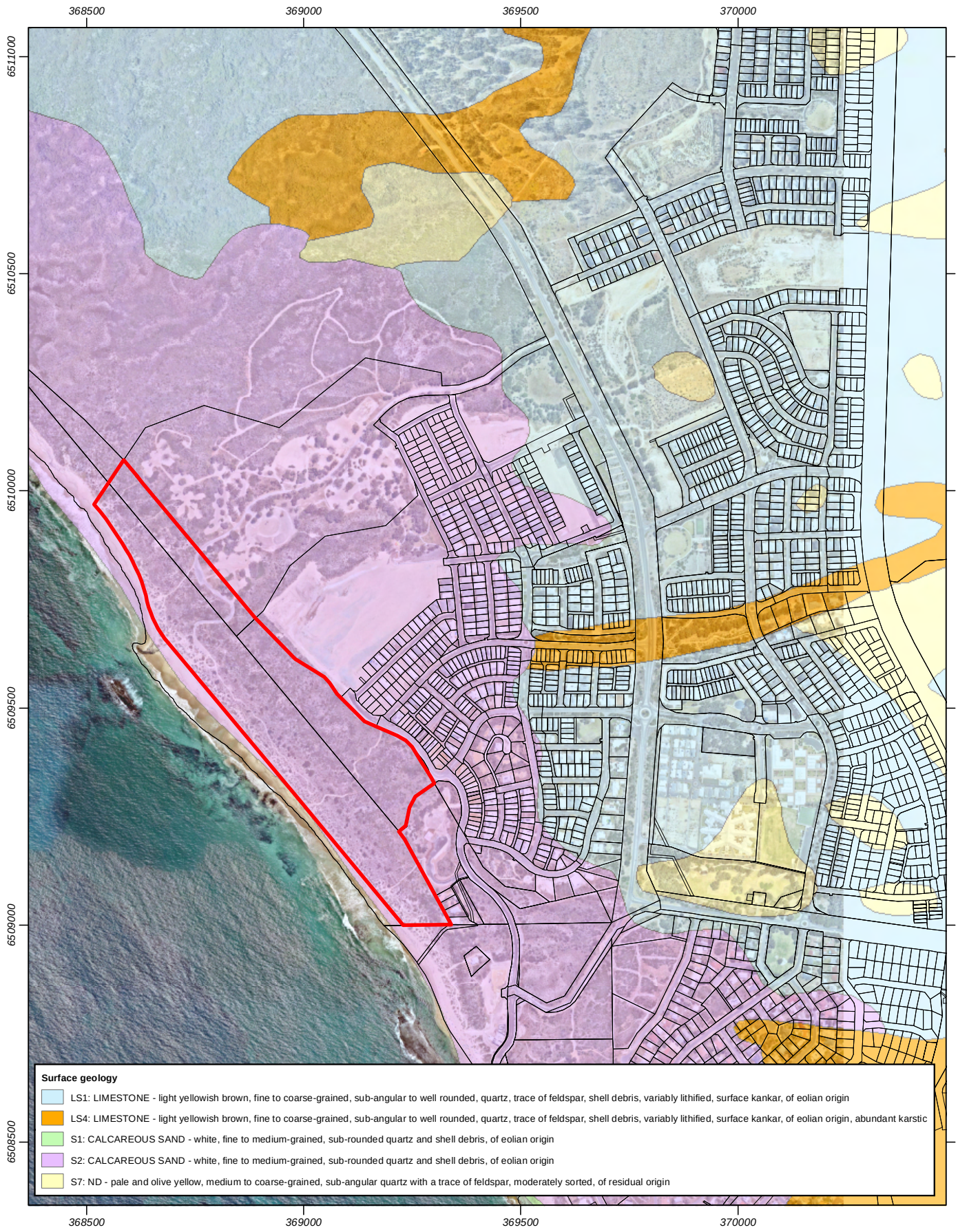

Figure 5: Geology, soils and landform of the study area

Scale 1:12,000 at A4

0 50 100 150 200 250 m

N

Legend

- Study area
- Existing cadastre

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 25/07/2017

Author: JCrute

Source: Aerial image: nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017. Geology: Yanchep map sheet, 1:50000, DMP, 2014.

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4.1.4 Flora and Vegetation

Strategen undertook a Level 2 flora and vegetation survey (Strategen 2016b; Appendix 2) of the proposed foreshore disturbance area and buffer area on 25 November 2016, in accordance with Level 2 survey requirements of *Guidance Statement 51 Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* and *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2004a). The survey included a detailed assessment of the proposed disturbance area and the balance of the Study area was traversed to confirm vegetation types of the Study area.

A supplementary survey was undertaken within the southern portion of the foreshore reserve on 23 May 2017; to the south of the 2016 survey area, including detailed quadrat analysis (Strategen 2017; Appendix 2). The field survey was conducted according to standards set out in recently revised *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). A summary of the findings of the surveys are detailed in the following sections.

Desktop assessment

Regional vegetation

Vegetation of the region has been mapped at a broad scale as part of regional mapping undertaken since the 1970s, notably as part of Beard (1990) mapping. The Beard mapping has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981) which led to the delineation of botanical districts as described in Beard (1990); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DEE 2015a) and System 6 Vegetation Complex mapping undertaken by Heddle *et al.* (1980).

A summary of the regional vegetation mapping comprising the Study area is presented in Table 1.

Table 1: Regional vegetation mapping

Regional mapping	Vegetation system	Description
Beard 1990	Drummond Botanical Subdistrict	Low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils.
IBRA	Swan Coastal Plain 2 IBRA subregion	*Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas.
System 6 and vegetation system association mapping	Quindalup Complex	Coastal dune complex consisting mainly of two alliances – the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *M. Lanceolata – Callitris preissii* and the closed scrub of *Acacia rostellifera.*
	Guilderton 1007 vegetation system association	Mosaic: Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath / Shrublands; *Acacia rostellifera* and *Acacia cyclops* thicket.

Threatened and Priority flora

A desktop survey for Threatened and Priority flora that may potentially occur within the Study area was undertaken using NatureMap (Parks and Wildlife 2007-), the Western Australian Herbarium (Western Australian Herbarium 1998-), and the DEE Protected Matters Search Tool (DEE 2015c).

Table 2 shows the Threatened and Priority flora potentially occurring within the Study area. The desktop assessment identified one Threatened flora and three Priority flora species that have been recorded in the regional area. Of these, based on specific habitat requirements, no Threatened flora species and two Priority flora species have the potential to occur within the Study area, including:

- *Leucopogon maritimus* (P1)
- *Stylidium maritimum* (P3).

Table 2: Threatened and Priority flora potentially occurring within the Study area

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Eucalyptus argutifolia (Wabling Hill Mallee)	Threatened – Vulnerable	Threatened	Mallee to 4 m tall with smooth bark. Flowers are white and visible March to April. Habitat for this species occurs within shallow soils over limestone, on slopes or gullies of limestone ridges and outcrops (Western Australian Herbarium 1998-).	**Unlikely –** Preferred soil type/habitat does not occur within the Study area.
Leucopogon maritimus (Coast Beard-heath)	Not listed	Priority 1	A low, spreading shrubs to 40 cm tall and 60 cm wide, often multi-stemmed close to the base but single-stemmed at ground level with a fire-sensitive rootstock. *Leucopogon maritimus* is restricted to near-coastal Quindalup dunes, from a small area of coastline about 40–70 km north of Perth. It occurs in deep, calcareous sands, on the mid to upper slopes of dunes or in shallow sand over limestone, but avoiding the thicker vegetation of the swales. It grows in low heathland communities often dominated by *Melaleuca systena, Acanthocarpus preissii, Acacia lasiocarpa and Olearia axillaris*, sometimes in close proximity to the common coastal epacrids *Leucopogon parviflorus* and *L. Insularis* (Hislop 2011).	**Possible** – Preferred habitat exists within the Study area.
Leucopogon sp. Yanchep	Not listed	Priority 3	An erect shrub, 0.15-1 m tall, to 0.6 m wide. Flowers are white/pink, occurring from April to June or September. This species occurs in light grey-yellow sand, brown loam, limestone, laterite or granite on coastal plain, breakaways, valley slopes or low hills (Western Australian Herbarium 1998-).	**Unlikely –** Preferred soil type/habitat does not occur within the Study area.
Stylidium maritimum	Not listed	Priority 3	Caespitose perennial herb to 70 cm tall. Leaves tufted, linear to narrowly oblanceolate. Flowers are white or purple and visible September to November. Habitat for this species is sandy soils over limestone on dune slopes and flats, typically growing within coastal heath and shrubland or open Banksia woodland (Western Australian Herbarium 1998-).	**Possible** – Preferred habitat exists within the Study area.

Threatened and Priority Ecological Communities

Three Threatened Ecological Communities (TECs) and one Priority Ecological Community (PEC) were identified as part of the database searches as occurring within 5 km of the Study area, including:

- *Banksia dominated woodlands of the Swan Coastal Plain IBRA region* (Endangered – EPBC Act[1]; Priority 3 PEC)
- SCP01: *Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain* (Endangered – EPBC Act, Critically Endangered – WC Act)
- FCT 26a: *Melaleuca huegelii - Melaleuca acerosa (currently M. systena) shrublands on limestone ridges* (Endangered – WC Act)
- FCT19b: *Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (Endangered – EPBC Act, Critically Endangered – WC Act).

[1]This community was identified during the database search and is also recognised as the recently listed TEC – *Banksia woodlands of the Swan Coastal Plain* (Endangered – EPBC Act). There has not been sufficient time since the listing of the EPBC Act TEC to update State records to reflect the new community name and conservation status.

Field survey

A total of 34 native vascular plant taxa from 28 plant genera and 15 plant families were recorded within the Study area. The majority of taxa were recorded within the Myrtaceae (6 taxa), Chenopodiaceae (6 taxa) and Fabaceae (4 taxa) families. The relatively low number of plant genera recorded reflects the presence of disturbed areas within the Study area.

Threatened and Priority flora

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the Study area at the time of assessment. The survey was conducted during the prime flowering time for these conservation significant species (spring), therefore during the optimum time for correct identification.

Vegetation of the Study area

Four native vegetation types (VTs) were defined and mapped within the Study area (Figure 6) and are summarised in Table 3. Areas containing vegetation in parkland cleared or highly degraded state have not been counted as unique native VTs but have been included in Table 3 for area calculation purposes. Total areas occupied within the Study area by each of the identified VTs are set out in Table 4.

Table 3: Vegetation Types

Vegetation Type	Description
1	*Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima* and **Thinopyrum distichum* low shrubland on sandy soils.
2	*Olearia axillaris, Acacia rostellifera, Rhagodia baccata* and *Scaevola crassifolia* heath over *Spinifex longifolius, Acanthocarpus preissii, Cassytha flava, *Pelargonium capitatum* and exotic grasses including on sandy soils.
3	*Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.
4	*Olearia axillaris, Scaevola crassifolia, Acacia rostellifera* and *Acacia truncata* heath with emergent *Agonis flexuosa* over *Acanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum,* and exotic grasses on sandy soils.
Planted	Planted palms (**Phoenix* sp.) and Japanese Pepper (**Schinus terebinthifolius).*
C	Cleared areas.

Vegetation type coverage

The total area mapped within the Study area was 22.41 ha which includes highly degraded and fully cleared areas (Table 4). The dominant native VT within the Study area was VT 3 which can be broadly described as a *Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.

Table 4: Area (ha) covered by each VT within the Study area

VT	Area (ha)	Percentage of the Study area
1	3.29	14.70
2	5.62	25.08
3	12.53	55.91
4	0.11	0.50
Planted	0.19	0.85
Cleared	0.66	2.96
TOTAL	**22.41**	**100**

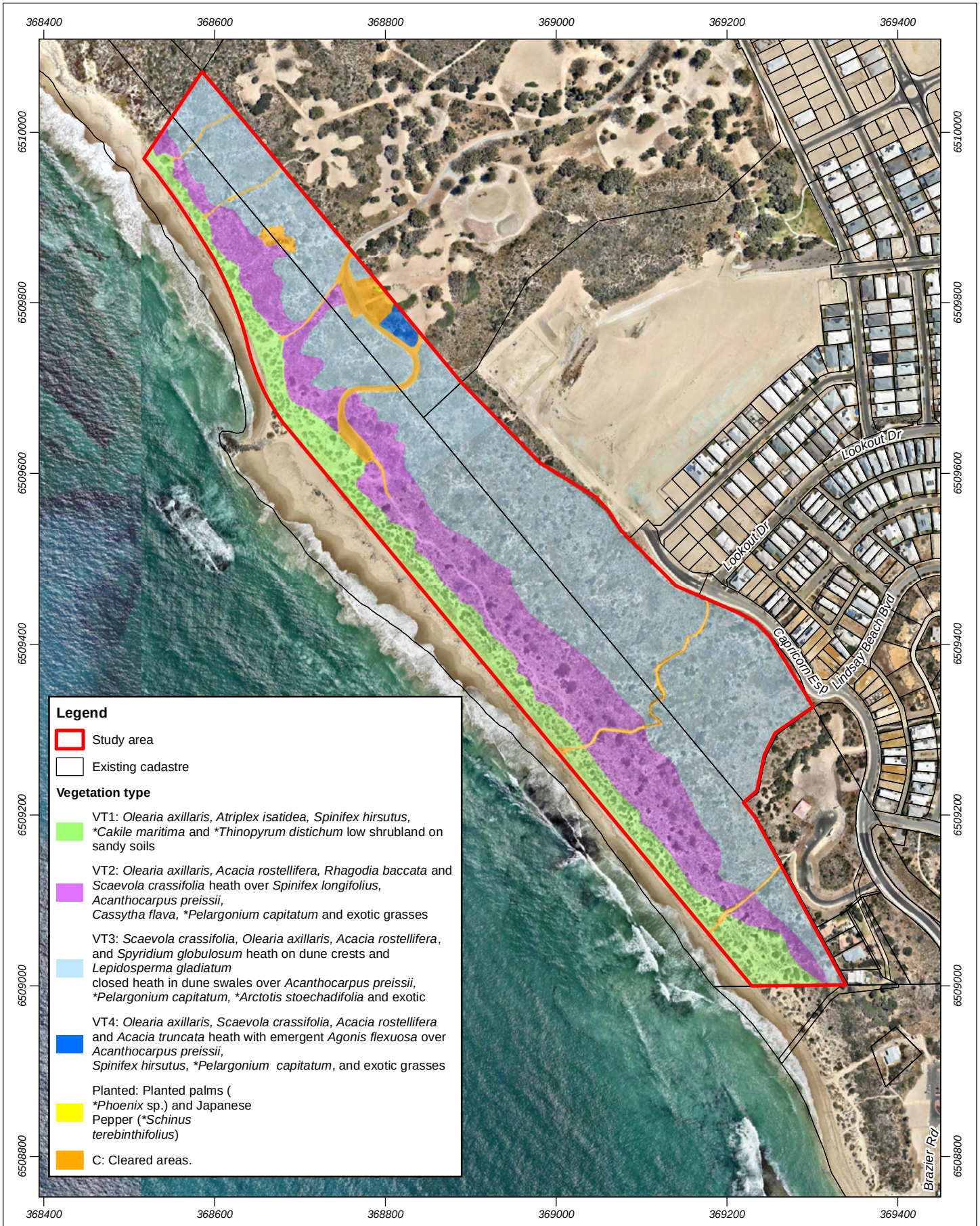

Figure 6: Vegetation types mapped within the survey area

Scale 1:6,000 at A4

0 50 100 150 200 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 26/07/2017

Author: JCrute

Source: Aerial image: Nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

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Vegetation condition

The Study area shows signs of having been degraded for a long period of time due to the widespread extent of weeds and human disturbance (e.g. trampling dune vegetation for access to the beach). As such, vegetation condition within the survey ranged from Completely Degraded to Good and generally aligned with the VT boundaries (Keighery 1994; Table 5).

Table 6 gives a numerical breakdown of the area occupied by each vegetation condition rating within the Study area.

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: Area (ha) covered by each vegetation condition category within the Study area

Vegetation Condition	Area (ha)	Percentage of the Study area
Very Good	12.30	54.90
Good to Very Good	5.71	25.47
Good	3.54	15.80
Completely degraded	0.86	3.84
Total	**22.41**	**100**

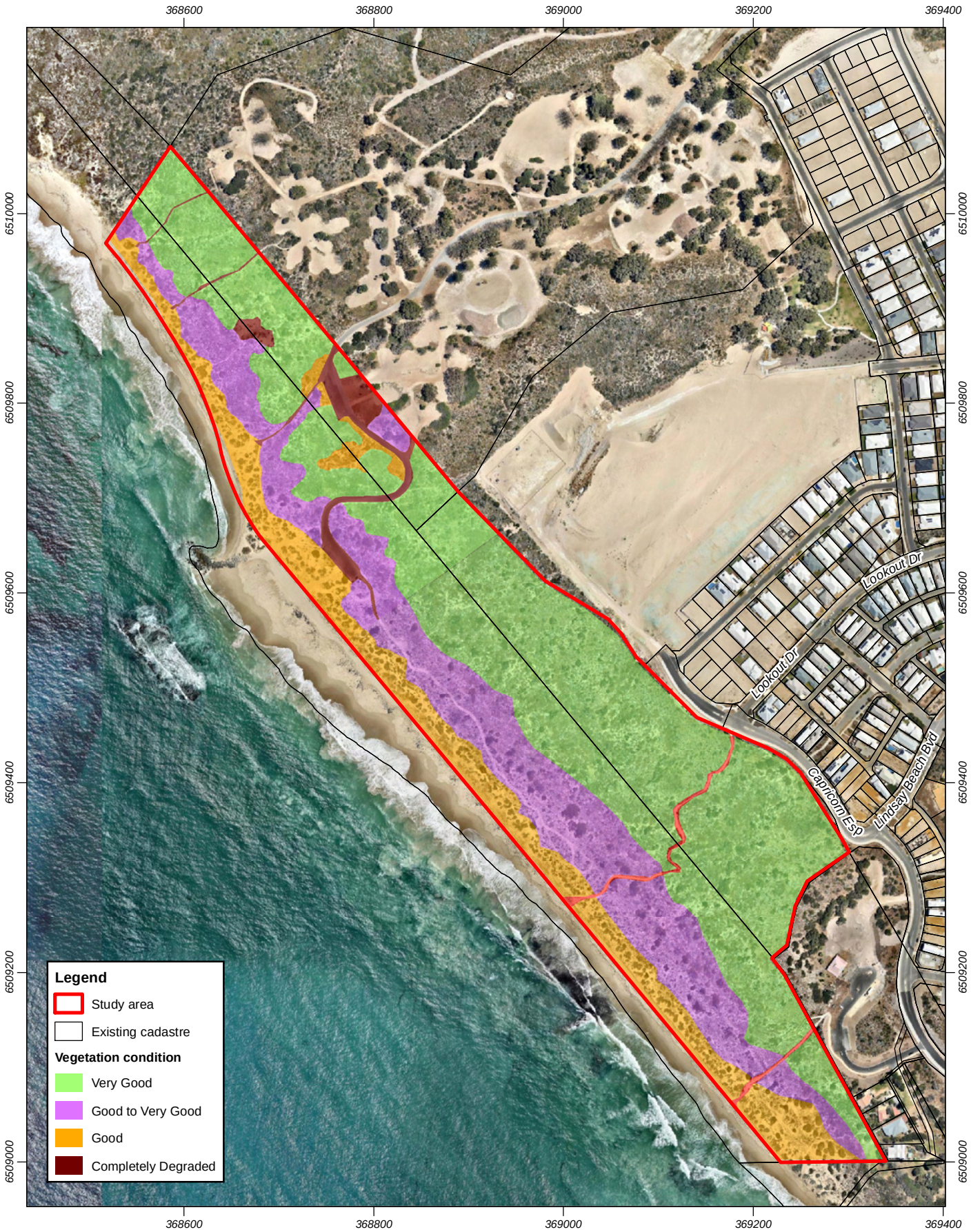

Figure 7: Vegetation condition mapped within the survey area

Scale 1:5,500 at A4

0 50 100 150 200 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 26/07/2017
Author: JCrute
Source: Aerial image: Nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

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Threatened and Priority Ecological Communities

The vegetation within the Study area did not resemble a known TEC, however the vegetation within VT 2 and VT 3 may resemble two Priority 3 PECs; FCTs 29a (Coastal Shrublands on shallow sands) and 29b (*Acacia* Shrublands on taller dunes). These FCTs were recorded in the previous vegetation surveys within the region (ATA 2007).

FCT 29 is largely restricted to the Quindalup System and contains two distinct subgroups. FCT 29a comprises mostly heaths on shallow sands over limestone close to the coast and occurs between Seabird and Garden Island. FCT 29a does not have a single dominant species but important species include *Spyridium globulosum, Rhagodia baccata* and *Olearia axillaris*. FCT 29b is dominated by *Acacia* Shrublands or mixed heaths of the larger dunes and ranges from Seabird to south of Mandurah. There is no consistent dominant species in FCT 29b, however species such as *Acacia rostellifera, Acacia lasiocarpa* and *Melaleuca systena* are important.

FCT 29a is inferred to potentially occur within VT2 based on the dominant species recorded during the survey (e.g. *Rhagodia baccata* and *Olearia axillaris*) while VT 3 may represent FCT 29b as it comprises *Acacia rostellifera* and *Melaleuca systena*. These FCTs are also restricted to the Quindalup complex within which the Study area occurs (GoWA 2000).

Therefore, it is considered likely that FCT 29a and FCT 29b occur within the Study area based on previous survey results (ATA 2007), the known vegetation complex within the Study area and dominant taxa recorded. Notwithstanding this, these FCTs are well represented within surrounding Bush Forever Site 397, under existing protection, furthermore, the proposed foreshore development will result in the removal of a small portion of the FCTs comprising (1.46 ha).

Introduced (exotic) taxa

A total of 17 introduced (exotic) taxa were recorded within the Study area. None of these species are Declared Plant species in Western Australia pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2016).

Summary of flora and vegetation values

Approximately 22.41 ha of vegetation ranging from Completely Degraded to Very Good condition was recorded within the Study area. No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the Study area. Given that the survey was conducted during the prime flowering time for majority of the conservation significant species potentially occurring within the Study area and the supplementary survey conducted in autumn, it is highly unlikely that occurrences of conservation significant species are present within the Study area.

The vegetation within the Study area did not resemble a known TEC; however, the vegetation within VT 2 and VT 3 may resemble two Priority 3 PECs; FCT 29a and FCT29b, comprising 5.62 ha and 12.53 ha of the Study area respectively, of which 0.21 ha and 1.25 ha will be cleared. These FCTs however are well represented within surrounding Bush Forever Site 397: Coastal Strip from Wilbinga to Mindarie which is under existing protection.

4.1.5 Fauna and fauna habitat

Desktop review

A Naturemap search and Commonwealth Protected Matters search within a 1 km radius of the Study area was undertaken to determine Threatened and Priority Fauna species known to occur in the broader area (Parks and Wildlife 2007-, DotE 2016).

The database searches identified the following as potentially occurring within the Study area:

- 31 listed Threatened fauna species protected under the EPBC Act
- 35 listed Migratory fauna species protected under the EPBC Act
- five rare or likely to become extinct species identified by nature map search
- three other specially protected fauna identified by nature map search
- four priority fauna identified by nature map search.

Level 1 fauna survey

Bamford Consulting Ecologists (Bamford) was commissioned to undertake a Level 1 fauna survey of the Study area in accordance with EPA *Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b; Appendix 3). The field component of the survey was undertaken in December 2016 and focussed on a 'values and impacts' approach to impact assessment with respect to fauna (Bamford 2017).

The Study area is characterised by Quindalup dunes which are steeply undulating with soils of pale calcareous sands over limestone with vegetation comprising coastal heath with areas of sedgeland (Coastal Sword-Sedge *Lepidosperma gladiatum*) in some valleys (Bamford 2017). The Bush Forever site to the north includes similar vegetation and landforms to the Study area, and is continuous with Yanchep National Park to the east (Bamford 2017).

Fauna assemblage characteristics

The fauna assemblage is largely determined by the vegetation, soils and landforms of the Study area. The fauna assemblage includes approximately 166 potential vertebrate species, however all of these species are unlikely to occur, due to the limited range of environments present in the Study area. Key features of the fauna assemblage expected in the Study area are:

- Uniqueness: The assemblage is typical of heathland on coastal dunes, located throughout the Swan Coastal Plain Bioregion
- Completeness: A slightly depauperate fauna assemblage is likely to occur in the coastal heathland as some reptile, mammal and bird species are expected to be locally extinct
- Richness: The assemblage in the Study area contains a moderate level of richness to be expected in relatively undisturbed intact heathland vegetation.

The likely composition of the major taxonomic groups is described in Table 7.

Table 7: Fauna assemblage

Taxonomic group	Anticipated species numbers
Frogs	Four species of frog may occur in the Study area. Frog species are likely to be locally common, regionally widespread and can be expected to breed in seasonal wetlands in the region.
Reptiles	53 species of reptile are known from the general area. The majority of reptile species that may occur in the area are common and regionally widespread on the coastal plain north of Perth.
Birds	92 species of bird may occur in the Study area, however species that may occur include species that fly over the Study area occasionally and therefore do not strictly use the Study area.
Mammals	17 mammal species could be present in the Study area, including five introduced species and several species are considered to be locally extinct. Approximately half of the native species potentially occurring in the Study area are bats, known from the general region north of Perth.
Invertebrates	Some species of conservation significance are known from the region.

Conservation significant species

Based on the likely fauna assemblage of the Study area, as described above, a total of 38 species of conservation significance may occur in the Study area. Species of conservation significance have been divided into three categories including:

1. Conservation significance (CS) 1 - listed under legislation (EPBC Act; WC Act).
2. Conservation significance (CS) 2 - listed as Priority by Department of Parks and Wildlife (Parks and Wildlife).
3. Conservation significance (CS) 3 - locally significant or otherwise of note in the area.

A summary of the key conservation significant species, comprising CS 1 and CS 2, recorded or with the potential to occur within the Study area is presented in Table 8.

Table 8: Conservation significant species recorded or with the potential to occur in the Study area

Species	Conservation status	Likelihood of occurrence within the Study area
Species of conservation significance level 1		
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Endangered EPBC Act Schedule 2 WC Act	The species is likely to be an irregular non-breeding visitor to the Capricorn area; it is common and with some pairs breeding slightly inland around Yanchep National Park. It is known to feed on seeding Banksia and Eucalyptus as well as proteaceous heaths (Johnstone and Storr 1998), which does not occur in the Study area. The coastal heathland present within the Study area provides minimal foraging value for the species. Due to the lack of suitable plant species, the foraging value ranges from a score of 1 to 2 out of 6. No evidence of roosting or nesting was recorded during the site inspection, and based on the lack of suitable habitat is unlikely to occur.
Rainbow Bee-eater *Merops ornatus*	EPBC Act Marine Schedule 5 WC Act	The Rainbow Bee-eater has recently been delisted as a Migratory species under the EPBC Act, however is listed as a Marine species under the Act. The Schedule 5 listing under the WC Act is likely to change as a result. The Rainbow Bee-eater was not recorded during the site inspection, but is likely to nest in the area during spring and was recorded at Burns Beach.
Eastern Osprey *Pandion cristatus*	EPBC Act Marine Schedule 5 WC Act	The Eastern Osprey has recently been delisted as a Migratory species under the EPBC Act, however is listed as a Marine species under the Act. The Schedule 5 listing under the WC Act is likely to change as a result. The Eastern Osprey was not recorded during the site inspection. The species may be an infrequent visitor to the Study area.
Fork-tailed Swift *Apus pacificus*	EPBC Act Migratory Schedule 5 WC Act	This species occurs as a spring to autumn, non-breeding migrant to Australia, and is widespread but infrequently observed in coastal and subcoastal areas between Augusta and Carnarvon, including nearshore and offshore islands. This species was not recorded during the survey but may occur occasionally on site, although it is a largely aerial species mostly independent of terrestrial ecosystems.
Peregrine Falcon *Falco peregrinus*	WC Act Schedule 7	This species is known to occur over a wide range of environments across Australia. Preferred nesting locations include a range of elevated locations with steep topography such as rocky hills, breakaways, cliffs and high artificial structures. The Peregrine Falcon may be a regular foraging visitor to the site, but the area would represent a very small proportion of a pair's range.
Species of conservation significance level 2		
Black-striped Snake *Neelaps calonotos*	Priority 3	The Black-striped Snake is restricted to the west coast from just north of Lancelin to Mandurah and, although locally common in some environments on the Swan Coastal Plain, its persistence is threatened by continuing loss of habitat due to urban development throughout its range. The species may be locally extinct at Capricorn and Yanchep due to habitat fragmentation. The species was not recorded during the survey but can be difficult to find.
Quenda, Southern Brown Bandicoot *Isoodon obesculus fusciventer*	Priority 5	The Quenda occurs in the south-west coast from Guilderton north of Perth to east of Esperance. This species previously occurred north to Geraldton but like many mammals in the region has undergone a large range reduction (Maxwell et al. 1996). It is commonly associated with dense, low vegetation, so may be present in heathland habitats within the Study area. No evidence (diggings or tracks) of the species was recorded.

Species	Conservation status	Likelihood of occurrence within the Study area
Brush Wallaby *Notamacropus irma*	Priority 4	The Brush Wallaby occurs in a range of shrublands and woodlands across much of the south-west of Western Australia, but is at risk from clearing and Foxes. The species was not recorded during the site inspection.

Source: Bamford 2017

Vegetation and substrate associations

The coastal heath on calcareous sand can be considered a single vegetation substrate association (VSA) that is well-represented to the north and south. It also tends to be the coastal strip of native vegetation that is retained during urban development. Vegetation includes a mix of low shrubs comprising, *Acacia rostellifera*, *Olearia axillaris* and *Scaevola* sp. over coastal sand dunes (Bamford 2017).

Sedgelands of *Lepidosperma gladiatum* sometimes form a distinct VSA in some locations (i.e. in deep swales) but are also mixed with other vegetation types across the site. The lack of variety in VSAs with the separation of the coastal heaths from more inland VSAs such as shrublands and woodlands will result in a slight reduction to the number of species present in the Study area. This VSA type is widespread in the local area, particularly to the north of the Study area.

Summary of fauna values

Overall, the fauna assemblage is constrained by the limited range of environments present in the Study area and the adjacent development areas (Bamford 2017). Few species of conservation significance are present, however locally significant birds and mammals may utilise the site. The fauna assemblage is affected by the long, narrow shape of the Study area and its relationship to areas of protected native vegetation to the north and south. A total of eight conservation significant species comprising five EPBC Act listed species and 3 Priority species were recorded or have the potential to utilise the Study area. None of the species recorded or with the potential to occur are considered to be restricted or rely solely on the Study area; therefore, any impacts are expected to be minor and can be readily managed through the implementation of avoidance measures, including relocation of fauna species prior to clearing activities commencing.

4.1.6 Social environment

Land-use history

The land use history for the Study area and the lagoon adjacent to the southern boundary of the Study area is detailed in Table 9.

Table 9: Land use past and present for the Study area

Timeframe	Land use
Past	1. The Yanchep Lagoon (located south of the Study area) was historically used as an anchorage for the fishing and crayfishing industries until the 1970s when the Two Rocks Marina was constructed. Mary Lindsay (original owner of the Mindsay Homestead) who settled in the area in 1926 was actively involved in protecting the natural dune environmental and assisting the fishing industry. Mary Lindsay built a hostel and store providing water, food and tackle to campers and fishermen within the area (inHerit 2015). 2. Fishermans Hollow and Yanchep Lagoon (immediately south of the Study area) have been used recreationally by holiday makers since the early 1900s (inherit 2015). 3. The Study area was utilised up until June 2015 as guests and visitors of the Club Capricorn chalets, hotel and caravan park.
Present	The Study area is currently utilised for recreational activities such as walking, surfing, swimming, recreational fishing and other beach usage. Access to the Study area is currently via existing boardwalk access points and historic beach access points that will be upgraded as part of the foreshore development.

Aboriginal heritage

A search of the Department of Aboriginal Affairs (DAA) site register on 5 September 2016 identified one registered mythological site within the Study area. The site is identified as:

- Yanchep Beach - Site ID 17599.

This heritage site is located within land subject to an Indigenous Land Use Agreement (ILUA) with the Whadjuk People. As the proposed development within the Study area has the potential to impact on the heritage site, a s 18 clearance to enable disturbance within the Study area may be required in accordance with provisions of the *Aboriginal Heritage Act 1972* (AH Act). CVJV will consult with relevant parties to determine the requirement for approval prior to commencing development within the Study area as detailed further in section 9.5.

European heritage

A search of the City of Wanneroo Heritage Sites Register and the State Heritage Council Register on 5 September 2016 identified three and five heritage listed sites respectively. The three heritage sites listed on the CoW Heritage List are:

- Lindsay Homestead (Site No. 67) – southeast of the Study area
- Yanchep Lagoon (Site No. 106) – south of the Study area
- Fishermans Hollow (Site No. 35) – south of the Study area.

The five heritage sites listed on the State Heritage Register include:

- Club Capricorn (Club Capricorn Resort) (Heritage Place No. 17527) – east of the Study area
- Fishermans Hollow (Heritage Place No. 17532) – south of the Study area
- Mary Lindsay Homestead (Well and Sheep Dip) (Heritage Place No. 14280) – southeast of the Study area
- Well & Sheep Dip (Lindsay Homestead) (Heritage Place No. 14297) – southeast of the Study area
- Yanchep Lagoon (Heritage Place No. 17949) – south of the Study area.

The Mary Lindsay Homestead was the first building in the Yanchep–Two Rocks area and is located on private land vested to the Crown and managed by the CoW, immediately south of the Study area. Recent works have been undertaken at the Mary Lindsay Homestead, including construction of beach access boardwalks, redevelopment of the POS component of the homestead, including the installation of play and picnic areas and a carpark. The works undertaken at Mary Lindsay Homestead continue to be undertaken by CoW. The Mary Lindsay Homestead, whilst occurring in close proximity to the Study area, does not form part of the foreshore area and is being managed separately by the CoW.

Yanchep Lagoon is a popular destination for residents from both Yanchep and Two Rocks. It is located just south of the Study area and provides a sheltered lagoon for family swimming due to the protection provided by the offshore reef. It is also used for snorkelling, recreational fishing and windsurfing and has a number of facilities provided to facilitate these activities including car parking, picnic areas, a kiosk, toilets and a surf club (ATA 2004). The Yanchep Lagoon heritage site will not be impacted by any development within the proposed foreshore area.

Fisherman's Hollow is seen as historically significant due to its associations with Mary Lindsay, the original owner of Lindsay Homestead. Socially, Fisherman's Hollow is significant for its associations with the early fishing industry and for the recreational pursuits undertaken there over the majority of the twentieth century (InHerit 2012). The Fisherman's Hollow heritage site will not be impacted by any development within the proposed foreshore area.

The Club Capricorn facility historically incorporated a group of accommodation chalets, a caravan park and manager's quarters and a two storey rendered brick and terracotta tiled roofed lodge. Club Capricorn is viewed as historically significant due to its associations with Alan Bond, aesthetically significant as it includes a group of buildings in the West Australian Vernacular style and socially significant to people who have enjoyed it recreationally throughout its lifetime (inherit 2012). As part of the development at Capricorn the CVJV are redeveloping the historic Club Capricorn area, as detailed further in Section 6.

4.1.7 Social values

Population Growth

The proposed development of the Yanchep–Two Rocks area is the largest single development in Perth and with an ultimate population of 155 000 expected over the next 40 years to accommodate 2–3% of the national population growth (Roberts Day 2010). A total population of approximately 13 600 people resided in Yanchep as of 2015, a growth of approximately 1700 people or 14.1% between 2014 and 2015 (ABS 2016). The Capricorn Coastal Node Structure Plan for the Capricorn Coastal Node provides a guiding framework for the detailed urban design and development of the Capricorn Centre. Approximately 2700 residential lots for approximately 7300 residents alone are proposed for the Capricorn Coastal Node and include a primary school, shopping precinct, resort/hotel and a Retirement Village.

Yanchep's population growth will create a number of opportunities for the foreshore reserve. The introduction of appropriate facilities and infrastructure will enhance the social and recreational use within the Study area, providing commercial, tourism and recreational possibilities. Conversely, the increase in Yanchep's population and the use of the Study area has the potential to increase pressure on the natural environment. The potential increased levels of infrastructure and facilities will result in potential vegetation clearing and conflict between groups of recreational users may be encountered. Additionally, actions such as unauthorised access, the introduction of weeds, illegal littering and pollution have the potential to damage the natural environment.

