DevelopmentWA

Ocean Reef Marina

Geotechnical Investigation
Native Vegetation Clearing Permit – Purpose Permit
Supporting Documentation

24 January 2020

57431-124655 (Rev 1)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

www.jbsg.com.au

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1. Introduction

1.1 Purpose and scope

This clearing permit application is to facilitate a geotechnical investigation in support of the proposed Ocean Reef Marina Development (the Development), located at Ocean Reef within the City of Joondalup (the City). The Development is a State Government priority project with an expectation to commence construction works in 2020.

The geotechnical investigation will include the excavation of a series of test pits using a tracked excavator at a variety of locations across the Development area. A grid layout plan and the project structure plan will be used to determine potential locations of the test pits. The exact number and locations of the test pits will be determined on site. Based on a conservative estimate, it is anticipated that up to 3.9 ha of native vegetation within the Development area will need to be cleared as part of the geotechnical investigation.

1.2 Project background and description

DevelopmentWA proposes to develop a world class recreational, residential, boating and tourist development, referred to as the Ocean Reef Marina within a preferred Concept Plan boundary of 61 ha, including land and sea components at Ocean Reef, Western Australia. The terrestrial portion of the Concept Plan has an area of approximately 42 ha.

In April 2014, a Metropolitan Region Scheme (MRS) amendment (1270/41) was initiated by the Western Australian Planning Commission (WAPC) to establish the appropriate MRS zonings to be established to enable the Development. The MRS amendment was referred to the Environmental Protection Authority (EPA) under s 48A of the *Environmental Protection Act 1986* (EP Act) in May 2014. The EPA determined that the amendment did not require formal assessment as it was considered that the terrestrial aspects could be adequately managed through the relevant planning. The EPA provided a 'Statement of reasons and public advice' for this decision in June 2014. In its decision, the EPA noted that the WAPC will require a Negotiated Planning Outcome (NPO) that secures an appropriate conservation outcome before final approval of the MRS Amendment is given. An NPO was prepared and formed part of WAPC's consideration of the MRS Amendment, leading to its gazettal on 29 November 2019. The amendment enables the appropriate MRS zonings to facilitate the Development. The Development area is zoned 'urban', 'parks and recreation', 'waterways', 'public purpose' and 'regional roads' (Figure 1.1).

The marine component of the Development was separately referred to the EPA under s 38 of the EP Act in May 2014. In June 2014 the EPA determined that the marine component (including coastal processes) of the Development would be assessed at a Public Environmental Review (PER) level of assessment with an eight-week public comment period. The marine portion of the Development has now been approved subject to conditions set in Ministerial Statement 1107 dated 7 August 2019. A Change to Proposal, has also be assessed and approved on 6 January 2020.

1.3 Scope

This document provides supporting information for a Native Vegetation Clearing Permit (NVCP) application (purpose permit) to clear up to 3.9 hectares (ha) of native vegetation within an area of approximately 30.5 ha (the application area; Figure 1.2), located at Ocean Reef within the City of Joondalup (the City).

This document has been prepared to support the assessment under s.51E of the *Environmental Protection Act 1986* (EP Act), and includes the following information relating to clearing impacts:

- an overview of the existing environmental conditions of the application area

- an evaluation of the proposed clearing against the '10 Clearing Principles' listed under Schedule 5 of the EP Act
- environmental approvals and management requirements.

1.4 Ownership and tenure

Site identification details for the proposed clearing footprint are provided in Table 1.1.

Table 1.1: Site identification details

Lot No	C/T Details	Survey Plan	Owner	Reserve #
9000	2701/335	DP 54595	Water Corporation	N/A
1032	1667/921	P13198	City of Joondalup	N/A
10098	LR3048/270	DP 216093	Water Corporation	36732
15446	LR3133/571	DP 40340	47831	City of Joondalup
555	LR3166/566	DP 402198	State of WA	45122 to City of Joondalup (Recreation)

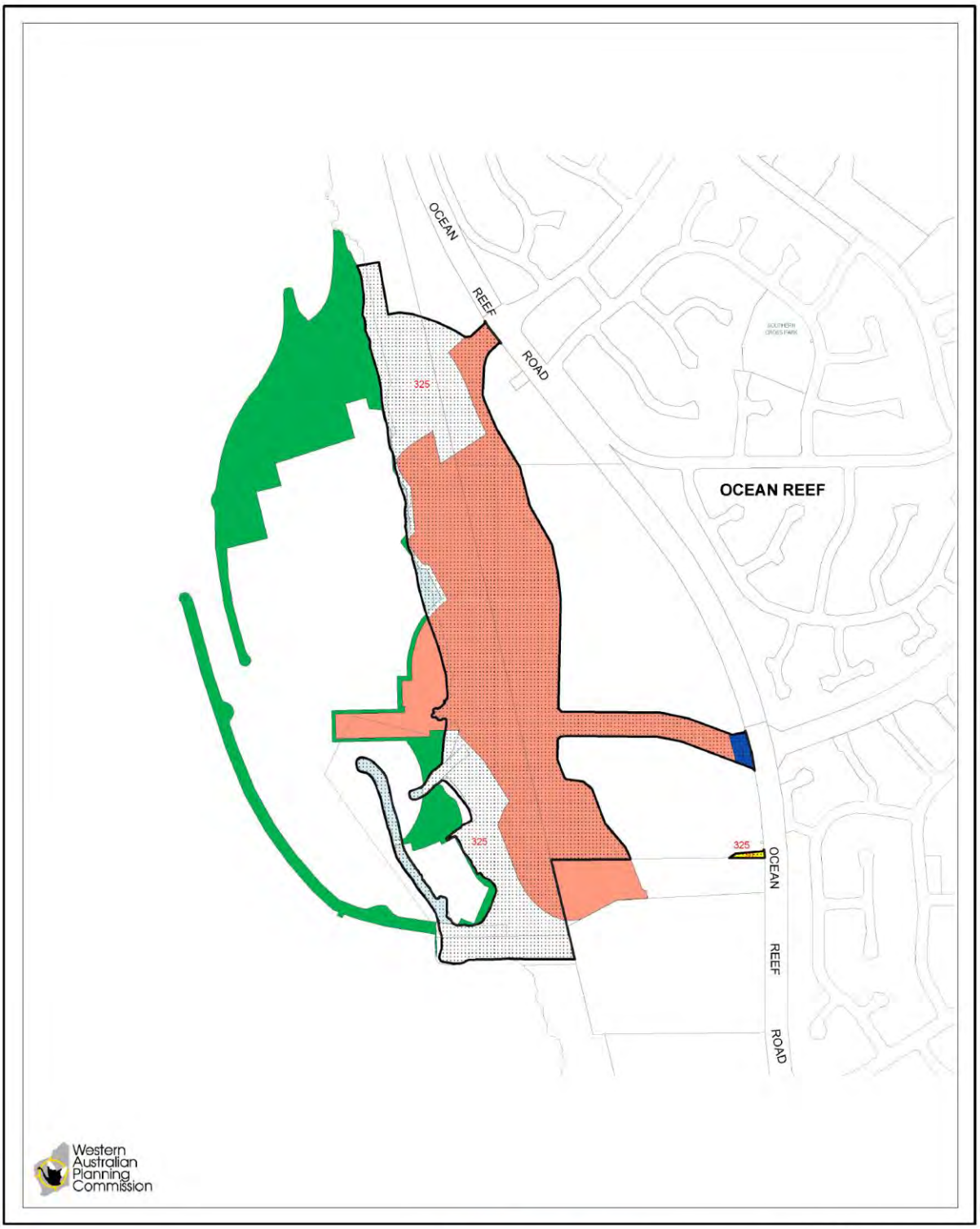
1.5 Related applications

DevelopmentWA has also lodged a clearing permit application to facilitate an Early Works program required to facilitate development of the Ocean Reef Marina Development (Strategen-JBS&G 2020). The Early Works program comprises the following items:

- new Hodges Drive extension
- new Boat Harbour Quays entry road
- diversion of existing Coastal Shared Use Path
- laydown area, site office and facilities (Site Compound).
- diversion of existing club and boat ramp access
- construction-site related signage.