Recreation Use

The main focus of the proposed development is to enhance and increase the recreational uses of the Study area. Currently, the Study area is utilised by residents for recreational activities including swimming, walking, recreational fishing, snorkelling, its scenic value, windsurfing and kitesurfing. Existing facilities include two boardwalks providing access from Capricorn Esplanade to the beach and general public access is also provided via the historic Club Capricorn driveway.

The Yanchep Lagoon, to the south of the Study area, is the main focus of recreational activity in the Yanchep area. The sheltered waters of the lagoon provide families with a safe swimming environment, while still being popular for snorkelling, recreational fishing, windsurfing and kitesurfing.

Anticipated Future Beach Use

In order to facilitate the future recreational demands on the Study area, the types of activities likely to occur must be determined and required infrastructure and facilities planned for. This will ensure the future recreational demands can be met and the natural environment is conserved. Potential recreational activities likely to occur within the Study area include:

- swimming, sunbathing, snorkelling and wading
- surfing, boogie boarding and bodysurfing
- windsurfing and kitesurfing
- surf lifesaving
- fishing
- walking, jogging, dog exercising, exercising
- picnicking, viewing scenery and environmental and heritage education.

The above activities can be enhanced by infrastructure and facilities of some description to cater for the increasing population. Potential infrastructure and facilities include beach access, car parking space, toilets, bike racks, change rooms, a kiosk, a dual use path, rubbish bins, signage, picnic areas, grassed areas and surf life saving facilities.

The proposed foreshore development (Section 6) aims to provide ample and appropriate infrastructure and facilities to meet the future recreational demands for the Study area while protecting the natural environment.

5. Coastal facilities demand

A review of the planning context relating to the Yanchep area including the demand for coastal facilities was undertaken to inform the FMP. The review was based on an assessment completed by MRA, for the Yanchep-Two Rocks Project *'Predicted Future Demand for Coastal Facilities - Yanchep-Two Rocks Project*' (MRA 2008) and utilised methodology discussed in the approved Alkimos Beach Foreshore Management Plan (RPS 2015). Additionally, key CoW policy documents have been utilised to inform infrastructure and facilities required within the foreshore reserve.

5.1 Predicted Future Demand for Coastal Facilities

To confirm the level of demand for coastal access within the Study area, and therefore the information to inform the coastal access infrastructure required; the assessment included a review of population predictions. Population predictions were based on staging plans identified in the St Andrews DSP (2007) and the Yanchep-Two Rocks DSP (Roberts Day 2010) as detailed in Table 10.

Table 10: Yanchep-Two Rocks population predictions

Year	Population
2021	21 560
2033	56 296
2046	110 628
2058	154 091

Source: MRA 2008

MRA undertook a preliminary assessment of the Perth Metropolitan coastline in 2005 in order to determine a conservative physical processes setback for the coastline (MRA 2008). The physical processes lines determined as part of the 2005 study were used as part of the 2008 coastal facilities demand assessment.

As part of the 2008 study, the level of beach use within the Yanchep-Two Rocks area was determined based on a review of the beach usage from Ocean Reef to Fremantle. The review was undertaken in consideration of the length of coastline between Ocean Reef to Fremantle to provide an estimate of beach usage within the Yanchep-Two Rocks area (MRA 2008). The length of coast at Yanchep - Two Rocks is approximately 14 km, in comparison to the Ocean Reef to Fremantle length of coastline of 32 km. Peak usage of Ocean Reef to Fremantle is approximately 14 000 people, therefore it is expected that peak use for Yanchep - Two Rocks will see around 6 400 people using the beaches, when utilising the same ratio. This corresponds to a level of beach usage of around 4% of the local population (MRA 2008). Based on the beach usage estimates, predictions of beach patronage at regional, district and local beaches were made, as summarised in Table 11.

Table 11: Beach usage by classification

Beach classification	Predicted no. People per metre of beach
Regional	2
District	1.2
Local	0.7

Source: MRA 2008

Considering the possible level of beach usage along the Yanchep - Two Rocks coast and the planned suburb growth, it is apparent that the demand for coastal access will be significant in the future. The predicted urbanisation must therefore be reflected in the provision of facilities along the foreshore. Associated with this increase in facilities, the beach capacity must be strategically maximised so that the supply of beach access at least meets demand (MRA 2008).

A beach hierarchy plan was prepared by MRA as part of the 2008 study which classified the Study area as a district beach (MRA 2008). The facilities usually associated with a district beach include:

- 150 car parking bays
- provision of toilets
- grassed areas
- shade/shelter
- picnic facilities
- kiosk/deli
- playground
- lighting.

A total of five district beaches were identified as part of the coastal facilities study to inform the Yanchep-Two Rocks DSP (MRA 2008). The study estimated that once developed, the length of beach that receives regular use for each district would be approximately 800 m, with the combined patronage anticipated to be 4 800 people (MRA 2008). One of the key recommendations from the study was to develop the regional beach on the southern section of the shoreline in close proximity to the regional activity centre and associated public transport routes. In addition, that the regional beach should be adjacent to a coastal activity centre to ensure integration of foreshore development (MRA 2008).

5.2 Local Planning Policy 4.2.1

The CoW Local Planning Policy 4.2.1 (LPP 4.2.1) released in August 2016 provides guidance as to the type of permanent and temporary assets that the CoW will consider within foreshore reserves and in relation to the location of proposed assets in relation to coastal processes as determined in accordance with SPP 2.6.

Consistent with the provisions of the LPP 4.2.1, the Study area was classified as a district beach as part of the 2008 MRA assessment detailed in section 5.1 above, prepared in support of the endorsed ASP 75. Accordingly, infrastructure proposed within the Study area has been determined consistent with permitted infrastructure for a district beach as per LPP 4.2.1; as described further in the supporting DA.

Adaptation planning measures for the proposed foreshore infrastructure have been developed, consistent with SPP 2.6, supporting management guidelines and LPP 4.2.1 as detailed in section 7 and the supporting DA.

6. Foreshore development, design and function

6.1 Design vision

The overarching vision for the Capricorn Beach development, comprising the Capricorn Village and Coastal Node is to create an intrinsically Australian coastal hamlet where residents and visitors feel like they are in a serene environment, despite the nearest convenience being only a short distance away. The design vision capitalises on the natural environment within the development area and surrounds, for example, the large number of mature trees to be retained within the Coastal Node.

The development has been designed to provide residents with a relaxed coastal, resort-like lifestyle. The established parklands, pristine beach, and quality design, aim to make Capricorn Village and Coastal Node and the north of Perth a more desirable place for people to establish a home.

The design vision and concept has been developed based on a number of key considerations including:

1. Regional and local context and demand factors - the Capricorn Beach development is currently underway and will provide approximately 3500 dwelling units, including the provision of the Coastal Node area providing tourism and accommodation facilities. In addition, based on the increased population predicted within the area, beach usage and pressure on the foreshore reserve is likely to increase, therefore resulting in the requirement for a considered and appropriate foreshore design and management strategy.
2. Coastal hazard and risk management - *State Coastal Planning Policy (SPP) No. 2.6*: *Coastal Hazard Risk Management and Adaption Planning* and the Coastal Hazard Risk Management and Adaption Planning Guidelines are key policy documents utilised in developing the Concept Plans and Masterplan, as detailed further in section 7.
3. Environmental site characteristics - the Study area comprises important environmental values for the Capricorn precinct and larger Yanchep area and therefore requires careful management. Access control is a key management measure to assist in controlling disturbance to areas outside of the proposed development areas. The Study area, particularly the foreshore park area comprises unique topography associated with the dune system. This topography and landform function has been enhanced as part of park design to recreate a distinctive landscape design.
4. Maximising previously disturbed areas - the Study area and surrounds have been subject to historic disturbance associated with the Club Capricorn infrastructure and existing beach access infrastructure. The foreshore concept plans have been designed to maximise development within previously disturbed areas and minimise disturbance to areas not subject to previous clearing.
5. Management considerations - to ensure the continued and improved condition of the foreshore area, a number of management strategies for key environmental and planning factors have been developed, including, flora, vegetation and weeds, fauna, fire, revegetation, Aboriginal heritage, access and public awareness, information and safety.

In consideration of the above, foreshore design and function promotes the enhancement and ongoing management of the environment within the Study area, whilst facilitating various land uses of the Capricorn area, including tourism development.

6.2 Current foreshore and surrounding infrastructure

Development within the Study area has been undertaken over a number of years. Development has included a range of works primarily related to the provision and upgrade to beach access points and redevelopment works associated with the Mary Lindsay Homestead (located to the south of the Study area). Table 12 includes a summary of the works completed to date.

Table 12: Current foreshore infrastructure

Infrastructure	Responsibility	Status	Location within the Study area
Beach access 2, Capricorn Esplanade, Yanchep	CVJV	Construction complete. Handover to the CoW accepted (24 April 2015).	Not within the Study area.
Mary Lindsay Homestead redevelopment works	CoW	Construction underway.	Not within the Study area.

6.3 Design concept - structural elements

The Capricorn Village Coastal Node is classified as a District Level Beach Node that will provide open space and recreational facilities adjacent to a dedicated tourism site and urban development. This Coastal Node is proposed to be constructed on a portion of the old Club Capricorn tourism site which was originally internal roads, informal carpark and managed landscaped areas adjacent chalets (now removed). Located at the western end of old Club Capricorn with access off Two Rocks Road, the retention of existing trees and meandering road to this node creates a unique landscape not found in developments in the northern corridor.

The POS character will reflect that of the Capricorn and Yanchep region, and will have higher specification treatments adjacent to the tourism site as a way of blending the landscape between public and private domains. Facilities proposed have been considered in relation to the future Mary Lindsay Homestead node and the Yanchep Lagoon node, and in addition, review the current usage of the northern beach area. The diversity of surrounding future development including lifestyle lots, high density living, tourism and possible commercial development requires this coastal node to allow full flexibility for the range of end users, which will extend to the existing Yanchep residents.

The Coastal Node will deliver the following key facilities:

1. Two beach access points located along existing tracks. Minor disturbance will be required within the Study area to facilitate required upgrades to current beach access points.
2. Conservation of the foreshore reserve, retention of existing dune formations and vegetation with restricted access via fencing.
3. Consideration of the coastal processes with the majority of amenities located outside of the 100 year coastal processes line.
4. Provision of a range of activities including open grass kick-about, viewing areas with decks, resting areas with shade, playground and water play, barbeques, drink fountains and public art catering for a range of beach users.
5. Provision of best practice sustainable planting and tree species that will maximise site stabilisation, provide shade and protection from winds. The potential to transplant trees from within the Club Capricorn site for shade within the Coastal Node POS will be also be investigated.
6. Universal access along pathways, provision of ACROD parking, and disability access to facilities.
7. Use of existing lower car park area as a temporary asset.
8. Toilet and change room facilities.

Construction of various components of the coastal node will be undertaken over a staged timeline. Rehabilitation planting will be proposed to soften the boundary between the developed and managed parkland area and the foreshore dunes.

The key structural and design elements within the Study area, including the Coastal Node and POS and beach access points have been developed consistent with requirements of SPP 2.6 and the CoW *LPP 4.21 Coastal Assets Policy* (CoW 2016), as detailed in the supporting DA documentation. The Coastal Node and POS area comprise 2.38 ha classified as District Open Space (DOS) in accordance with *City of Wanneroo District Planning Scheme No. 2.* The Coastal Node and POS utilises previous disturbance areas where possible, however will involve some areas of new disturbance including approximately 1.68 ha, which represents approximately 7.5% of the 22.41 ha Study area.

The Coastal Node POS has been divided into categories, as detailed in the Capricorn Village: Coastal Node POS park assets table (refer to supporting DA), including:

- key facilities
- minor fixtures
- play area
- lookout structures.

A detailed summary of POS park assets is presented in the supporting DA and summarised in the following sections. Indicative cost estimates for life cycle/asset management for the works proposed within this FMP have been developed in accordance with the CoW asset template as discussed below and provided in the supporting DA.

6.3.1 Proposed key facilities

The proposed key facilities for the Study area comprise of the following:

- shade structure
- picnic settings
- various seating (moonstone curved sculpture seat; treeline bench seat)
- directional and sculptural signage
- electric barbecues
- drink fountain
- outdoor showers
- pole top lights
- concrete and rock sea stack structures.

In addition, the supporting DA details the coastal vulnerability of each of the key facilities. Importantly, the majority of key infrastructure is located outside of the 100-year coastal vulnerability line as shown on Figure 8.

6.3.2 Proposed minor fixtures

The proposed minor fixtures for the Study area comprise of the following:

- tree grille/grates
- bike racks
- beach safety signage
- in ground decking.

All proposed minor fixtures will be constructed outside the 50-year coastal vulnerability line, with the exception of beach safety signage that is required within these zones to assist in maintaining a safe beach environment.

6.3.3 Proposed play area

The proposed play area within the Study area comprise of the following:

- shade sails over play items
- ocean theme water play
- lookout tower
- large embankment slide
- embankment wave slide
- net play

- swing
- boat/dinghy play component
- hand grips
- toddler springers/rockers.

All infrastructure within the play areas are outside of the 100-year coastal vulnerability lines as presented in Figure 8.

6.3.4 Lookout structures

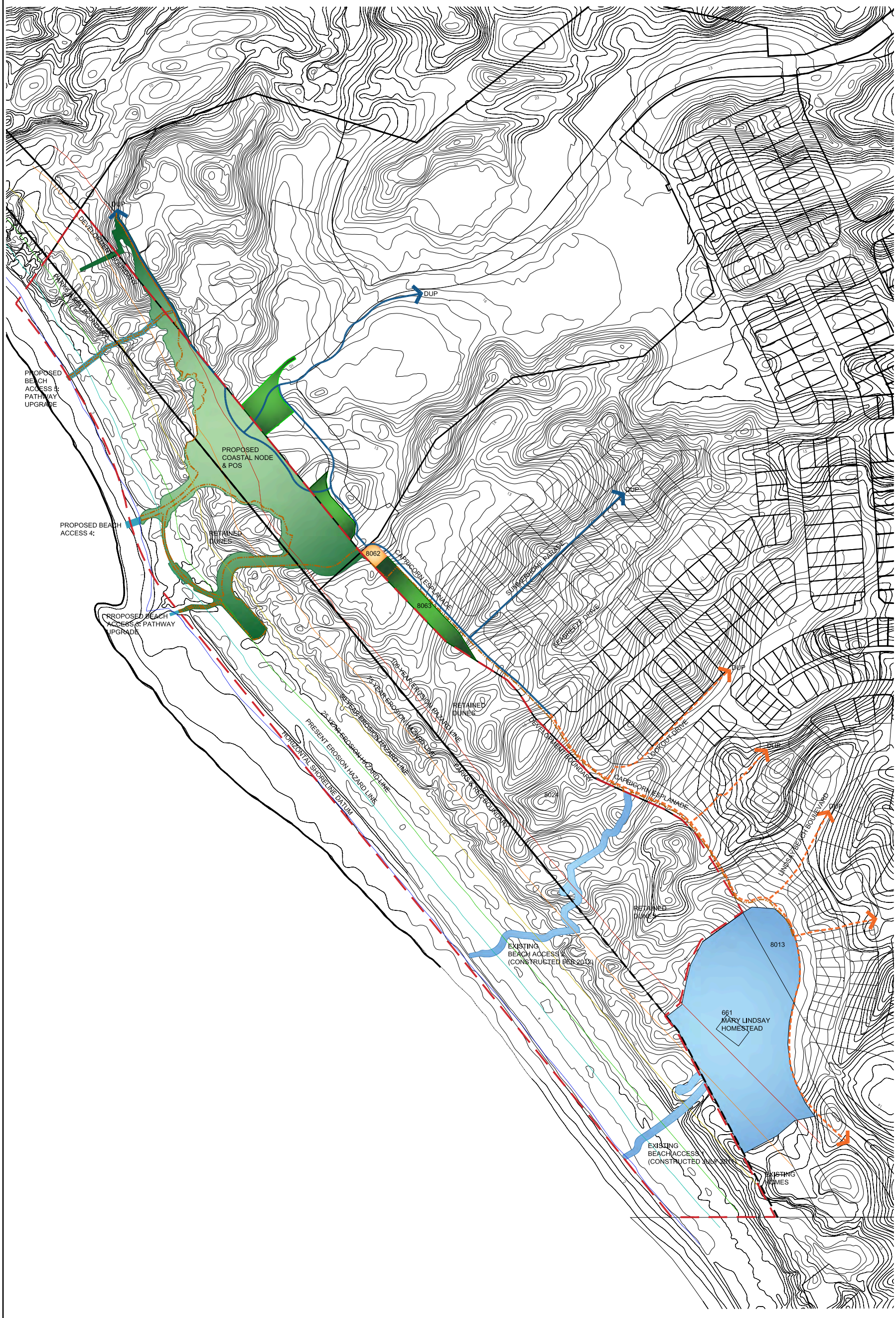
The lookout structures will be constructed from lightweight and recyclable materials making it easier to dissemble and reassemble to a new location if necessary. The lookout structures are outside of the 50 year and 25 year coastal vulnerability lines as presented in Figure 8 and the supporting DA.

6.3.5 Access paths and carpark

SPP 2.6 requires the provision of public access to the coast that is consistent with the values and management objectives of the area including, the interests of security, safety and protection of coastal resources as well as the recreational opportunities, both on and offshore, of that section of coast. The main beach access pathway comprises seated resting areas, showers and drink taps. A 3 m wide universal and maintenance access pathway also traverses the site providing direct access from the car park to open space areas.

The existing carpark comprises 34 bays, this carpark will act as the temporary carpark until the permanent carpark is required. The temporary carpark is located seaward of the 50-year coastal processes line and therefore is proposed to be subject to a retreat management approach. The permanent carpark as shown on Figure 8 comprises 74 bays including 4 ACROD bays and is located behind the 100-year coastal processes line.

In addition to the proposed access points within the POS area, existing beach access paths will be upgraded to facilitate controlled access of the site.



LEGEND:

- EXTENT OF WORKS: FORESHORE MANAGEMENT PLAN SUBMISSION APPROXIMATELY 22.80HA
- PROPOSED COASTAL NODE & POS (REFER DETAILED CONCEPT PLAN) APPROXIMATELY 2.38HA
- PROPOSED UPGRADED BEACH ACCESS PATHWAYS (LOCATED ALONG EXISTING BEACH ACCESS TRACKS)
- PROPOSED POS OR PAW AREAS (TO BE DESIGNED)
- PROPOSED PUMP STATION SITE
- EXISTING BEACH ACCESS BOARDWALKS (MANAGEMENT ORDER WITH CoW DATED 23rd APRIL 2015) & MARY LINDSAY HOMESTEAD ALSO UNDER CoW MANAGEMENT ORDER
- PARKS & RECREATION BOUNDARY
- PROPOSED DUAL USE PATH / BIKE PATH 2.5 WIDE, CONCRETE
- EXISTING DUAL USE PATH / BIKE PATH 2.5m WIDE, CONCRETE
- PHYSICAL BARRIER: EITHER CONSERVATION FENCE, BALUSTRADE OR WALL PREVENTING ACCESS INTO DUNES

No.	REVISION	BY	DATE
C	FMP FINAL MASTERPLAN	KD	210717
B	CoW CHRMAP LINES INCLUDED	KD	120517
A	BASE PLAN UPDATED	KD	140217

Title
FORESHORE MANAGEMENT PLAN MASTERPLAN

Project
CAPRICORN VILLAGE

Client
ACUMEN / CVJV

EPCAD Pty Ltd
28-30 Mayfair Street West Perth Western Australia 6005
PO Box 1233 West Perth WA 6872 Tel 08 94814410 Fax 08 94816903
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Project No. B0494/FMP/M01
Category
Drawing No.

Date FEB 2017
Scale 1:2000 @ A1
Issue FMP
Drawn KD
Revision C
Checked

Figure 8: Foreshore Masterplan

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7. Coastal hazard risk management

In accordance with *State Coastal Planning Policy (SPP) No. 2.6*: *Coastal Hazard Risk Management and Adaption Planning* is required in any areas that may be at risk from coastal hazards. SPP 2.6 and the Coastal Hazard Risk Management and Adaption Planning Guidelines are required to be utilised in conjunction to manage potential coastal risks along the Western Australian coastline.

7.1 Coastal Aquatic Risk Assessment

A Coastal Aquatic Risk Assessment (CARA) of the Study area was undertaken by Surf Life Saving Western Australia (SLSWA, 2017) to support the FMP (Appendix 4). The purpose of the assessment was to assess the suitability of the beach as a recreational aquatic activity and swimming beach and review signage currently in place and required to ensure a safe beach is maintained. A number of recommendations were made as part of the assessment relating to the signage and access to the Study area.

The CARA determined that Capricorn Beach, adjacent to the Study area is suitable for continued usage for recreational aquatic activity, particularly Capricorn Beach north of the groyne, due to the absence of rock/reef platforms. As a result, this portion of the Study area is the preferred location for development of the coastal node, comprising infrastructure to support safe aquatic recreation in the area, including:

- defined access tracks
- emergency vehicle access points
- safety signage.

The CARA identified as part of a hazard identification and risk assessment a range of key risk treatments that could be applied to the proposed foreshore development, based on hazards and their individual risk to public safety. The risk assessment found that the current overall risk level for Yanchep and Capricorn Beach were 29 and 26 respectively, representing a low risk level and planning priority.

The CARA noted that the risk treatments identified should be reviewed to determine which risk treatments are appropriate and can feasibly be implemented at the Capricorn Beach. Risk treatments to be applied, consistent with SLSWA recommendations as summarised in the following sections:

7.1.1 Access and ongoing maintenance

The following recommendations were made in relation to access and ongoing maintenance:

- consider wider emergency access for vehicles and other approved users
- remove hazards associated with access tracks and recreational areas where possible
- restrict access to areas not suitable for swimming or recreational use
- major access points should direct swimmers to more ‘friendly areas for swimming, including patrolled areas.

Pedestrian access points and emergency vehicle access details are provided in the detailed landscaping drawings provided in the supporting DA. Management recommendations in relation to access and maintenance are detailed in section 9.6.

7.1.2 System of safety signage

Appropriate signage was noted during the CARA within the Study area, however some signage has been removed as part of the Club Capricorn demolition works and damaged and out of date temporary signage was also observed. SLSWA recommends that once access tracks, roads and carparks are developed or upgraded, appropriate signage should be installed, including:

- beach and aquatic safety signage
- location signage
- aquatic zoning signage
- signage relating to location of toilets/disabled access
- signage relating to location of nearest lifesaving service
- local government regulation signage
- environmental and conservation signage
- community information signage including safety, security and crime prevention.

An inspection regime for signage was also recommended as part of the CARA. Details regarding the proposed signage inspection are included in the supporting DA and section 9.6.

7.1.3 System of supervision – lifesaving service level analysis

The CARA included an assessment of the lifesaving service level requirements. The assessment concluded that a lifesaving service is not required at Yanchep or Capricorn Beach, comprising the Study area, however the requirement for lifesaving services will need to be reassessed as development progresses within the Coastal Node.

Activity zoning should be considered as required by the final land manager (CoW) as development in the area progresses and conflicting aquatic and recreation activities occur, i.e. surfing and swimming.

7.1.4 Existence of emergency action plans

The SLSWA CARA assessment recommends that the party responsible for implementing and maintaining aquatic safety strategies should develop, implement and review Emergency Access Plans (EAP) to ensure a planned and coordinated response to the range of potential and localised aquatic and recreation emergencies that may occur along the foreshore reserve.

7.1.5 Education and awareness

A recommendation of the CARA was to promote awareness for beach safety within the Yanchep area through communication with residents. In order to promote safety awareness, a range of measures have been proposed as detailed in section 9.6.

7.1.6 Dune vegetation maintenance

The CARA noted some erosion along the dune faces and near informal access points, however the remaining dunes were identified as being stable and well vegetated and unlikely at this stage to promote any hazards in terms of erosion and sand collapse.

The proposed development of the Coastal Node will further reduce the potential for erosion by ensuring dedicated access points are constructed and revegetation of tracks no longer used and informal tracks is undertaken. Details relating to beach access are included in the supporting DA and revegetation management is discussed in section 9.4.

7.2 Coastal hazard risk

As part of the planning undertaken for the proposed Capricorn development, MRA were engaged to complete a review of the coastal erosion hazard allowances for the North Yanchep development areas including:

- North Yanchep Coastal Setback Assessment – MRA Report R337 Rev 2 completed for the Capricorn Village Joint Venture (CVJV) in January 2013
- North Yanchep – North of Groyne Assessment of Setback – MRA Report R340 Rev 2 completed for the CVJV in July 2014 (MRA 2014).

Both assessments were completed in accordance with the requirements of SPP 2.6; noting that the 2013 assessment was completed in January, prior to the most recent amendment to SPP 2.6 in July 2013. Notwithstanding this, as noted with the 2013 study, a draft of the proposed 2013 revision to SPP 2.6 was available at the time, therefore an assessment of coastal setbacks (now termed coastal erosion hazard allowance) was made in accordance with the proposed amendments to the policy. These proposed amendments have subsequently been adopted as policy, therefore the assessment presented within this report was consistent with requirements of the 2013 version of SPP 2.6.

As approximately 5 years has passed since completion of the assessments (using shoreline movement information up until 2012), an update to the assessment was completed using aerial imagery from February 2017; in addition, the southern extent of the hazard lines needs to be extended to cover shoreline fronting Mary Lindsay Homestead. Results of the 2017 are summarised in the following sections and the complete report is provided in Appendix 5.

7.2.1 North of the Capricorn Village Groyne

Assessment of the shoreline position in 2017 shows a continuation of the trends observed prior to 2012. Essentially, the shoreline north of the Capricorn Village groyne has accreted markedly since 1965. As a result the allowance for long term shoreline movement (S2) that were made remain appropriate. Likewise, the allowances for severe storm erosion (S1) and coastal recession due to sea level rise (S3) also remain appropriate.

7.2.2 South of the Capricorn Village Groyne

Assessment of the shoreline position in 2017 for the shoreline south of the Capricorn Village groyne also shows a continuation of the trends observed prior to 2012. The shoreline immediately south of the Capricorn Village groyne has accreted markedly since 1965, however the extent of ongoing accretion reduces with distance south. In fact, since 1996 the shoreline just south of the Mary Lindsay Homestead shows an erosion trend of around 0.3 m/year.

This trend is consistent with the shoreline movement noted within the CHRMAP Part 1 works (as presented in MRA Report R607 Rev 0: CHRMAP Part 1 – Coastal Vulnerability Study and Hazard Mapping) completed for the City of Wanneroo. As a result the allowances for long term shoreline movement (S2) will need to vary across the expanded assessment area.

A long-term shoreline movement allowance (S2) of 0 m/year will be appropriate for the shoreline from the Capricorn Village groyne extending south 600 m (report R337 Rev 2 chainages 1,500 to 2,100 m). From this location the S2 allowance will need to transition to 0.3 m/year at a location around 900 m south of the groyne (report R337 Rev 2 chainage 1,200 m).

Consideration of the severe storm erosion (S1) and coastal recession due to sea level rise (S3) allowances suggests that the values outlined in report R337 Rev 2 will be appropriate over the expanded assessment area given the similar aspect, exposure and form of the coastline.

Total coastal erosion hazard allowances for a variety of planning horizons are subsequently provided in Tables 2 and 3 for the area immediately south of the groyne (report R337 Rev 2 chainages 1,500 to 2,100 m) and the location 900 m south of the groyne (report R337 Rev 2 chainage 1,200 m) respectively. These allowances are measured in a landward direction from the Horizontal Shoreline Datum (HSD) which has been updated based on the 2017 information.

7.2.3 Concluding comments

It is noted that the locations of the coastal hazard lines determined as part of the assessment are slightly different to those prepared for CoW as part of the CHRMAP Part 1 works. The reason for this difference is as follows:

1. The CHRMAP Part 1 works used data up to and including 2015. This investigation for the CVJV has used data up to and including 2017. Some small differences in the location of the shoreline between 2015 and 2017 are noted (generally up to 2-3 m) and will affect the locations of the coastal hazard lines.
2. The CHRMAP Part 1 works required consideration of different timeframes, including a 105 year planning horizon to 2120. As a result the S3 Allowance for sea level rise was slightly bigger than required for this CVJV study (due to the extended planning horizon of 105 years versus 100 years). Furthermore, the Allowance for Uncertainty was also 1 m greater given the extended planning horizon.

The coastal hazard lines between the CVJV and CoW assessments are slightly different, however MRA have advised that the coastal erosion hazard lines determined in this letter are the most appropriate coastal hazard lines to be used to guide coastal planning within the Study area, given that the assessment includes the most recent data and planning horizon of 100 years, as required in SPP 2.6.

7.3 Coastal Hazard Risk Management and adaptation planning

SPP 2.6 requires proponents to consider the potential risk to development associated with coastal hazards. Where risk assessments identify a level of risk that is unacceptable to the affected community or proposed development, adaptation measures need to be prepared to reduce those risks to acceptable or tolerable levels. The hierarchy, presented in a sequential and preferential basis with regard to the coastal hazard risk requires:

- avoid - the presence of new development in an area affected by coastal hazards
- planned or managed retreat - relocation or removal of assets within an area identified as likely to be subject to intolerable risk damage from coastal hazards over the planning timeframe
- accommodation - If sufficient justification can be provided for not avoiding development of land that is at risk from coastal hazards then accommodation adaptation measures should be provided that suitably address the identified risks
- protection - where sufficient justification can be provided for not avoiding the use or development of land that is at risk from coastal hazards and accommodation measures alone cannot adequately address the risks from coastal hazards, then coastal protection works may be proposed for areas where there is a need to preserve the foreshore reserve, public access and public safety, property and infrastructure that is not expendable.

All significant public assets and private properties proposed to be developed are located outside of the 100 year coastal processes line, resulting in an 'avoidance' management strategy from coastal hazards. Some infrastructure occurs within the 50 year coastal processes line including:

- temporary carpark (consistent with its current location)
- existing beach access points:

A managed retreat approach will be adopted for these components as this approach is considered to be beneficial for the community compared to developing this infrastructure further landward from the outset (MRA 2014). The proposed location of these facilities in closer proximity to the coast provides for improved amenity for the users and also ensures connection to the coast is maintained.

A reduction in the north-south alignment of the foreshore will occur over time resulting in a reduction in the need for certain infrastructure with eventual removal; including the temporary carpark, the north-south connecting boardwalk and emergency vehicle access; therefore, a managed retreat approach is proposed. With the exception of the carpark, the north-south boardwalk and emergency vehicle access may no longer be required in the future as the shoreline decreases as existing north-south linkages will remain within the Coastal Node area, including the 2.5 m wide dual use path and 3 m wide reinforced access pathways.

The temporary carpark will be removed as required as part of the managed retreat approach and the proposed carpark servicing the coastal node will cater for the loss of the temporary carpark, as detailed in the supporting DA.

As the foreshore reserve width is reduced, beach access points will be reduced and relocated if required, to coincide with the rate of coastal movement. To ensure the risk of coastal hazards impacting within the Study area is contemporary and appropriate for the infrastructure, it is recommended that ongoing monitoring and review of structures is undertaken. It is likely that reassessment of coastal vulnerability is undertaken to determine appropriate new locations for infrastructure.

Infrastructure within the Study area will continue to be managed for a period of 5 years by CVJV following practical completion prior to handover to the CoW as discussed in section 8.

8. Management framework and responsibilities

8.1 Implementation

Construction of the Coastal Node POS will be undertaken over two broad stages as described further in the supporting DA, with implementation of the FMP taking place over three years as described in sections 9.1 to 9.7. A separate DA will be submitted for approval to develop the Coastal Node POS and other infrastructure and works within the Study area as required, providing a greater level of detail, including detailed landscaping, engineering and drainage design as required. Notwithstanding this, the CoW and WAPC will have regard to this FMP when considering future development of the Study area.

This FMP will be implemented by the proponent and relevant contractors engaged to undertake individual works programs. Implementation and management responsibilities are discussed further for each factor detailed in sections 9.1 to 9.7.

8.2 Maintenance and practical completion

Maintenance works within the foreshore reserve are planned to continue for five years following practical completion, prior to being handed over to the CoW for management in perpetuity. Practical completion as defined in this FMP is 'sign-off' from the CoW when development (landscaping, construction or revegetation works) have been undertaken in accordance with detailed landscaping/engineering drawings and plans and the Capricorn FMP. The CoW practical completion process requires that the following documentation be provided to the CoW prior to sign-off:

- 'As constructed' landscape plans in PDF format, in DWG format and A3 hard copy
- bore installation details, controller manuals and software
- 'As constructed' electrical plans in PDF format, in DWG format and A3 hard copy
- electrical certification for lights, BBQ, bore cabinet etc
- copy of current bore licenses (license to take water).
- certification for playground and playground audit (required upon installation prior to practical completion and on an annual basis thereafter)
- building permits where required for structures
- 'As constructed' irrigation plans in PDF format, in DWG format and A3 hard copy.

Following a final inspection by CoW additional detail will be required including:

- capital costs of all physical assets for inclusion in the CoW asset register
- 12-month maintenance schedule and estimate of annual maintenance costs.

Maintenance requirements for the foreshore area will be similar to the maintenance expectations for POS outlined in the CoW LPP 4.3: POS (2010); whereby:

- the City being satisfied that the maturity of vegetation, density of planting, species selection and standard of infrastructure are consistent with that specified in the landscaping plan approved by the City, as being acceptable for handover to the City
- for at least 12 consecutive months prior to handover, the developer maintaining the POS to the same standard as it would otherwise be maintained by the City post-handover
- the developer providing the City with annual metered bore water usage data for any irrigated public open space during the term of their maintenance period, to demonstrate compliance with the water licence allocation for that area
- the developer providing the City with as-constructed drawings and asset management data for the public open space and any facilities/infrastructure contained therein.

In addition to the above, the developer is required to maintain the Study area for five years following practical completion, in accordance with SPP 2.6.

8.3 Handover

Handover of the Study area to the CoW after the five-year maintenance period will include provision of the following documentation:

- monitoring reports (revegetation monitoring)
- 'intention to handover' documentation
- bore licences transferred to CoW prior to handover, including electrical certification on completion of installation
- 'As constructed' drawings and asset management data for POS and facilities/infrastructure, including maintenance schedules and costs
- annual playground audit reports.

8.4 Timing

Timing for development of infrastructure within the foreshore area is proposed to commence in late 2017 and be completed by 2020. A more detailed schedule of development has been included in the supporting DA. The Study area will be created as a 'Parks and Recreation' reserve and vested to the Crown as agreed by CVJV and the WAPC. Upon the transfer of the foreshore to the Crown, the foreshore will be vested to the CoW.

9. Foreshore management considerations

This section provides a summary of key considerations for the management of the Study area, focussing on management of environmental and social values associated with all aspects of the Project. Key factors relevant to the management of the foreshore values include:

- flora, vegetation and weeds
- fauna
- fire
- revegetation
- Aboriginal heritage
- access
- public awareness information and safety.

9.1 Flora, vegetation and weed management

A total of 1.53 ha of native vegetation comprising two Priority 3 PECs; FCT 29a and FCT29b, comprising 0.18 ha and 1.09 ha respectively, will be cleared within the Study area to facilitate construction of foreshore infrastructure. It is noted however that the PECs are well represented throughout the region and in conservation as part of Bush Forever 397. Furthermore, development within the Study area has been designed to minimise the clearing footprint, whilst maximising use of previously disturbed areas for the placement of assets and infrastructure.

Development within the Study area has the potential to impact on flora and vegetation through the following:

- accidental clearing of vegetation outside of the agreed clearing footprint
- degradation of vegetation as a result of edge effects in areas adjacent to the clearing footprint
- spread of weeds and pathogens as a result of clearing
- disturbance to vegetation as a result of unauthorised third-party access.

The introduction and spread of weed species or diseases has the potential to occur through a number of means, particularly associated with spread from vehicles and machinery entering the Study area. The key activities which may result in the introduction and spread of weed and diseases include the following:

- movement of vehicles, machinery and people onto the Study area
- movement of vehicles, machinery and people along tracks and roads from the development area may spread weeds and diseases
- importation of material containing weeds or diseases may cause introduction of new diseases or weed infestations to the Study area.

9.1.1 Objectives, targets and key performance indicators

Environmental objectives, targets and key performance indicators for the management of flora, vegetation and weeds are detailed in Table 13.

Table 13: Environmental objectives, targets and key performance indicators for flora, vegetation and weed management

Objective	Target	Key performance indicator
To minimise and manage disturbance to vegetation	No unauthorised clearing of vegetation.	All construction activities undertaken within the approved footprint.
Minimise the spread of existing weed populations and introduction of new weed species within the Study area	Prevent unauthorised movement of vehicles from spreading weeds.	All vehicles and machinery clean-on-entry to site[2]. No incidents relating to non-compliance with weed management procedures.
	To avoid spreading weeds through inappropriate use or storage of potentially infested topsoil.	No soil or vegetation matter that has the capability of introducing weeds will be brought into the Study area by CVJV contractors.
Minimise weed presence within the Study area	Prevent the introduction and dispersal of weeds, pathogens and pest species.	Weed cover is no more than 10% prior to handover.

9.1.2 Management actions

Management of flora, vegetation and weeds will be undertaken in accordance with actions detailed in Table 14.

Table 14: Management actions for flora, vegetation and weed management

Item	Action	Timing	Responsibility
Induction	Induct all contractors working within the Study area in relation to flora and vegetation protection and weed management.	Prior to entering the Study area	CVJV Project Manager
Vegetation clearing	Provide GPS coordinates of areas to be cleared and areas to be retained to all contractors entering the Study area.	Prior to clearing	Clearing contractor
	Clearing boundaries will be clearly demarcated using distinctive markers (flagging tape, fencing, signage etc).	At all times	Clearing contractor
Fencing/flagging	Install fencing/flagging in accordance with the proposed fencing strategy (detailed in the supporting DA) to prevent access to vegetation to be retained and/or protected.	At all times	CVJV Project Manager
Access and vehicular /machinery movement	Ensure vehicles and machinery are clean on entry to the Study area.	At all times	All personnel
	Ensure vehicles remain on designated roads and access tracks and do not go beyond the approved clearing footprint and/or approved locations	At all times	All personnel
	Clean-down vehicles and machinery outside of the Study area if found to contain weeds and/or soil material and dispose of material at an appropriate waste receptacle off site.	At all times	All personnel
Weed control	Determine weed species requiring targeted and prioritised control measures	Prior to development within the Study area	Weed control contractor
	Undertake weed control at least twice or as deemed appropriate by the revegetation contractor prior to commencing revegetation works.	Prior to revegetation (indicative timeframe is Spring and following the first winter rains).	Weed control contractor

[2] Once vehicles/equipment are mobilised to site, inspected and determined to be clean, they are then defined as clean for the project unless they are deployed to another work area.

Item	Action	Timing	Responsibility
	Undertake ongoing maintenance weed control	Biannually for five years from the initial planting completion date, or as advised by the revegetation contractor	Weed control contractor
Dust control	Implement construction activities or other activities with the potential to generate dust during dry and windy weather conditions	Ongoing	Construction Manager
	Undertake clearing progressively to minimise the potential for exposed surfaces resulting in dust lift-off	During clearing	Construction Manager
	Water carts will be used in conjunction with earth moving/clearing activities and as required based on prevailing weather conditions at the time of construction works.	During clearing/earthmoving	Construction Manager

9.1.3 Monitoring

Monitoring and reporting requirements for flora, vegetation and weeds are detailed in Table 15.

Table 15: Flora, vegetation and weed management monitoring and reporting requirements

Parameter	Purpose	Location	Frequency / Timing	Responsibility
Photographic evidence and/or GPS coordinates of proposed clearance areas	To record incidences of clearing of vegetation and/or flora outside approved construction areas.	All areas of proposed disturbance of native vegetation.	Prior to ground disturbance. Following each clearing campaign.	Clearing contractor
Induction records	To ensure compliance with induction requirements for all personnel.	Study area.	Annually.	CVJV Project Manager
Fencing / flagging	To monitor integrity of fencing and/or flagging within the Study area.	All areas delineated by fencing and/or flagging.	Fortnightly during construction.	CVJV Project Manager
Weed species presence	• to monitor weed occurrence, density and type • to monitor weed growth and compare against targets and KPIs	Study area	Annually in Spring.	Weed control contractor
Vehicle/machinery register	To ensure equipment and machinery is free from soils, weed and weed material on entry to the Study area.	Study area.	Prior to entering the Study area.	CVJV Project Manager
Visual observations of dust generation	Monitor dust emissions	Within and adjacent to the Study area boundary	Opportunistically during clearing, construction and other potential dust generating activities	All personnel

9.1.4 Contingencies

Contingency measures to be implemented for flora, vegetation and weeds are detailed in Table 16.

Table 16: Flora, vegetation and weed management contingency measures

Trigger	Action	Responsibility
Clearing occurs outside approved areas	1. Determine extent of clearing. 2. Determine activity that caused the clearing. 3. Advise DWER and CoW of breach in approved clearing area. 4. Implement rehabilitation measures/proposed mitigation measures as soon as practicable following consultation with DWER.	CVJV Project Manager
Flagging and fencing not sufficient or not maintained	1. Repair or reinstate flagging and/or fencing. 2. Review frequency of monitoring.	CVJV Project Manager
New infestation of weed(s) identified and/or spread of existing weed species in the Study area	Investigate source of weed infestation.	Weed control contractor
	Undertake weed control immediately and follow up weed control during to monitor success	Weed control contractor
	Review weed management procedures including contractor training	Weed control contractor
Disturbance to areas outside of designated tracks/clearing areas observed	1. Determine extent of disturbance. 2. Identify cause of disturbance. 3. Identify mitigation measures that may include revegetation, increased contractor and staff awareness and training. 4. Monitor success of remediation measures.	CVJV Project Manager
Reporting	Any breaches of the weed management procedures shall be reported to CVJV and investigated.	Clearing Contractor / Utilities provider
Excessive ambient dust levels observed and/or excessive dust deposition noted on vegetation	1. Investigate cause, including nature of activities and appropriateness, in relation to weather conditions. 2. Determine additional dust measures to be implemented, including the use of water carts or dust stabilisation measures 3. Implement appropriate additional dust measures 4. Continue monitoring (visual observations) to determine success.	Construction Manager

9.2 Fauna

Based on the review of available literature and the field survey completed by Bamford (2016) the number of significant fauna species that may use the Study area is considered to be low. In addition, the proposed disturbance area is small within the context of the larger Study area; therefore, impacts are expected to be minimal. The key impacting processes are summarised below:

1. Habitat loss leading to population decline and fragmentation – there is the potential for fragmentation of habitat as the development will reduce the width of the foreshore reserve at one point associated with Coastal Node POS clearing; reducing the width of the belt of vegetation along the secondary dunes.
2. Degradation of habitat due to weed invasion, trampling and general vegetation degradation leading to population decline.
3. Fauna injury as a result of construction activities – fauna injury and/or death may occur through foreshore construction activities and future use of the area, including fauna death from new parking areas. Fauna injury and/or death, whilst potentially resulting in localised impacts is unlikely to be an impacting process of concern with respect to the project.
4. Species interactions including feral and overabundant native species – the development and in particular pathway development will improve access into the foreshore reserve for feral species such as foxes and cats.
5. Altered fire regime– there will be an increased fire risk with increased access; and if grassy weeds become established.
6. Disturbance as a result of dust, light, and noise – unlikely to be of concern as it is small scale compared with the adjacent urban development.

In consideration of the impacting processes described above, the following aspects of the proposed works within the Study area have been identified as requiring management to ensure protection of fauna values:

- vegetation clearing will directly disturb terrestrial fauna habitat and may result in habitat fragmentation
- vehicle movements have the potential for mortality of individual fauna, especially less-mobile species
- disturbance associated with the proposed works may affect fauna behaviour and distribution, and potentially create conditions favourable for feral fauna
- direct and indirect disturbance from light, noise, vibration and dust may reduce habitat quality in areas within and surrounding the disturbance area.

Detailed relocation requirements have been included for species of conservation significance that may occur in the Study area (as detailed in section 4.1.5) requiring specific relocation measures. Where specific relocation measures are not required, standard relocation measures will be implemented for all species as detailed in Table 18.

9.2.1 Objectives, targets and key performance indicators

The environmental objectives, targets and key performance indicators for fauna protection are detailed in Table 17.

Table 17: Environmental objectives, targets and indicators for fauna protection

Objective	Target	Key performance indicator
Minimise the impact of feral animals on native terrestrial fauna	No significant observed increase in feral animal abundance in the vicinity of the Study area.	Number of feral animals observed during foreshore works shows declining trend.
Minimise impacts to local terrestrial fauna populations	No clearing or disturbance of habitat outside pre-defined boundaries throughout the duration of the foreshore works.	All activities undertaken within the approved footprint.
	To relocate fauna with the potential to be impacted by clearing through trapping and relocation immediately prior to clearing.	Number of visual observations during clearing operations.

9.2.2 Management actions

Specific management and mitigation measures have been identified to assist in achieving the fauna management objectives detailed in Table 18.

Table 18: Management actions for fauna protection

Parameter	Action	Timing	Responsibility
Induction	Induct all contractors working within the Study area in relation to fauna protection, management and interactions including: • on-site speed limit restrictions • rubbish disposal procedures • fauna encounter procedures • on-site prohibitions (e.g. pets, feeding animals).	Induction	CVJV Project Manager
Clearing and earthworks	Clearing boundaries will be clearly demarcated using distinctive markers (flagging tape, signage etc).	Prior to ground disturbance	Clearing contractor
	Provide GPS coordinates of areas to be cleared and areas to be retained to all contractors entering the Study area.	Prior to ground disturbance	Clearing contractor
	Minimise clearing by locating infrastructure in already cleared or disturbed areas where possible.	Prior to ground disturbance	Clearing contractor
Native fauna protection	All vehicles shall remain on designated roads/tracks and shall not be permitted off designated roads unless in the case of an emergency.	At all times	All personnel
	All personnel shall observe onsite vehicle speed limits (maximum of 40 km/hr) to prevent the likelihood of road kill.	At all times	All personnel
	Provide signage in areas of known wildlife activity.	Prior to ground disturbance	All personnel
Native fauna relocation	Undertake a Southern Brown Bandicoot trapping and translocation program by a suitably qualified fauna expert, in accordance with an appropriate licence issued by Parks and Wildlife, for all areas of vegetation containing suitable habitat within the Project area. The Southern Brown Bandicoot trapping will occur as follows: • prior to trapping an appropriate fauna relocation permit will be sought from Parks and Wildlife, including confirmation of appropriate release locations • site reconnaissance will be undertaken by the qualified fauna expert prior to trapping to determine where Southern Brown Bandicoot will occur • traps will be set accordingly across each stage of habitat to be cleared • traps will be set and checked for each trapping	Within 7 days of clearing suitable habitat in each clearing stage	Fauna Specialist

Parameter	Action	Timing	Responsibility
	night and Southern Brown Bandicoot relocated • the trapping event will continue for a minimum of 3 nights, or until such time as the data indicates that the population on-site has been significantly reduced based on the advice of a fauna expert • following each trapping event, a report will be provided detailing the methodology, number of animals relocated and the locations to which they were released • the summary reports will be made available to CoW.		
	Undertake targeted reptile trapping and translocation program, specifically for Black-striped Snake a suitably qualified reptile expert during warmer months for all areas of suitable habitat within the Project area. The targeted reptile trapping will occur as follows: • prior to trapping an appropriate fauna relocation permit will be sought from Parks and Wildlife, including confirmation of appropriate release locations • site reconnaissance will be undertaken by the qualified reptile expert prior to trapping to determine the optimal locations for traps, and methods of trapping • a variety of methods will be used for capturing targeted reptiles dependent upon the habitat type present in each stage; the site conditions; and the prevailing weather conditions. These may include single pits, pit trap lines (10 litre and 20 litre pit sizes) as well as manual capture • each trapping event will run for a minimum of 3 days, based on the advice of a fauna expert with traps and pits checked during the day and at night for nocturnal pits • following each trapping phase a summary report will be provided detailing the methodology, number of animals relocated and the locations to which they were released • the summary reports will be made available to CoW.	Within 5 weeks of clearing suitable habitat in each clearing stage (during warmer months on the advice of a qualified reptile expert)	Fauna Specialist
	Inspect each stage of development to be cleared for evidence of Rainbow Bee-eater presence in the form of nest burrows. If Rainbow Bee-eaters nesting burrows are identified during the survey, implement contingency actions as listed in Table 20.	Within 7 days of clearing suitable habitat in each clearing stage (September - February)	Fauna Specialist
	Areas being cleared will be searched immediately prior to clearing for reptiles, mammals and birds. Species targeted will include (but not be limited to) conservation significant species potentially occurring within the area (section 4.1.5).	Prior to ground disturbance	Fauna Specialist
	Fauna relocation will be undertaken no longer than seven days prior to clearing of adjacent vegetated areas that will not be impacted by clearing activities.	No longer than seven days prior to clearing	Fauna Specialist
	Relocation of fauna will be undertaken by suitably trained and licensed personnel or trained animal handlers.	Prior to ground disturbance	Fauna Specialist
Native fauna encounter	Native fauna encountered onsite shall be given the opportunity to move on if there is no threat to personnel safety in doing so.	Ongoing	All personnel

Parameter	Action	Timing	Responsibility
	If sick or injured animals are encountered, the nominated carer or Wildlife Hotline shall be called to rescue the animal. The CVJV Manager shall escort the rescuer on and off the site and ensure they are complying with the site safety controls.	As required	Fauna Specialist / CVJV Project Manager
Feral animal species	Feral animals control measures shall be implemented, including: • prohibiting the feeding of animals • food scraps and other waste shall be appropriately disposed of to onsite waste disposal bins • assisting with feral animal trapping and eradication in consultation with Parks and Wildlife.	Ongoing	Fauna Specialist / CVJV Project Manager

9.2.3 Monitoring and reporting

Table 19 provides a summary of objectives and corresponding monitoring actions to enable an assessment of the effectiveness of the fauna management and mitigation measures in place.

Table 19: Monitoring actions for fauna protection

Parameter	Purpose	Location	Frequency / Timing	Responsibility
Feral fauna	Monitor feral fauna presence within the Study area to determine further management measures that may be required.	Study area.	Opportunistically during construction.	All personnel
Reports of fauna encounters/ collisions	To determine if management actions are successful in minimising fauna injury.	Study area.	As required - if fauna encountered or fauna collisions occur during construction.	All personnel
Reports of fauna relocation activities	To report on fauna encountered and status of fauna relocation activities.	Study area (where clearing is proposed).	Following completion of fauna relocation activities.	Fauna Specialist
Delineation of retained vegetation	To ensure retained habitat remains protected.	Vegetation to be retained.	Weekly inspection during clearing.	CVJV Project Manager
Induction records	To ensure compliance with induction requirements for all personnel.	Study area.	Annually during construction.	CVJV Project Manager

9.2.4 Contingencies

Table 20 identifies the appropriate contingency actions to be initiated in the event that the objectives for fauna protection are not met.

Table 20: Contingency actions for fauna protection

Trigger	Action
Increased number of feral fauna and/or native pest species	1. Investigate cause. 2. Determine appropriate mitigation measures; i.e. may include improved waste management and staff awareness. 3. Implement mitigation measures. 4. Monitor success of mitigation measures.
Unauthorised access beyond, or breach of clearing boundaries	1. Investigate cause. 2. Redefine boundaries if breach due to inadequate boundary marking. 3. Reinform all personnel of access restrictions beyond clearing boundaries. 4. Advise DWER of breach in approved clearing area. 5. Implement rehabilitation measures/proposed mitigation measures as soon as practicable following consultation with DWER.

Trigger	Action
Fauna death resulting from construction activities, including vehicle movement	1. Investigate cause. 2. Determine if additional mitigation measures are required. 3. Implement mitigation measures if appropriate and practical.
Injured animals	1. Injured animals shall be reported to the CVJV Project Manager. 2. Injured fauna should be assessed by an experienced zoologist to determine whether translocation, transfer to wildlife carer or euthanasia is required. 3. If the injured fauna is of conservation significance, Parks and Wildlife should be advised. 4. Contact the Parks and Wildlife Wildcare Helpline 24-hour emergency hotline on (08) 9474 9055 if sick or injured animals are encountered.
Presence of Rainbow Bee-eaters nesting burrows are identified by fauna specialist in proposed clearance areas.	1. Mark the area with temporary bunting and signage. 2. Retain vegetation where the nest burrow was observed for the duration of nesting season. 3. Re-inspect the area for Rainbow Bee-eater active nest burrows at the end of nesting season or prior to clearing to confirm all birds have vacated the area. 4. Report the status of the area to the Development Manager and Development Manager and suitability for clearing.

9.3 Fire management

The bushland within the coastal reserve, as well as adjacent boundaries in particular to the north of Capricorn Village, represents a potential bushfire hazard to the Study area if appropriate measures are not put in place. Land to the east is predominantly cleared and therefore does not pose a significant bush fire risk to the Study area.

The Study area is predominantly undulating vegetated sand dunes of varying slope, with vegetation comprised mainly of Class D (scrub) and Class C (shrubland) vegetation categories as described in *Australian Standard 3959-2009 (Construction of Buildings in Bushfire Prone Areas)*. Should a fire occur on the steeper slopes of the dunes, this will contribute to an increase in bushfire intensity.

Ignition sources for bushfires in urban reserves can be attributed to either natural causes, such as lightning etc, or human factors, such as accidental ignition and arson. Under suitable weather conditions, these ignition sources have the potential to generate a bushfire that could impact on life, property and the environment.

A separate Bushfire Management Plan has been prepared to support the Capricorn Coastal Node subdivision application and DA, including fire management requirements of the foreshore reserve in consideration of the Coastal Node development.

9.3.1 Objectives, targets and key performance indicators

The objective for bushfire management within the foreshore is to implement management measures that will minimise the potential occurrence and impact of bush fires occurring in the Study area.

The intended performance management targets and indicators for bush fire protection are outlined in Table 21.

Table 21: Performance management targets and indicators for bush fire protection

Issue	Objective	Performance indicator
Impacts to life, property and the environment from bushfires	To ensure that should a bushfire occur within the Study area, fire impacts on site will be minimised, and life, property and environmental assets will be protected as much as practicable.	No impacts to life, property and the environment from bushfire.

This bushfire management plan will be divided into two sections. The first section will address hazards anticipated during the construction of the Capricorn Village coastal node, while the second section will relate to ongoing management and use of the area, in addition to any future development.

9.3.2 Construction stage

This section highlights the specific hazards, management responses and ongoing monitoring activities required to manage bushfire risk during the construction of the coastal node.

9.3.2.1 Management measures

Management measures for mitigation of bushfire impacts, during construction, are detailed below in Table 22.

Table 22: Management measures - construction stage

Factor	Management measures	Timing	Responsibility
Bush fire prevention	Ensure all construction personnel are aware of fire emergency contact details, site evacuation plans. This should be included in all staff inductions and training. If personnel are not trained in the site-specific bushfire and emergency plan, they should be accompanied by trained personnel.	During construction	Construction Manager
	Construction personnel are to provide adequate fire suppression resources on hand during the designated fire season as determined by the City of Wanneroo.	During construction	Construction Manager
	Construction activities to be managed in association with fire hazards, e.g. no hot work, such as welding, is to occur on days of extreme or catastrophic fire danger.	During construction	Construction Manager
	Implementation of the City of Wanneroo fire break and hazard reduction notice in relation to establishing and maintaining adequate fire breaks around the perimeter of the reserve.	During construction	CVJV Project Manager then the CoW
	Vehicles will not operate on areas other than designated roads, access tracks and construction areas.	During construction	CVJV Project Manager and CoW
	Construction of CVJV coastal node POS is to be constructed in a low threat fuel condition. The landscaping and gardens should meet the requirements of an Asset Protection Zone in accordance with Schedule 1 of SPP 3.7. Additionally, all roads, carparks and walkways are to be kept free of vegetation and combustible items.	During construction	Construction Manager
Bush fire suppression	Should a bushfire occur within or adjacent to the study area (as a result of the construction activities or not), construction personnel should alert the both CoW and DFES immediately.	Immediately upon detection of bushfire	Construction Manager / CVJV Project Manager
	Any bush fires occurring within or adjacent to the study area will be contained as quickly as possible by using available suppression equipment only if it is deemed safe to do so. Upon arrival, the relevant fire authorities are to take command of suppression activities and provide additional resources (as required).	In the event of a bushfire	CVJV Project Manager, CoW and DFES
Evacuation	All construction personnel, visitors and other occupants are to be evacuated immediately other than those undertaking suppression activities. Should it not be safe to undertake initial suppression activities on a bushfire, all personnel are to be evacuated immediately.	In the event of a bushfire	CVJV Project Manager

9.3.2.2 Monitoring

Monitoring requirements for bushfire during construction are summarised in Table 23.

Table 23: Monitoring requirements - construction stage

Parameter / purpose	Location	Frequency/timing	Responsibility
Monitor fire weather conditions and any DFES -issued fire bans/vehicle movement restrictions.	Study area.	Daily, throughout the designated bush fire season (30 November–31 May) or during any days of Extreme of Catastrophic fire danger.	CVJV Project Manager and COW
During days of Extreme and Catastrophic fire danger, at the conclusion of daily construction activities and prior to leaving site, an inspection shall be conducted for evidence of fire.	Study area.	On all days of Extreme of Catastrophic fire danger.	CVJV Project Manager
Monitor bush fire occurrences within and adjacent to the subject area to allow early implementation of emergency response procedures, bushfire suppression activities and evacuation.	Study area and adjacent properties.	Opportunistically in the event of bush fire.	CVJV Project Manager, CoW DFES
Visual inspection of perimeter of retained vegetation for signs of unauthorised vehicle usage and ensure compliance with the fire break notice	Perimeter of study area.	Weekly.	CVJV Project Manager initially then COW
Application of State Planning Policy 3.7 (Planning in Bushfire Prone Areas) and Guidelines for future/subsequent building or structures	Study area.	All future buildings or structures are required to comply with requirements SPP 3.7, where triggered to do so at development application and/or building licence stages. This will be documented in a Bushfire Management Plan that will accompany the development application.	CVJV Project Manager and COW

9.3.3 Post-construction stage

This section highlights the ongoing management responses required to manage bushfire risk during following construction of the coastal node (Table 24). Once operational, the risk to occupants using the Capricorn Village Coastal Node, from bushfire in surrounding land, is primarily related to evacuation to a place of relative safety, while permitting DFES and City of Wanneroo fire fighting personnel to access the area to undertake suppression activities.

Table 24: Post-construction bushfire management measures

Management measure	Timing and Requirements	Responsibility
Ongoing maintenance of CVJV coastal node landscaped gardens and POS	The landscaped gardens and POS associated with the coastal node are to be maintained in a low threat fuel condition on a regular and ongoing basis. The landscaping and gardens should meet the requirements of an Asset Protection Zone in accordance with Schedule 1 of SPP 3.7. All roads, carparks and walkways are to be kept free of vegetation and combustible items	CVJV Project Manager initially then COW
Ongoing maintenance of CVJV coastal node roads, carparks and walkways	All roads, carparks and walkways are to be kept free of vegetation and combustible items. Additionally, all roads and walkways from the beach and coastal node POS are to be open during bushfire season (and on all days of Extreme of Catastrophic fire danger	CVJV Project Manager initially then COW
Evacuation and access routes	During bushfire season (and on all days of Extreme of Catastrophic fire danger), all roads and walkways from the beach and coastal node POS are to be open and in useable condition to permit occupant egress from the area, vehicular egress and firefighter access.	CVJV Project Manager initially then COW
Bushfire suppression response	It is likely that members of the public will alert relevant fire authorities (DFES) upon detection of bushfire in the area. Upon notification of a bushfire it is anticipated that firefighting resources will be dispatched to the area to take command of the emergency response, undertake suppression activities and assist in the evacuation of the area	CoW and DFES
Application of State Planning Policy 3.7 (Planning in Bushfire Prone Areas) and Guidelines for future/subsequent building or structures	All future buildings or structures are required to comply with requirements SPP 3.7, where triggered to do so at development application and/or building licence stages. This will be documented in a Bushfire Management Plan that will accompany the development application	CoW

9.4 Revegetation management

Revegetation within the foreshore reserve, with the exception of landscape planting as part of the Coastal Node POS area, will be undertaken within areas adjacent to disturbance associated with path development and in some degraded areas of the Study area. The key rehabilitation activities required within these degraded areas will include weed control, fencing and/or access restraints and infill planting. It is expected that revegetation areas will be further refined as development within the foreshore reserve progresses.

9.4.1 Objectives, targets and key performance indicators

Objectives, targets and key performance indicators for revegetation areas are summarised in Table 25.

Table 25: Environmental objectives, targets and indicators for revegetation

Objective	Target	Key performance indicator
Revegetate a minimum of 0.62 ha of degraded vegetation within the Study area (shown as indicative revegetation on Figure 9).	Five years from the commencement of revegetation vegetation communities established are representative of reference sites including: • number and type of species (overstorey and mid/understorey species) • weed species and density.	Revegetation comprises a diverse mix of species, including overstorey and mid/understorey.
		No or minor evidence of: • grazing on seedlings • vegetation decline as a result of weeds.
		80% survival rate achieved for seedlings planted within revegetation areas after 5 years.
	Planted species are local provenance species.	Revegetation contractor records identify species used in revegetation as local provenance
Enhance vegetation health within retained areas of vegetation	Monitoring shows no evidence of vegetation decline as a result of stress, weeds, pests or pathogens after 5 years	No evidence of vegetation decline as a result of stress, significant weeds, pests or pathogens

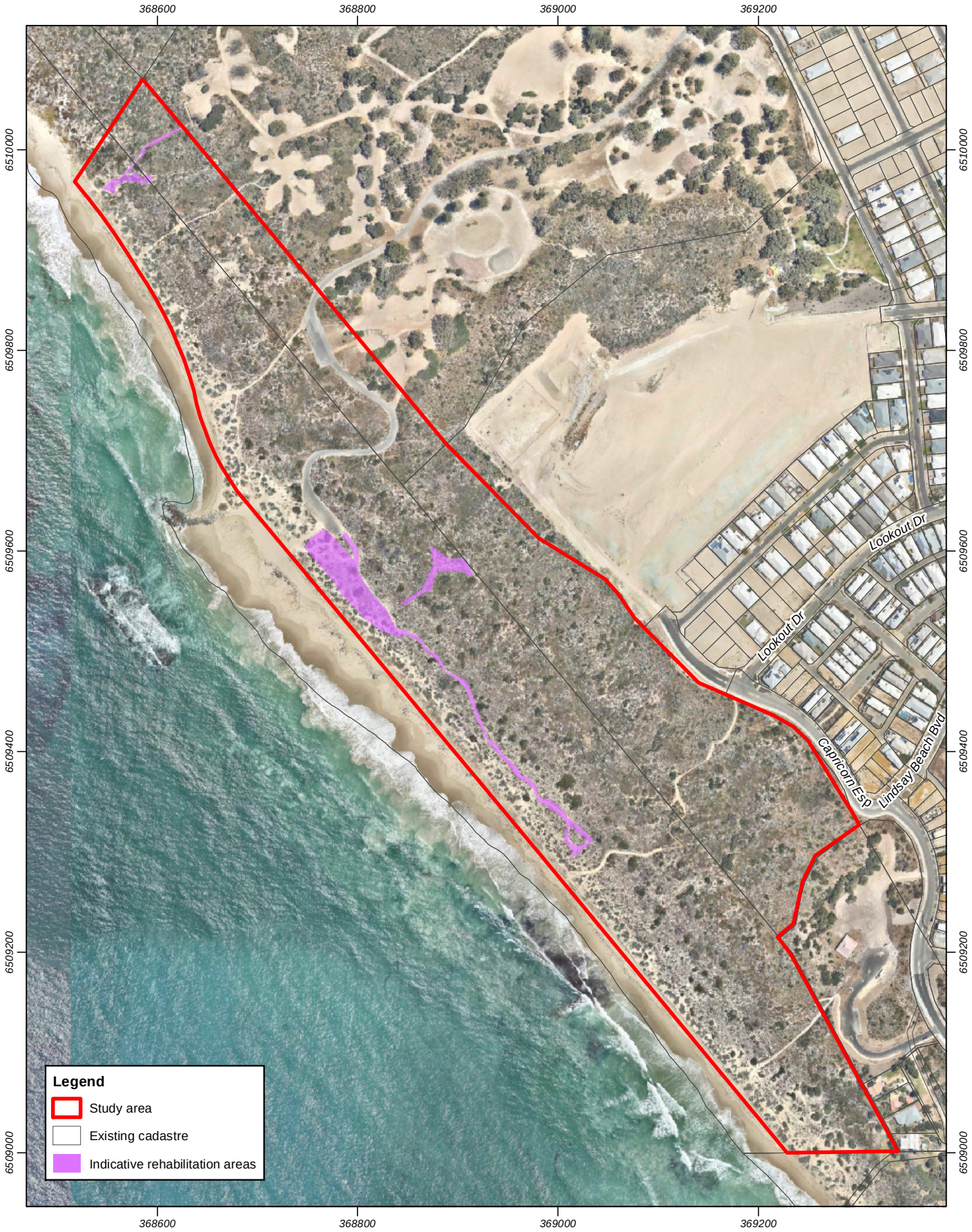

Figure 9: Indicative rehabilitation areas

Scale 1:5,214 at A4

0 50 100 150 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 25/07/2017
Author: JCrute
Source: Aerial image: Nearmap, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Concept plan: Client 03/2017.

Path: Q:\Consult\2016\ADS\ADS16184\ArcMap_documents\R001\RevB\ADS16184_01_R001_RevC_F009.mxd

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9.4.2 Management actions

Specific management and mitigation measures have been identified to assist in achieving the revegetation management objectives in Table 26.

Table 26: Management actions for revegetation management

Parameter	Action	Timing	Responsibility
Contractor engagement	Appoint an experienced revegetation contractor(s) to undertake seed collection, weed control and other site preparation, and direct seeding/seedling planting.	Prior to the seed collection season (approximately October– April) before clearing commences	CVJV Project Manager
Site selection / reference sites	Select revegetation sites based on indicative revegetation areas (Figure 9).	Prior to revegetation	Revegetation contractor
	Establish baseline vegetation monitoring quadrats within remnant vegetation of the same vegetation type as the revegetation sites (within the Study area) to determine: • native species composition of remnant native vegetation within revegetation areas to determine suitable species for use in rehabilitation • baseline levels of weeds including weed species within revegetation areas • overstorey and mid/understorey species (number and species type).	Prior to revegetation	Revegetation contractor
Site preparation	Compile list of appropriate species to be planted in rehabilitation areas based on flora and vegetation surveys and baseline assessment.	Prior to seed collection	Revegetation contractor
	Obtain appropriate licences from DBCA for seed collection.	Prior to seed collection	Revegetation contractor
	Undertake seed collection activities from within the Yanchep area or Perth coastal region for use in revegetation.	Prior to revegetation (indicative timeframe of October– April).	Revegetation contractor
	Undertake weed control prior to revegetation as detailed in Table 14.	Prior to revegetation (indicative timeframe is Spring and following the first winter rains).	Weed control contractor / Revegetation contractor
	Revegetation activities will utilise seed propagated from seed collected from the local area or Perth coastal region. Propagation will be undertaken by a NIASA (Nursery Industry Accreditation Scheme of Australia) accredited nursery.	Indicative timing for seed propagation is September to May following seed collection	Revegetation contractor
	Apply appropriate pre-planting treatments which may include mulch, brushing and/or coir netting to assist with erosion.	Prior to revegetation (indicative timeframe is July).	Revegetation contractor
Seedling planting	Ensure seedlings (in the form of tubestock) are suitably mature, between 6 to 12 months and not root bound to enable optimal establishment and growth.	Indicative timing is May - June depending on the first rains.	Revegetation contractor

Parameter	Action	Timing	Responsibility
	Install grazing control measures within the revegetation area to minimise impacts to seedlings from fauna. This could include: • a minimum of three stakes and a protective guard manufactured for such purpose should be placed around the seedling to protect the vegetation from grazing and wind damage • fencing of the revegetation areas; which may include wind-break fencing as appropriate • feral fauna control measures such as bating.	During revegetation.	Revegetation contractor
	Utilise additives to assist in plant growth if required, such as fertilisers or wetting agents.	During revegetation.	Revegetation contractor
	Ensure all plants and other materials used in revegetation are free of pathogens and weeds.	During revegetation.	Revegetation contractor
	Ensure vehicles, machinery, equipment and footwear are free of mud and soil when entering the Study area.	At all times.	All personnel
	Procure seedlings of suitable provenance to conduct top-up planting in areas not meeting 80% survival rates.	When monitoring indicates survival rates have not been met	Revegetation contractor
Direct seeding	Undertake direct seeding utilising seed collected during seed collection activities or other sources as appropriate.	Indicative timing is May - June depending on the first rains.	Revegetation contractor
	Utilise coir netting, brushing or other stabilisation measures as appropriate based on the soil and slope of revegetation sites.	Direct seeding	Revegetation contractor
	Ensure seed utilised in revegetation is from areas free from dieback and other pathogens.	During revegetation.	Revegetation contractor
Hygiene	Implement ongoing weed control and hygiene measures as detailed in Table 14.	As required	Weed control contractor / Revegetation contractor

9.4.3 Monitoring

Table 27 provides a summary of objectives and corresponding monitoring actions to enable an assessment of the effectiveness of the revegetation management and mitigation measures in place.

Table 27: Monitoring actions for revegetation management

Parameter	Purpose	Location	Frequency / Timing	Responsibility
Revegetation monitoring will include a review of: • baseline levels of weeds including weed species within revegetation areas • overstorey and mid/understorey species (number and species type) • seedling survival rate.	• to monitor species density, richness and composition • to monitor establishment of vegetation in comparison to reference sites • to monitor seedling survival rate • provide CoW with results of revegetation monitoring to inform future management	Revegetation areas.	Annually in Spring.	Revegetation contractor / CVJV Project Manager
Plant health (i.e. evidence of water stress, pests, animal grazing)	• to monitor plant health and any evidence of animal grazing • to monitor weed occurrence.	Revegetation areas.	Annually in Spring.	Revegetation contractor / CVJV Project Manager
Species used in revegetation (revegetation contractor progress reports)	Ensure local provenance species have been utilised.	NA	Annual review of progress reports	CVJV Project Manager

Rehabilitation monitoring will be undertaken utilising quadrats. The location of monitoring quadrats will be determined by the appointed rehabilitation contractor, taking into account revegetation areas in relation to vegetation communities within the Study area. It is proposed that after five years following the date of initial planting, handover to the CoW will occur if all objectives, targets and KPIs are met. In the event targets and KPIs are not met at the end of the five-year period, a number of key maintenance and specific contingency measures will be developed in consultation with the CoW.

9.4.4 Contingencies

Contingency actions will be initiated if monitoring indicates that management actions have not been successful or effective and/or completion criteria are not being achieved. Contingency actions for revegetation management are detailed in Table 28 below.

Table 28: Contingency actions

Trigger	Action
Monitoring reports show survival rates of planted species are below 80%.	1. Map the extent of seedling deaths to obtain approximate percentage of dead seedlings. 2. Identify potential causes of deaths. 3. Implement approach to remedy cause which could include: • procure sufficient seedlings and/or seed as required to account for insufficient native plant species richness and/or cover, on advice of the Revegetation contractor • undertaking infill seedling planting as required on advice of the Revegetation contractor • application of additives such as seasol, water granules, soil breaker, water retainer, wetting agent or fertiliser tablets as deemed necessary by Revegetation contractor • further weed and/or pest control if required. 4. Monitor success of contingency measure(s).
Revegetation monitoring shows that the number and type of species, including overstorey and mid/understorey species are not representative of reference sites.	1. Investigate cause (e.g. presence of pests, plant stress, weeds, erosion) 2. Implement measures to prevent decline in species numbers. 3. Conduct supplementary seeding/planting as advised by Revegetation contractor. 4. Continue monitoring as required by this FMP.

Trigger	Action
New infestation of weed(s) identified in the Study area	1. Investigate source of weed infestation. 2. Undertake weed control immediately and follow up weed control as advised by the Revegetation contractor. 3. Review weed management procedures.
Increase in distribution, abundance or density/cover of a significant weed species within revegetation sites	1. Map the revised extent of the significant weed species within the site. 2. Identify activities that may have potentially increased the abundance, distribution or density/cover of significant weed species. 3. Plan and implement a significant weed control program (may involve seeking advice from relevant authorities). 4. Apply additional hygiene control and education measures.
Increase in abundance and/or distribution of pest grazing animals within rehabilitation areas	1. Investigate cause. 2. Review control measures and procedures. 3. Re-inform all personnel of any changes to control procedures. 4. Implement remedial and/or revised control measures. 5. Implement of a pest animal control program. 6. Monitor outcome.
Unauthorised access (people and vehicles, unless required for emergency access) to the Study area	1. Implement measures to prevent further unauthorised access (e.g. installation of temporary fencing and signage), as practicable. 2. Monitor success of contingency measure(s). 3. Restrict access to controlled areas already disturbed or degraded.