The application area which is the subject of this application overlaps the proposed clearing footprint within the clearing permit application for the required Early Works.

Figure 1.1: MRS amendment 1270/41



Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary
- Cadastral boundaries
- Roads (MRWA)

Scale 1:5,869 at A4 (0 50 100 150 metres)		**Ocean Reef Marina Development**
Coord. Sys. GDA 1994 MGA Zone 50		**PROPOSED CLEARING AREA**
Job No: 57431		
Client: DevelopmentWA		**FIGURE 1-2**
Version: 2	Date: 24-Jan-2020	strategen JBS&G
Drawn By: hsullivan	Checked By: RD	

File Name: W:\Projects\1)Open\LandCorp\57431 Ocean Reef NVCP\GIS\Maps\R02 Rev A\57431_02_1_PpsdClearingArea.mxd
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019

2. Existing environment

2.1 Climate

The locality has a Mediterranean climate, characterised by hot dry summers and mild wet winters, typical of coastal areas in the Perth metropolitan region. Temperatures range from a mean maximum of 30.4°C in February to a mean minimum of 9.7°C in July and the long term mean annual rainfall at Swanbourne (009215) was 734 mm (Bureau of Meteorology 2019).

Winds are an important feature of coastal environmental settings as they are a major determinant of landwards sand migration, landforms and landscape. During summer, winds blow from the south-east in the morning and from the southwest in the afternoon with the local sea breeze. Winter is characterised by north-westerly storm winds that back around to the west and southwest, interspersed with calmer periods.

The nearest official meteorological weather station is the Swanbourne station located approximately 25 km south of the project area. Summary climate data for the nearest meteorological station is presented in Figure 2.1.

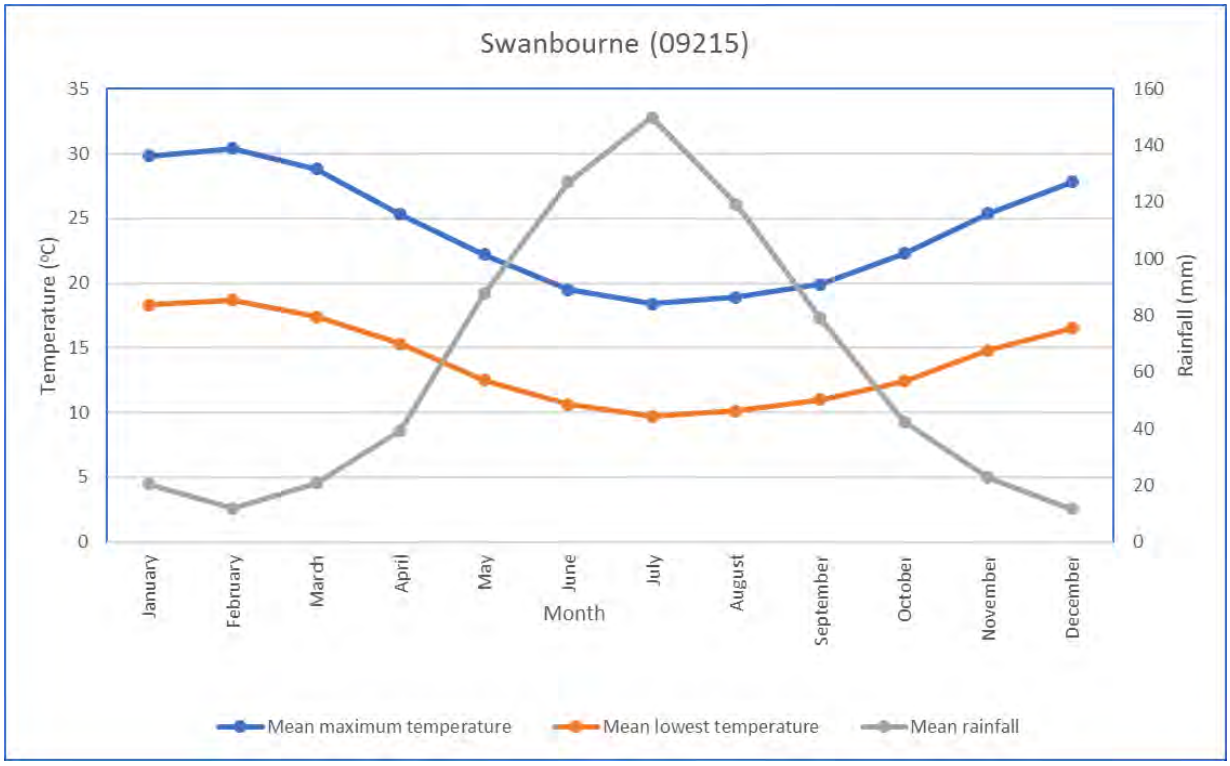


Figure 2.1: Climate data for Swanbourne - 09215 (nearest meteorological station) (Source: Bureau of Meteorology 2019)

2.2 Landform and topography

The application area is characteristic of a typical coastal landscape with undulating sand dunes and steep limestone cliffs adjacent to the coastline. Previous development has resulted in significant localised earthwork activity to form car parks and other recreational facilities.

Ground elevations vary from approximately 26 m Australian height Datum (AHD) in the eastern portion to 0 m AHD along the coast (Figure 2.2).

The majority of the application area is dominated by undulating topography formed by dune systems that vary in height by up to approximately 12 m. The dunes are locally bound to the west by limestone cliffs that vary in height from 2 to 4 m AHD.

Modifications to topography have occurred as a result of construction of the harbour wall, groyne, boat launching facilities, car park and footpaths. The two car park areas required the use of fill material to ensure that a flat, stable area was created (Golder Associates 2015). As a result, the southern car parking facility is approximately 8 m to 10 m higher than the present boat launching facilities and playground.

Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary
- Topographic contours (mAHD)

Scale 1:6,000 at A4

0 50 100 150
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57431

Client: DevelopmentWA

Version: 2 | Date: 24-Jan-2020

Drawn By: hsullivan | Checked By: RD

Ocean Reef Marina Development

TOPOGRAPHY

FIGURE 2-2

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2.3 Soils and geology

2.3.1 Geology

The Swan Coastal Plain comprises five major geomorphological 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 and McArthur 1980, Gibson et al 1994 in Mattiske 2013). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward and McArthur 1980, Gibson et al 1994 in Mattiske 2013). The Swan Coastal Plain forms part of a deep linear trough of sedimentary rocks known as the Perth Basin. The Perth Basin extends north-south parallel to the coastline with sediments of marine, alluvial and aeolian origin.

The application area is situated on two major geomorphological systems namely the Quindalup and Spearwood Dunes. This is illustrated by the Department of Mines, Industry Regulation and Safety (DMIRS) geomorphology mapping (Figure 2.3). These dunes systems may be described as follows:

- Spearwood Dune system consists of leached and podzolized surface sands overlying yellow reddish-brown sands at depth; and
- Quindalup Dune System consists of unconsolidated calcareous sands, locally over limestone.