9.5 Aboriginal heritage

The foreshore development will not result in any potential impacts to European heritage, therefore management of European heritage has not been considered further in this FMP.

One registered mythological Aboriginal heritage site (Yanchep Beach - Site ID 17599) occurs within the Study area.

This heritage site is located within land subject to an ILUA with the Whadjuk People. As the proposed development within the Study area has the potential to impact on the heritage site, a s 18 clearance to enable disturbance within the Study area may be required in accordance with provisions of the AH Act. CVJV will consult with the Whadjuk People, South West Aboriginal Land and Sea Council (SWALSC) and DAA to determine if a s 18 clearance is required. In the event a s 18 clearance is required, conditions of the clearance will be implemented as part of foreshore development.

9.6 Access

Demand for use of the Study area will increase as a result of the Capricorn and surrounding Yanchep developments and from increased use of the area at the regional scale as part of the larger Yanchep-Two Rocks area. To ensure the natural values of the foreshore are protected, whilst fulfilling community expectations associated with access to the area, access is a key management consideration. Vehicle access will be restricted within the Study area except for maintenance, firefighting and emergency purposes.

The Study area will contain a mixture of passive and active recreation facilities located in areas that will minimise impact to the natural values of the area. Key access infrastructure proposed within the Study area includes:

- two beach access points located along existing tracks
- universal access along pathways, provision of ACROD parking, and disability access to facilities
- 3 m wide reinforced access path for maintenance and emergency access
- use of existing lower car park area as a temporary asset
- fencing.

Uncontrolled and unmanaged access to the Study area can result in impacts to the integrity of the foreshore vegetation, including the promotion of weeds and increased erosion. Impacts as a result of unmanaged access to the Study area are already evident, largely due to uncontrolled traversing of the dunes outside of designated paths and access ways. In order to manage potential impacts on the Study area as a result of uncontrolled access a range of measures will be implemented.

9.6.1 Objectives, targets and key performance indicators

The environmental objectives, targets and key performance indicators for access management are detailed in Table 29.

Table 29: Environmental objectives, targets and key performance indicators for access and infrastructure

Objective	Target	Key performance indicator
Provide appropriate access through the Study area for pedestrian and emergency services	No unauthorised access outside of the designated areas.	No incidence relating to unauthorised access to areas not identified for access.
Minimise access outside of designated access areas		
Prevent third party access during the proposed foreshore development works	No unauthorised access to the Study area.	No incidents relating to unauthorised people on site.

9.6.2 Management actions

Specific management and mitigation measures have been identified to assist in achieving the access management objectives in Table 30.

Table 30: Access management actions

Item	Management action	Timing	Responsibility
Vegetation clearing	Clearing boundaries will be clearly demarcated using distinctive markers (flagging tape, fencing, signage etc).	Prior to clearing.	CVJV Project Manager
Permanent fencing	Install permanent fencing along the boundaries of the beach access paths and recreational open space to restrict unauthorised access to areas of retained vegetation.	Post clearing.	CVJV Project Manager
	Install bollards along the perimeter of all roads or parking areas that adjoin the Study area to prevent vehicles accessing areas of foreshore vegetation. If necessary, place demountable or removable bollards at appropriate locations for fire-fighting and maintenance purposes, including emergency access.	Post clearing.	CVJV Project Manager
	Restrict access to unwanted tracks through the use of brush material and/or fencing.	Post clearing / revegetation.	CVJV Project Manager
Signage	Install signage to encourage public education and awareness on: • the importance of retained bushland • the detrimental effects of rubbish on biodiversity • revegetation works being undertaken within the area.	Post construction of access tracks through the area of retained vegetation.	Construction contractor
Paths	Formalise paths that provide beach access to prevent access to areas of retained vegetation.	Foreshore construction.	Construction Contractor
Surveillance	Install surveillance measures as required (i.e. cameras etc).	As required	CVJV Project Manager

EAS	Develop an Emergency Access Plan to the satisfaction of the CoW and SLSWA following development of the Study area. The EAS should include where practical and appropriate, SLSWA recommendations.	Post development	CVJV Project Manager

9.6.3 Monitoring

Monitoring and reporting requirements for access are detailed in Table 31.

Table 31: Access and infrastructure monitoring and reporting requirements

Parameter	Purpose	Location	Frequency /Timing	Responsibility
Fencing / demarcation	To monitor integrity of fencing and/or demarcation within the Study area.	All demarcated areas	Fortnightly during construction.	CVJV Project Manager
			Monthly (during maintenance period).	
Signage	To monitor the integrity of signage within the Study area.	All demarcated areas	Fortnightly during construction.	CVJV Project Manager
			Monthly (during maintenance period).	

9.6.4 Contingencies

Table 32 identifies the appropriate contingency actions to be initiated in the event that the objectives for access management are not met.

Table 32: Access management

Trigger	Action
Unauthorised access outside of the formalised pathways	1. Investigate cause. 2. Redefine boundaries if breach due to inadequate boundary marking. 3. Reinform all personnel of access restrictions beyond access boundaries. 4. If damage has been done to the fencing or if the fencing is deemed inadequate then the fencing will be repaired or replaced. 5. Consult with adjacent land users and the CoW as required to determine combined access management approaches. 1. An Environmental Incident Report shall be completed.
Fencing or bollards not sufficient or not maintained	1. Repair or reinstate fencing or bollards. 2. Review frequency of fencing and bollard monitoring. 3. Record incident in Incident Register.
Infrastructure not maintained	1. Repair or reinstate infrastructure. 2. Review frequency of infrastructure monitoring. 3. Record incident in Incident Register.

9.7 Public awareness and information management

In order to promote public awareness and provide information to residents and beach users, public awareness and information management is an integral component of ensuring delivery of the foreshore meets expectations of the surrounding residents and beach users.

Informative signage will be provided around the POS areas to ensure the community and visitors are informed about the values and history of the area. Informative signage will be placed at strategic resting points, pathway intersections or near sites of relevant context within the Study area. The signage information will detail local Indigenous history, past land uses, existing and endemic flora and fauna and general site safety. Directional signage will also be installed along the path systems detailing distances for walks and providing a location map to encourage the community to interact with the site. Further interpretive sculptures, posts or the use of onsite materials such as large logs may also be considered to also assist with way finding and interaction.

Key management actions to be undertaken as part of foreshore development are provided in Table 33.

Table 33: Public awareness and information management actions

Management action	Responsibility
Incorporate Aboriginal names in the naming and signposting in consultation with representatives from the Aboriginal community prior to installation.	CVJV/ Landscape Architect & Contractor
Provide educational signage on matters such as cultural history, protection of native vegetation and fauna (including venomous snakes), impacts of pets, and activities that could affect the foreshore reserve.	CVJV/ Landscape Architect & Contractor
Liaise with local schools, community and conservation groups to be involved in management activities.	CVJV
Install directional and public safety signage as required within the POS area and beach access points.	CVJV/ Landscape Architect & Contractor
Provide interpretive sculptures, posts, or onsite materials to assist with way finding where possible.	CVJV/ Landscape Architect & Contractor

10. Reporting and review

Monitoring and reporting requirements for each key factor are summarised in sections 9.1 and 9.7. In addition to these requirements, an annual monitoring report will be provided to the CoW including reporting on the following:

- reporting against objectives, targets and KPIs for each factor
- reporting of any breaches and/or triggering of contingency measures
- other matters of note/consideration.

The annual report will be provided annually during the five-year maintenance period to provide a progress update on the foreshore management works and will assist in planning for future management requirements to be undertaken by the CoW, following the maintenance period.

10.1 Auditing and inspections

On completion of foreshore development works, CVJV will organise an independent audit to be undertaken to certify activities and results are in accordance with concept plans and designs. Once the CoW are satisfied that the works have been completed, CVJV will commence the three-year maintenance period.

CVJV will implement undertake monitoring consistent with monitoring commitments detailed in this FMP.

10.2 Management plan review

The implementation of management measures identified in this FMP will be reviewed in response to changes in the natural environment, recreations use and community values. CVJV will maintain accurate records of activities until transfer of management to the CoW. Changes to this FMP will be undertaken in consultation with the CoW.

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Appendix 3
Level 2 flora and vegetation survey and supplementary survey

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Capricorn foreshore reserve

Flora and vegetation survey

Prepared for
Acumen Development Solutions
by Strategen

July 2017

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ENVIRONMENTAL

Capricorn foreshore reserve

Flora and vegetation survey

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July 2017

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

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Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Client: Acumen Development Solutions

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	A	Client review	C Courtauld / D Panickar / D Newsome	Electronic	22 Dec 2016
Final Report	B	Issue to CoW / DoP	C Courtauld / T Bowra	Electronic	31 July 2017

Filename: ADS16585_01 R001 Rev B - 31 July 2017

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1. Introduction

This report presents the findings of a Level 2 flora and vegetation survey undertaken to support the proposed development of the Capricorn foreshore reserve that forms part of the Coastal Village and Coastal Node, Yanchep (the survey area; Figure 1).

This flora and vegetation assessment will support the Foreshore Management Plan for the proposed foreshore development. The survey area will be created as a 'Parks and Recreation' reserve and vested to the Crown as agreed by CVJV and the WAPC. Upon the transfer of the foreshore to the Crown, the foreshore will be vested to the City of Wanneroo (CoW).

1.1 Background

Capricorn Village Joint Venture (CVJV) is proposing to develop the Capricorn Coastal Village and Coastal Node, located in Yanchep, Western Australia, approximately 51 km north-northwest of the Perth Central Business District (CBD). The Capricorn Coastal Village and Coastal Node (the Project), incorporates Part Lot 312 and Lots 2, 303 and 304, Two Rocks Road, Yanchep, in the City of Wanneroo (CoW, Figure 1).

The foreshore reserve provides a link between the Indian Ocean and urban development and as such provides opportunity for both conservation and development purposes. The proposed foreshore development will require clearing of native vegetation and as such, a flora and vegetation survey was deemed necessary to determine the environmental values of the proposed clearing area. The survey area was designed based on the draft concept plan, focussing on areas of proposed disturbance and a buffer area (Figure 1).

1.2 Scope

The scope of this flora and vegetation survey was to undertake a desktop assessment and field assessment within the survey area consistent with the requirements of *Guidance Statement 51 Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* and *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2004; Parks and Wildlife 2015) and meeting the definition of a Level 2 survey as described by the guidance.

The objectives were to:

- conduct a desktop survey for Threatened and Priority flora which have been identified as being present in or around the survey area during historic surveys
- collect and identify the vascular plant species present within the survey area
- search areas of suitable habitat for Threatened and/or Priority flora
- define and map the native vegetation communities present within the survey area
- map vegetation condition within the survey area
- provide recommendations on the local and regional significance of the vegetation communities
- prepare a report summarising the findings.

A supplementary survey was undertaken within the southern portion of the foreshore reserve; to the south of the 2016 survey area, including detailed quadrat analysis. The field survey was conducted according to standards set out in Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016); as presented in Appendix 5.

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Capricorn Village and Coastal Node – Level 2 Flora and Vegetation Survey

The Survey Area

Figure 1

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2. Context

2.1 Legislative context

This biological survey has been conducted with reference to the following Australian and Western Australian legislation and guidance:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Wildlife Conservation Act 1950* (WC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) – State
- *Guidance Statement 51 Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* and *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2004; Parks and Wildlife 2015).

2.1.1 Conservation significant flora and ecological communities

Conservation significant flora and ecological communities are determined at a state and federal legislative level. Threatened species are listed under the EPBC Act at the Australian Government level and under the WC Act at the State level (Appendix 1). Priority species are listed by the Department of Parks and Wildlife (Parks and Wildlife) and include species of 'significant conservation value' (Appendix 1).

Threatened Ecological Communities (TECs) are listed under both the EPBC Act and EP Act (Appendix 1). Priority Ecological Communities (PECs) are listed by Parks and Wildlife and include species of significant conservation value (Appendix 1).

2.1.2 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the EP Act, and include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed Threatened species
- TECs.

2.1.3 Protection of native vegetation

Native vegetation is defined under the EP Act as "indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation".

This definition of native vegetation does not include vegetation that was intentionally sown, planted or propagated unless either of the following applies:

(a) the vegetation was sown, planted or propagated as required under the EP Act or another written law

(b) the vegetation is declared to be native under Regulation 4 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Regulation 4 prescribes the kinds of intentionally planted indigenous vegetation that are "native vegetation" and which therefore require a clearing permit or exemption to clear and includes:

(a) planting that was funded (fully or partly)
    i. by a person who was not the owner of the land
    ii. for the purpose of biodiversity conservation or land conservation

(b) intentionally planted vegetation that has one of the following:
    i. a conservation covenant or agreement to reserve under section 30B of the *Soil and Land Conservation Act 1945*
    ii. a covenant to conserve under section 21A of the *National Trust of Australia (WA) Act 1964*
    iii. restrictive covenant to conserve under section 129B of the *Transfer of Land Act 1983*
    iv. some other form of binding or undertaking to establish and maintain, or maintain, the vegetation.

Native vegetation can only be cleared with a clearing permit, unless for some circumstances where exemptions apply pursuant to the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Regulations). Clearing permits issued pursuant to the Regulations may be issued as area permits or purpose permits. Exemptions for clearing under Regulation 5 of the Regulations do not apply within ESAs.

2.1.4 Introduced species

The BAM Act provides for management and control of listed organisms, including introduced flora species (weeds). Species listed as declared pests under the BAM Act are classified under three categories:

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

Under the BAM Act, land managers are required to manage populations of declared pests as outlined under the relevant category.

2.2 Environmental setting

2.2.1 Soils and topography

The survey area is located within the Swan Coastal Plain 2 (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.

2.2.2 Climate

The Yanchep locality experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The nearest Bureau of Meteorology (BoM) weather station at Gingin Aero (Station No. 009178) provides average monthly climate statistics for the Yanchep locality (Figure 2). Average annual rainfall recorded at Gingin Aero since 1996 is 620.2 mm (BoM 2016). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur between December and February, with average monthly maximums ranging from 30.6℃ in December to 33.3℃ in February (BoM 2016). Lowest temperatures occur between June and September, with average monthly minimums ranging from 6.2℃ in July to 7.4℃ in September (BoM 2016).

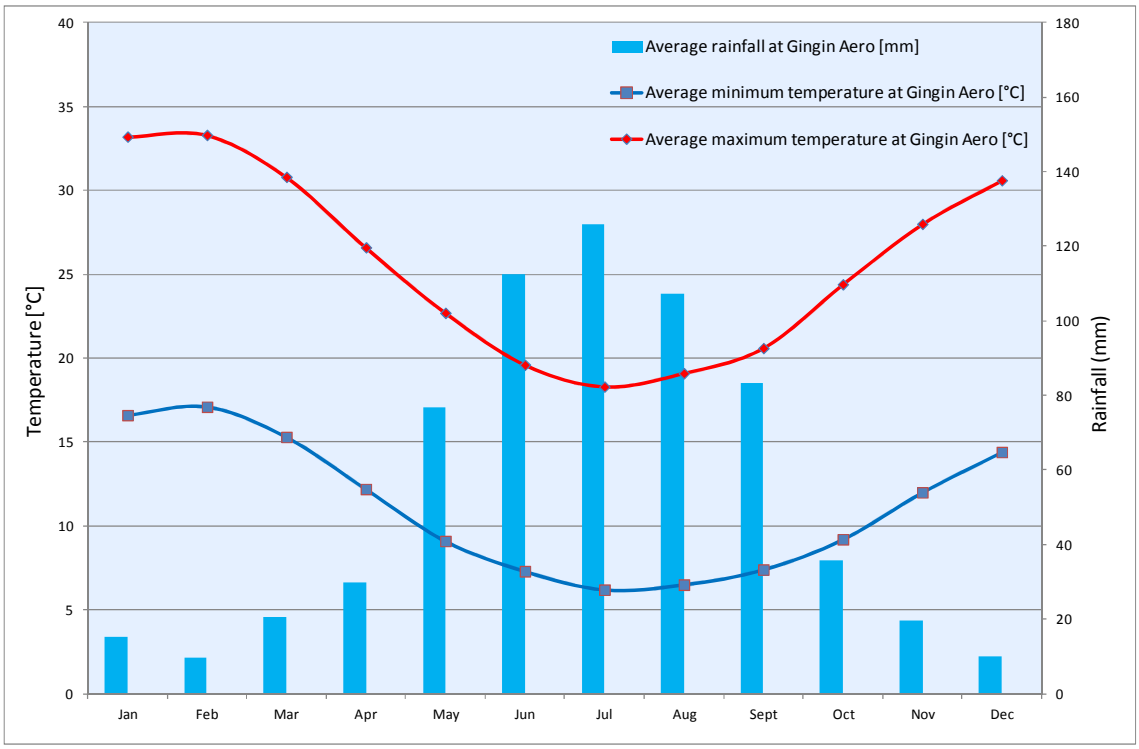

Figure 2: Mean monthly climatic data (temperature and rainfall) for Gingin Aero

2.2.3 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) which led to the delineation of botanical districts as described in Beard (1990); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DEE 2015a) and System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980).

Beard (1990) Botanical Subdistrict

The survey area occurs within the Drummond Botanical Subdistrict which is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (Tuart), *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) woodlands on less leached soils (Beard 1990).

IBRA subregion

IBRA describes a system of 85 'biogeographic regions' (bioregions) and 403 subregions covering the entirety of the Australian continent (Thackway & Cresswell 1995). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The survey area occurs within the Swan Coastal Plain 2 IBRA subregion which is dominated by *Banksia* or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca*) in swampy areas (Mitchell et al. 2002).

System 6 and vegetation system association mapping

System 6 mapping refers to vegetation mapping undertaken at a Vegetation Complex scale by Heddle *et al.* (1980). This is the primary source of information used to calculate potential impacts of proposals to clear native vegetation on the Swan Coastal Plain. The survey area occurs within the Quindalup Complex (Figure 3) which is described as:

> Coastal dune complex consisting mainly of two alliances – the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *M. Lanceolata – Callitris preissii* and the closed scrub of *Acacia rostellifera.*

At a finer scale, the survey area likely[1] falls within the Guilderton 1007 vegetation system association (i.e. Mosaic: Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath / Shrublands; *Acacia rostellifera* and *Acacia cyclops* thicket) as defined in Government of Western Australia (2016).

[1] The survey area falls outside of the extent mapped by Government of Western Australia (2016). This is likely attributable to a georeferencing error associated with the mapped dataset and as such, the system association within the survey area has been inferred through a comparison of vegetation descriptions and location in the landscape.

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Capricorn Village and Coastal Node – Level 2 Flora and Vegetation Survey

Regional Vegetation Mapping

Figure 3

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3. Methods

3.1 Desktop assessment

A desktop assessment was conducted using Florabase, Parks and Wildlife, and Department of the Environment (DEE) databases to identify the possible occurrence of TECs, PECs and Threatened and Priority flora potentially occurring within the survey area. Reports that document regional flora, vegetation and fauna within the surrounds of the survey area were also reviewed prior to the field assessment.

A database search request was also submitted to the Threatened Communities Branch of Parks and Wildlife to identify any potential TECs or PECs within 5 km of the survey area.

3.2 Field assessment

The field survey was conducted according to standards set out in *Guidance Statement 51 Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* and *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2004; Parks and Wildlife 2015). The assessment of flora and vegetation within the survey area was undertaken by one ecologist from Strategen on 25 November 2016. Table 1 identifies staff involved in the field surveys, their role and qualifications. The survey area was traversed on foot to record changes in vegetation structure and type and eight vegetation quadrats were surveyed to identify vegetation types (Figure 1; Appendix 3).

Table 1: Personnel

Name	Role
Ms. C. Courtauld Strategen (Ecologist)	Planning, fieldwork, plant identification, data interpretation and report preparation.

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the survey area. Vegetation mapping sites were determined from aerial photographs. The survey area was traversed on foot, allowing for opportunistic sites to be placed where a change in vegetation structure or composition was observed.

Flora and vegetation was described and sampled systematically at each quadrat and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum.

For each vascular plant species, the average height, number of plants and percent cover were recorded.

All plant specimens collected during the field surveys were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

3.3 Data analysis and vegetation mapping

Due to the degraded nature and uniform distribution of vegetation within the survey area; quadrat data were grouped into a species by site matrix to delineate individual vegetation types (VTs) present within the survey area. Aerial photography interpretation and field notes taken during the survey were then used to develop VT mapping polygon boundaries over the survey area. These polygon boundaries were then digitised using Geographic Information System (GIS) software.

VT descriptions (though floristic in origin) have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (ESCAVI 2003), a system of describing structural vegetation units (based on dominant taxa). This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. For the purposes of this report, a VT is considered equivalent to a NVIS sub-association as described in ESCAVI (2003).

Vegetation condition was recorded at all quadrats, and also opportunistically within the survey area during the field assessment where required. Vegetation condition was described using the vegetation condition scale for the South West Botanical Province (Keighery 1994). Vegetation condition polygon boundaries were developed using this information in conjunction with aerial photography interpretation, and were digitised as for vegetation type mapping polygon boundaries.

The degraded nature of the survey area did not allow for statistically valid multivariate analyses to be undertaken to determine resemblance of sites to Floristic Community Types (FCTs) as mapped and defined by Gibson *et al.* (1994). Therefore, inferences between recorded VTs and FCT and Parks and Wildlife descriptions of TECs/PECs were used to determine any potential occurrence of a conservation significant vegetation community where necessary. The Bush Forever list of FCTs per vegetation complex was also used as a guide to infer potential occurrence of conservation significant FCTs within the survey area (GoWA 2000).

3.4 Survey limitations and constraints

Table 2 displays the evaluation of the flora and vegetation assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 2: Flora and vegetation survey potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.**	The survey has been undertaken in the Drummond Botanical Subdistrict on the Swan Coastal Plain which has been well studied and documented with ample literature available (Beard 1990).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.**	Due to the degraded nature and uniform distribution of vegetation within the survey area and timing of the survey (i.e. spring); most life forms are likely to have been sampled adequately during the time of the survey.
Proportion of flora/fauna collected and identified (based on sampling, timing and intensity).	**Not a constraint.**	The proportion of flora surveyed was adequate. The entire survey area was traversed and flora species were recorded systematically.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint**	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	**Not a constraint.**	Aerial photography of a suitable scale was used to map the survey area and identify potential fauna habitat. Sites were chosen from these aerials to reflect changes in community structure. Opportunistic sites were also used if differences were observed during on ground reconnaissance. Vegetation types were assigned to each site based on topography, soil type and presence/absence and percent foliage cover of vegetation.
Timing, weather, season, cycle.	**Not a constraint.**	Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2004). The field assessment was conducted in November (i.e. spring) in fine weather conditions and therefore these factors are not deemed to be constraints.
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint.**	The survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the survey area.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint.**	The survey area was traversed on foot and all differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.**	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint.**	Existing tracks enabled adequate access to survey the vegetation and fauna within the survey area. Where access was not available by car, the area was easily traversed by foot.
Experience levels (e.g. degree of expertise in species identification to taxon level).	**Not a constraint.**	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

4. Results

4.1 Desktop assessment results

A total of 176 native vascular plant taxa from 66 plant families have the potential to occur within the survey area (Parks and Wildlife 2007-; DEE 2015c). The majority of taxa were from within the Asteraceae (14 taxa) and Fabaceae (14 taxa) families.

4.1.1 Threatened and Priority flora

A desktop survey for Threatened and Priority flora that may potentially occur within the survey area was undertaken using NatureMap (Parks and Wildlife 2007-), the Western Australian Herbarium (Western Australian Herbarium 1998-), and the DEE Protected Matters Search Tool (DEE 2015c).

Flora within Western Australia that is considered to be under threat may be classed as either Threatened flora or Priority flora. Where flora has been gazetted as Threatened flora under the WC Act, the taking of such flora without the written consent of the Minister is an offence. The WC Act defines "to take" flora as to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means. Parks and Wildlife (2016) contains the current list of Threatened flora in Western Australia.

Priority flora are considered to be species which are potentially under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Parks and Wildlife categorises Priority flora according to their conservation priority using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such species. Priority flora species are regularly reviewed and may have their priority status changed when more information on the species becomes available. Appendix 1 defines levels of Threatened and Priority flora (Western Australian Herbarium 1998-).

At the national level, the EPBC Act lists Threatened species as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent. Appendix 1 defines each of these categories of Threatened species. The EPBC Act prohibits an action that has or will have a significant impact on a listed Threatened species without approval from the Australian Government Minister for the Environment. The current EPBC Act list of Threatened flora may be found on the DEE (2015d) website.

Table 3 shows the Threatened and Priority flora potentially occurring within the survey area. The desktop assessment identified one Threatened flora and three Priority flora species that have been recorded in the regional area. Of these, based on specific habitat requirements, no Threatened flora species and two Priority flora species were considered to have the potential to occur within the survey area;

- *Leucopogon maritimus* (P1)
- *Leucopogon* sp. Yanchep (P3).

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

Species	Conservation status		Description	Potential to occur
	EPBC Act	WC Act		
Eucalyptus argutifolia (Wabling Hill Mallee)	**Threatened** – Vulnerable	Threatened	Mallee to 4 m tall with smooth bark. Flowers are white and visible March to April. Habitat for this species occurs within shallow soils over limestone, on slopes or gullies of limestone ridges and outcrops (Western Australian Herbarium 1998-).	**Unlikely –** Preferred soil type/habitat does not occur within the survey area.
Leucopogon maritimus (Coast Beard-heath)	Not listed	Priority 1	A low, spreading shrubs to 40 cm tall and 60 cm wide, often multi-stemmed close to the base but single-stemmed at ground level with a fire-sensitive rootstock. *Leucopogon maritimus* is restricted to near-coastal Quindalup dunes, from a small area of coastline about 40–70 km north of Perth. It occurs in deep, calcareous sands, on the mid to upper slopes of dunes or in shallow sand over limestone, but avoiding the thicker vegetation of the swales. It grows in low heathland communities often dominated by *Melaleuca systena, Acanthocarpus preissii, Acacia lasiocarpa and Olearia axillaris*, sometimes in close proximity to the common coastal epacrids *Leucopogon parviflorus* and *L. Insularis* (Hislop 2011).	**Possible** – Preferred habitat exists within the survey area.
Leucopogon sp. Yanchep	Not listed	Priority 3	An erect shrub, 0.15-1 m tall, to 0.6 m wide. Flowers are white/pink, occurring from April to June or September. This species occurs in light grey-yellow sand, brown loam, limestone, laterite or granite on coastal plain, breakaways, valley slopes or low hills (Western Australian Herbarium 1998-)..	**Unlikely –** Preferred soil type/habitat does not occur within the survey area.
Stylidium maritimum	Not listed	Priority 3	Caespitose perennial herb to 70 cm tall. Leaves tufted, linear to narrowly oblanceolate. Flowers are white or purple and visible September to November. Habitat for this species is sandy soils over limestone on dune slopes and flats, typically growing within coastal heath and shrubland or open Banksia woodland (Western Australian Herbarium 1998-).	**Possible** – Preferred habitat exists within the survey area.

4.1.2 Threatened and Priority Ecological Communities

A TEC is defined under the EP Act as an ecological community listed, designated or declared under a written law or a law of the Australian Government as Threatened, Endangered or Vulnerable. There are four State categories of TECs (DEC 2010)[2]:

- presumed totally destroyed (PD)
- critically endangered (CR)
- endangered (EN)
- vulnerable (VU).

A description of each of these TEC categories is presented in Appendix 1. TECs are gazetted as such (Parks and Wildlife 2015a) and some Western Australian TECs are listed as Threatened under the EPBC Act.

Ecological communities identified as Threatened, but not listed as TECs, are classified as Priority Ecological Communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. Parks and Wildlife categorises PECs according to their conservation priority, using five categories, P1 (highest conservation significance) to P5 (lowest conservation significance), to denote the conservation priority status of such ecological communities. Appendix 1 defines PECs (DEC 2010). A list of current PECs can be viewed at the Parks and Wildlife (2015b) website.

Under the EPBC Act, a person must not undertake an action that has or will have a significant impact on a listed TEC without approval from the Australian Government Minister for the Environment, unless those actions are not prohibited under the EPBC Act. A description of each of these categories of TECs is presented in Appendix 1. The current EPBC Act list of TECs can be located on the DEE (2015d) website.

Three TECs and one PEC were identified within 5 km of the survey area (Figure 4);

- *Banksia dominated woodlands of the Swan Coastal Plain IBRA region* (Endangered – EPBC Act[3]; Priority 3 PEC)
- SCP01: *Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain* (Endangered – EPBC Act, Critically Endangered – WC Act)
- FCT 26a: *Melaleuca huegelii - Melaleuca acerosa (currently M. systena) shrublands on limestone ridges* (Endangered – WC Act)
- FCT19b: *Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (Endangered – EPBC Act, Critically Endangered – WC Act).

The closest known occurrences of TECs were SCP01 - *Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain,* which is listed as Critically Endangered under the EPBC Act and WC Act and is located approximately 1 km from the survey area, and *Banksia dominated woodlands of the Swan Coastal Plain Bioregion* (Priority 3; now EPBC Act listed TEC), which is located approximately 3 km from the survey area.

All other identified communities are located greater than 5 km from the survey area.

[2]The Department of Environment and Conservation is still listed as the author of all TEC and PEC databases and have been referred to as such in this document instead of the Department of Parks and Wildlife (Parks and Wildlife).

[3]This community was identified during the database search and is also recognised as the recently listed TEC – *Banksia woodlands of the Swan Coastal Plain* (Endangered – EPBC Act). There has not been sufficient time since the listing of the EPBC Act TEC to update State records to reflect the new community name and conservation status.

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BREAKWATER DR
TWO ROCKS
TWO ROCKS RD
Leucopogon maritimus
Stylidium maritimum
Stylidium maritimum
Leucopogon maritimus
Leucopogon maritimus
YANCHEP
Leucopogon sp. Yanchep (M. Hislop 1986)
Leucopogon sp. Yanchep (M. Hislop 1986)
Leucopogon sp. Yanchep (M. Hislop 1986)
INDIAN OCEAN
YANCHEP BEACH RD
Eucalyptus argutifolia
MARMION AV
Stylidium maritimum
Stylidium maritimum
EGLINTON
ALKIMOS

Legend

- Survey Area
- 5km Survey Site Buffer

Threatened and Priority Flora

- Threatened
- Priority 1
- Priority 2
- Priority 3

Threatened and Priority Ecological Communities

- Critically Endangered, Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain
- Critically Endangered, Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994).
- Endangered, Melaleuca huegelii - Melaleuca acerosa (currently M. systena) shrublands on limestone ridges (Gibson et al. 1994 type 26a)
- Priority 3, Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region

Scale: 1:40,000 @ A3

0 0.2 0.4 0.8 1.2 1.6 2 km

N

Coordinate System: GDA 1994 MGA Zone 50
Note: Position errors may occur in some areas
Date: 20/12/2016
Author: ENVIRONMAPS
Source: Cadastre - Landgate, 2016
Orthophoto - Nearmap, 04.11.16
TEC/PEC - DPaW, 15.12.16

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Capricorn Village and Coastal Node – Level 2 Flora and Vegetation Survey

Location of TECs, PECs and Threatened/Priority Flora Within 5km of the Survey Area

Figure 4

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4.1.3 Wetlands

No mapped geomorphic wetlands occur within the survey area (Landgate 2016). The closest such wetland is located approximately 2 km east of the survey area (Wetland UFI: 8010; Conservation Category Wetland).

4.1.4 Bush Forever

The survey area occurs within the mapped extent of Bush Forever Site 397: *Coastal Strip from Wilbinga to Mindarie*. Bush Forever Site 397 corresponds to the existing coastal foreshore reserve between Mindarie and Wilbinga and is therefore identified in Bush Forever as a '*Site with some Existing Protection*'.

Bush Forever Site 397 comprises part of the Yanchep foreshore reserve. The foreshore reserve boundary was determined in 1996 as part of MRS Amendment 975/33 and is based on the Coastal Planning Strategy prepared for the Yanchep-Two Rocks area (Alan Tingay & Associates, 1993).

4.2 Field survey results

4.2.1 Native flora

A total of 34 native vascular plant taxa from 28 plant genera and 15 plant families were recorded within the survey area. The majority of taxa were recorded within the Myrtaceae (6 taxa), Chenopodiaceae (6 taxa) and Fabaceae (4 taxa) families (Appendix 4). The relatively low number of plant genera recorded reflects the disturbed nature of the survey area.

4.2.2 Threatened and Priority flora

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area at the time of assessment. The survey was conducted during the prime flowering time for these conservation significant species (spring), therefore during the optimum time for correct identification.

4.2.3 Introduced (exotic) taxa

A total of 17 introduced (exotic) taxa were recorded within the survey area (Appendix 4).

* None of these species are Declared Plant species in Western Australia pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2016).

4.2.4 Vegetation types

Four native vegetation types (VTs) were defined and mapped within the survey area (Figure 5) and are summarised in Table 4. Areas containing vegetation in parkland cleared or highly degraded state have not been counted as unique native VTs but have been included in Table 4 for area calculation purposes. Total areas occupied within the survey area by each of the identified VTs are set out in Table 5.

Table 4: Vegetation Types

Vegetation Type	Description
1	*Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima* and **Thinopyrum distichum* low shrubland on sandy soils.
2	*Olearia axillaris, Acacia rostellifera, Rhagodia baccata* and *Scaevola crassifolia* heath over *Spinifex longifolius, Acanthocarpus preissii, Cassytha flava, *Pelargonium capitatum* and exotic grasses including on sandy soils.
3	*Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.
4	*Olearia axillaris, Scaevola crassifolia, Acacia rostellifera* and *Acacia truncata* heath with emergent *Agonis flexuosa* over *Acanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum,* and exotic grasses on sandy soils.
Planted	Planted palms (**Phoenix* sp.) and Japanese Pepper (**Schinus terebinthifolius).*
C	Cleared areas.

Vegetation type coverage

The total area mapped within the survey area was 10.22 ha which includes highly degraded and fully cleared areas (Table 5). The dominant native VT within the survey area was VT 3 which can be broadly described as a *Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.

Table 5: Area (ha) covered by each VT within the survey area

VT	Area (ha)	Percentage of the Survey area
1	1.31	12.78
2	1.86	18.17
3	5.51	53.96
4	0.19	1.86
Planted	0.04	0.44
Cleared	1.31	12.84
TOTAL	**10.22**	**100**

Vegetation condition

The survey area shows signs of having been degraded for a long period of time due to the widespread extent of weeds and human disturbance (e.g. trampling dune vegetation for access to the beach). As such, vegetation condition within the survey ranged from Completely Degraded to Good and generally aligned with the VT boundaries (Keighery 1994; Figure 6; Table 6).

Table 7 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area.

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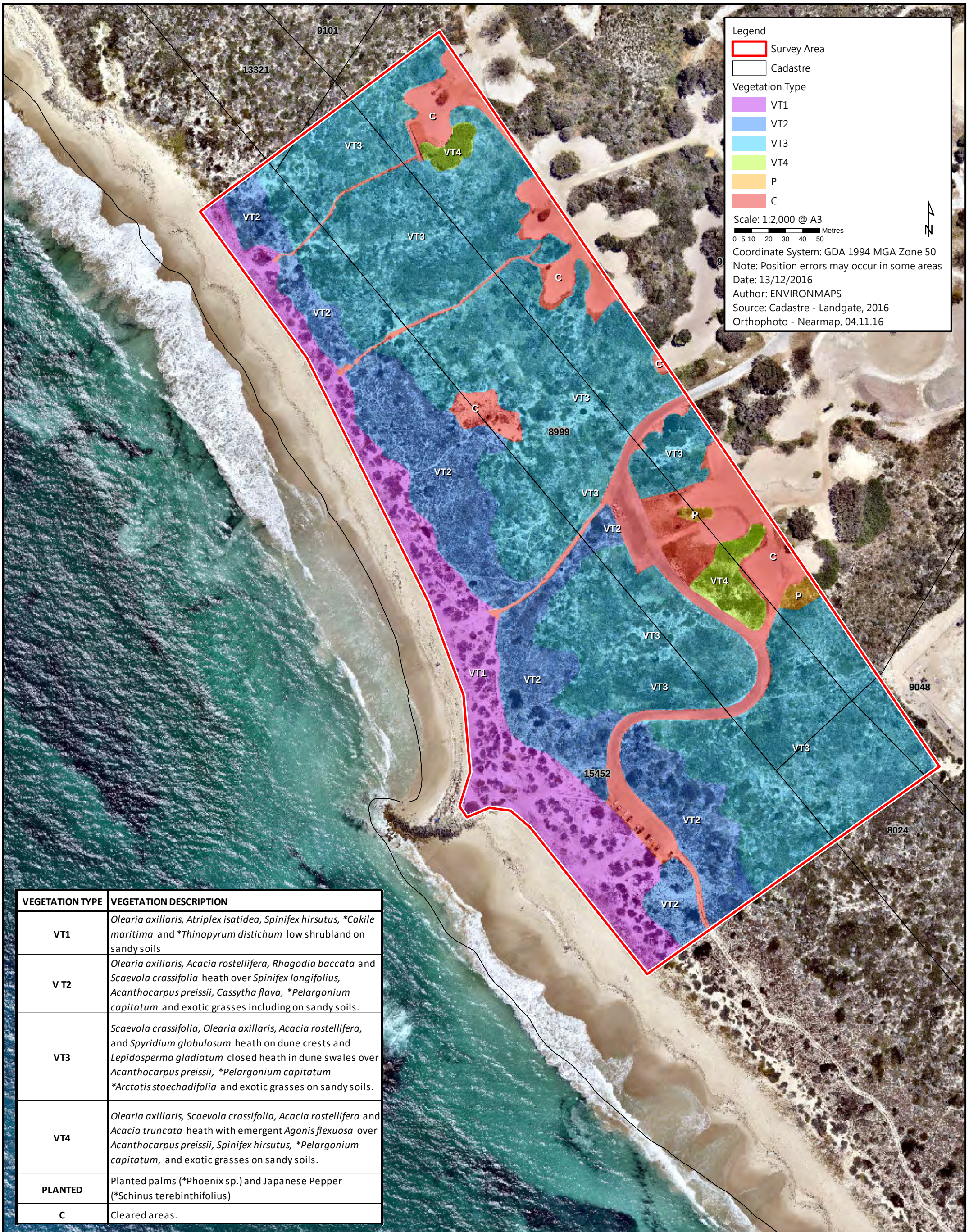

VEGETATION TYPE	VEGETATION DESCRIPTION
VT1	*Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima* and **Thinopyrum distichum* low shrubland on sandy soils
V T2	*Olearia axillaris, Acacia rostellifera, Rhagodia baccata* and *Scaevola crassifolia* heath over *Spinifex longifolius, Acanthocarpus preissii, Cassytha flava, *Pelargonium capitatum* and exotic grasses including on sandy soils.
VT3	*Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.
VT4	*Olearia axillaris, Scaevola crassifolia, Acacia rostellifera* and *Acacia truncata* heath with emergent *Agonis flexuosa* over *Acanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum,* and exotic grasses on sandy soils.
PLANTED	Planted palms (*Phoenix sp.) and Japanese Pepper (*Schinus terebinthifolius)
C	Cleared areas.

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Vegetation Types Mapped Within the Survey Area

Figure 5

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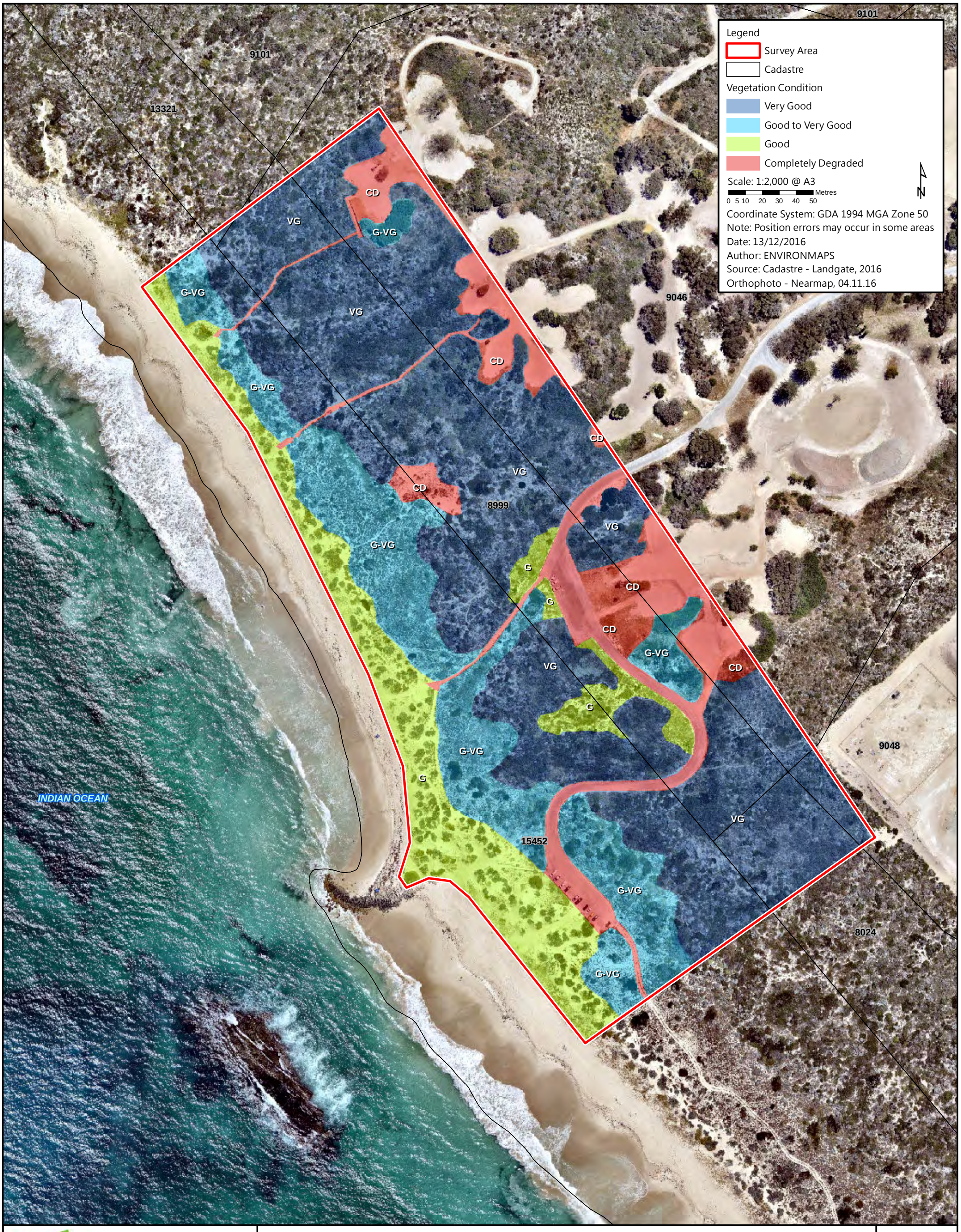

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Capricorn Village and Coastal Node – Level 2 Flora and Vegetation Survey

Vegetation Conditions Mapped Within the Survey Area

Figure 6

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Table 6: 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 7: Area (ha) covered by each vegetation condition category within the survey area

Vegetation Condition	Area (ha)	Percentage of the Survey area
Very Good	5.28	51.69
Good to Very Good	2.03	19.84
Good	1.56	15.24
Completely degraded	1.36	13.28
Total	**10.22**	**100**

4.2.5 Threatened and Priority Ecological Communities

Three TECs and one PEC were identified as having the potential to occur within 5 km of the survey area by the desktop survey.

The vegetation within the survey area did not resemble a known TEC, however the vegetation within VT 2 and VT 3 may resemble two Priority 3 PECs; FCTs 29a (Coastal Shrublands on shallow sands) and 29b (Acacia Shrublands on taller dunes), comprising 1.86 ha and 5.51 ha respectively. These FCTs were recorded in the previous vegetation surveys within the region (ATA 2007).

FCT 29 is largely restricted to the Quindalup System and contains two distinct subgroups. FCT 29a comprises mostly heaths on shallow sands over limestone close to the coast and occurs between Seabird and Garden Island. FCT 29a does not have a single dominant species but important species include *Spyridium globulosum, Rhagodia baccata* and *Olearia axillaris*. FCT 29b is dominated by Acacia Shrublands or mixed heaths of the larger dunes and ranges from Seabird to south of Mandurah. There is no consistent dominant species in FCT 29b, however species such as *Acacia rostellifera, Acacia lasiocarpa* and *Melaleuca systena* are important.

FCT 29a is inferred to potentially occur within VT2 (1.86 ha) based on the dominant species recorded during the survey (e.g. *Rhagodia baccata* and *Olearia axillaris*) while VT3 (5.51 ha) may represent FCT 29b as it comprises *Acacia rostellifera* and *Melaleuca systena*. These FCTs are also restricted to the Quindalup complex within which the survey area occurs (GoWA 2000). Therefore, it is considered likely for FCT 29a and FCT 29b to occur within the survey area based on previous survey results (ATA 2007), the known vegetation complex within the survey area and dominant taxa recorded.

5. Discussion

Vegetation within the survey area comprises four VTs and cleared areas. Transitions between VTs were generally discontinuous, though occasionally abrupt with margins representing admixtures of more than one VT. This discontinuity is primarily due to changes in soil profile and topography, and presence of cleared areas. Vegetation condition generally aligned with the VT boundaries and at a broad scale, the majority of the survey area was observed to be in various states of degradation due to coastal erosion and historical clearing within the survey area. The remnant vegetation shows signs of degradation and structural alteration particularly where the parking and beach access tracks are located.

The flora and vegetation assessment conducted within the survey area was undertaken during November 2016, during the prime flowering time for majority of species within the area with field reconnaissance focussing on traversing the entire survey area to delineate broad vegetation types. This is consistent with the requirements of a Level 2 flora and vegetation survey as specified in GS 51.

The number of species recorded within the survey area totalled 34 native vascular plant taxa from 28 plant genera and 15 plant families and 17 introduced taxa. No Declared Plant species pursuant to section 22 of the BAM Act were recorded within the survey area (DAFWA 2016).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area. Given that the survey was conducted during the prime flowering time for majority of the conservation significant species potentially occurring within the survey area, it is highly unlikely that occurrences of conservation significant species are present within the survey area.

Vegetation condition within the survey area ranged from Completely Degraded to Very Good (Keighery 1994), with majority of the survey area (51.7%) mapped to be in 'Very Good' condition. It is worth noting that a large portion of vegetation within the Survey Area has been historically cleared where the Club Capricorn infrastructure occurred previously.

The vegetation within the survey area did not resemble a known TEC, however, the survey area contains two Priority 3 PECs (FCT 29a – *Coastal Shrublands on shallow sands*, FCT 29b – *Acacia Shrublands on taller dunes*) based on dominant taxa recorded, the known vegetation complex within the survey area and previous survey results (ATA 2007). Whilst the PECs may occur in the survey area, these FCTs are very well represented within surrounding Bush Forever Site 397: *Coastal Strip from Wilbinga to Mindarie* which is under existing protection. Furthermore, these VTs will be retained within the larger foreshore reserve, subject to protection and management measures detailed in the Foreshore Management Plan.

6. Conclusion

The Level 2 flora and vegetation survey (conducted 25 November 2016) has been successful in collecting data to define and assess the presence, extent and significance of vegetation types within the survey area.

Approximately 10.22 ha of vegetation ranging from Completely Degraded to Very Good condition was recorded within the survey area.

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area. Given that the survey was conducted during the prime flowering time for majority of the conservation significant species potentially occurring within the survey area, it is highly unlikely that occurrences of conservation significant species are present within the survey area.

The vegetation within the survey area did not resemble a known TEC; however the vegetation within VT 2 and VT 3 may resemble two Priority 3 PECs; FCT 29a and FCT29b, comprising 1.86 ha and 5.51 ha respectively. These FCTs are well represented within surrounding Bush Forever Site 397: *Coastal Strip from Wilbinga to Mindarie* which is under existing protection.

This flora and vegetation assessment will support the Foreshore Management Plan for the proposed foreshore development which aligns with the *CoW Local Biodiversity Strategy* (2011) and the *CoW Coastal Management Plan* (CoW 2012) for the Capricorn coastal region.

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Capricorn foreshore reserve
Supplementary flora and vegetation surveys

Background

Capricorn Village Joint Venture (CVJV) is proposing to develop the Capricorn Coastal Village and Coastal Node, located in Yanchep, Western Australia, approximately 51 km north-northwest of the Perth Central Business District (CBD). The Capricorn Coastal Village and Coastal Node (the Project), incorporates Part Lot 312 and Lots 2, 303 and 304, Two Rocks Road, Yanchep, in the City of Wanneroo (CoW, Figure 1).

The foreshore reserve provides a link between the Indian Ocean and urban development and as such provides opportunity for both conservation and development purposes. The proposed foreshore development will require clearing of native vegetation and as such, a flora and vegetation survey was deemed necessary to determine the environmental values of the proposed clearing area. The original survey area was designed based on the draft Coastal Node concept plan, focussing on areas of proposed disturbance and a buffer area (Figure 1). The balance of the foreshore reserve (comprising the 2017 survey area; Figure 1) was traversed to confirm broad vegetation types on 23 May 2017, and was subject to a detailed Spring survey on 3 October 2017.

This memo presents the findings of a flora and vegetation survey to be supplemented to a Level 2 flora and vegetation survey conducted within the Project area on 25 November 2016. The supplementary survey was undertaken within the southern portion of the foreshore reserve; to the south of the 2016 survey area, including detailed quadrat analysis to support the proposed development of the Capricorn foreshore reserve that forms part of the Coastal Village and Coastal Node, Yanchep (the survey area; Figure 1).

This flora and vegetation assessment will support the Foreshore Management Plan for the proposed foreshore development.

Figure 1: The survey area

Scale 1:6,500 at A4

0 50 100 150 200 250 m

N

Legend

- Survey area 2017
- Survey area 2016
- Existing cadastre

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 6/10/2017

Author: JCrute

Source: Aerial image: nearma, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Path: Q:\Consult\2017\ADS\ADS17225\ArcMap_documents\ADS17225_G004_RevA.mxd

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Methods

The field survey was conducted according to standards set out in Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). The assessment of flora and vegetation within the survey area was undertaken by one ecologist on 23 May 2017 and one botanist on 3 October 2017 from Strategen. Table 1 identifies the staff involved in the field surveys, their role and qualifications. The survey area was traversed on foot to record changes in vegetation structure and type, with four vegetation quadrats surveyed in May 2017 with an additional six vegetation quadrats surveyed in the Spring October 2017 survey, with two quadrats being placed in each of the three vegetation types occurring in the survey area.

Table 1: Personnel

Name	Role
Ms. C. Courtauld Strategen (Ecologist)	Planning, fieldwork, plant identification, data interpretation and report preparation.
Ms. A. Dalton Strategen (Botanist)	Fieldwork, plant identification, data interpretation and report preparation.

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the survey area. Vegetation mapping sites were determined from aerial photographs. The survey area was traversed on foot, allowing for opportunistic sites to be placed where a change in vegetation structure or composition was observed.

Flora and vegetation was described and sampled systematically at each quadrat and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum.

For each vascular plant species, the average height, number of plants and percent cover were recorded.

The entire survey area was traversed to record the density of weed species. The GPS locations and population of each weed species were recorded.

All plant specimens collected during the field surveys were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

Results

Native flora

A total of 56 native vascular plant taxa from 50 plant genera and 25 plant families were recorded within the survey area. The majority of the taxa were recorded within the Poaceae (8 taxa) and Asteraceae (6 taxa) families (Table 2). The flora species recorded in the survey area were consistent with the 2016 survey.

Table 2: Flora taxa recorded during the 2017 survey

Family	Species
Aizoaceae	*Carpobrotus virescens*
	**Tetragonia decumbens*
Araliaceae	*Trachymene pilosa*
Asparagaceae	*Acanthocarpus preissii*
	Lomandra maritima
Asphodelaceae	**Trachyandra divaricata*
Asteraceae	**Arctotheca calendula*
	**Arctotis stoechadifolia*
	Olearia axillaris
	Pithocarpa cordata
	Senecio pinnatifolius
	**Sonchus oleraceus*
Brassicaceae	**Brassica tournefortii*
	**Cakile maritima*
	Raphanus raphanistrum
Chenopodiaceae	*Atriplex cinerea*
	Atriplex isatidea
	Rhagodia baccata
	Salsola australis
	Threlkeldia diffusa
Crassulaceae	*Crassula glomerata*
Cupressaceae	*Callitris preissii*
Cyperaceae	*Ficinia nodosa*
	Lepidosperma gladiatum
	Sporobolus virginicus
Cupressaceae	*Calitris preissii*
Fabaceae	*Acacia lasiocarpa*
	Acacia rostellifera
	Acacia truncata
	Hardenbergia comptoniana
	**Lupinus angustifolius*
Geraniaceae	**Pelargonium capitatum*
Goodeniaceae	*Hibbertia subvaginata*
	Scaevola crassifolia
	Scaevola nitida
Haemodoraceae	*Conostylis candicans*
Lauraceae	*Cassytha flava*
Myrtaceae	**Leptospermum laevigatum*
	Melaleuca systena
	Scholtzia involucrata
Onagraceae	**Oenothera drummondii*
Oxalidaceae	**Oxalis exilis*

Family	Species
Poaceae	**Avena barbata*
	**Bromus diandrus*
	**Ehrharta calycina*
	**Lagurus ovatus*
	**Poaceae poiformis*
	Spinifex hirsutus
	Spinifex longifolius
	**Thinopyrum distichum*
Ranunculaceae	*Clematis linearifolia*
Rhamnaceae	*Spyridium globulosum*
Santalaceae	*Exocarpos sparteus*
	Santalum acuminatum
Scrophulariaceae	*Myoporum insulare*

Threatened and Priority flora

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area at the time of assessment. The survey was conducted during the prime flowering time for these conservation significant species (spring), with no rare flora being observed in spring 2016 or 2017 and therefore it is unlikely that Threatened or Priority flora are likely to occur within the survey area.

Introduced (exotic) taxa

A total of 18 introduced (exotic) taxa were recorded within the survey area (Table 2). None of these species are Declared Plant species in Western Australia pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2016). The density of introduced taxa in the survey area is displayed in Figure 2.

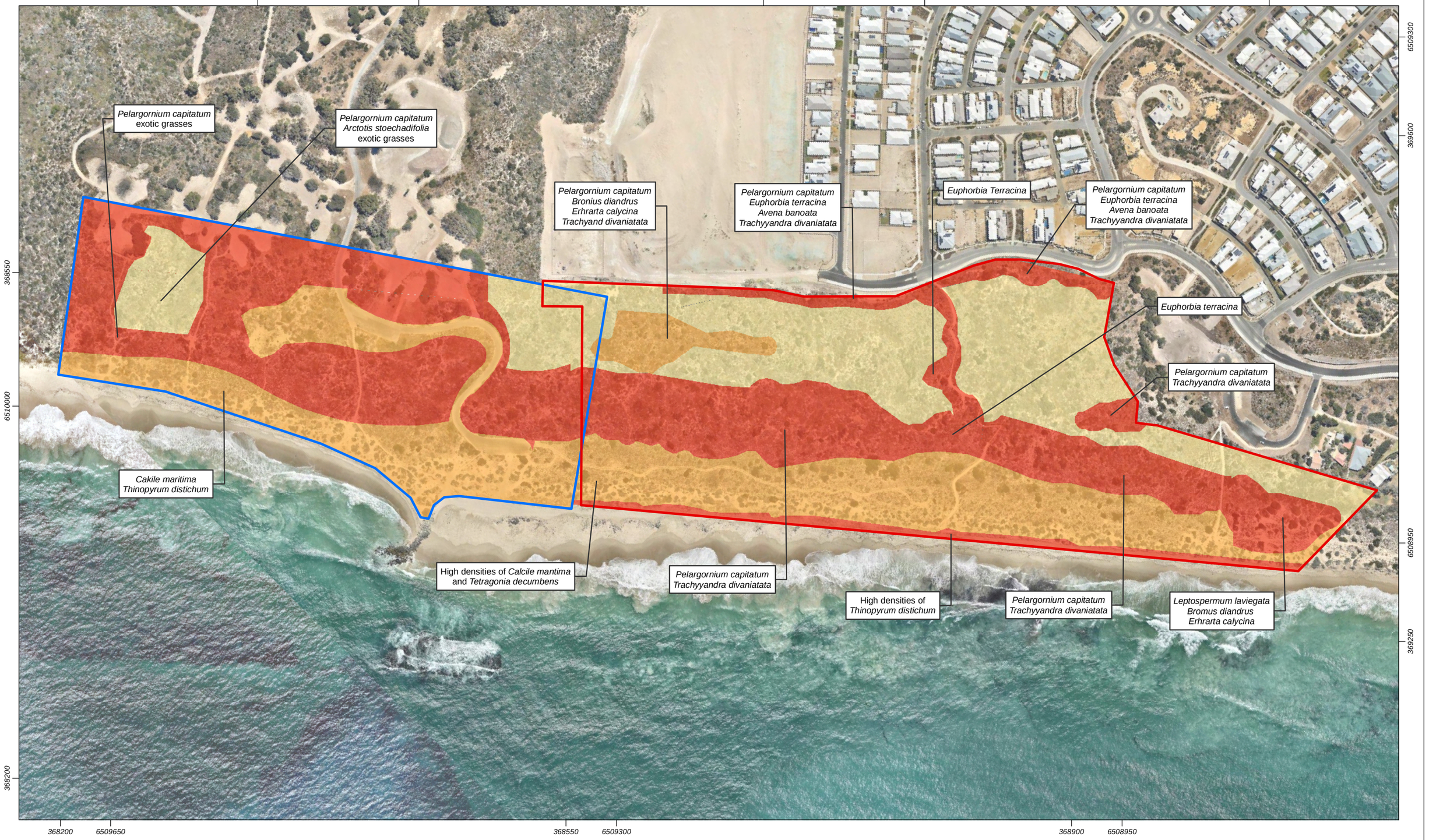

Figure 2: High level weed mapping

* 2016 area inferred

Scale 1:3,500 at A3

0 35 70 105 Metres

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 6/10/2017
Author: JCrute
Source: Topography: Geoscience Australia 2011.
Path: Q:\Consult\2017\ADS\ADS17225\ArcMap_documents\ADS17225_G002_RevA.mxd

Legend

- 2016 survey area
- 2017 Survey area

Weed mapping density

- High
- Medium
- Low

Weed density	Cover
Low	< 5%
Medium	6 - 75 %
High	76 - 100 %

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Vegetation types

Four native vegetation types (VTs) were previously defined and mapped within the survey area in 2016 (Strategen 2016). The survey area comprised VTs 1, 2, and 3 and cleared areas as summarised in Table 3. All VTs recorded in the 2017 survey area were recorded in the 2016 survey area, except for VT 4 (*Olearia axillaris, Scaevola crassifolia, Acacia rostellifera, Acacia truncata* heath with emergent *Agonis flexuosa* over *Acanthocanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum*, and exotic grasses on sandy soils), comprising only 0.19 ha of the 2016 survey area. Areas containing vegetation in a highly degraded state were not counted as unique native VTs but have been included in Table 3 for area calculation purposes. Total areas occupied within the survey area by each of the identified VTs are set out in Table 4.

Table 3: Vegetation Types

Vegetation Type	Description
1	*Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima* and **Thinopyrum distichum* low shrubland on sandy soils.
2	*Olearia axillaris, Acacia rostellifera, Rhagodia baccata* and *Scaevola crassifolia* heath over *Spinifex longifolius, Acanthocarpus preissii, Cassytha flava, *Pelargonium capitatum* and exotic grasses including on sandy soils.
3	*Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.
C	Cleared areas.

Vegetation type coverage

The total area mapped within the survey area was 14.46 ha which includes highly degraded and fully cleared areas (Table 4). The dominant native VT within the survey area was VT 3 which can be described as a *Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils.

Table 4: Area (ha) covered by each VT within the survey area

VT	Area (ha)	Percentage of the Survey area
1	2.13	14.73
2	3.81	26.35
3	8.33	57.61
Cleared	0.19	1.31
TOTAL	**14.46**	**100**

Vegetation condition

The survey area shows signs of having been degraded for a long period of time due to the widespread extent of weeds and human disturbance (e.g. trampling of dune vegetation and use of vehicle tracks for beach access). Other disturbances included the presence of rabbits, with rabbit droppings being found in the survey area. As such, vegetation condition within the survey ranged from Completely Degraded to Very Good and generally aligned with the VT boundaries (Keighery 1994; Figure 4; Table 5). Much of VT 2 is dominated by the weed species **Pelargonium capitatum* which may be a result of degradation caused by vehicle tracks which run through much of this vegetation type.

Table 6 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area.

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: Area (ha) covered by each vegetation condition category within the survey area

Vegetation Condition	Area (ha)	Percentage of the Survey area
Very Good	8.33	57.61
Good to Very Good	3.81	26.35
Good	2.13	14.73
Completely degraded	0.19	1.31
Total	**14.46**	**100**

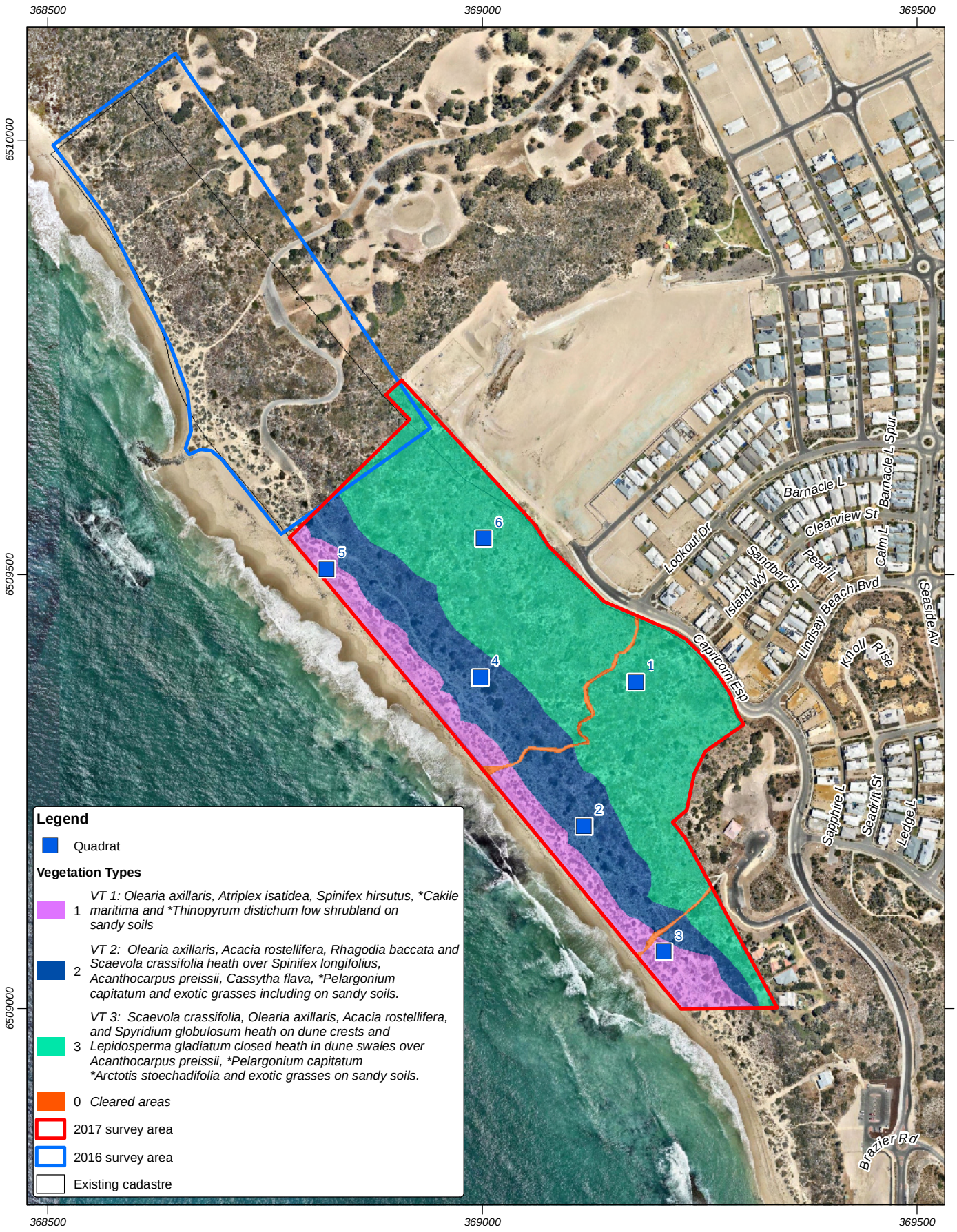

Figure 3: Vegetation Types (VTs) mapped within the survey area

Scale 1:6,000 at A4

0 50 100 150 200 250 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 6/10/2017
Author: JCrute
Source: Aerial image: nearma, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

Path: Q:\Consult\2017\ADS\ADS17225\ArcMap_documents\ADS17225_G001_RevA.mxd

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Figure 4: Vegetation condition mapped within the survey area

Scale 1:6,000 at A4

0 50 100 150 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 6/10/2017
Author: JCrute
Source: Nearmap: Aerial 2017.

Legend

- 2017 survey area
- 2016 survey area
- Existing cadastre

Vegetation condition

- Very Good
- Good-Very Good
- Good
- Completely degraded

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Threatened and Priority ecological communities

As recorded within the 2016 report (Strategen 2016), the vegetation within the survey area did not resemble a known TEC, however it contains two Priority 3 PECs (FCT 29a – *Coastal Shrublands on shallow sands*, FCT 29b – *Acacia Shrublands on taller dunes*) based on dominant taxa recorded, the known vegetation complex within the survey area and previous survey results.

Discussion

Vegetation within the survey area comprises three VTs and cleared areas and was overall consistent with the 2016 vegetation mapping (Strategen 2016). Transitions between VTs were generally discontinuous, though occasionally abrupt with margins representing admixtures of more than one VT. This discontinuity is primarily due to changes in soil profile and topography. Vegetation condition generally aligned with the VT boundaries and at a broad scale, the majority of the survey area was observed to be in various states of degradation due to coastal erosion and historical clearing within the survey area. The remnant vegetation shows signs of degradation and structural alteration particularly where the beach access tracks are located.

A total of 56 native vascular plant taxa from 50 plant genera and 25 plant families, along with 18 introduced species were recorded within the survey area. No Declared Plant species pursuant to section 22 of the BAM Act were recorded within the survey area (DAFWA 2016).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area.

Approximately 14.46 ha of vegetation ranging from Completely Degraded to Very Good condition was recorded within the survey area.

The vegetation within the survey area did not resemble a known TEC. Whilst two Priority 3 PECs (FCT 29a – *Coastal Shrublands on shallow sands*, FCT 29b – *Acacia Shrublands on taller dunes*) may occur in the survey area, these FCTs are very well represented within surrounding Bush Forever Site 397: *Coastal Strip from Wilbinga to Mindarie* which is under existing protection. Furthermore, these VTs will be retained within the foreshore reserve, subject to protection and management measures detailed in the Foreshore Management Plan.

Conclusion

The Level 2 flora and vegetation survey (conducted May and October 2017) has been successful in collecting data to define and assess the presence, extent and significance of vegetation types within the survey area.

This flora and vegetation assessment will support the Foreshore Management Plan for the proposed foreshore development which aligns with the *CoW Local Biodiversity Strategy* (2011) and the *CoW Coastal Management Plan* (CoW 2012) for the Capricorn coastal region.

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Appendix 1
Conservation significant flora and ecological community definitions

Conservation Codes for Western Australia (Western Australian Herbarium 1998-)

Under the *Wildlife Conservation Act* (1950), the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

Species which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List Criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild
- X: Presumed Extinct Flora (Declared Rare Flora – Extinct).

Species that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the *Wildlife Conservation Act 1950*).

Priority Flora

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

Priority One: Poorly-known Species

Species that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Two: Poorly-known Species

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

Priority Three: Poorly-known Species

Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

Priority Four: Rare, Near Threatened and other species in need of monitoring

1. Rare: Species that are considered to be have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
2. Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Species that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

Priority 5: Conservation Dependent Species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within 5 years.