Geological logging undertaken by Strategen-JBS&G to install bores as part of a Detailed Site Investigation (DSI) over the Development area confirms that the Development consists of Safety Bay Sand and Tamala Limestone (Strategen 2015a). These units can be described as:

- Safety Bay Sand: white, fine to medium grained, sub-rounded quartz and shell debris, of aeolian origin, associated with the Quindalup Dune System; and
- Tamala Limestone: white to light brown, fine to coarse grained, subangular to well-rounded quartz sand, shell debris, variably lithified/cemented, often overlain by a variable thickness of residual sandy gravel residual soil (Gozzard 1982).

2.3.2 Karst features

The Tamala Limestone may potentially contain karst features such as caves, vugs and solution channels. These features may vary in size and location within the rockmass and present a risk to building stability as a result of localised collapse and associated settlement. A broad geotechnical survey of the Development area has been undertaken.

A *Preliminary Geotechnical Investigation* was undertaken by Golder Associates (2015) to assess the likelihood of these structures occurring. The survey included a walk over survey, test pits and boreholes, with the deepest holes being drilled to -6 mAHD. With respect to the karst features, the study identified:

- limestone comprising generally weakly to moderately cemented rock with some well cemented zones, typically medium to high strength, moderately to highly leached with highly fractures and gravelly zones. The limestone is variable both in terms of the extent and degree of cementation with numerous zones of weakly to moderately cemented calcarenite;
- no surface expressions of karst or cavernous features were identified across the Development during the investigation; and
- limestone solution features in the form of outcropping limestone pinnacles, root tubes sand pockets and cap rock.

Golder Associates (2015) advised that the risks posed by such karstic features in the Development area are low. However, a series of recommendations were provided to assist manage the karstic risk during development and construction (of the Development). These included adoption of specific

foundations designs where solution features are encountered, site inspections during construction and the completion of additional geotechnical investigations (the subject of this report).

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Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary

Coastal geomorphology

- Barrier complex, Spearwood Dune System calcarenite
- Made ground
- Parabolic and nested parabolic dune complexes, Quindalup Dune System

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0 100 metres

Ocean Reef Marina Development

GEOLOGY

Job No: 57431		Scale 1:4,000 at A3		
Client: DevelopmentWA		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: hsullivan	Checked By: RD	Version: A	Date: 24-Jan-2020	**FIGURE: 2-3**

Document Path: W:\Projects\1)Open\LandCorp\57431 Ocean Reef NVCP\GIS\Maps\R02 Rev A\57431_02_3_Geology.mxd

Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019.

2.3.3 Acid sulfate soils

A review of the WAPC *Planning Bulletin No. 64 - Acid Sulfate Soils* (2003) and the Landgate WA Atlas (2013), has identified that the application area does not contain geology consistent with the presence of actual acid sulfate soils (AASS) or potential acid sulfate soil (PASS) occurring at depths greater than 3 m.

Soil and rock materials indicative of the presence of acid sulfate soils were not observed during the investigations undertaken by Strategen (2015a) or Golder Associates (2015).

2.3.4 Contamination

The DSI undertaken (2015a) for the terrestrial portion of the broader Development area indicated that:

1. Soils were tested for a range of contaminants including hydrocarbons and trace metals. Concentrations of contaminants in soil samples complied with adopted assessment criteria. Soil within the Development area is not contaminated and there is no risk to human health or the environment from exposure to the soil. The soil is suitable for use in the development as proposed.
2. With the exception of nickel at one location, no contaminants in groundwater were identified that are a risk to human health.
3. Limited Potential Asbestos Containing Material (PACM) has been identified, but this appears to be localised (Strategen 2015). The City [of Joondalup] has previously been acting to remove the identified PACM fragments, however, further PACM is likely to be present within the Development area.

2.4 Groundwater and surface water

Monitoring by Strategen (2019) indicates that groundwater levels vary from approximately 0 m AHD at the western boundary, to 1 m AHD near the eastern boundary. Given the variable topography of the application area, this corresponds to a depth to groundwater of between 0 m at the coast and 23 m below ground level (Strategen 2015a) at the eastern boundary. Groundwater at the coast is affected by changes in sea level including tides and storm surge[1] events. Moving away from the coast, this effect reduces until the groundwater levels are only affected by seasonal trends related to rainfall.

Climate change is estimated to cause a rise in mean sea level of 0.3 m by 2060 and 0.9 m by 2110 (DoT 2010). In near coastal areas, groundwater levels are expected to rise as a consequence of the rise in sea levels. In the immediate coastal area, the rise in sea level as a result of climate change is anticipated to result in an equivalent rise in groundwater levels. Further from the land directly adjacent to the coast, other factors affecting groundwater flow and levels (such as rainfall patterns) will have a greater effect on groundwater levels.

Due to the location of the Development on the coast, a rise in sea level as a result of climate change is anticipated to result in an equivalent rise in groundwater levels. This results in an estimated maximum groundwater level for 2110 of between 1.89 m AHD and 2.19 m AHD (Strategen 2015a, Figure 2.2).

Wetlands and terrestrial surface waters are not present within or adjacent to the application area.

[1] The rising of the sea as a result of wind and atmospheric pressure changes associated with a storm.

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MB01
MGL: 2.09

MB01

1.9

2.0

2.1

MB02

MB02
MGL: 2.09

MB03
MGL: 1.89

MB03

DoW 4931
MGL: 2.09

DOW 4931

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Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary
- Design groundwater level contour (mAHD)
- WIN Site bore
- Monitoring bores

strategen JBS&G

0 100
metres

Ocean Reef Marina Development

GROUNDWATER

Job No: 57431		Scale 1:4,000 at A3	
Client: DevelopmentWA		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: hsullivan	Checked By: RD	Version: A	Date: 24-Jan-2020

FIGURE: 2-4

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Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019.

2.5 Vegetation and flora

2.5.1 Surveys conducted

A number of vegetation and flora surveys of the application area have been undertaken to date, comprising:

- Mattiske Consulting (2000), *Flora and Vegetation Assessment of Lot 1029 and Bushplan Site 325*, City of Joondalup, prepared for The Planning Group (survey conducted in June 2000);
- Bowman Bishaw Gorham (2002), *Vegetation and Flora Assessment Pt Lot 1029, Lots 1032 and 1033 Ocean Reef Road, Ocean Reef*, prepared for City of Joondalup (surveys conducted in April & May 2002);
- Natural Area Management Services (2008), Vegetation Condition, Ecological Community and Flora Search Report, Ocean Reef Marina, prepared for the City of Joondalup (surveys conducted 19 & 23 September 2008);
- SMEC Australia Limited & Natural Area Management Services (2009), *Additional Flora Survey, Northern Portion of Proposed ORM Development Site*, prepared for the City of Joondalup (survey conducted September 2009);
- Mattiske Consulting (2013), *Level 2 Flora and Vegetation Survey of the Proposed Ocean Reef Marina Survey Area*, prepared for Strategen on behalf of City of Joondalup (surveys conducted 14 to 17 October 2013); and
- Strategen-JBS&G (2019), *Spring survey for Rehabilitation Planning for the Proposed Ocean Reef Marina,* prepared by Strategen-JBS&G.

Given previous mapping was undertaken in 2013, an additional walkover was completed in Spring 2019 by Strategen-JBS&G to confirm the results of the previous mapping undertaken. This resulted in minor amendments to the Mattiske (2013) mapping which are reflected in Figure 2.5 where relevant to the proposed clearing footprint.

2.5.2 Regional context

The application area is located in the South Western Botanical Province of Western Australia, in the Darling Botanical District and the Swan Coastal Plain subregion of the Drummond Botanical District (Mattiske 2013).