Definition of Threatened Ecological Communities (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies:

- records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- all occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria:

1. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply:
   (a) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years)
   (b) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
2. Current distribution is limited, and one or more of the following apply:
   (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years)
   (b) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
   (c) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
3. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

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

1. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:
   (a) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years)
   (b) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

2. Current distribution is limited, and one or more of the following apply"
    (a) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years)
    (b) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
    (c) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
3. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

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

1. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
2. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
3. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definition of Priority Ecological Communities (DEC 2010)

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

1. Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
2. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
3. Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 2
Desktop assessment results (Parks and Wildlife 2007-, DEE 2015c)

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 24/11/2016

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 37' 06" E,31° 32' 28" S
Buffer	5km
Group By	Family

Family	Species	Records
Acrotylaceae	1	1
Aizoaceae	1	1
Amaranthaceae	1	1
Apiaceae	3	3
Araliaceae	3	3
Areschougiaceae	1	1
Asparagaceae	5	8
Asphodelaceae	1	2
Asteraceae	14	17
Bangiaceae	1	1
Brassicaceae	3	4
Campanulaceae	4	4
Caprifoliaceae	1	1
Caryophyllaceae	1	1
Casuarinaceae	1	1
Caulerpaceae	3	4
Ceramiaceae	2	2
Chenopodiaceae	2	3
Cladophoraceae	1	1
Convolvulaceae	1	1
Crassulaceae	1	1
Cyperaceae	3	8
Dasyaceae	1	1
Dilleniaceae	4	5
Droseraceae	1	1
Ericaceae	10	27
Euphorbiaceae	2	2
Fabaceae	14	15
Gentianaceae	1	1
Geraniaceae	1	1
Goodeniaceae	6	6
Haemodoraceae	2	3
Hemerocallidaceae	2	2
Iridaceae	3	4
Lamiaceae	3	5
Lauraceae	2	3
Loranthaceae	1	1
Malvaceae	4	4
Myrtaceae	7	9
Olacaceae	1	1
Onagraceae	1	1
Orchidaceae	5	6
Orobanchaceae	2	2
Oxalidaceae	1	1
Papaveraceae	1	1
Phyllanthaceae	1	1
Plantaginaceae	2	2
Plocamiaceae	1	1
Poaceae	5	5
Polygalaceae	3	3
Portulacaceae	1	1
Proteaceae	6	8
Ranunculaceae	2	4
Restionaceae	3	3
Rhamnaceae	4	5
Rhodomelaceae	3	5
Rubiaceae	2	2
Santalaceae	2	2
Scrophulariaceae	2	3
Solanaceae	3	5
Stylidiaceae	2	5
Tamaricaceae	1	1
Thymelaeaceae	1	2
Ulvaceae	1	1
Urticaceae	1	1
Violaceae	1	1
TOTAL	**176**	**232**

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acrotylaceae					
1.	26665	*Claviclonium ovatum*			
Aizoaceae					
2.	2798	*Carpobrotus virescens (Coastal Pigface, Kolboko, Bain)*			
Amaranthaceae					
3.	40841	*Ptilotus stirlingii subsp. stirlingii*			
Apiaceae					
4.	6218	*Daucus glochidiatus (Australian Carrot)*			
5.	6219	*Eryngium pinnatifidum (Blue Devils)*			
6.	6221	*Foeniculum vulgare (Fennel)*	Y		
Araliaceae					
7.	6229	*Hydrocotyle diantha*			
8.	19041	*Trachymene coerulea subsp. coerulea*			
9.	6280	*Trachymene pilosa (Native Parsnip)*			
Areschougiaceae					
10.	26534	*Callophycus dorsifer*			
Asparagaceae					
11.	1208	*Acanthocarpus preissii*			
12.	1231	*Lomandra maritima*			
13.	1243	*Lomandra sericea (Silky Mat Rush)*			
14.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
15.	1343	*Thysanotus patersonii*			
Asphodelaceae					
16.	1368	*Trachyandra divaricata*	Y		
Asteraceae					
17.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
18.	7840	*Arctotis stoechadifolia (White Arctotis, Silver Arctotis)*	Y		
19.	7947	*Cotula turbinata (Funnel Weed)*	Y		
20.	16311	*Gazania linearis*	Y		
21.	12741	*Hyalosperma cotula*			
22.	17852	*Leptorhynchos scaber (Lanky Buttons)*			
23.	16449	*Leucophyta brownii*			
24.	8105	*Millotia myosotidifolia*			
25.	8127	*Olearia axillaris (Coastal Daisybush)*			
26.	42281	*Pithocarpa cordata*			
27.	13300	*Rhodanthe citrina*			
28.	45146	*Roebuckiella oncocarpa*			
29.	25884	*Senecio pinnatifolius var. latilobus*			
30.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
Bangiaceae					
31.	27184	*Porphyra lucasii*			
Brassicaceae					
32.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
33.	3011	*Diplotaxis muralis (Wall Rocket)*	Y		
34.	3041	*Lepidium pseudoruderale*			
Campanulaceae					
35.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
36.	7402	*Lobelia gibbosa (Tall Lobelia)*			
37.	7403	*Lobelia heterophylla (Wing-seeded Lobelia)*			
38.	7405	*Lobelia rarifolia*			
Caprifoliaceae					
39.	7368	*Scabiosa atropurpurea (Purple Pincushion)*	Y		
Caryophyllaceae					
40.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
Casuarinaceae					
41.	13908	*Allocasuarina lehmanniana subsp. lehmanniana*			
Caulerpaceae					
42.	44539	*Caulerpa cylindracea*			
43.	27382	*Caulerpa longifolia forma crispata*			
44.	26571	*Caulerpa papillosa*			
Ceramiaceae					
45.	26511	*Bornetia binderiana*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
46.	26599	*Ceramium puberulum*			
Chenopodiaceae					
47.	2463	*Atriplex isatidea (Coast Saltbush)*			
48.	11341	*Rhagodia baccata subsp. baccata*			
Cladophoraceae					
49.	26607	*Chaetomorpha aerea*			
Convolvulaceae					
50.	11021	*Cuscuta planiflora*	Y		
Crassulaceae					
51.	3140	*Crassula glomerata*	Y		
Cyperaceae					
52.	744	*Baumea laxa*			
53.	20216	*Ficinia nodosa (Knotted Club Rush)*			
54.	42742	*Lepidosperma calcicola*			
Dasyaceae					
55.	26738	*Dasya elongata*			
Dilleniaceae					
56.	5112	*Hibbertia aurea*			
57.	5134	*Hibbertia huegelii*			
58.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
59.		*Hibbertia sp.*			
Droseraceae					
60.	3118	*Drosera pallida (Pale Rainbow)*			
Ericaceae					
61.	6295	*Acrotriche cordata (Coast Ground Berry)*			
62.	6349	*Conostephium preissii*			
63.	6405	*Leucopogon insularis*			
64.	40801	*Leucopogon maritimus*		P1	
65.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
66.	6434	*Leucopogon polymorphus*			
67.	6436	*Leucopogon propinquus*			
68.	6440	*Leucopogon racemulosus*			
69.	19460	*Leucopogon sp. Yanchep (M. Hislop 1986)*		P3	
70.	34736	*Lysinema pentapetalum*			
Euphorbiaceae					
71.	4636	*Euphorbia paralias (Sea Spurge)*	Y		
72.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
Fabaceae					
73.	3262	*Acacia cochlearis (Rigid Wattle)*			
74.	11611	*Acacia lasiocarpa var. lasiocarpa*			
75.	3525	*Acacia rostellifera (Summer-scented Wattle)*			
76.	30032	*Acacia saligna subsp. saligna*			
77.	20482	*Gastrolobium nervosum*			
78.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
79.	3968	*Hovea trisperma (Common Hovea)*			
80.	14783	*Jacksonia calcicola*			
81.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
82.	4042	*Kennedia nigricans (Black Kennedia)*			
83.	4044	*Kennedia prostrata (Scarlet Runner)*			
84.	4256	*Templetonia retusa (Cockies Tongues)*			
85.	4292	*Trifolium campestre (Hop Clover)*	Y		
86.	4309	*Trifolium scabrum (Rough Clover)*	Y		
Gentianaceae					
87.	17800	*Centaurium pulchellum*	Y		
Geraniaceae					
88.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
Goodeniaceae					
89.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
90.	7614	*Scaevola globulifera*			
91.	7626	*Scaevola nitida (Shining Fanflower)*			
92.	13181	*Scaevola repens var. angustifolia*			
93.	7647	*Scaevola thesioides*			
94.	13152	*Scaevola thesioides subsp. thesioides*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Haemodoraceae					
95.	11261	*Anigozanthos manglesii subsp. manglesii*			
96.	12027	*Conostylis candicans subsp. calcicola*			
Hemerocallidaceae					
97.	1260	*Stypandra glauca (Blind Grass)*			
98.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
Iridaceae					
99.	19179	*Moraea flaccida (One-leaf Cape Tulip)*	Y		
100.	1552	*Patersonia rudis (Hairy Flag)*			
101.	11544	*Romulea rosea var. australis (Guildford Grass)*	Y		
Lamiaceae					
102.	16933	*Hemiandra glabra*			
103.	38320	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*			
104.	6939	*Westringia dampieri*			
Lauraceae					
105.	2956	*Cassytha pomiformis (Dodder Laurel)*			
106.	2957	*Cassytha racemosa (Dodder Laurel)*			
Loranthaceae					
107.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
Malvaceae					
108.	4906	*Alyogyne huegelii (Lilac Hibiscus)*			
109.	5011	*Guichenotia ledifolia*			
110.	5077	*Thomasia cognata*			
111.	5105	*Thomasia triphylla*			
Myrtaceae					
112.	13091	*Eucalyptus argutifolia (Wabling Hill Mallee)*		T	
113.	5649	*Eucalyptus foecunda (Narrow-leaved Red Mallee)*			
114.	13541	*Eucalyptus petrensis*			
115.	5887	*Melaleuca cardiophylla (Tangling Melaleuca)*			
116.	5922	*Melaleuca lanceolata (Rottnest Teatree, Moonah)*			
117.	18598	*Melaleuca systena*			
118.	6101	*Verticordia nitens (Morrison Featherflower, Kodjeningara)*			
Olacaceae					
119.	2365	*Olax benthamiana*			
Onagraceae					
120.	20052	*Oenothera jamesii*	Y		
Orchidaceae					
121.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
122.	1635	*Diuris longifolia (Common Donkey Orchid)*			
123.	15418	*Leptoceras menziesii*			
124.	15425	*Prasophyllum calcicola*			
125.	11118	*Pterostylis pyramidalis (Snail Orchid)*			
Orobanchaceae					
126.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
127.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
Oxalidaceae					
128.	30375	*Oxalis exilis*			
Papaveraceae					
129.	31532	*Fumaria muralis subsp. muralis*	Y		
Phyllanthaceae					
130.	4675	*Phyllanthus calycinus (False Boronia)*			
Plantaginaceae					
131.	7303	*Plantago lanceolata (Ribwort Plantain)*	Y		
132.	7109	*Veronica calycina (Cup Speedwell)*			
Plocamiaceae					
133.	27156	*Plocamium mertensii*			
Poaceae					
134.	247	*Bromus arenarius (Sand Brome)*			
135.	249	*Bromus diandrus (Great Brome)*	Y		
136.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
137.	10970	*Rostraria cristata*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
138.	625	*Spinifex longifolius (Beach Spinifex)*			
Polygalaceae					
139.	4552	*Comesperma confertum*			
140.	4555	*Comesperma integerrimum*			
141.	4564	*Comesperma virgatum (Milkwort)*			
Portulacaceae					
142.	40827	*Calandrinia tholiformis*			
Proteaceae					
143.	1842	*Banksia prionotes (Acorn Banksia)*			
144.	15607	*Conospermum acerosum subsp. acerosum*			
145.	1885	*Conospermum triplinervium (Tree Smokebush)*			
146.	2146	*Hakea costata (Ribbed Hakea)*			
147.	2175	*Hakea lissocarpha (Honey Bush)*			
148.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
Ranunculaceae					
149.	10804	*Clematis linearifolia*			
150.	2932	*Ranunculus colonorum (Common Buttercup)*			
Restionaceae					
151.	1056	*Alexgeorgea nitens*			
152.	17663	*Desmocladus asper*			
153.	16595	*Desmocladus flexuosus*			
Rhamnaceae					
154.	4802	*Cryptandra mutila*			
155.	4809	*Cryptandra pungens*			
156.	4828	*Spyridium globulosum (Basket Bush)*			
157.	11665	*Trymalium ledifolium var. ledifolium*			
Rhodomelaceae					
158.	26689	*Coeloclonium umbellula*			
159.	26752	*Dasyclonium incisum*			
160.	27013	*Lenormandia spectabilis*			
Rubiaceae					
161.	7323	*Galium murale (Small Goosegrass)*	Y		
162.	18255	*Opercularia vaginata (Dog Weed)*			
Santalaceae					
163.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
164.	2344	*Leptomeria empetriformis*			
Scrophulariaceae					
165.	7289	*Myoporum caprarioides (Slender Myoporum)*			
166.	7291	*Myoporum insulare (Blueberry Tree, boobialla)*			
Solanaceae					
167.	11725	*Anthocercis ilicifolia subsp. ilicifolia*			
168.	6949	*Anthocercis littorea (Yellow Tailflower)*			
169.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
Stylidiaceae					
170.	7710	*Stylidium cygnorum*			
171.	13127	*Stylidium maritimum*		P3	
Tamaricaceae					
172.	15741	*Tamarix aphylla (Athel Tree)*	Y		
Thymelaeaceae					
173.	5243	*Pimelea ferruginea*			
Ulvaceae					
174.	27352	*Ulva lactuca*			
Urticaceae					
175.	1762	*Parietaria debilis (Pellitory)*			
Violaceae					
176.	5216	*Hybanthus calycinus (Wild Violet)*			

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

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

3 - Priority 3
4 - Priority 4
5 - Priority 5

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

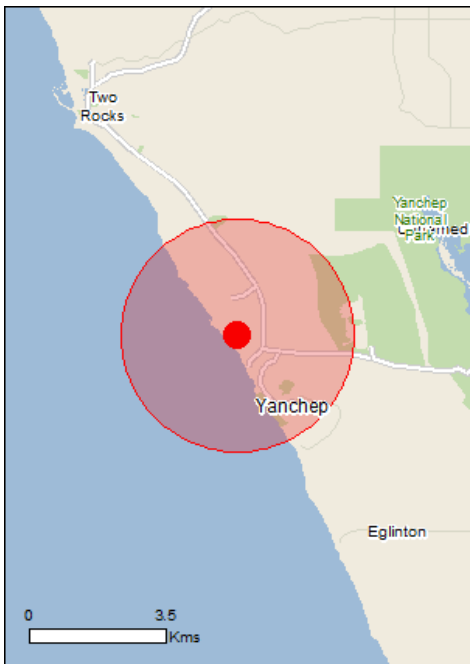
EPBC Act Protected Matters Report

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

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

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/11/16 17:20:10



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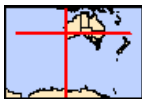

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	41
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Plants		
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour may occur within area

Name	Threatened	Type of Presence
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stigmatopora olivacea a pipefish [74966]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Reptiles		
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.54362 115.62209

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 3
Photographic record of site and vegetation types

Plate 1: VT1 – Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima and *Thinopyrum distichum low shrubland on sandy soils

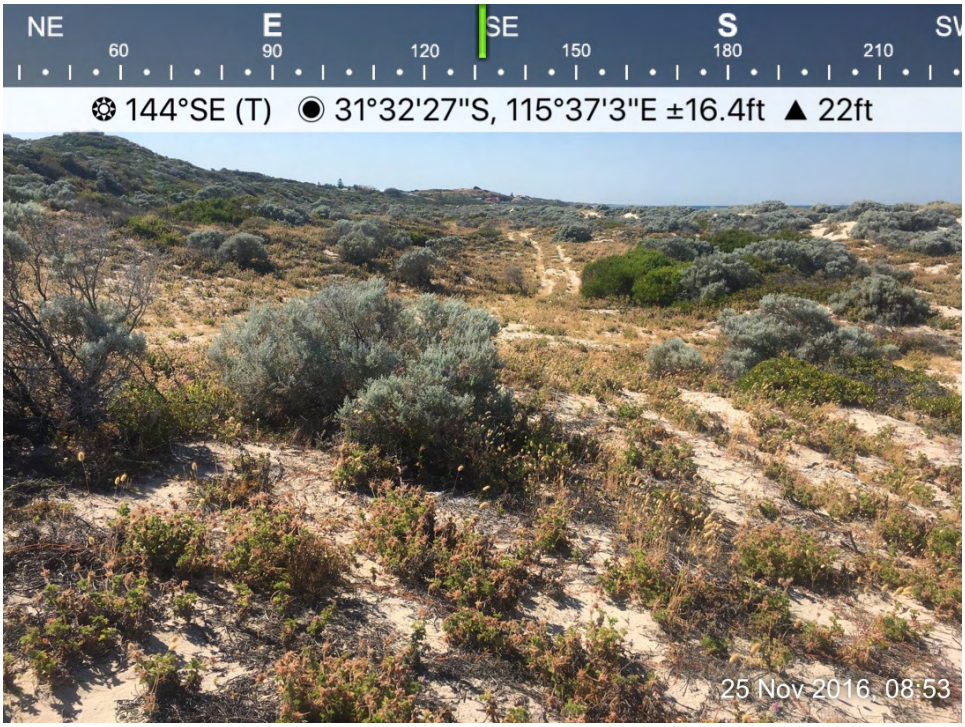

Plate 2: VT2 – *Olearia axillaris, Acacia rostellifera, Rhagodia baccata* and *Scaevola crassifolia* heath over *Spinifex longifolia, Acanthocarpus preissii, Cassytha flava, *Pelargonium capitatum* and exotic grasses including on sandy soils

Plate 3: VT3 – *Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,* and *Spyridium globulosum* heath on dune crests and *Lepidosperma gladiatum* closed heath in dune swales over *Acanthocarpus preissii, *Pelargonium capitatum *Arctotis stoechadifolia* and exotic grasses on sandy soils

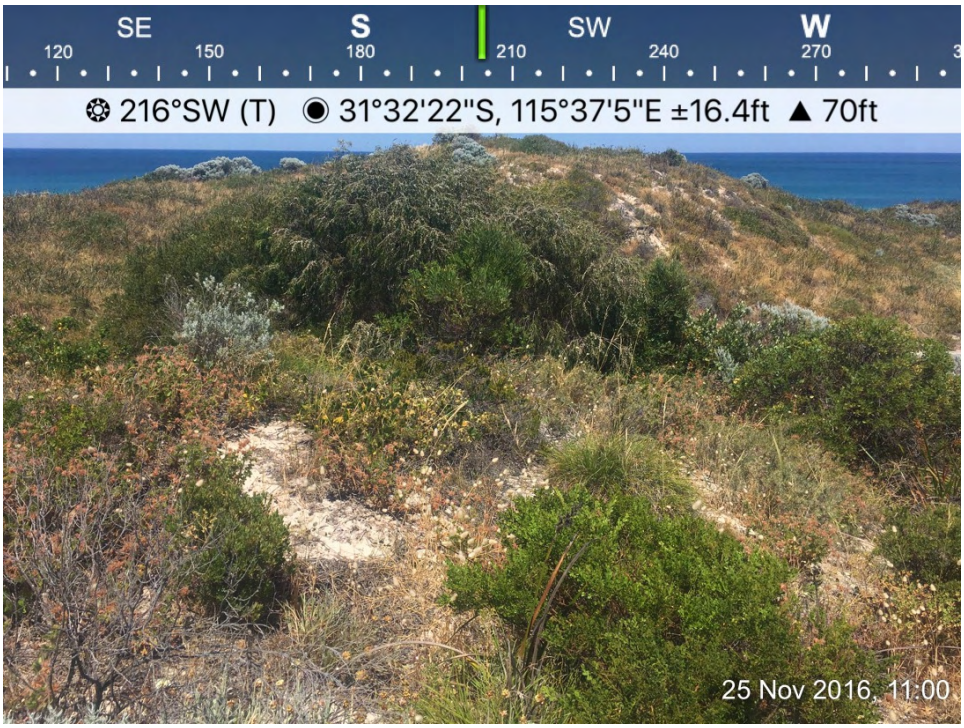

Plate 4: VT4 – *Olearia axillaris, Scaevola crassifolia, Acacia rostellifera* and *Acacia truncata* heath with emergent *Agonis flexuosa* over *Acanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum,* and exotic grasses on sandy soils

Plate 5: Planted **Schinus terebinthifolius*

Plate 6: Cleared areas and planted palm

Appendix 4
Vascular plant taxa recorded from quadrats within the survey area

family	species
Aizoaceae	*Carpobrotus virescens*
Anacardiaceae	**Schinus terebinthifolius*
Arecaceae	**Phoenix* sp.
Asparagaceae	*Acanthocarpus preissii*
	Lomandra maritima
Asphodelaceae	**Trachyandra divaricata*
Asteraceae	**Arctotis stoechadifolia*
	Olearia axillaris
	Senecio pinnatifolius
	**Sonchus oleraceus*
	Waitzia suaveolens var. suaveolens
Brassicaceae	**Brassica tournefortii*
	**Cakile maritima*
	**Raphanus raphanistrum*
Chenopodiaceae	*Atriplex isatidea*
	Atriplex cinerea
	Atriplex isatidea
	Rhagodia baccata
	Salsola australis
	Threlkeldia diffusa
Cupressaceae	*Callitris preissii*
Cyperaceae	*Ficinia nodosa*
	Lepidosperma gladiatum
	Sporobolus virginicus
Fabaceae	*Acacia cyclops*
	Acacia rostellifera
	Acacia truncata
	Hardenbergia comptoniana
	**Trifolium arvense*
Geraniaceae	**Pelargonium capitatum*
Goodeniaceae	*Scaevola crassifolia*
Haemodoraceae	*Conostylis candicans*
Lauraceae	*Cassytha flava*
Myrtaceae	*Agonis flexuosa*
	Casuarina spp.
	Eucalyptus gomphocephala
	Melaleuca nesophila
	Melaleuca systena
	Scholtzia involucrata
Poaceae	**Avena barbata*
	**Avena barbata*

family	species
	**Bromus diandrus*
	**Cynodon dactylon*
	**Ehrharta calycina*
	**Lagurus ovatus*
	Spinifex hirsutus
	Spinifex longifolia
	**Thinopyrum distichum*
Rhamnaceae	*Spyridium globulosum*
Santalaceae	*Exocarpos* sp.
Scrophulariaceae	*Myoporum insulare*

Appendix 5
Supplementary flora and vegetation survey

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Capricorn foreshore reserve
Supplementary flora and vegetation survey

Background

Capricorn Village Joint Venture (CVJV) is proposing to develop the Capricorn Coastal Village and Coastal Node, located in Yanchep, Western Australia, approximately 51 km north-northwest of the Perth Central Business District (CBD). The Capricorn Coastal Village and Coastal Node (the Project), incorporates Part Lot 312 and Lots 2, 303 and 304, Two Rocks Road, Yanchep, in the City of Wanneroo (CoW, Figure 1).

The foreshore reserve provides a link between the Indian Ocean and urban development and as such provides opportunity for both conservation and development purposes. The proposed foreshore development will require clearing of native vegetation and as such, a flora and vegetation survey was deemed necessary to determine the environmental values of the proposed clearing area. The survey area was designed based on the draft concept plan, focussing on areas of proposed disturbance and a buffer area (Figure 1). The balance of the foreshore reserve (comprising both the 2016 and 2017 survey areas; Figure 1) was also traversed to confirm broad vegetation types, however this area was not subject to detailed quadrat analysis.

This memo presents the findings of a flora and vegetation survey to be supplemented to a Level 2 flora and vegetation survey conducted within the Project area on 25 November 2016. The supplementary survey was undertaken within the southern portion of the foreshore reserve; to the south of the 2016 survey area, including detailed quadrat analysis to support the proposed development of the Capricorn foreshore reserve that forms part of the Coastal Village and Coastal Node, Yanchep (the survey area; Figure 1).

This flora and vegetation assessment will support the Foreshore Management Plan for the proposed foreshore development.

Methods

The field survey was conducted according to standards set out in Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). The assessment of flora and vegetation within the survey area was undertaken by one ecologist from Strategen on 23 May 2017. Table 1 identifies staff involved in the field surveys, their role and qualifications. The survey area was traversed on foot to record changes in vegetation structure and type and four vegetation quadrats were surveyed to identify vegetation types.

Table 1: Personnel

Name	Role
Ms. C. Courtauld Strategen (Ecologist)	Planning, fieldwork, plant identification, data interpretation and report preparation.

Site selection for vegetation mapping was based on differences in structure and species composition of the communities present within the survey area. Vegetation mapping sites were determined from aerial photographs. The survey area was traversed on foot, allowing for opportunistic sites to be placed where a change in vegetation structure or composition was observed.

Flora and vegetation was described and sampled systematically at each quadrat and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were noted:

- GPS location
- topography
- soil type and colour
- outcropping rocks and their type
- percentage cover and average height of each vegetation stratum.

For each vascular plant species, the average height, number of plants and percent cover were recorded.

All plant specimens collected during the field surveys were identified using appropriate reference material or through comparisons with pressed specimens housed at the Western Australian Herbarium where necessary. Nomenclature of the species recorded is in accordance with Western Australian Herbarium (1998-).

Results

Native flora

A total of 23 native vascular plant taxa from 21 plant genera and 14 plant families were recorded within the survey area. The majority of taxa were recorded within the Chenopodiaceae (5 taxa) and Cyperaceae (3 taxa) families (Table 2). The flora species recorded within the survey area were consistent with the 2016 survey.

Table 2: Flora taxa recorded during the 2017 survey

Family	Species
Aizoaceae	***Carpobrotus virescens***
Asparagaceae	***Acanthocarpus preissii***
	Lomandra maritima
Asphodelaceae	****Trachyandra divaricata***
Asteraceae	****Arctotis stoechadifolia***
	Olearia axillaris
Brassicaceae	****Cakile maritima***
Chenopodiaceae	***Atriplex cinerea***
	Atriplex isatidea
	Rhagodia baccata
	Salsola australis
	Threlkeldia diffusa
Cupressaceae	***Callitris preissii***
Cyperaceae	***Ficinia nodosa***
	Lepidosperma gladiatum
	Sporobolus virginicus
Fabaceae	***Acacia rostellifera***
	Hardenbergia comptoniana
Geraniaceae	****Pelargonium capitatum***

Family	Species
Goodeniaceae	***Scaevola crassifolia***
Haemodoraceae	***Conostylis candicans***
Lauraceae	***Cassytha flava***
Myrtaceae	***Scholtzia involucrata***
Poaceae	****Avena barbata***
	****Bromus diandrus***
	****Ehrharta calycina***
	****Lagurus ovatus***
	Spinifex hirsutus
	Spinifex longifolius
	****Thinopyrum distichum***
Rhamnaceae	***Spyridium globulosum***
Scrophulariaceae	***Myoporum insulare***

Threatened and Priority flora

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area at the time of assessment. Although the survey was not conducted during the prime flowering time for these conservation significant species (spring), no rare flora were observed in spring 2016 therefore it is unlikely that Threatened or Priority are likely to occur within the survey area.

Introduced (exotic) taxa

A total of eight introduced (exotic) taxa were recorded within the survey area (Table 2). None of these species are Declared Plant species in Western Australia pursuant to section 22 of the ***Biosecurity and Agriculture Management Act 2007*** (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2016).

Vegetation types

Four native vegetation types (VTs) were previously defined and mapped within the survey area in 2016 (Strategen 2016). The survey area comprised VTs 1, 2, and 3 and cleared areas as summarised in Table 3. All VTs recorded in the 2017 survey area were recorded in the 2016 survey area, except for VT 4 (***Olearia axillaris, Scaevola crassifolia, Acacia rostellifera, Acacia truncata*** heath with emergent ***Agonis flexuosa*** over ***Acanthocanthocarpus preissii, Spinifex hirsutus, *Pelargonium capitatum***, and exotic grasses on sandy soils), comprising only 0.19 ha of the 2016 survey area. Areas containing vegetation in a highly degraded state were not counted as unique native VTs but have been included in Table 3 for area calculation purposes. Total areas occupied within the survey area by each of the identified VTs are set out in Table 4.

Table 3: Vegetation Types

Vegetation Type	Description
1	***Olearia axillaris, Atriplex isatidea, Spinifex hirsutus, *Cakile maritima*** and ****Thinopyrum distichum*** low shrubland on sandy soils.
2	***Olearia axillaris, Acacia rostellifera, Rhagodia baccata*** and ***Scaevola crassifolia*** heath over ***Spinifex longifolius, Acanthocarpus preissii, Cassytha flava,*** ****Pelargonium capitatum*** and exotic grasses including on sandy soils.
3	***Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,*** and ***Spyridium globulosum*** heath on dune crests and ***Lepidosperma gladiatum*** closed heath in dune swales over ***Acanthocarpus preissii,*** ****Pelargonium capitatum *Arctotis stoechadifolia*** and exotic grasses on sandy soils.
C	Cleared areas.

Figure 1: The survey area

Scale 1:6,500 at A4

0 50 100 150 200 250 m

N

Legend

- Survey area 2017
- Survey area 2016
- Existing cadastre

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 7/06/2017

Author: JCrute

Source: Aerial image: nearma, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

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Vegetation type coverage

The total area mapped within the survey area was 14.46 ha which includes highly degraded and fully cleared areas (Table 4). The dominant native VT within the survey area was VT 3 which can be broadly described as a ***Scaevola crassifolia, Olearia axillaris, Acacia rostellifera,*** and ***Spyridium globulosum*** heath on dune crests and ***Lepidosperma gladiatum*** closed heath in dune swales over ***Acanthocarpus preissii,*** ****Pelargonium capitatum *Arctotis stoechadifolia*** and exotic grasses on sandy soils.

Table 4: Area (ha) covered by each VT within the survey area

VT	Area (ha)	Percentage of the Survey area
1	2.13	14.73
2	3.81	26.35
3	8.33	57.61
Cleared	0.19	1.31
TOTAL	**14.46**	**100**

Vegetation condition

The survey area shows signs of having been degraded for a long period of time due to the widespread extent of weeds and human disturbance (e.g. trampling dune vegetation for access to the beach). As such, vegetation condition within the survey ranged from Completely Degraded to Good and generally aligned with the VT boundaries (Keighery 1994; Figure 3; Table 5).

Table 6 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area.

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: Area (ha) covered by each vegetation condition category within the survey area

Vegetation Condition	Area (ha)	Percentage of the Survey area
Very Good	8.33	57.61
Good to Very Good	3.81	26.35
Good	2.13	14.73
Completely degraded	0.19	1.31
Total	**14.46**	**100**

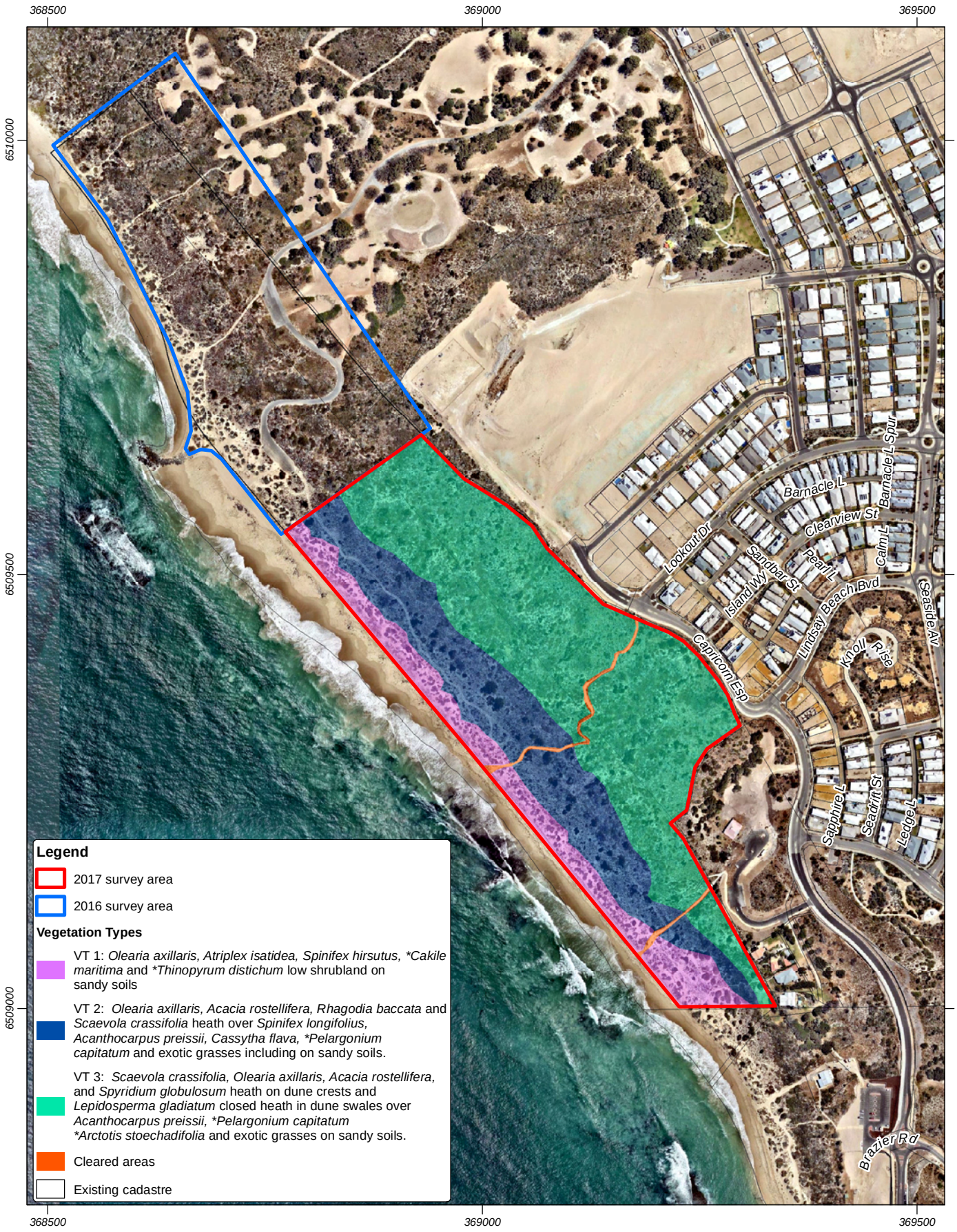

Figure 2: Vegetation Types (VTs) mapped within the survey area

Scale 1:6,000 at A4

0 50 100 150 200 250 m

N

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 7/06/2017

Author: JCrute

Source: Aerial image: nearma, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

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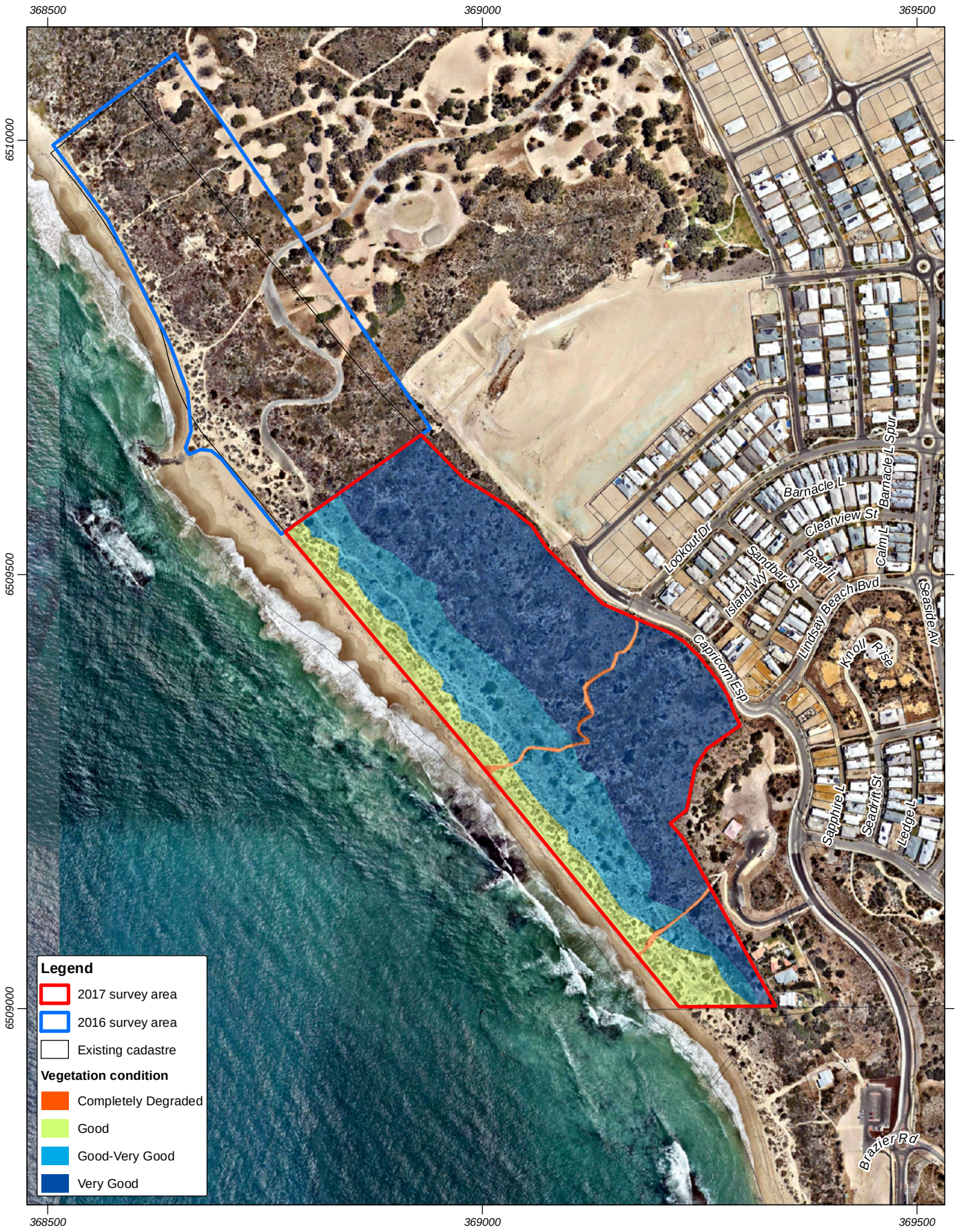

Figure 3: Vegetation condition mapped within the survey area

Scale 1:6,000 at A4

0 50 100 150 200 250 m

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 7/06/2017
Author: JCrute
Source: Aerial image: nearma, flown 01/2017. Existing cadastre: SLIP, Landgate 2017. Master plan: Client 03/2017.

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Threatened and Priority ecological communities

As recorded within the 2016 report (Strategen 2016), the vegetation within the survey area did not resemble a known TEC, however it contains two Priority 3 PECs (FCT 29a – ***Coastal Shrublands on shallow sands***, FCT 29b – ***Acacia Shrublands on taller dunes***) based on dominant taxa recorded, the known vegetation complex within the survey area and previous survey results.

Discussion

Vegetation within the survey area comprises three VTs and cleared areas and was overall consistent with the 2016 vegetation mapping (Strategen 2016). Transitions between VTs were generally discontinuous, though occasionally abrupt with margins representing admixtures of more than one VT. This discontinuity is primarily due to changes in soil profile and topography. Vegetation condition generally aligned with the VT boundaries and at a broad scale, the majority of the survey area was observed to be in various states of degradation due to coastal erosion and historical clearing within the survey area. The remnant vegetation shows signs of degradation and structural alteration particularly where the beach access tracks are located.

A total of 23 native vascular plant taxa from 21 plant genera and 14 plant families and eight introduced species were recorded within the survey area. No Declared Plant species pursuant to section 22 of the BAM Act were recorded within the survey area (DAFWA 2016).

No Threatened flora species as listed under section 178 of the EPBC Act or pursuant to Schedule 1 of the WC Act and as listed by Parks and Wildlife (2015) or Priority flora species as listed by Western Australian Herbarium (1998-) were recorded within the survey area.

Approximately 14.46 ha of vegetation ranging from Completely Degraded to Very Good condition was recorded within the survey area.

The vegetation within the survey area did not resemble a known TEC. Whilst two Priority 3 PECs (FCT 29a – ***Coastal Shrublands on shallow sands***, FCT 29b – ***Acacia Shrublands on taller dunes***) may occur in the survey area, these FCTs are very well represented within surrounding Bush Forever Site 397: ***Coastal Strip from Wilbinga to Mindarie*** which is under existing protection. Furthermore, these VTs will be retained within the foreshore reserve, subject to protection and management measures detailed in the Foreshore Management Plan.

Conclusion

The Level 2 flora and vegetation survey (conducted May 2017) has been successful in collecting data to define and assess the presence, extent and significance of vegetation types within the survey area.

This flora and vegetation assessment will support the Foreshore Management Plan for the proposed foreshore development which aligns with the ***CoW Local Biodiversity Strategy*** (2011) and the ***CoW Coastal Management Plan*** (CoW 2012) for the Capricorn coastal region.

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Environmental Protection Authority (EPA) 2016, ***Technical Guidance (in accordance with the Environmental Protection Act 1986) – Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia.*** Government of Western Australia, Perth.

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

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Western Australian Herbarium 1998-, ***FloraBase – the Western Australian Flora***, [Online], Government of Western Australia, Available from: ***http://florabase.dpaw.wa.gov.au/*** [May 2017].