2.5.2.1 Swan Coastal Plain Bioregion

Regional scale vegetation complex mapping by Heddle *et al* (1980 in Mattiske 2013) indicates that vegetation associations within the Development (and survey) area are likely to belong to two broad complexes that are locally influenced by a third complex.

Vegetation types of the broader Development are dominated by the Quindalup vegetation complex, with some influence from the Cottesloe vegetation complex: Central and South, and Karrakatta vegetation complex: Central and South (Mattiske 2013).

The Quindalup Complex is restricted to the coastal dunes. Here, the vegetation differs in its structure and species composition from one area to another. The resulting mosaic largely reflects variation in the dunal environment in association with soil and topographic factors and the degree of shelter from salt laden winds. The vegetation typically comprises a mix of *Acacia* species, *Melaleuca systena*, *Pimelea ferruginea* and occasional tall woodlands of *Agonis flexuosa*.

The Cottesloe Complex: Central and South supports heaths on limestone outcrops. The deeper sands support a mosaic of tuart woodland and an open forest of tuart, jarrah and marri.

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Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary
- Bush Forever site (DOP)

Vegetation type

- H1 (7.97 ha)
- H2 (0.70 ha)
- H3 (0.04 ha)
- H4 (1.08 ha)
- S1 (3.19 ha)
- S2 (0.79 ha)
- S3 (1.90 ha)
- S4 (1.12 ha)
- S5 (2.11 ha)
- DS (0.23 ha)
- FR (0.32 ha)
- Tuart woodland (0.08 ha)
- CL

strategen JBS&G

0 100 metres

Ocean Reef Marina Development

VEGETATION TYPE

Job No: 57431		Scale 1:4,000 at A3	
Client: DevelopmentWA		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: hsullivan	Checked By: RD	Version: A	Date: 24-Jan-2020

FIGURE: 2-5

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Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019.

The Karrakatta Complex: Central and South consists predominately of an open tuart, jarrah and marri forest, commonly supporting *Banksia attenuata*, *Banksia menziesii*, *Banksia grandis* and *Allocasuarina fraseriana*. Shrubs include *Jacksonia sternbergiana*, *Jacksonia furcellata*, *Acacia Cyclops*, *Acacia saligna*, *Hibbertia* spp., *Allocasuarina humilis*, *Calothamnus quadrifidus* and *Grevillea preissii* subsp. p*reissii* (Mattiske 2013). In the deeper sands the tuart is replaced by jarrah, with marri on the moister areas.

2.5.3 Threatened and Priority Vegetation Communities

No State or Commonwealth listed Threatened Ecological Communities (TECs) have been identified as existing within the application area. Three Priority 3 Priority Ecological Communities (P3 PECs) were inferred by Mattiske (2013) to occur within the application area (Figure 2.6), being:

- SCP 24: 'Northern Spearwood shrublands and woodlands'
- SCP 29a: 'Coastal shrublands over shallow sands, southern Swan Coastal Plain'
- SCP 29b: 'Acacia shrublands on taller dunes, southern Swan Coastal Plain'.

DBCA categorises PECs according to their conservation priority, using five categories. The three P3 PECs identified on site are currently listed (DBCA 2019) as '*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'.*

SCP 24: 'Northern Spearwood shrublands and woodlands' is listed (within the approved conservation advice (Threatened Species Scientific Committee (TSSC 2016)) as a Floristic Community Type (FCT) with relationships to the EPBC Act listed 'Banksia Woodlands of the Swan Coastal Plain' threatened ecological community. However, vegetation within the Development does not contain any of the four diagnostic Banksia species, and therefore does not meet the criteria to be classified as the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) listed TEC.

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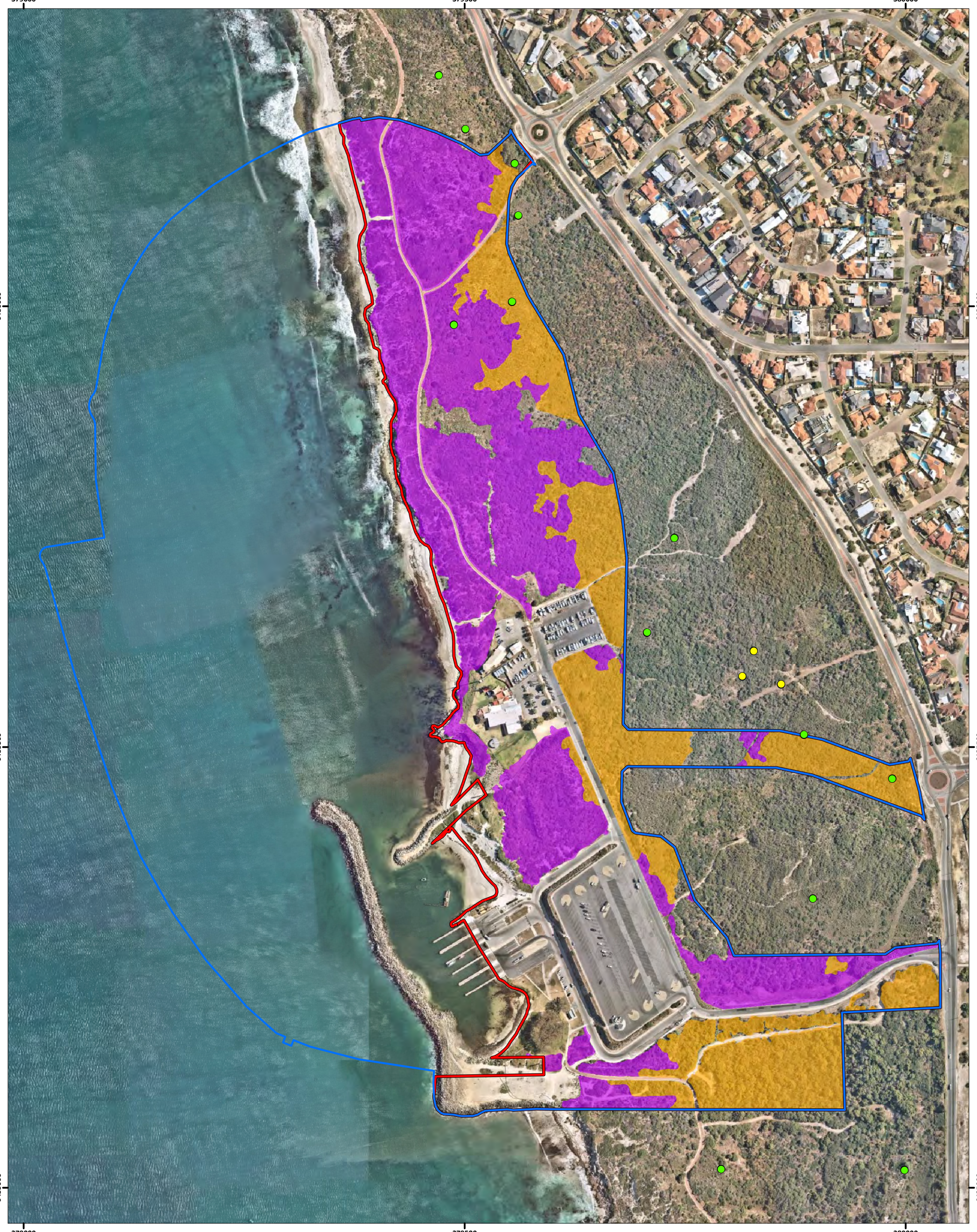

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Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary

Protected Ecological Communities

- SCP29a
- SCP29b

Conservation significant flora species

- *Grevillea* sp. Ocean Reef (D. Pike Joon 4) (P1)
- *Conostylis bracteata* (P3)

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0 100 metres

Ocean Reef Marina Development

PROTECTED ECOLOGICAL COMMUNITIES AND THREATENED AND PRIORITY FLORA

Job No: 57431		Scale 1:4,000 at A4	
Client: DevelopmentWA		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: hsullivan	Checked By: RD	Version: A	Date: 24-Jan-2020

FIGURE: 2-6

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Image Reference: www.nearmap.com© - Imagery Date: 19. October 2019.

2.5.4 Vegetation communities

A total of nine vegetation communities have been defined and mapped within the application area (Table 2.1, Figure 2.5).

Table 2.1: Vegetation types across the application area

Plant Community	Description	Area within application area (ha)
Heath		
H1	Low open scrubland to heath of *Acacia cyclops, Acacia rostellifera, Spyridium globulosum* and *Templetonia retusa* over *Scaevola crassifolia, Olearia axillaris, Myoporum insulare* and *Rhagodia baccata* subsp. *dioica* over *Acanthocarpus preissii, Threlkeldia diffusa, Senecio pinnatifolius* and *Frankenia pauciflora* over *Lepidosperma gladiatum, Spinifex longifolius, Sporobolus virginicus* and mixed exotics on white sands or light grey sands of fore-and primary dunes with frequent limestone outcropping.	7.94
H2	Open heath of *Melaleuca systena, Acanthocarpus preissii, Leucopogon insularis* and *Acacia lasiocarpa* var. *lasiocarpa* with emergent *Acacia rostellifera* and *Santalum acuminatum* over *Lomandra maritima, Conostylis bracteata* (P3), *Poa drummondii* and mixed exotics on grey sands of secondary dune slopes.	0.7
H3	Closed heath of *Acacia lasiocarpa* var. *lasiocarpa, Cryptandra mutila, Leucopogon insularis* and *Melaleuca systena* over *Comesperma confertum, Gompholobium tomentosum* and *Opercularia vaginata* over *Lepidosperma pubisquameum, Dianella revoluta* var. *divaricata* and mixed exotics on light grey sands of secondary dune slopes.	0.04
H4	Low open scrub to heath of *Acacia rostellifera, Spyridium globulosum* and *Acacia saligna* over *Melaleuca systena, Acanthocarpus preissii, Olearia axillaris, Phyllanthus calycinus* and mixed exotics on white to light grey sands of primary and secondary dune crests.	1.08
Shrublands and scrublands		
S1	Mid closed scrubland of *Acacia rostellifera* and *Melaleuca huegelii* with occasional emergent *Banksia sessilis* var. *cygnorum* over *Spyridium globulosum, Rhagodia baccata* subsp. *dioica* and *Hibbertia cuneiformis* over *Acanthocarpus preissii, Clematis linearifolia, Hardenbergia comptoniana* and mixed exotics on deep grey sands of primary and secondary dunes.	3.19
S2	Tall shrubland of *Banksia sessilis* var. *cygnorum, Spyridium globulosum, Santalum acuminatum* and *Acacia saligna* with occasional emergent *Eucalyptus todtiana* over *Rhagodia baccata* subsp. *dioica, Alyogyne huegelii* and *Trymalium odoratissimum* over *Conostylis bracteata* (P3), *Desmocladus asper, Lepidosperma pubisquameum* and mixed exotics on deep grey or brown sands of secondary dune swales.	0.79
S3	Tall shrubland of *Spyridium globulosum, Acacia rostellifera , Banksia sessilis* var. *cygnorum* and *Santalum acuminatum* over *Phyllanthus calycinus, Hibbertia hypericoides* and *Melaleuca systena* over *Clematis linearifolia, Austrostipa flavescens, Desmocladus flexuosus* and mixed exotics on light grey or brown sands of secondary dune swales.	1.90
S4	Mid to tall scrubland of *Acacia rostellifera, Spyridium globulosum, Templetonia retusa, Melaleuca huegelii* and *Melaleuca cardiophylla* over *Leucopogon parvifolius, Thomasia cognata, Acanthocarpus preissii, Phyllanthus calycinus* and mixed exotics on grey sands of secondary dunes with frequent limestone outcropping.	1.12
S5	Tall closed shrubland of *Acacia cochlearis, Acacia cyclops, Acacia rostellifera, Allocasuarina lehmanniana* subsp. *lehmanniana, Melaleuca huegelii* and *Templetonia retusa* over *Melaleuca systena, Scaevola crassifolia* and mixed exotics on grey sands of secondary dune swales with frequent limestone outcropping.	2.11
Woodland		
Tuart Woodlands	Low woodland of *Eucalyptus gomphocephala* over mixed native and introduced species.	0.08
Other		
DS	Degraded dune swale.	0.23
FR	Foredune rehabilitation.	0.31
CL	Cleared.	8.30

Adapted from: Mattiske (2013).

2.5.5 Vegetation condition

Vegetation condition was assessed as part of all recent flora and vegetation investigations. The most recent investigation by Mattiske (2013) covered the application area and areas to the east and south (Figure 2.7). Investigations undertaken by Mattiske (2013) have characterised vegetation condition in the vicinity of the Development as ranging from completely degraded (cleared) to excellent with the majority (45%) of the Development being in Good to Very Good condition based on the Keighery (1994) vegetation condition scale. Widespread and sustained weed invasions have resulted in high weed densities and have replaced native understory in many instances.

The vegetation condition was confirmed during the Spring 2019 site visit by Strategen-JBS&G.

The application area has been subject to disturbance from human activity which is evidenced through the presence of numerous tracks, the majority open to pedestrian and cycle traffic. A dual-use path runs from the north of the Development before re-starting at the southern end of the Development and continuing along the coast (Natural Area Management Services 2008).

2.5.6 Flora

A total of 137 vascular plant taxa which are representative of 105 plant genera and 43 plant families were recorded within the terrestrial component of the Development by Mattiske (2013). Of the 137 plant taxa recorded within the survey area, 49 species (36%) were introduced. The high percentage of introduced species is considered to reflect the fragmentation of the Development, historical clearing, dumping of refuse and its proximity to adjacent residential areas.

No Threatened flora species have been identified within the Development during surveys, including the most recent Spring survey undertaken by Mattiske (2013).

A flora survey by SMEC (2009) identified the Priority 3 *Hibbertia spicata* subs *leptotheca* (P3) within the Development.

Mattiske (2013) recorded two state listed Priority flora species (Figure 2.6):

- *Grevillea* sp. Ocean Reef (Priority 1[2]); and
- *Conostylis bracteata* (Priority 3[3]).

Grevillea sp. Ocean Reef is less well conserved and this is the only known population of the Ocean Reef species in the database of the Western Australian Herbarium. However, the mapped locations of *Grevillea* sp. Ocean Reef occur outside of the application area (Mattiske 2013).

Conostylis bracteata is present within the application area. This species is relatively common and the proposed clearing of 3.9 ha within the application area is unlikely to alter the conservation status of this species.

[2] Species that are considered by DBCA to be 'known from one or a few locations (generally five or less) which are potentially at risk'.

[3] Species that are considered by DBCA to be poorly known and ' known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat'.

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Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary
- Bush Forever site (DOP)

Vegetation condition

- EX
- VG-EX
- VG
- G
- D-G
- D
- CL

strategen JBS&G

0 100 metres

Ocean Reef Marina Development

VEGETATION CONDITION

Job No: 57431		Scale 1:4,000 at A3		
Client: DevelopmentWA		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: hsullivan	Checked By: RD	Version: A	Date: 24-Jan-2020	**FIGURE: 2-7**

Document Path: W:\Projects\1)Open\LandCorp\57431 Ocean Reef NVCP\GIS\Maps\R02 Rev A\57431_02_7_Vegetation_Condition.mxd

Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019.