Appendix 4
Level 1 fauna survey

Capricorn Coastal Reserve
Fauna Assessment

View from east to west over the survey area (photo: M. Bamford)

Prepared for: Strategen Environmental
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1st February 2017

Executive summary

Bamford Consulting Ecologists (BCE) was commissioned by Strategen Environmental to conduct a level 1 fauna assessment of a coastal reserve at the Capricorn estate, located approximately 50 kilometres (km) north of Perth. The proposal is for development of approximately 1.5 hectares (ha) within a coastal foreshore reserve of 27ha.

A level 1 assessment involves a site inspection and desktop review, and can be a powerful approach for impact assessment where there is abundant information available on the fauna assemblage and the general region is familiar to the consultant, as is the case in this instance. Databases contain extensive information on fauna in the region, and BCE has undertaken several level 1 assessments nearby (Bamford and Davis 2005, Everard and Bamford 2017), as well as two level 2 (comprehensive trapping) assessments (Bamford 1998; 2006, Turpin and Bamford 2008).

BCE uses a 'values and impacts' approach to impact assessment with respect to fauna. Components of this approach are:

- The identification of **fauna values**:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape; and
    - Ecological processes upon which the fauna depend.
- The review of **impacting processes** such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes; and
    - Disturbance (dust, light and noise).
- The **recommendation** of actions to mitigate impacts.

The purpose of this report is to provide information on the fauna values of the survey area, particularly for significant species and an overview of the ecological function of the site within the local and regional context, and to provide discussion on the interaction of the proposal on these fauna values and functions.

The fauna investigations were based on a desktop assessment and site inspection in December 2016. The desktop study identified 166 vertebrate fauna species as potentially occurring in the survey area: four frogs, 53 reptiles, 92 birds, 12 native and five introduced mammals. The vertebrate assemblage includes up to 38 species of conservation significance. Some species have been excluded from the assemblage as they are almost certainly locally extinct. A further three conservation significant invertebrate species were identified from the desktop assessment.

Key fauna values are:

Fauna assemblage. Largely intact but with some mammals locally extinct. The assemblage is typical of heathland on coastal dunes, located throughout the Swan Coastal Plain Bioregion. A slightly

depauperate fauna assemblage is likely to occur in the coastal heathland as some reptile, mammal and bird species are expected to be locally extinct. The assemblage contains a moderate level of richness to be expected in relatively undisturbed intact heathland vegetation.

Species of conservation significance. Several significant species are likely to occur in the survey area. Carnaby's Black-Cockatoo (CS1) is an irregular non-breeding visitor to the area, although the coastal heathland present at the site provides minimal foraging value for the species. No evidence of roosting or nesting was recorded during the site inspection, and based on the lack of suitable habitat is unlikely to occur. The Graceful Sun-Moth (CS2) has been recorded south of Yanchep and also has the potential to occur at the site. The Moodit or Southern Bush-rat (CS3) is also of interest, as it occurs in near-coastal heathlands north of Perth and is likely to be present in the survey area.

Vegetation and Substrate Associations (VSAs). The coastal heath on calcareous sand can be considered a single VSA that is well-represented to the north and south. It also tends to be the coastal strip of native vegetation that is retained during urban development. Vegetation includes a mix of low shrubs comprising, *Acacia rostellifera*, *Olearia axillaris* and *Scaevola* sp. over coastal sand dunes.

Sedgelands of *Lepidosperma gladiatum* sometimes form a distinct VSA in some locations (i.e. in deep swales) but are also mixed with other vegetation types across the site. The lack of variety in VSAs with the separation of the coastal heaths from more inland VSAs such as shrublands and woodlands will slightly reduce the number of species present. This is because some species will move between vegetation types seasonally but this opportunity has been lost with development nearby. This VSA type is widespread in the local area, particularly to the north of the survey area.

Patterns of biodiversity. Species are likely to have distinct distributions even over short distances but understanding these requires very detailed investigation. Of interest, however, is that the Graceful Sun-Moth will breed on the upper slopes of dunes where *Lomandra* spp. occur (its food-plant), the White-breasted Robin will be associated with thickets of taller vegetation and the Moodit often occurs on the margins of sedgelands. The coastal fringe (foredunes) may support slightly fewer species and possibly lower levels of abundance than the more developed and complex vegetation of the secondary dunes 50m or so inland.

Key ecological processes. Processes can include factors such as fire, interactions with other species and hydrology, but the key process in the context of the survey area is likely to be its shape and relationship with other areas of native vegetation. This affects connectivity and the ability of species to move through the landscape (landscape permeability). The presence of a large Bush Forever site to the north is important in allowing fauna species to persist and move into and out of the survey area. Landscape permeability is likely to be reduced to the east and particularly to the south towards Yanchep, due to urban development.

Impacting processes

Impacting processes (listed above) have to be considered in the context of fauna values and the nature of the proposed action. The impacts of greatest concern are those of fragmentation, degradation and feral species (in particular domestic Cats). The proposed development is small within the context of the foreshore reserve; it represents about 5% of the reserve. However, it will constrict the reserve at one point.

Recommendations

General recommendations include:

- Minimise the disturbance footprint where possible;
- Clearly delineate areas to be cleared to minimise unnecessary vegetation loss;
- Maintain linkages to adjacent vegetation where possible (i.e. to the Bush Forever site north of the survey area);
- Rehabilitate as soon as practical;
- Employ industry standard hygiene management measures to avoid introducing weeds into the area;
- Educate employees on the vulnerability of some species to roadkill (e.g. Quenda);
- Provide signage in areas of known wildlife activity;
- Rehabilitate access tracks as soon as possible to discourage access by feral fauna. In the long term, it may be necessary to develop a feral fauna management plan in conjunction with the Department of Parks and Wildlife;
- Ensure appropriate waste disposal during construction activities to avoid attracting feral species to the area;
- Educate personnel not to feed (deliberately or inadvertently) feral species;
- Ensure local hydrology is not affected, including alterations to runoff through the landscape; and
- Avoid runoff to ensure sediment or any chemicals do not contaminate soil and groundwater and install appropriate erosion control, if required;
- Implement a fire management plan in consultation with the Department of Parks and Wildlife during construction and operational activities to ensure wildfires do not occur as a result of activities and appropriate responses are in place should a wildfire occur; and
- Reduce dust, noise and light impacts where possible, with onsite management procedures.

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1 Introduction

1.1 Background

Bamford Consulting Ecologists (BCE) was commissioned by Strategen Environmental to conduct a level 1 fauna assessment of a coastal reserve at the Capricorn estate, located approximately 50 kilometres (km) north of Perth. A level 1 assessment involves a site inspection and desktop review, and can be a powerful approach for impact assessment where there is abundant information available on the fauna assemblage and the general region is familiar to the consultant, as is the case in this instance. Databases contain extensive information on fauna in the region, and BCE has undertaken several level 1 assessments nearby (Bamford and Davis 2005, Everard and Bamford 2017), as well as two level 2 (comprehensive trapping) assessments (Bamford 1998; 2006, Turpin and Bamford 2008) (see section 3.2.2).

The proposal is for development of approximately 1.5 hectares (ha) within a coastal foreshore reserve of 27ha. The reserve is adjacent to substantial urban subdivisions immediately to the east and a Bush Forever site lies immediately to the north (Figure 1).

BCE uses a 'values and impacts' approach to impact assessment with respect to fauna. Components of this approach are:

- The identification of **fauna values**:
    - Assemblage characteristics: uniqueness, completeness and richness;
    - Species of conservation significance;
    - Recognition of vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
    - Patterns of biodiversity across the landscape; and
    - Ecological processes upon which the fauna depend.
- The review of **impacting processes** such as:
    - Habitat loss leading to population decline;
    - Habitat loss leading to population fragmentation;
    - Degradation of habitat due to weed invasion leading to population decline;
    - Ongoing mortality from operations;
    - Species interactions including feral and overabundant native species;
    - Hydrological change;
    - Altered fire regimes; and
    - Disturbance (dust, light and noise).
- The **recommendation** of actions to mitigate impacts.

Descriptions and background information on these values and processes can be found in Appendices 1 to 3. The purpose of this report is to provide information on the fauna values of the survey area, particularly for significant species and an overview of the ecological function of the site within the local and regional context, and to provide discussion on the interaction of the proposal on these fauna values and functions.

1.2 Description of the survey area

The foreshore reserve is long and narrow; about 1.25km north-south and up to 250m wide from the coast to the inland boundary (Figure 1). It consists of Quindalup dune systems which are steeply undulating with soils of pale calcareous sands over limestone. The vegetation is coastal heath with areas of sedgeland (Coastal Sword-Sedge *Lepidosperma gladiatum*) in some valleys (Plate 1). The Bush

Forever site to the north includes similar vegetation and landforms (Plate 2), and is continuous with Yanchep National Park to the east. Residential development occurs immediately to the south and east of the survey area. The site is situated in the City of Wanneroo.

Figure 1. Location of survey area.

Plate 1. Coastal heath in the foreshore reserve. Note sedgeland in valley (central middle distance).

Plate 2. View from Two Rocks Road looking across the Bush Forever area towards the foreshore reserve.

2 Regional description

The Interim Biogeographic Regionalisation of Australia (IBRA) (Environment Australia 2000) has identified 26 bioregions in Western Australia that are further divided into subregions (Figure 2). Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA 2004). The survey area lies in the Swan Coastal Plain Bioregion (DSEWPaC 2012) and in the Swan Coastal Plain subregion (SWA2) as shown in Figure 2.

The Swan Coastal Plain subregion is broadly characterised by 'low lying coastal plain, mainly covered with woodlands and dominated by Banksia or Tuart on sandy soils.' The Perth subregion is composed of colluvial and Aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, Banksia and Jarrah Banksia woodlands on Quaternary marine dunes of various ages (Mitchell *et al.* 2002)

Figure 2. IBRA Subregions in Western Australia. Note the survey area (indicated by red circle) lies in the SWA2 Perth IBRA subregion.

3 Methods

3.1 Overview

The methods used for this assessment are based upon the general approach to fauna investigations for impact assessment as outlined in Section 1.1 and with reference to Appendices 1 to 3. This approach to fauna impact assessment has been developed with reference to guidelines and recommendations set out by the Western Australian Environmental Protection Authority (EPA) on fauna surveys and environmental protection, and Commonwealth biodiversity legislation (EPA 2002; EPA 2004).

The EPA proposes two levels of investigation that differ in the approach to field investigations, level 1 being a review of data and a site reconnaissance to place data into the perspective of the site, and level 2 being a literature review and intensive field investigations (e.g. trapping and other intensive sampling). The level of assessment recommended by the EPA is determined by the size and location of the proposed disturbance, the sensitivity of the surrounding environment in which the disturbance is planned, and the availability of pre-existing data.

This report does not provide an assessment of specific impacts upon fauna, rather evaluates and discusses the fauna values and impacting processes of the proposal, with a particular focus on conservation significant species.

The approach consisted of a desktop assessment and field investigation (site visit) and are summarised below:

- Desktop assessment. The purpose of the desktop review is to produce a species list that can be considered to represent the vertebrate fauna assemblage of the project area based on unpublished and published data using a precautionary approach; and
- Field investigations. The purpose of the field investigations is to gather information on this assemblage: confirm the presence of as many species as possible (with an emphasis on species of conservation significance), place the list generated by the desktop review into the context of the environment of the project area, collect information on the distribution and abundance of this assemblage, and develop an understanding of the project area's ecological processes that maintain the fauna. Note that field investigations cannot confirm the presence of an entire assemblage, or confirm the absence of a species. This requires far more work than is possible in the EIA process. For example, in an intensive trapping study, How and Dell (1990) recorded in any one year only about 70% of the vertebrate species found over three years. In a study spanning over two decades, Bamford *et al.* (2010) has found that the vertebrate assemblage varies over time and space, meaning that even complete sampling at a set of sites only defines the assemblage of those sites at the time of sampling.

3.2 Desktop assessment

3.2.1 Sources of information

Information on the fauna assemblage of the survey area was drawn from a wide range of sources. These included state and federal government databases and results of regional studies. Databases accessed were the Atlas of Living Australia (ALA), DPaW NatureMap (incorporating the Western Australian Museum's FaunaBase and the DPaW Threatened and Priority Fauna Database), BirdLife Australia's Atlas Database (BA), the EPBC Protected Matters Search Tool and the BCE database (Table 1). Information from the above sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were:

- Fish: Allan *et al.* (2002);
- Frogs: Tyler *et al.* (2000) and Anstis (2013);
- Reptiles: Storr *et al.* (1983); Storr *et al*. (1990); Storr *et al*. (1999); Storr *et al.* (2002) and Wilson and Swan (2013);
- Birds: Blakers *et al*. (1984); Johnstone and Storr (1998, 2004) and Barrett *et al*. (2003); and
- Mammals: Menkhorst & Knight (2004); Churchill (2008); and Van Dyck and Strahan (2008).

Table 1. Sources of information used for the desktop assessment.

Database	Type of records held on database	Area searched
Atlas of Living Australia (ALA 2017)	Records of biodiversity data from multiple sources across Australia.	Point search: 31° 32' 24'' S, 115° 37' 02'' E plus 10 km buffer. Searched: January 2017.
NatureMap (DPaW 2017)	Records in the WAM and DPaW databases. Includes historical data and records on Threatened and Priority species in WA.	Point search: 31° 32' 24'' S, 115° 37' 02'' E plus 20 km buffer. Searched: January 2017.
BirdLife Australia Atlas Database (Birdlife Australia 2017)	Records of bird observations in Australia, 1998-2017.	Point search: 31° 32' 24'' S, 115° 37' 02'' E plus 10 km buffer. Searched: January 2017.
EPBC Protected Matters (DoEE 2017a)	Records on matters of national environmental significance protected under the EPBC Act.	Point search: 31° 32' 24'' S, 115° 37' 02'' E plus 20 km buffer. Searched: January 2017.
Birdlife Australia Great Cocky Count roost data 2016 (Peck *et al.* 2016)	Black-Cockatoo roost sites (confirmed, potential, and unconfirmed).	Data search for any roost sites known in the Capricorn/Yanchep region.

3.2.2 Previous fauna surveys

The desktop assessment included a review of numerous fauna surveys conducted by BCE in the local and regional area. Reports reviewed include two level 1 assessments of the Alkimos Wastewater Treatment Plant, located approximately 10km to the south (Bamford and Davis 2005; Everard and Bamford 2017) and level 2 surveys (site inspection and field sampling) nearby at Burns Beach (Bamford 1998), Jindee (Bamford 2006) and South Yanchep (Turpin and Bamford 2008). The reports provide data on conservation significant species recorded in vegetation and substrate associations (VSAs) in some cases similar to those found in the current fauna assessment.

3.2.3 Nomenclature and taxonomy

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's (WAM) *Checklist of the Fauna of Western Australia 2016*. The authorities used for each vertebrate group were: amphibians (Doughty *et al*. 2016), reptiles (Doughty *et al.* 2016), birds (Johnstone and Darnell 2016), and mammals (Travouillon 2016). In some cases, more widely-recognised names and naming conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds). English names of species, where available, are used throughout the text; Latin species names are presented with corresponding English names in tables in the appendices.

3.2.4 Interpretation of species lists

Species lists generated from the review of sources of information are generous as they include records drawn from a large region and possibly from environments not represented in the survey area. Therefore, some species that were returned by one or more of the data searches have been excluded because their ecology, or the environment within the survey area, meant that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial, inland site, but for which the site is of no importance. Species returned from databases but excluded from species lists are presented in Appendix 5.

Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered potentially present or expected to be present in the survey area at least occasionally, whether or not they were recorded during field surveys, and whether or not the survey area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status in the survey area.

The status categories used are:

- Resident: species with a population permanently present in the survey area;
- Regular migrant or visitor: species that occur within the survey area regularly in at least moderate numbers, such as part of annual cycle;

- Irregular Visitor: species that occur within the survey area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the survey area in at least moderate numbers and for some time;
- Vagrant: species that occur within the survey area unpredictably, in small numbers and/or for very brief periods. Therefore, the survey area is unlikely to be of importance for the species; and
- Locally extinct: species that would have been present but has not been recently recorded in the local area and therefore is almost certainly no longer present in the survey area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the site is not important in a conservation sense, and species which use the site in other ways but for which the site is important at least occasionally. This is particularly useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times. The status categories are assigned conservatively. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence the site will not support it, and even then it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals.

3.3 Field survey

3.3.1 Overview

The field survey included the identification of VSAs and general searching for conservation significant fauna, particularly foraging evidence of the Carnaby's Black-Cockatoo and Southern Brown Bandicoot or Quenda.

Vegetation and Substrate Associations (VSAs) in the survey area were assessed during the desktop review and as part of the field investigations. Within the survey area, all major VSAs were visited to develop an understanding of major fauna habitat types present and to assess the likelihood of conservation significant species being present in the area.

The survey area was searched for ecological values for the species and these were based on the definitions of breeding, foraging and roosting habitat as per the EPBC Act referral guidelines for black-cockatoos (DSEWPaC 2012), with foraging values assessed using systems developed by Bamford Consulting Ecologists. Black-cockatoos are known to forage in suitable vegetation in the Southern, Coastal and Southwest regions, leaving distinctive marks on dropped feeding material such as eucalypt fruit, and foraging signs on trees. The native vegetation within the site was assessed for foraging value based on the method outlined in Appendix 6.

3.3.2 Dates and personnel

The survey area was visited on the 8th December 2016 by Dr Mike Bamford (B.Sc. Hons. Ph.D.). The fauna assessment report was prepared by Cameron Everard (B.Sc. M.Sc.) and Dr Mike Bamford.

3.4 Survey limitations

The EPA Guidance Statement 56 (EPA 2004) outlines a number of limitations that may arise during surveying. The survey limitations are discussed in the context of the site inspection in Table 2.

Table 2. Survey limitations as outlined by EPA (2004).

EPA Limitation	**BCE Comment**
Level of survey.	Level 1 (desktop study with reconnaissance survey). Survey intensity was deemed adequate due to the small area and availability of previous studies in the region.
Competency/experience of the consultant(s) carrying out the survey.	The authors have had extensive experience in conducting desktop reviews and have conducted multiple fauna surveys in the Swan Coastal Plain bioregion with surveys focussed on relevant local species including black-cockatoos.
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	The site investigation targeted descriptions of the environment and fauna values for the significant species potentially occurring to occur.
Proportion of fauna identified, recorded and/or collected.	Key significant species were identified and the desktop provided information on other species.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	Sources include previous fauna surveys in the Alkimos, Yanchep and Burns beach area (Bamford 1998, Bamford and Davis 2005, Bamford 2006, Turpin and Bamford 2008 and Everard and Bamford 2017) and databases (BA, DPaW, EPBC, BCE and ALA database).
The proportion of the task achieved and further work which might be needed.	This report provides fauna values for significant species.
Timing/weather/season/cycle.	There were no constraints from the weather and conditions allowed personnel to move around readily.
Disturbances (e.g. fire, flood, accidental human intervention etc.) that affected results of survey.	None
Intensity. (In retrospect, was the intensity adequate?)	All major VSAs were visited and significant species habitat and traces were identified.
Completeness (e.g. was relevant area fully surveyed).	Site was fully surveyed to the level appropriate for a level 1 assessment and identifying fauna values.
Resources (e.g. degree of expertise available in animal identification to taxon level).	Field personnel have extensive experience with fauna in the region.
Remoteness and/or access problems.	There were no remoteness/access problems encountered.
Availability of contextual (e.g. biogeographic) information on the region.	Extensive regional information was available and was consulted.

3 Fauna values

3.1 Vegetation and Substrate Associations

The coastal heath on calcareous sand can be considered a single VSA. It tends to be the coastal strip of native vegetation that is retained during urban development with some rperesenttion to the south and extensive representation to the north. Vegetation includes a mix of low shrubs comprising, *Acacia rostellifera*, *Olearia axillaris* and *Scaevola* sp. over coastal sand dunes. Sedgelands of *Lepidosperma gladiatum* sometimes form a distinct VSA in some locations (i.e deep swales) but are also mixed with other vegetation types across the site. The lack of variety in VSAs with the separation of the coastal heaths from more inland VSAs such as shrublands and woodlands will slightly reduce the number of species present. This is because some species will move between vegetation types seasonally but this opportunity has been lost with development nearby.

3.2 Vertebrate fauna

3.5.1 Overview of the fauna assemblage

The desktop study identified 166 vertebrate fauna species as potentially occurring in the survey area: four frogs, 53 reptiles, 92 birds, 12 native and five introduced mammals (Appendix 4). There are several locally extinct mammal species that would have occurred in the survey area and include the Honey Possum *Tarsipes rostratus*, Ashy-grey Mouse *Pseudomys albocinereus*, White-tailed Dunnart *Sminthopsis granulipes* and Grey-bellied Dunnart *Sminthopsis griseoventer*. These species are locally extinct and therefore have not been included in the list. Species returned from databases but which are not considered to be part of the survey area's fauna assemblage are presented in Appendix 5.

Frogs. Up to four species, of which three species, the Pobblebonk, Guenther's Toadlet and Moaning Frog, utilise areas several kilometres away from wetlands during the non-breeding season (Bamford 1992). Frog species are likely to be locally common, regionally widespread and can be expected to breed in seasonal wetlands in the region.

Reptiles. 53 species are known from the general area in coastal heaths, but distributions can be patchy and therefore not all 53 species may be present in such a small area. The majority of the reptile species expected in the area are common and regionally widespread on the coastal plain north of Perth. In a sampling survey of six days at Jindee, Bamford (2006) recorded 22 reptile species. Furthermore, sampling at South Yanchep recorded 16 reptile species (Turpin and Bamford 2008).

Birds. Up to 92 species may be present, but these would include birds that might fly over the site only occasionally, and species that occur along the coast and thus do not strictly use the survey area. The Jindee study (Bamford 2006) recorded 35 bird species. Sampling at South Yanchep recorded 51 bird species (Turpin and Bamford 2008).

Mammals. Up to 17 species could be present in the survey area, five of these are introduced and several species are almost certainly locally extinct. Almost half the native species are bats that are

known from the general region north of Perth. Bamford (2006) recorded three native and four introduced species at Jindee. Sampling at South Yanchep recorded four native and four introduced species (including the CS3 Bush-Rat/Moodit) (Turpin and Bamford 2008).

Invertebrates. Invertebrate assemblages are extremely hard to document but some species of conservation significance are known from the region. These are discussed below.

Overall, the fauna assemblage may consist of up to 166 vertebrate species, but all these are unlikely to occur due to the limited range of environments present in the survey area.

Key features of the fauna assemblage expected in the survey area are:

- Uniqueness: The assemblage is typical of heathland on coastal dunes, located throughout the Swan Coastal Plain Bioregion.
- Completeness: A slightly depauperate fauna assemblage is likely to occur in the coastal heathland as some reptile, mammal and bird species are expected to be locally extinct.
- Richness: The assemblage in the survey area contains a moderate level of richness to be expected in relatively undisturbed intact heathland vegetation.

3.5.2 Species of Conservation Significance

The current vertebrate assemblage potentially includes 38 species of conservation significance, with a further four species considered to be locally extinct. The overall list of significant species includes six CS1 species, three CS2 species and 29 CS3 species. Numbers and classes of significant species broken down by major taxonomic group and still expected to be present are listed in Tables 3 and 4.

Species classed as CS1 are those listed under legislation, while those classed as CS2 are listed as Priority by the Department of Parks and Wildlife. The CS3 class is more subjective, but includes species that have declined extensively across the Swan Coastal Plain due to land clearing, for urban development and species that occur at the edge of their range. This makes their presence in the survey area significant as populations on the edge of a species' range are often less abundant and more vulnerable to extinction than populations at the centre of the range (Curnutt *et al.* 1996).

Table 3. Conservation significant vertebrate species expected in the survey area.

Taxon	CS1	CS2	CS3	Total
Frogs	-	-	-	-
Reptiles	-	1	1	2
Birds	6	-	26	32
Mammals*	-	2	2	4
Total	**6**	**3**	**29**	**38**

*Excludes four local extinct mammal species.

Table 4. Conservation significant fauna species expected to occur in the survey area.
This list is based on desktop review and their expected status within the site.

Common Name	Latin Name	Conservation Status			Expected status in project area
		CS1	CS2	CS3	
Reptiles					
South-West Carpet Python	*Morelia spilota imbricata*			CS3	Resident
Black-striped Snake	*Neelaps calonotos*		P3		Resident
Birds					
Eastern Osprey	*Pandion cristatus*	Mar S5			Irregular visitor
Square-tailed Kite	*Lophoictinia isura*			CS3	Irregular visitor
Whistling Kite	*Haliastur sphenurus*			CS3	Irregular visitor
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Mar			Irregular visitor
Brown Goshawk	*Accipiter fasciatus*			CS3	Irregular visitor
Collared Sparrowhawk	*Accipiter cirrhocephalus*			CS3	Visitor
Wedge-tailed Eagle	*Aquila audax*			CS3	Irregular visitor
Little Eagle	*Hieraaetus morphnoides*			CS3	Irregular visitor
Peregrine Falcon	*Falco peregrinus*	S7			Irregular visitor
Painted Button-quail	*Turnix varia*			CS3	Irregular visitor
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	E S2			Visitor
Rock Parrot	*Neophema petrophila*			CS3	Vagrant
Fork-tailed Swift	*Apus pacificus*	Mig S5			Migrant, occasional visitor
Rainbow Bee-eater	*Merops ornatus*	Mar S5			Migrant, occasional visitor
Splendid Fairy-wren	*Malurus splendens*			CS3	Resident
Variegated Fairy-wren	*Malurus lamberti*			CS3	Resident
White-winged Fairy-wren	*Malurus leucopterus*			CS3	Resident
Southern Emu-wren	*Stipiturus malachurus*			CS3	Resident
White-browed Scrubwren	*Sericornis frontalis*			CS3	Resident
Weebill	*Smircornis brevirostris*			CS3	Resident
Inland Thornbill	*Acanthiza apicalis*			CS3	Resident
Western Thornbill	*Acanthiza inornata*			CS3	Resident
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*			CS3	Resident
Western Wattlebird	*Anthochaera lunulata*			CS3	Resident
White-cheeked Honeyeater	*Phylidonyris nigra*			CS3	Resident
New Holland Honeyeater	*Phylidonyris novaehollandiae*			CS3	Resident
Tawny-crowned Honeyeater	*Phylidonyris melanops*			CS3	Resident
Western Spinebill	*Acanthorhynchus superciliosus*			CS3	Resident
Hooded Robin	*Melanodryas cucullata*			CS3	Resident
White-breasted Robin	*Eopsaltria georgiana*			CS3	Resident
Grey Shrike-thrush	*Colluricincla harmonica*			CS3	Resident

Common Name	Latin Name	Conservation Status			Expected status in project area
Black-faced Woodswallow	*Artamus cinereus*			CS3	Visitor
Mammals					
Quenda, Southern Brown Bandicoot	*Isoodon obesculus fusciventer*		P5		Resident
Brush Wallaby	*Notamacropus irma*		P4		Resident
Brush-tailed Possum	*Trichosurus vulpecula*			CS3	Resident
Moodit or Bush-Rat	*Rattus fuscipes*			CS3	Resident
Invertebrates					
A land snail	*Bothriembryon perobesus*		P1		Resident
A biting midge	*Austroconops mcmillani*		P2		Resident
Graceful Sun-Moth	*Synemon gratiosa*		P4		Resident

See Appendix 1 and 2 for descriptions of conservation significance levels. Species recorded are indicated and the predicted status of each species in the survey area is also given.
EPBC Act listed species: V = Vulnerable, E = Endangered, C = Critically Endangered, Mig = Migratory, Mar = Marine.
WC Act listed species: S1 – S7 = Schedule 1 - 7; DPaW Priority Species: P1 - P5 = Priority 1 - 5.

Species of Conservation Significance level 1

No frogs, reptiles or mammals are listed as conservation significance level 1. Six bird species were identified, but most are likely to be infrequent visitors only. These include:

Carnaby's Black-Cockatoo (Endangered – EPBC Act, WC Act)
The Carnaby's Black-Cockatoo is listed as Endangered at the state and federal level. The species is likely to be an irregular non-breeding visitor to the Capricorn area; it is common and with some pairs breeding slightly inland around Yanchep National Park. It is known to feed on seeding *Banksia* and *Eucalyptus* as well as proteaceous heaths (Johnstone and Storr 1998), which does not occur in the survey area. The coastal heathland present at the site provides minimal foraging value for the species. Due to the lack of suitable plant species, the foraging value ranges from a score of 1 to 2 out of 6 (foraging value categories and descriptions are provided in Appendix 6). Carnaby's Black-Cockatoo was recorded foraging at Burns Beach by Bamford (1998) and flying over the survey area at South Yanchep (Turpin and Bamford 2008).

No evidence of roosting or nesting was recorded during the site inspection, and based on the lack of suitable habitat is unlikely to occur. Several known roosting sites occur to the east of the survey area at Yanchep National Park (approximately 5 km from the survey area), Carabooda and Nowergup (Department of Planning Western Australia 2011). Data from Birdlife Australia's Great Cocky Count survey indicate that a single roost site located east of Yanchep had a count of 4,897 Carnaby's Black-Cockatoos and accounted for 45% of all of the Carnaby's recorded on the Perth-Peel Coastal Plain (Peck *et al*. 2016). Breeding is known to occur further inland, east of the survey area. There are several small resident populations on the northern Swan Coastal Plain at Yanchep National Park, Boonanarring and Mooliabeenee. Birds at these sites are known to forage in remnant bushland and in adjacent pine plantations (Johnstone *et al.* 2011 in DoEE 2017b).

Rainbow Bee-eater (Marine – EPBC Act, Schedule 5 – WC Act)
Until recently listed as Migratory under the EPBC Act, the Rainbow Bee-eater now appears under the EPBC Act only as Marine, despite being migratory but not marine, and this curious revision means that it is no longer a Matter of National Environmental Significance (MNES) under the federal legislation. Its listing under the WC Act is also likely to change as a result. The Rainbow Bee-eater was not recorded during the site inspection, but is likely to nest in the area during spring and was recorded at Burns Beach (Bamford 1998). The species will often construct its burrows on slopes that are sparsely vegetated, including slopes around construction sites.

Eastern Osprey (Marine – EPBC Act, Schedule 5 – WC Act) and **White-bellied Sea-Eagle** (Marine – EPBC Act)
Several other species listed as Migratory until recently have also been removed from the EPBC list, including the Eastern Osprey and White-bellied Sea-Eagle. These are likely to be infrequent visitors to the area. Both Ospreys and White-bellied Sea-Eagles are known to nest in Tuart trees around the Peel Inlet. They nest on the ground or on the tops of high dunes on islands, but are unlikely to do so on the mainland.

Fork-tailed Swift (Schedule 5 – WC Act)
This species occurs is a spring to autumn, non-breeding migrant to Australia, and is widespread but infrequently observed in coastal and subcoastal areas between Augusta and Carnarvon, including nearshore and offshore islands (DoEE 2017b). This species was not recorded during the survey but may occur occasionally on site, although it is a largely aerial species mostly independent of terrestrial ecosystems.

Peregrine Falcon (Schedule 7 – WC Act)
This species is known to occur over a wide range of environments across Australia. Preferred nesting locations include a range of elevated locations with steep topography such as rocky hills, breakaways, cliffs and high artificial structures. It will also nest in very large, horizontally-aligned tree hollows, and in old Raven nests in tall trees (M. Bamford pers. obs.). The Peregrine Falcon may be a regular foraging visitor to the site, but the area would represent a very small proportion of a pair's range.

Species of Conservation Significance level 2

No frog or bird species are listed as conservation significance level 2. One reptile, two mammal and three invertebrate species are listed and include:

Black-striped Snake (Priority 3 – WC Act)
The Black-striped Snake is restricted to the west coast from just north of Lancelin to Mandurah and, although locally common in some environments on the Swan Coastal Plain, its persistence is threatened by continuing loss of habitat due to urban development throughout its range. The

species may be locally extinct at Capricorn and Yanchep due to habitat fragmentation. It was not recorded during the site inspection but can be very difficult to find.

Quenda/Southern Brown Bandicoot (Priority 5 – WC Act)
The Quenda occurs in the south-west coast from Guilderton north of Perth to east of Esperance. This species previously occurred north to Geraldton but like many mammals in the region has undergone a large range reduction (Maxwell *et al.* 1996). It is commonly associated with dense, low vegetation, so may be present in heathland habitats within the survey area. No evidence (diggings or tracks) of the species was recorded, however the species has been recorded at South Yanchep, approximately 3km to the south (Turpin and Bamford 2008).

Brush Wallaby (Priority 4 – WC Act)
The Brush Wallaby occurs in a range of shrublands and woodlands across much of the south-west of Western Australia, but is at risk from clearing and Foxes. This species has been recorded previously in the Neerabup National Park (DPaW 2017). The species was not recorded during the site inspection.

CS2 Invertebrates
Detailed searching for potential Short Range Endemic (SRE) invertebrates is beyond the scope of a site inspection and is based on the results of the desktop assessment. The DPaW (2017) lists three CS2 invertebrates for the general area. These are: the terrestrial snail *Bothriembryon perobesus* (Priority 1), a biting midge *Austroconops mcmillani* (Priority 2) and the Graceful Sun-Moth *Synemon gratiosa* (Priority 4).

The terrestrial snail has been recorded in coastal vegetation near Yanchep and Guilderton (DPaW 2017) and has the potential to be present. The biting midge has been recorded at Yanchep National Park (DPaW 2017) and may occur in the survey area. The Graceful Sun-Moth has also been recorded south of Yanchep and also has the potential to occur at the site.

Species of Conservation Significance level 3

No frogs, one reptile, 26 bird and two mammal species are locally significant if they occur on the site. These are all species that have declined in the Perth region and include:

Carpet Python
The south-west race of the Carpet Python was until recently listed as Priority by DPaW and a population in the survey area would be locally significant as the species is still at risk from feral species and clearing. This species is likely to occur due to the presence of suitable habitat in survey area. There are also several records to the north and east of the site (DPaW 2017).

Conservation Significance level 3 Birds
Up to 26 bird species are considered to be of local significance (Table 4), because their populations have declined dramatically across much of their range due to clearing for agricultural and urban

developments. These species also show poor persistence in fragmented landscapes, and therefore populations in large tracts of native vegetation are important for their long-term conservation.

Of concern include habitat specialists such as sedentary insectivorous birds that rely on intact and continuous native vegetation. Probably of most significance are the White-winged Fairy-wren and White-breasted Robin, which have few populations in the Perth area and favour coastal heaths. They are also sensitive to habitat loss, fragmentation and predation by feral and domestic species.

Conservation Significance level 3 Mammals

The Moodit or Southern Bush-rat is locally common in near-coastal heathlands north of Perth and is likely to occur at the site. The species was recorded at South Yanchep in *Lepidosperma gladiatum* Sedgeland (Turpin and Bamford 2008). Other native small mammals may be present, but appear to have disappeared from the outskirts of Perth.

The Brush-tailed Possum is patchily distributed north of Perth. The species has been recorded at Burns Beach (Bamford 1998) and at Neerabup (DPaW 2017), and may occur in the survey area.

4.3 Patterns of biodiversity

Species are likely to have distinct distributions even over short distances but understanding these requires very detailed investigation. Of interest, however, is that the Graceful Sun-Moth will breed on the upper slopes of dunes where *Lomandra* spp. occur (its food-plant), the White-breasted Robin will be associated with thickets of taller vegetation and the Moodit often occurs on the margins of sedgelands. The coastal fringe (foredunes) may support slightly fewer species and possibly lower levels of abundance than the more developed and complex vegetation of the secondary dunes 50m or so inland. Areas with dense heath are important for species that prefer dense cover such as some birds and mammals. There are no ephemeral or permanent wetlands at the site and as a result, are unlikely to attract species dependant on this type of habitat.

Due the extensive fragmentation of native vegetation on the northern Swan Coastal Plain some fauna species likely to occur in the survey area have isolated and restricted distributions in the region. Such species may include Black-striped Snake, Brush Wallaby, Quenda, White-winged Fairy-wren, White-breasted Robin, Bush Rat and some invertebrate species. Ongoing development of the northern coastal plain (to Two Rocks and beyond) is likely to contribute to further isolation and fragmentation of fauna populations. Habitats supporting species with fragmented and restricted ranges (including short-range endemics, Quenda and Bush-Rat) need to be managed to minimise any potential impacts.