2.6 Bush Forever

Until gazettal of MRS Amendment 1271/40 the land component of the Development was almost entirely within Bush Forever site 325 (BF 325) (including the existing boat harbour), except for the portion associated with the Water Corporation's ocean outfall from the Beenyup Waste Water treatment plant. BF 325 is a semi-contiguous north-south coastal strip of native vegetation between Burns Beach and Hillarys and covers approximately 195.3 ha. BF 325 represents a linkage between adjacent bushland to the east recognised as part of a regionally significant fragmented bushland/wetland linkage (Government of Western Australia 2000).

MRS amendment 1270/41 has removed the approximate 26 ha portion of the Development area (inclusive of the application area) from within BF 325 (Figure 2.5). As such, this proposal will not impact Bush Forever.

To mitigate impacts, DevelopmentWA committed to an NPO as part of the rezoning process, that resulted in an appropriate conservation outcome with consideration of SPP 2.8 and the public advice of the EPA regarding the MRS amendment. The NPO included the following components:

1. 90% land acquisition: 22.7 ha of coastal vegetation has been acquired.
2. 10% rehabilitation within BF 325: Rehabilitation of 5 ha of degraded vegetation within BF 325 to at least Very Good condition within five years will be undertaken in accordance with a Rehabilitation Plan.

A suitable offset site that achieves the site selection criteria outlined in the NPO was identified in consultation with EPA Services, Department of Biodiversity, Conservation and Attractions and Department of Planning and acquired by DevelopmentWA. The offset site achieved the following selection criteria:

- native vegetation in Very Good to Excellent condition
- within 10 km of the coast
- contains conservation significant species and communities of similar value and priority for protection
- contain vegetation communities as similar as practicable to the impacted site
- occur within the Perth subregion of the Swan Coastal Plain bioregion.
- an improved area to perimeter ratio than the impacted site
- is contiguous with an existing conservation area
- enhances biological corridors or ecological linkages between conservation areas.

The acquisition of a suitable offset site formed part of WAPCs consideration of the MRS Amendment, leading to its gazettal on 29 November 2019. Further information on the acquisition site is provided in Section 2.6.1.1.

Development WA is also committed to ensuring the rehabilitation component of the NPO is undertaken. A Rehabilitation Plan is being prepared to support rehabilitation of 5 ha of degraded vegetation adjacent to the Development area and is expected to be a requirement of subsequent planning approvals required to facilitate the Development.

The application area within which up to 3.9 ha of clearing will be required is wholly located outside of Bush Forever and has been mitigated through the acquisition of a suitable offset site.

2.6.1.1 Acquisition site

An offset site that achieves the requirements of the NPO has been secured, namely a portion of Lot 51 Walding Road, Carabooda (Carabooda property).

The property is located adjacent to Yanchep National Park, approximately 50 km north-northwest of Perth and approximately 20 km from the proposed Ocean Reef Marina. The entire property is approximately 53 ha in size and is currently zoned as 'Rural Resource' in the City of Wanneroo District Planning Scheme. An area of 22.7 ha on the western portion of this site (acquisition area) has been allocated to the Development to achieve the acquisition requirements of the approved NPO.

Topography, soils and landform

The topography of the property is influenced by the Spearwood dunes, undulating from a low of 14 AHD at the western and southern boundaries to a ridge in the western half ranging from 25m to 29m AHD which runs parallel to Walding Road. The highest elevation occurs in the north-eastern corner of the property with a high point of up to 31m AHD (ATA Environmental 2002).

The property is underlain by the Tamala Limestone formation, covered in places by sand from the Spearwood Dune System. The Tamala Limestone is exposed in places, particularly on the western ridge. The soils on the property are primarily shallow brown/grey sands overlaying yellow sands and limestone at variable depths (ATA Environmental 2002).

Vegetation

A vegetation assessment of Lot 51 was undertaken by ATA Environmental in May 2002. On a regional scale, the Carabooda property is mostly within the Cottesloe Complex: Central and South, with some representation of the Herdsman Complex (ATA Environmental 2002).

The site is dominated by Tuart (*Eucalyptus gomphocephala*) woodland to forest over mixed shrublands and heath, with some Jarrah (*Eucalyptus marginata*) and Banksia (*Banksia menziesii, B. attenuata*) woodland (ATA Environmental 2002). A total of nine vegetation communities were mapped on the site (Table 2.2). The vegetation of the study area corresponds most closely with Floristic Community Type (FCT) 25 (Northern Spearwood Shrublands and Woodlands) and Type 28 (Spearwood *Banksia attenuata* or Banksia – *Eucalyptus* Woodlands. In addition, small pockets of the study area comprising vegetation on the limestone ridges and outcrops was thought to correspond to FCT 26a (*Melaleuca huegelii – M. acerosa* Shrublands of limestone ridge).

Table 2.2: Vegetation types of Lot 51, Walding Road, Carabooda

Vegetation type	Area (ha)
Cleared	5.48
E.g.: Tuart (*Eucalyptus gomphocephala*) woodland over a degraded understorey of *Acacia saligna, Jacksonia furcellata* and *J. sternbergiana.*	3.26
EgAsDs: Upland area comprising a Tuart Open Woodland over an Open Heath to Open Scrub of *Acacia saligna, Dryandra sessilis, Calothamnus quadrifidus, Hakea prostrata, Spyridium globulosum* and occasional *Melaleuca huegelii.*	6.62
EgAsDsJfSg: Tuart Closed to Open Forest over a variable understorey comprising monospecific stands or an admixture of *Acacia saligna, Dryandra sessilis, Jacksonia furcellata, Spyridium globulosum.*	31.43
EgBmBa: Tuart Woodland over an Open Woodland of *Banksia menziesii* and *B. attenuata.*	1.31

Vegetation type	Area (ha)
EgDsMh: Upland areas and limestone ridges comprising a Tuart Open Forest over a Closed to Open Heath of *Dryandra sessilis* and *Melaleuca huegelii* with *Hakea trifurcata*, *Eremophila glabra, Xanthorrhoea preissii* and *Hibbertia hypericoides.*	2.65
EgEmBa: Tuart and Jarrah (Eucalyptus marginata) Woodland over Banksia attenuata and occasional *B. menziesii* over *Xanthorrhoea preissii* and *Hibbertia hypericoides.*	2.02
Gv: Closed heath of *Grevillea vestita.*	0.13
Jc: Low closed heath of *Jacksonia calcicola* and *Calothamnus quadrifidus.*	0.19
Mr: Degraded wetland area with scattered Paperbarks (*Melaleuca rhaphiophylla)* and regrowth Tuart.	0.25
TOTAL	53.38

Based on the vegetation mapping there is approximately 47.88 ha of remnant vegetation on Lot 51, the majority of which is in Very Good to Excellent condition (Table 2.3). Some cleared areas exist in the southeast corner of the site (5.48 ha).

Table 2.3: Vegetation condition of Lot 51, Walding Road, Carabooda

Vegetation condition	Area (ha)	Proportion
Degraded	4.48	9.36%
Good	2.85	5.95%
Very Good to Excellent	40.55	84.69%
TOTAL	53.38	100%

Ecological communities

The 2002 vegetation survey noted the inferred presence of FCT 24, FCT 28 and FCT 26a (ATA Environmental 2002). More recent information suggests FCT26a, may be FCT 26b due the presence of Tuart, which is not found in FCT 26a.

FCT 24 is recognised as PEC at State level. FCT 26b and FCT 28 are not listed as TEC or PECs.

Both FCT 24 and 28 are sub-communities of the Commonwealth listed TEC 'Banksia Woodlands of the Swan Coastal Plain'. *Banksia attenuata* and *Banksia menziesii* only occur in isolated patches on the site. Both species are in very low densities in the area considered potentially to be FCT 24 in the northern Tuart Mixed Heath. Therefore, small patches of the site may qualify as the TEC 'Banksia Woodlands of the Swan Coastal Plain'.

Tuart woodlands have also been nominated as a TEC at Commonwealth level. The nomination is currently being assessed with possible listing in 2018. The Tuart vegetation on the site is likely to meet the Tuart woodland TEC.

Flora

Additional values of the site include the potential presence of three Priority listed flora identified as potentially occurring by ATA Environmental (2002), which included *Acacia benthamii* P2, *Jacksonia sericea* P4 and *Sarcozona bicarinata* P3.

A NatureNap search and EPBC Protected Matters Search Tool (PMST) was also conducted for the site with a 2km buffer to identify other potentially occurring Priority or Threatened flora species (Attachment 1).

One priority species, *Stylidum maritimum* (P3) was identified as potentially occurring at the site (Parks and Wildlife 2007).

The EPBC PMST identified four Threatened species including *Diuris micrantha* (Vulnerable), *Drakaea elastica* (Endangered), *Eleocharis keigheryi* (Vulnerable) and *Lepidosperma rostratum* (Endangered) (DEE 2018) as potentially occurring in the area.

Fauna

NatureMap and EPBC PMST searches were undertaken (2km radial buffer) to identify whether any terrestrial vertebrate fauna species of conservation significance have the potential occur in the site. A total of 11 conservation significant fauna species (nine Threatened and two Priority listed) were identified from the database searches (Parks and Wildlife 2007, DEE 2018) (Table 2.4).

Table 2.4: Conservation significant fauna considered to potentially occur in the survey area

Species	Conservation Status (EPBC Act & WC Act)
Birds	
Australasian Bittern (*Botaurus poiciloptilus*)	Endangered
Australian Painted Snipe (*Rostratula australis*)	Endangered
Blue-billed Duck (*Oxyura australis*)	Priority 4
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	Endangered
Curlew Sandpiper (*Calidris ferruginea*)	Critically Endangered
Eastern Curlew (*Numenius madagascariensis*)	Critically Endangered
Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)	Vulnerable
Malleefowl (*Leipoa ocellata*)	Vulnerable
Red Knot (*Calidris canutus*)	Endangered
Mammals	
Chuditch, Western Quoll (*Dasyurus geoffroii*)	Vulnerable
Quenda, Southern Brown Bandicoot (*Isoodon fusciventer*)	Priority 4

Assessment against site selection criteria

An assessment of the site against the established NPO criteria is provided in Table 2.5.

Table 2.5: Site selection criteria assessment

Site selection criteria	Development area environmental values	Carabooda property environmental values	Outcome
Minimum of 22.7 ha of native vegetation in Very Good to Excellent condition	Vegetation condition of the Development area and surrounds was assessed as ranging from Completely Degraded (cleared) to Excellent with the majority of the survey area being in Good to Very Good condition.	22.7ha of the western portion of the site has been allocated to the Ocean Reef Marina development. Approximately 94% of the Western portion is in Very Good to Excellent Condition	**Achieves criteria**
Within 10 km of the coast	The Development area is located on the coast.	The property is located approximately 5.5 km from the coast.	**Achieves criteria**
Contain conservation significant species and communities of similar value and priority for protection	No Threatened flora species have been identified within the Development area during surveys. Two state listed Priority flora species have been recorded: Grevillea sp. Ocean Reef (Priority 1) and *Conostylis bracteata* (Priority 3). No Threatened Ecological Communities (TECs) have been identified as existing within the Development area. Three Priority 3 Ecological Communities (PECs) were inferred to occur: • Swan Coastal Plain (SCP) 24 – Northern Spearwood shrublands and woodlands • SCP 29a – Coastal shrublands on shallow sands, southern Swan Coastal Plain	The Carabooda property supports at least three Priority flora species. The site also supports the following listed floristic community types: FCT 24 Northern Spearwood shrublands and woodlands (State listed Priority 3 Priority Ecological Community). This is a sub community of Banksia woodlands of the Swan Coastal Plain TEC and may also meet criteria as a sub community of Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain, which is currently under assessment at Commonwealth level. FCT28 Spearwood *Banksia attenuata* or *Banksia attenuata* – Eucalyptus woodlands. Sub community of Banksia woodlands of the Swan Coastal Plain TEC, where areas meet the Approved Conservation Advice key diagnostic characteristics and condition thresholds.	**Achieves criteria** The Carabooda property has higher conservation value than the Development area

	• SCP 29b – Acacia shrublands on taller dunes, southern Swan Coastal Plain.	FCT26b Woodlands and mallees on limestone. May align with Priority 3 ecological community Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain, which is currently under assessment at Commonwealth level. Threatened Ecological Community - Aquatic Root Mat Community in Caves of the Swan Coastal Plain, which is listed as Critically Endangered at state level and Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).	
Contain vegetation communities as similar as practicable to the impacted site.	On a regional scale, vegetation of the Development area falls within the Quindalup Complex, with some influence from the Cottesloe Complex: Central and South. The vegetation types mapped included shrubland/scrubland and heath communities with a clear coastal mosaic of vegetation types, with occurrence primarily determined by dune type and position.	On a regional scale, the proposed offset is within Cottesloe Complex – Central and South and Herdsman Complex. The site is dominated by Tuart (*Eucalyptus gomphocephala*) woodland to forest over mixed shrublands and heath communities, with some Jarrah (*Eucalyptus marginata*) and Banksia (*Banksia menziesii, B. attenuata*) woodland. Overall, vegetation communities of the Proposal area are different to those mapped at Lot 51, although there is some overlap of species. The Western portion contains four vegetation types that share at least one species in common with vegetation types from Lot 51. Shared species include *Acacia saligna, Hibbertia hypericoides, Spyridium globulosum, Melaleuca huegelii* and *Banksia sessilis*.	Both sites support shrubland and heath type communities with an overlap of some species. Both sites also contain FCT 24. While the site does not fully support the same vegetation communities, it was determined to be *as similar as practicable* to the Development area. **The site is therefore assessed as meeting this criterion.**
Occur within the Perth subregion of the Swan Coastal Plain bioregion	The Development area is located within the Perth subregion of the Swan Coastal Plain bioregion	The Carabooda property is located within the Perth subregion of the Swan Coastal Plain bioregion	**Achieves criteria**
Have an improved area to perimeter ratio than the impacted site	The Development area is within the long linear remnant vegetation of BF 325 which is partially interrupted by roads and carparks. Thus, the Proposal area has a medium area to perimeter ratio.	The Western Portion of Lot 51 is a substantial remnant which is partially bounded by vegetation along its entire western boundary. Therefore, this area has been assessed as having a high area to perimeter ratio.	**Achieves criteria**
Contiguous with an existing conservation area	The Development area is within the long linear remnant vegetation of BF 325.	The acquisition site is east of and contiguous with Yanchep National Park	**Achieves criteria**
Enhance biological corridors or ecological linkages between conservation areas		The acquisition site is contiguous with Yanchep National Park, the addition of a portion of Lot 51 to the conservation estate will enlarge the National Park and thus enhance biological linkages within the region.	**Achieves criteria**

2.7 Fauna

A Level 1 fauna assessment was undertaken by Western Wildlife in 2008, including a desktop assessment and site survey. Based on available habitat, only four conservation significant species

were considered likely to occur in the Development: Carnaby's Black-Cockatoo, Rainbow Bee-eater, Black-Striped Snake and Quenda (Western Wildlife 2008).