4.4 Ecological processes

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (refer to Appendix 3 for descriptions and other ecological processes). These include:

Local hydrology. Interruptions of hydroecological processes can have significant effects upon vertebrate and invertebrate fauna because they underpin primary production in ecosystems. Construction of roads and other civil earthworks have the potential to alter both surface and sub-surface hydrology. Maintaining local hydrological flows is considered key to managing impacts upon fauna in the survey area. While the sands of the study area are likely to absorb water with little surface flow, drainage from hard surfaces could alter the movement of water though the site.

Fire. Fire is a natural feature of the environment and banksia woodlands of the Swan Coastal Plain Bioregion are fire-adapted but the flora and fauna assemblages can be altered by too-frequent fires; and even by fire exclusion. Some species are particularly sensitive to wildfires and altered fire regimes. Fire season may also be important in seed germination. As the site consists of open banksia woodland to dense heaths and thickets, fire is expected to occur at the site. Fire could further reduce recruitment of vegetation and hence the biodiversity and resilience of the area in the absence of remedial action. Fire Management strategies may be implemented as part of the management of the area to protect long-unburnt habitats that may be important for fauna.

Feral species and interactions with over-abundant native species. Feral species occur throughout Western Australia and it is expected that the fauna assemblage within the survey area has been impacted by feral species (particularly foxes and cats), which has resulted in the loss of some mammal and bird species. Rabbits and introduced rodents may cause further degradation to the native vegetation and, in combination with introduced predators (cats and foxes), reduce the capacity of the area to support native fauna diversity.

Connectivity and landscape permeability. The survey area is part of a greater area of native vegetation, located to the north and to some extent to the south. Some fauna, such as birds and mammals, are likely to move across the landscape, although permeability is reduced due to urban development situated to the east and particularly to the south towards Yanchep.

4.5 Summary of fauna values

The desktop study identified 166 vertebrate fauna species as potentially occurring in the Capricorn survey area: four frogs, 53 reptiles, 92 birds, 12 native and five introduced mammals, but with local extinction of some species. The vertebrate assemblage comprises of up to 38 species of conservation significance, including the Endangered Carnaby's Black-Cockatoo.

Fauna values within the study area can be summarised as follows:

Fauna assemblage. Largely intact but with some mammals locally extinct. The assemblage is typical of heathland on coastal dunes, located throughout the Swan Coastal Plain Bioregion. A slightly depauperate fauna assemblage is likely to occur in the coastal heathland as some reptile, mammal and bird species are expected to be locally extinct. The assemblage contains a moderate level of richness to be expected in relatively undisturbed intact heathland vegetation.

Species of conservation significance. Several significant species are likely to occur in the survey area. Carnaby's Black-Cockatoo (CS1) is an irregular non-breeding visitor to the area, although the coastal heathland present at the site provides minimal foraging value for the species. No evidence of roosting or nesting was recorded during the site inspection, and based on the lack of suitable habitat is unlikely to occur. The Graceful Sun-Moth (CS2) has been recorded south of Yanchep and also has the potential to occur at the site. The Moodit or Southern Bush-rat (CS3) is also of interest, as it occurs in near-coastal heathlands north of Perth and is likely to be present in the survey area.

Vegetation and Substrate Associations (VSAs). The coastal heath on calcareous sand can be considered a single VSA that is well-represented to the north and south. It also tends to be the coastal strip of native vegetation that is retained during urban development. Vegetation includes a mix of low shrubs comprising, *Acacia rostellifera*, *Olearia axillaris* and *Scaevola* sp. over coastal sand dunes.

Sedgelands of *Lepidosperma gladiatum* sometimes form a distinct VSA in some locations (i.e. in deep swales) but are also mixed with other vegetation types across the site. The lack of variety in VSAs with the separation of the coastal heaths from more inland VSAs such as shrublands and woodlands will slightly reduce the number of species present. This is because some species will move between vegetation types seasonally but this opportunity has been lost with development nearby. This VSA type is widespread in the local area, particularly to the north of the survey area.

Patterns of biodiversity. Species are likely to have distinct distributions even over short distances but understanding these requires very detailed investigation. Of interest, however, is that the Graceful Sun-Moth will breed on the upper slopes of dunes where *Lomandra* spp. occur (its food-plant), the White-breasted Robin will be associated with thickets of taller vegetation and the Moodit often occurs on the margins of sedgelands. The coastal fringe (foredunes) may support slightly fewer species and possibly lower levels of abundance than the more developed and complex vegetation of the secondary dunes 50m or so inland.

Key ecological processes. Processes can include factors such as fire, interactions with other species and hydrology, but the key process in the context of the survey area is likely to be its shape and relationship with other areas of native vegetation. This affects connectivity and the ability of species to move through the landscape (landscape permeability). The presence of a large Bush Forever site to the north is important in allowing fauna species to persist and move into and out of the survey

area. Landscape permeability is likely to be reduced to the east and particularly to the south towards Yanchep, due to urban development.

Overview of fauna values. Overall, the fauna assemblage is somewhat limited by the limited range of environments present in the survey area and the development of vegetation immediately inland. Few species of conservation significance are present, but there is a suite of locally significant birds and mammals that may rely on the site. The assemblage is affected by its long, narrow shape and its relationship with a large area of native vegetation to the north.

5 Impacting processes

Impacting processes have to be considered in the context of fauna values and the nature of the proposed action, and are examined below. The proposed development is small within the context of the foreshore reserve; it represents about 5% of the reserve. However, it will constrict the reserve at one point.

Habitat loss leading to population decline. Only a small proportion of habitat will be lost and it is typical of the vegetation across the foreshore reserve. This could be interpreted as a 5% decline in population size of most species, although the decline might be slightly larger than this as the development affects secondary dunes rather than foredunes which may be poorer (fewer species and possibly lower levels of abundance) in fauna species.

Habitat loss leading to population fragmentation. There is some potential for fragmentation as the development will reduce the width of the foreshore reserve at one point. In particular, this will reduce the width of the belt of vegetation along the secondary dunes which may be more important for some species.

Degradation of habitat due to weed invasion leading to population decline. There is potential for weed invasion on the edges of the area to be developed and along the pathway and lookout to be established. Trampling and general vegetation degradation could also occur. This risk needs to be managed.

Ongoing mortality from operations. This is unlikely to be an impacting process of concern with respect to the proposed development except possibly from roadkill in new parking areas.

Species interactions including feral and overabundant native species. The development and in particular the pathway will improve access into the foreshore reserve for feral species such as Foxes and Cats. In this respect, the key concern is probably the management of domestic Cats in the neighbouring urban development. Some local governments now have a ‘three strikes’ policy for domestic Cats caught in reserves to encourage owners to keep their pets on their own property, particularly at night.

Hydrological change. This is unlikely to be a concern assuming runoff and drainage are appropriately managed.

Altered fire regimes. Some of the vegetation in the foreshore reserve is fire-retardant but there will be an increased fire risk with increased access; and especially so if grassy weeds become established. Controlling grassy weeds may become important. Revegetation along the pathway using fire-retardant species could reduce the fire risk.

Disturbance (dust, light, noise). Disturbance due to the proposed development is unlikely to be a concern as it is small scale compared with the adjacent urban development. Despite this, some measures to reduce disturbance could be implemented, such as using shielded lighting.

Based on the above review, the impacts of greatest concern are those of fragmentation, degradation and feral species (in particular domestic Cats).

6 Recommendations

Section 5 (Impacting processes) identified several potential adverse impacts upon fauna that may occur. Although impacts are mostly expected to be minor or less, any reduction in impacts is desirable.
Some general management strategies are provided below.

Loss of habitat and fragmentation

- Minimise the disturbance footprint where possible;
- Clearly delineate areas to be cleared to minimise unnecessary vegetation loss;
- Maintain linkages to adjacent vegetation where possible (i.e. to the Bush Forever site north of the survey area); and
- Where required, rehabilitate as soon as practical.

Weed invasion

- Employ industry standard hygiene management measures to avoid introducing weeds into the area.

Ongoing mortality

- Educate employees on the vulnerability of some species to roadkill (e.g. Quenda); and
- Provide signage in areas of known wildlife activity.

Species interactions

- Rehabilitate access tracks as soon as possible to discourage access by feral fauna. In the long term, it may be necessary to develop a feral fauna management plan in conjunction with the Department of Parks and Wildlife;
- Ensure appropriate waste disposal during construction activities to avoid attracting feral species to the area; and
- Educate personnel not to feed (deliberately or inadvertently) feral species.

Hydrological changes

- Ensure local hydrology is not affected, including alterations to runoff through the landscape from hard surfaces; and
- Avoid runoff to ensure sediment or any chemicals do not contaminate soil and groundwater and install appropriate erosion control, if required.

Changes in fire regime

- Implement a fire management plan in consultation with the Department of Parks and Wildlife to ensure wildfires do not occur as a result of activities and appropriate responses are in place should a wildfire occur.

Dust, noise, light and disturbance

- Reduce dust, noise and light impacts where possible, with onsite management procedures.

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8 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

Vegetation and substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a

large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Wildlife Conservation Act 1950* (Wildlife Conservation Act). In addition, the Western Australian Department of Parks and Wildlife (DPaW) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The Wildlife Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories and ranks species within the Schedules using the categories of Mace and Stuart (1994).

Conservation Significance (CS) 2: Species listed as Priority by the DPaW but not listed under State or Commonwealth Acts.

In Western Australia, the DPaW has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DPaW feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DPaW, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (DEP 2000).

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined below are effectively the ecological processes that can be altered to result in impacts upon fauna.

Appendix 2. Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Wildlife Conservation Act 1950*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Wildlife Conservation Act 1950*

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

WA Department of Parks and Wildlife Priority species (species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al.* 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 20 key threatening processes listed by the federal Department of the Environment and Energy (DoEE 2017c):

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.

- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant).

General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, DSEWPaC has produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?
- Will the proposed action disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action interfere with the recovery of the species?

Appendix 4. Vertebrate fauna expected to occur in the survey area.

These lists are derived from the results of database and literature searches and from previous field surveys conducted in the local area. These are:

- ALA = Atlas of Living Australia, searched January 2017;
- Nat Map = Naturemap Database, searched January 2017;
- Bird Data = Birdlife Australia's Birdata database, searched January 2017;
- BCE 05 = Alkimos site inspection and desktop assessment (Bamford and Davis 2005);
- BCE 08 = South Yanchep Level 2 fauna assessment (Turpin and Bamford 2008); and
- BCE 17 = Alkimos site inspection and desktop assessment (Everard and Bamford 2017).

Status codes include: CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 2 for full explanation.

Frogs

Species	CS Status	ALA	Nat Map	BCE05	BCE08	BCE17
Myobatrachidae (ground frogs)						
Moaning Frog *Heleioporus eyrei*		X	X			
Pobblebonk *Limnodynastes dorsalis*		X	X			
Turtle Frog *Myobatrachus gouldii*		X	X			
Guenther's Toadlet *Pseudophryne guentheri*		X	X			
Total number of frog species expected: 4	-	**4**	**4**	-	-	-

Reptiles

Species	CS Status	ALA	Nat Map	BCE05	BCE08	BCE17
Gekkonidae (geckoes)						
Marbled Gecko *Christinus marmoratus*		X	X			
Diplodactylidae						
Clawless Gecko *Crenadactylus ocellatus*		X	X			
Spiny-tailed Gecko *Strophurus spinigerus*		X	X		X	
Pygopodidae						
Sandplain Worm Lizard *Aprasia repens*		X	X			
Javelin Legless Lizard *Delma concinna*		X	X		X	
Fraser's Legless Lizard *Delma fraseri*		X	X			
Gray's Legless Lizard *Delma grayii*		X	X			
Burton's Legless Lizard *Lialis burtonis*		X	X		X	
Keeled Legless Lizard *Pletholax gracilis*		X	X			
Common Scaly foot *Pygopus lepidopodus*		X	X			
Agamidae (dragon lizards)						
Western Bearded Dragon *Pogona minor*		X	X		X	
Sandhill Dragon *Ctenophorus adelaidensis*		X	X			
Varanidae (monitors or goannas)						
Gould's Sand Goanna *Varanus gouldii*		X	X			X

Species	CS Status	ALA	Nat Map	BCE05	BCE08	BCE17
Black-tailed Tree Goanna *Varanus tristis*		X	X			
Scincidae (skink lizards)						
Cool Skink *Acritoscincus trilineatus*		X	X			
Cryptoblepharus buchananii		X	X		X	
Limestone Ctenotus *Ctenotus australis*		X	X			
West Coast Ctenotus *Ctenotus fallens*		X	X		X	
Cyclodomorphus celatus		X	X		X	
King's Skink *Egernia kingii*		X	X			
Egernia napoleonis		X	X		X	
Hemiergis quadrilineata		X	X			
Lerista elegans		X	X		X	
Lerista lineopunctulata		X	X			
Western Worm Lerista *Lerista praepedita*		X	X		X	
Dwarf Skink *Menetia greyii*		X	X		X	
Spotted Morethia *Morethia lineoocellata*		X	X			
Dusky Morethia *Morethia obscura*		X	X		X	
Western Bluetongue *Tiliqua occipitalis*		X	X		X	
Bobtail *Tiliqua rugosa*		X	X	X	X	X
Typhlopidae (blind snakes)						
Southern Blind Snake *Ramphotyphlops australis*						
Boidae (pythons)						
Carpet Python *Morelia spilota imbricata*	CS3	X	X			
Elapidae (front-fanged snakes)						
Half-ringed Snake *Brachyurophis semifasciata*		X	X			
Narrow Banded Snake *Brachyurophis fasciolata*		X	X			
Yellow-faced Whip-Snake *Demansia psammoph*		X	X		X	
Bardick *Echiopsis curtus*		X	X			
Black-naped Snake *Neelaps bimaculatus*		X	X			
Black-striped Snake *Neelaps calonotos*	CS2	X	X			
Tiger Snake *Notechis scutatus*		X	X			
Dugite *Pseudonaja affinis*		X	X	X	X	X
Gould's Snake *Parasuta gouldii*		X	X			
Parasuta nigriceps		X	X			
Jan's Bandy-Bandy *Simoselaps bertholdi*		X	X			
Total number of reptile species expected: 53	**2**	**42**	**42**	**2**	**16**	**3**

Birds

Bird Species	CS Status	ALA	Nat Map	Bird Data	BCE05	BCE08	BCE17
Dromaiidae (emus)							
Emu *Dromaius novaehollandiae*		X	X	X	X	X	X
Threskiornithdae							
Australian White Ibis *Threskiornis molucca*		X	X	X			
Accipitridae (kites, hawks and eagles)							
Eastern Osprey *Pandion cristatus*	CS1	X	X	X	X	X	X
Black-shouldered Kite *Elanus axillaris*		X	X	X			
Square-tailed Kite *Lophoictinia isura*	CS3	X	X			X	
Whistling Kite *Haliastur sphenurus*	CS3	X	X	X		X	
White-bellied Sea-Eagle *Haliaeetus leucogaster*	CS1	X	X				
Spotted Harrier *Circus assimilis*		X	X	X			
Brown Goshawk *Accipiter fasciatus*	CS3	X	X	X		X	
Collared Sparrowhawk *Accipiter cirrhocephalus*	CS3	X	X	X		X	
Wedge-tailed Eagle *Aquila audax*	CS3	X	X	X			
Little Eagle *Hieraaetus morphnoides*	CS3	X	X	X		X	
Falconidae (falcons)							
Peregrine Falcon *Falco peregrinus*	CS1	X	X	X			
Australian Hobby *Falco longipennis*		X	X	X			
Brown Falcon *Falco berigora*		X	X	X			
Nankeen Kestrel *Falco cenchroides*		X	X	X		X	
Turnicidae (button-quails)							
Painted Button-quail *Turnix varia*	CS3						
Little Button-quail *Turnix velox*		X	X	X			
Phasianidae (pheasants and quails)							
Stubble Quail *Coturnix p*		X	X	X		X	
Charadriidae (lapwings and plovers)							
Banded Lapwing *Vanellus tricolor*		X	X				
Laridae (gulls and terns)							
Silver Gull *Larus novaehollandiae*		X	X	X	X	X	
Columbidae (pigeons and doves)							
Rock Dove (Domestic Pigeon) *Columba livia*	Int	X	X	X			
Laughing Turtle-Dove *Streptopelia senegalensis*	Int	X	X	X		X	
Common Bronzewing *Phaps chalcoptera*		X	X	X		X	
Brush Bronzewing *Phaps elegans*		X	X	X			
Crested Pigeon *Ocyphaps lophotes*		X	X	X			
Cacatuidae (cockatoos)							
Long-billed Corella *Cacatua tenuirostris*		X		X			
Galah *Cacatua roseicapilla*		X	X	X		X	X
Little Corella *Cacatua sanguinea*	Int	X	X	X			
Carnaby's Black-Cockatoo *Calyptorhynchus*	CS1	X	X	X		X	X
Psittacidae (lorikeets and parrots)							
Rainbow Lorikeet *Trichoglossus haematodus*	Int	X	X	X			
Australian Ringneck *Barnardius zonarius*		X	X	X		X	
Red-capped Parrot *Purpureicephalus spurius*		X	X	X		X	

Bird Species	CS Status	ALA	Nat Map	Bird Data	BCE05	BCE08	BCE17
Rock Parrot *Neophema petrophila*	CS3						
Elegant Parrot *Neophema elegans*		X	X	X		X	
Cuculidae (cuckoos)							
Fan-tailed Cuckoo *Cacomantis flabelliformis*		X	X	X			
Pallid Cuckoo *Cuculus pallidus*		X	X	X			
Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*		X	X	X		X	
Shining Bronze-Cuckoo *Chrysococcyx lucidus*		X	X	X			
Strigidae (hawk-owls)							
Southern Boobook *Ninox novaeseelandiae*		X	X	X			
Tytonidae (barn owls)							
Barn Owl *Tyto alba*		X	X	X			
Podargidae (frogmouths)							
Tawny Frogmouth *Podargus strigoides*		X	X	X			
Aegothelidae (owlet-nightjars)							
Australian Owlet-nightjar *Aegotheles cristatus*		X	X	X			
Caprimulgidae (nightjars)							
Spotted Nightjar *Eurostopodus argus*		X	X				
Apodidae (swifts)							
Fork-tailed Swift *Apus pacificus*	CS1	X	X	X			
Halcyonidae (forest kingfishers)							
Laughing Kookaburra *Dacelo novaeguineae*	Int	X	X	X			
Sacred Kingfisher *Todiramphus sanctus*		X	X	X			
Meropidae (bee-eaters)							
Rainbow Bee-eater *Merops ornatus*	CS1	X	X	X		X	
Maluridae (fairy-wrens)							
Splendid Fairy-wren *Malurus splendens*	CS3	X	X	X		X	
Variegated Fairy-wren *Malurus lamberti*	CS3	X	X	X		X	
White-winged Fairy-wren *Malurus leucopterus*	CS3	X	X	X	X	X	
Southern Emu-wren *Stipiturus malachurus*	CS3						
Pardalotidae (pardalotes)							
Spotted Pardalote *Pardalotus punctatus*		X	X	X			
Striated Pardalote *Pardalotus striatus*		X	X	X			
White-browed Scrubwren *Sericornis frontalis*	CS3	X	X	X	X	X	
Weebill *Smircornis brevirostris*	CS3	X	X	X			
Western Gerygone *Gerygone fusca*		X	X	X		X	
Inland Thornbill *Acanthiza apicalis*	CS3	X	X	X		X	
Western Thornbill *Acanthiza inornata*	CS3	X	X	X		X	
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	CS3	X	X	X		X	
Meliphagidae (honeyeaters)							
Red Wattlebird *Anthochaera carunculata*		X	X	X	X	X	X
Western Wattlebird *Anthochaera lunulata*	CS3	X	X	X		X	
Yellow-throated Miner *Manorina flavigula*		X	X	X		X	
Singing Honeyeater *Lichenostomus virescens*		X	X	X	X	X	X
Brown Honeyeater *Lichmera indistincta*		X	X	X		X	
White-cheeked Honeyeater *Phylidonyris nigra*	CS3	X	X	X		X	

Bird Species	CS Status	ALA	Nat Map	Bird Data	BCE05	BCE08	BCE17
New Holland Honeyeater *Phylidonyris novaehol*	CS3	X	X	X		X	
Tawny-crowned Honeyeater *Phylidonyris melar*	CS3			X			
Western Spinebill *Acanthorhynchus superciliosu*	CS3	X	X	X		X	
White-fronted Chat *Epthianura albifrons*		X	X	X			
Petroicidae (Australian robins)							
Hooded Robin *Melanodryas cucullata*	CS3	X	X				
White-breasted Robin *Eopsaltria georgiana*	CS3	X	X	X		X	
Neosittidae							
Varied Sittella *Daphoenositta chrysoptera*		X	X	X			
Pachycephalidae (whistlers)							
Rufous Whistler *Pachycephala rufiventris*		X	X	X		X	
Grey Shrike-thrush *Colluricincla harmonica*	CS3	X	X	X		X	
Dicruridae (flycatchers)							
Magpie-lark *Grallina cyanoleuca*		X	X	X			
Grey Fantail *Rhipidura fuliginosa*		X	X	X		X	
Willie Wagtail *Rhipidura leucophrys*		X	X	X	X	X	X
Campephagidae (cuckoo-shrikes)							
Black-faced Cuckoo-shrike *Coracina novaehollа*		X	X	X	X	X	
White-winged Triller *Lalage sueurii*		X	X	X		X	
Artamidae (woodswallows)							
Black-faced Woodswallow *Artamus cinereus*	CS3	X	X	X		X	X
Grey Butcherbird *Cracticus torquatus*		X	X	X	X	X	
Australian Magpie *Gymnorhina tibicen*		X	X	X	X	X	X
Corvidae (ravens and crows)							
Australian Raven *Corvus coronoides*		X	X	X		X	X
Motacillidae (pipits and true wagtails)							
Australian Pipit *Anthus novaeseelandiae*		X	X	X	X	X	
Dicaeidae (flower-peckers)							
Mistletoebird *Dicaeum hirundinaceum*		X	X	X			
Hirundinidae (swallows)							
White-backed Swallow *Cheramoeca leucosternu*		X	X	X			
Welcome Swallow *Hirundo neoxena*		X	X	X	X	X	X
Tree Martin *Hirundo nigricans*		X	X	X	X	X	
Sylviidae (Old World warblers)							
Rufous Songlark *Cincloramphus mathewsi*		X	X	X			
Brown Songlark *Cincloramphus cruralis*					X	X	
Zosteropidae (white-eyes)							
Silvereye *Zosterops lateralis*		X	X	X	X	X	X
Total number of bird species expected: 92	**CS: 32 Int: 5**	**87**	**86**	**83**	**16**	**51**	**12**

Mammals

Mammal Species	Status	ALA	Nat Map	BCE05	BCE08	BCE17
Tachyglossidae (echidnas)						
Echidna *Tachyglossus aculeatus*		X	X			
Peramelidae (bandicoots)						
Quenda or Brown Bandicoot *Isoodon obesulus*	CS2	X	X		X	
Phalangeridae (brushtail possums)						
Brush-tailed Possum *Trichosurus vulpecula*	CS3	X	X		X	
Macropodidae (kangaroos and wallabies)						
Western Grey Kangaroo *Macropus fuliginosus*		X	X	X		X
Brush Wallaby *Notamacropus irma*	CS2	X	X			
Mollosidae (mastiff bats)						
White-striped Bat *Tadarida australis*		X	X		X	
Western Freetail Bat *Mormopterus planiceps*						
Vespertilionidae (vesper bats)						
Gould's Wattled Bat *Chalinolobus gouldii*		X	X			
Chocolate Wattled Bat *Chalinolobus morio*		X	X			
Lesser Long-eared Bat *Nyctophilus geoffroyi*		X	X			
Southern Forest Bat *Vespadelus regulus*		X	X			
Muridae (rats and mice)						
House Mouse *Mus musculus*	Int.	X	X	X	X	
Moodit or Bush-Rat *Rattus fuscipes*	CS3	X	X		X	?*
Black Rat *Rattus rattus*	Int.	X	X			
Leporidae (rabbits and hares)						
Rabbit *Oryctolagus cuniculus*	Int.	X	X	X	X	X
Canidae (foxes and dogs)						
European Red Fox *Vulpes vulpes*	Int.	X	X	X	X	X
Felidae (cats)						
Feral Cat *Felis catus*	Int.	X	X	X	X	
Total number of mammal species expected: 17	**CS: 4 Int: 5**	**16**	**16**	**5**	**8**	**4**

*Potential *R.fuscipes* diggings recorded in cleared area (December 2016)

Appendix 5. Vertebrate species returned in database searches but unlikely to occur in the survey area.

Database searches often return found nearby but that are unlikely to be present in the survey area due to lack of suitable habitat (e.g. aquatic species) or ecological barriers preventing them from reaching the area (e.g. island species). There are also some errors, out-of-date Latin names, zoo specimens and subtleties of distribution that are not recognised in databases. The species listed below are considered highly unlikely to be found in the survey area (although some species could occur as very rare vagrants).

Common name	Latin name
Reptiles	
Stimson's Python	*Antaresia stimsoni*
Loggerhead Turtle	*Caretta caretta*
Oblong Turtle	*Chelodina colliei*
Green Turtle	*Chelonia mydas*
Squelching Froglet	*Crinia insignifera*
Fence Skink	*Cryptoblepharus plagiocephalus*
Odd-striped Ctenotus	*Ctenotus impar*
Leatherback Turtle	*Dermochelys coriacea*
Western Stone Gecko	*Diplodactylus granariensis*
Spotted Sandplain Gecko	*Diplodactylus polyophthalmus*
Crowned Snake	*Elapognathus calonotos*
Sand Frog	*Heleioporus psammophilus*
Yellow-bellied Seasnake	*Hydrophis platurus*
Bold-striped-Slider	*Lerista christinae*
South-western Orange-tailed Slider	*Lerista distinguenda*
Slender Tree Frog	*Litoria adelaidensis*
Motorbike Frog	*Litoria moorei*
Flatback Turtle	*Natator depressus*
Birds	
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*
Australian Reed Warbler	*Acrocephalus australis*
Common Sandpiper	*Actitis hypoleucos*
Chestnut Teal	*Anas castanea*
Grey Teal	*Anas gracilis*
Northern Mallard	*Anas platyrhynchos*
Australasian Shoveler	*Anas rhynchotis*
Pacific Black Duck	*Anas superciliosa*
Australasian Darter	*Anhinga novaehollandiae*
Australian Lesser Noddy	*Anous tenuirostris subsp. melanops*
Cattle Egret	*Ardea ibis*
Eastern Great Egret	*Ardea modesta*
White-faced Heron	*Ardea novaehollandiae*

White-necked Heron	*Ardea pacifica*
Ruddy Turnstone	*Arenaria interpres*
Dusky Woodswallow	*Artamus cyanopterus*
Masked Woodswallow	*Artamus personatus*
Hardhead	*Aythya australis*
Musk Duck	*Biziura lobata*
Australasian Bittern	*Botaurus poiciloptilus*
Sulphur-crested Cockatoo	*Cacatua galerita*
Western Corella	*Cacatua pastinator*
Sharp-tailed Sandpiper	*Calidris acuminata*
Sanderling	*Calidris alba*
Red Knot	*Calidris canutus*
Curlew Sandpiper	*Calidris ferruginea*
Red-necked Stint	*Calidris ruficollis*
Long-toed Stint	*Calidris subminuta*
Great Knot	*Calidris tenuirostris*
Forest Red-tailed Black-Cockatoo	*Calyptorhynchus banksii naso*
Baudin's Black-Cockatoo	*Calyptorhynchus baudinii*
Greater Sand Plover	*Charadrius leschenaultii*
Black-fronted Dotterel	*Charadrius melanops*
Red-capped Plover	*Charadrius ruficapillus*
Australian Wood Duck	*Chenonetta jubata*
Swamp Harrier	*Circus approximans*
Banded Stilt	*Cladorhynchus leucocephalus*
Rufous Treecreeper	*Climacteris rufa*
Little Crow	*Corvus bennetti*
Brown Quail	*Coturnix ypsilophora*
Pied Butcherbird	*Cracticus nigrogularis*
White-backed Magpie	*Cracticus tibicen subsp. dorsalis*
Black Swan	*Cygnus atratus*
Amsterdam Albatross	*Diomedea amsterdamensis*
Yellow-nosed Albatross	*Diomedea chlororhynchos*
Grey-headed Albatross	*Diomedea chrysostoma*
Southern Royal Albatross	*Diomedea epomophora (sensu stricto)*
Wandering Albatross	*Diomedea exulans (sensu lato)*
Northern Royal Albatross	*Diomedea sanfordi*
Little Egret	*Egretta garzetta*
Eastern Reef Egret	*Egretta sacra*
Western Yellow Robin	*Eopsaltria australis subsp. Griseogularis*
Red-kneed Dotterel	*Erythrogonys cinctus*
Little Penguin	*Eudyptula minor subsp. novaehollandiae*

Western Shrike-tit, Crested Shrike-tit	*Falcunculus frontatus subsp. leucogaster*
Eurasian Coot	*Fulica atra*
Dusky Moorhen	*Gallinula tenebrosa*
Buff-banded Rail	*Gallirallus philippensis*
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*
Pied Oystercatcher	*Haematopus longirostris*
Blue Petrel	*Halobaena caerulea*
Black-winged Stilt	*Himantopus himantopus*
Australian Black Bittern	*Ixobrychus flavicollis subsp. australis*
Australian Little Bittern	*Ixobrychus minutus subsp. dubius*
Pacific Gull	*Larus pacificus*
Malleefowl	*Leipoa ocellata*
White-eared Honeyeater	*Lichenostomus leucotis*
Bar-tailed Godwit	*Limosa lapponica*
Black-tailed Godwit	*Limosa limosa*
Southern Giant Petrel	*Macronectes giganteus*
Northern Giant Petrel	*Macronectes halli*
Pink-eared Duck	*Malacorhynchus membranaceus*
Little Grassbird	*Megalurus gramineus*
Brown-headed Honeyeater	*Melithreptus brevirostris*
White-naped Honeyeater	*Melithreptus lunatus*
Little Pied Cormorant	*Microcarbo melanoleucos*
Jacky Winter	*Microeca fascinans*
Australasian Gannet	*Morus serrator*
Restless Flycatcher	*Myiagra inquieta*
Eastern Curlew	*Numenius madagascariensis*
Nankeen Night-Heron	*Nycticorax caledonicus*
Bridled Tern	*Onychoprion anaethetus*
Crested Bellbird	*Oreoica gutturalis gutturalis*
Blue-billed Duck	*Oxyura australis*
Golden Whistler	*Pachycephala pectoralis*
Slender-billed Prion	*Pachyptila belcheri*
Antarctic Prion	*Pachyptila desolata*
Fairy Prion	*Pachyptila turtur*
Australian Pelican	*Pelecanus conspicillatus*
Fairy Martin	*Petrochelidon ariel*
Red-capped Robin	*Petroica goodenovii*
Scarlet Robin	*Petroica multicolor*
Great Cormorant	*Phalacrocorax carbo*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Pied Cormorant	*Phalacrocorax varius*

Sooty Albatross	*Phoebetria fusca*
Yellow-billed Spoonbill	*Platalea flavipes*
Royal Spoonbill	*Platalea regia*
Western Rosella	*Platycercus icterotis*
Glossy Ibis	*Plegadis falcinellus*
Grey Plover	*Pluvialis squatarola*
Great Crested Grebe	*Podiceps cristatus*
Hoary-headed Grebe	*Poliocephalus poliocephalus*
Regent Parrot	*Polytelis anthopeplus*
Little Grassbird	*Poodytes gramineus*
Purple Swamphen	*Porphyrio porphyrio*
Australian Spotted Crake	*Porzana fluminea*
Baillon's Crake	*Porzana pusilla subsp. palustris*
Spotless Crake	*Porzana tabuensis*
White-chinned Petrel	*Procellaria aequinoctialis*
Kerguelen Petrel	*Pterodroma brevirostris*
Soft-plumaged Petrel	*Pterodroma mollis*
Yellow-plumed Honeyeater	*Ptilotula ornatus*
Fleshy-footed Shearwater	*Puffinus carneipes*
Wedge-tailed Shearwater	*Puffinus pacificus*
Red-necked Avocet	*Recurvirostra novaehollandiae*
Australian Painted Snipe	*Rostratula australis*
Crested Tern	*Sterna bergii*
Caspian Tern	*Sterna caspia*
Roseate Tern	*Sterna dougallii subsp. gracilis*
Australian Fairy Tern	*Sternula nereis nereis*
Freckled Duck	*Stictonetta naevosa*
Grey Currawong	*Strepera versicolor*
Australasian Grebe	*Tachybaptus novaehollandiae*
Australian Shelduck	*Tadorna tadornoides*
Indian Yellow-nosed Albatross	*Thalassarche carteri*
Shy Albatross	*Thalassarche cauta cauta*
White-capped Albatross	*Thalassarche cauta steadi*
Campbell Albatross,	*Thalassarche impavida*
Black-browed Albatross	*Thalassarche melanophris*
Hooded Plover	*Thinornis rubricollis*
Straw-necked Ibis	*Threskiornis spinicollis*
Black-tailed Native-hen	*Tribonyx ventralis*
Common Greenshank	*Tringa nebularia*
Masked Owl	*Tyto novaehollandiae*
Masked Lapwing	*Vanellus miles*

Mammals	
New Zealand Fur Seal	*Arctocephalus forsteri*
Sub-antarctic Fur Seal	*Arctocephalus tropicalis*
Dwarf Minke Whale	*Balaenoptera acutorostrata*
Blue Whale	*Balaenoptera musculus*
Boodie, Burrowing Bettong	*Bettongia lesueur subsp. graii*
Woylie, Brush-tailed Bettong	*Bettongia penicillata subsp. ogilbyi*
European Cattle	*Bos taurus*
Camel	*Camelus dromedarius*
Dog, Dingo	*Canis lupus*
Western Pygmy-possum	*Cercartetus concinnus*
Chuditch, Western Quoll	*Dasyurus geoffroii*
Southern Right Whale	*Eubalaena australis*
Water-rat	*Hydromys chrysogaster*
Pygmy Sperm Whale	*Kogia breviceps*
Humpback Whale	*Megaptera novaeangliae*
Andrew's Beaked Whale	*Mesoplodon bowdoini*
European Polecat, Ferret	*Mustela putorius*
Australian Sea Lion	*Neophoca cinerea*
Greater Long-eared Bat	*Nyctophilus timoriensis*
Sheep	*Ovis aries*
Western Barred Bandicoot	*Perameles bougainville subsp. Bougainville*
Desert Bandicoot	*Perameles eremiana*
Sugar Glider	*Petaurus breviceps subsp. ariel*
Black-flanked Rock-wallaby	*Petrogale lateralis subsp. lateralis*
Sperm Whale	*Physeter macrocephalus*
Ashy-grey Mouse	*Pseudomys albocinereus*
Fat-tailed Dunnart	*Sminthopsis crassicaudata*
Gilbert's Dunnart	*Sminthopsis gilberti*
White-tailed Dunnart	*Sminthopsis granulipes*
Grey-bellied Dunnart	*Sminthopsis griseoventer*
Honey Possum	*Tarsipes rostratus*
Northern Brushtail Possum	*Trichosurus vulpecula subsp. arnhemensis*
Bottlenose Dolphin	*Tursiops truncatus*

Appendix 6. Scoring system for the assessment of Black-Cockatoo foraging values.

Site Score	Vegetation Description
	Carnaby's Black-Cockatoo
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples would be salt lakes and bare ground.
1	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these <2%. Could include urban areas with scattered foraging trees. Blue Gum plantations are considered to have a score of 1 as foraging by Black-Cockatoos has been reported but appears to be unusual.
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, with <10% projected foliage cover. • Open eucalypt woodland/mallee of small-fruited species. • Paddocks with melons or other weeds (a short-term, seasonal food source).
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, with 10-20% projected foliage cover. • Woodland with tree banksias 2-10% projected foliage cover. • Eucalypt woodland/mallee of small-fruited species; Marri, if present, <10% project foliage cover.
4	Moderate foraging value. Examples: • Woodland with tree banksias 20-40% projected foliage cover. • Eucalypt woodland/forest with Marri 20-40% projected foliage cover.
5	Moderate to High foraging value. Examples: • Banksia woodlands with tree banksias >40%. Vegetation condition moderate due to weed invasion and some tree deaths.
6	High foraging value. Example: • Banksia woodlands of key species (e.g. *B. attenuata, B. menziesii*) with projected foliage cover >60%. Vegetation condition good with low weed invasion and low tree death to indicate it is robust and unlikely to decline in the medium term.

Proteaceous plants include species such as *Banksia*, *Hakea* and *Grevillea.*