Carnaby's Black-Cockatoo

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered under the Commonwealth EPBC Act and the State *Biodiversity Conservation Act 2016*. This species is endemic to the south-west of Western Australia, mainly occurring in uncleared remnant native eucalypt woodlands, especially those that contain Salmon gum and wandoo, and in shrubland or kwongan heathland dominated by *Hakea, Dryandra, Banksia* and *Grevillea* species (DSEWPaC 2012).

The application area does not contain any trees suitable for Carnaby's Black-Cockatoo nesting hollows. However, it does contain a number of flora species that may be used as food sources, primarily *Banksia sessilis*. Accordingly, it is expected that Carnaby's Black-Cockatoo will not reside in the application area but may visit the area to feed.

The application area includes an area of approximately 0.57 ha of suitable foraging habitat for Carnaby's Black-Cockatoo (Strategen 2016b, Figure 2.8). This potential habitat ranges in condition from Degraded to Very good.

The application area was referred under the EPBC Act and resulted in a "Not a Controlled Action" decision (4 July 2014).

Rainbow Bee-eater

The Rainbow Bee-eater (*Merops ornatus*) is listed as Marine under the EPBC Act and is afforded protection in marine areas. The Rainbow Bee-eater is a common summer visitor to Perth, where it breeds in sandy banks (Western Wildlife 2008). This species will forage and breed in relatively degraded areas and is likely to be a breeding visitor to the application area. Clearing of vegetation is unlikely to result in the loss of nesting sites. The Rainbow bee-eater is common with a broad distribution and populations of this species are unlikely to be significantly affected by the proposed clearing.

Black-striped Snake

The Black-striped Snake (*Neelaps calonotos*) is a DBCA State listed Priority 3 listed species restricted to coastal plains between Mandurah and Lancelin and as such is vulnerable to habitat loss, primarily resulting from urban development (Western Wildlife 2008). The Black-striped Snake is known to occur in Banksia and Eucalyptus woodlands, as well as sandy areas. The species has the potential to occur in within the application area as suitable habitat exists.

Quenda

The Quenda is known to occur in areas with dense understorey and is often particularly common in dense wetland vegetation (Western Wildlife 2008). The Quenda has been recorded in proximity to the Development as identified in the Parks and Wildlife Threatened and Priority Fauna database (Western Wildlife 2008). Characteristic diggings of the species were not observed within the application area; however, Quenda may occur. The proposed clearing therefore has the potential to result in loss of some habitat (Western Wildlife 2008).

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Legend:

- Proposed clearing footprint (28.52 ha)
- Concept plan boundary
- Potential Carnaby's Black Cockatoo habitat

strategen JBS&G

0 100 metres

Ocean Reef Marina Development

POTENTIAL CARNABY'S BLACK-COCKATOO HABITAT

Job No: 57431		Scale 1:4,000 at A4		
Client: DevelopmentWA		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: hsullivan	Checked By: RD	Version: A	Date: 24-Jan-2020	**FIGURE: 2-8**

Document Path: W:\Projects\1)Open\LandCorp\57431 Ocean Reef NVCP\GIS\Maps\R02 Rev A\57431_02_8_PotlBCHabitat.mxd

Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019.

2.8 Social environment

2.8.1 Indigenous heritage

The Development has been subject to five Aboriginal heritage surveys, which did not identify any registered sites within the application area.

The closest registered Aboriginal site is located approximately 1 km south of the Development (Aboriginal Site ID 3673 containing artefacts/scatter) and will not be impacted by the proposed clearing.

There are currently no known Aboriginal sites or historical heritage sites within the Development (Archaeological and Heritage Management Solutions (AHMS 2015)). The potential for sub-surface Aboriginal or historical archaeological sites is generally low (AHMS 2015).

Table 2.6: Aboriginal heritage surveys incorporating the Development

Survey date	Survey title	Survey conducted by	Survey purpose
1 April 1970	An Archaeological survey project: the Perth Area, Western Australia	University of Western Australia	Archaeological and Ethnographic
1 January 1994	Ballaruk Aboriginal site recording project	Heritage Council of Western Australia	Ethnographic
1 July 1997	Cultural Significance of Aboriginal sites in the Wanneroo area – Final report	Australian Heritage Commission and Heritage Council of Western Australia	Ethnographic
17 June 2005	Study of Groundwater – related Aboriginal Cultural Values on the Gnangara Mound, Western Australia	Department of Environment	Ethnographic
20-21 January 2015	Ocean Reef Marina: Indigenous and European Heritage Investigation	Archaeological and Heritage Management Services	Historical and Indigenous archaeological, anthropological

2.8.2 European heritage

There are no historical heritage places within the Development currently included on the State Heritage Register (AHMS 2015).

A potential *Vergulde Draeck* inscription is located on the site (AHMS 2015). The *Vergulde Draeck* inscription is a rock engraving located on the beach foredune in the northern portion of the Development, which originally bore the words “VERGULDE DRAECK 1656” and was purportedly left behind by shipwrecked Dutch sailors (AHMS 2015). The inscription is considered to be a hoax but is included on the WA Maritime Museum Shipwrecks database and on the State Heritage Office inHerit database (AHMS 2015).

The proposed clearing will not impact on this site.

3. Assessment against the ten clearing principles

The following table presents an assessment against the ten clearing principles as set out in the EP Act.

Table 3.1: Assessment against ten clearing principles

Principle	Assessment	Conclusion
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity	Clearing of native vegetation to enable completion of the geotechnical investigation will result in the removal of approximately 3.9 ha of native vegetation (or approximately 20% of the total area of native vegetation to be cleared within the application area). The clearing is will not impact threatened flora *Conostylis bracteata* is present within the application area however this species is relatively common and the proposed clearing is unlikely to alter the conservation status of this species. Test pit locations will avoid this species where possible. No State or Commonwealth listed TECs occur within the application area. Three P3 PECs were inferred by Mattiske (2013) to occur within the application area, being: • SCP 24: 'Northern Spearwood shrublands and woodlands'; • SCP 29a: 'Coastal shrublands over shallow sands, southern Swan Coastal Plain'; and • SCP 29b: 'Acacia shrublands on taller dunes, southern Swan Coastal Plain'. For the purpose of MRS amendment 1270/41, a NPO has been developed that comprises the acquisition of land into the conservation estate and rehabilitation of 5 ha of degraded vegetation within BF 325, adjacent to the Ocean Reef Marina Development area. The NPO was developed in accordance with State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region (SPP 2.8). A suitable offset site that achieves the site selection criteria outlined in the NPO has been identified and acquired. DevelopmentWA is also committed to ensuring the rehabilitation component of the NPO is undertaken. A Rehabilitation Plan is being prepared and will be submitted as part of the subdivision application process. The clearing does not occur in an area representative of an area of high biodiversity, or that has a higher diversity than other examples of the vegetation in the region. The clearing required as part of the Development has already been offset through the NPO.	The proposed clearing is unlikely be at variance with this principle
(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	Clearing to enable completion of the geotechnical investigation will result in the removal of approximately 3.9 ha of native vegetation. The application area includes approximately 0.57 ha quality Black Cockatoo foraging habitat. The application area does not contain any trees suitable for Carnaby's Black-Cockatoo nesting hollows.	The proposed clearing is unlikely to be at variance with this principle

Principle	Assessment	Conclusion
	However, it does contain a number of flora species that may be used as food sources, primarily *Banksia sessilis*. Accordingly, it is expected that Carnaby's Black-Cockatoo will not reside in the application area but may visit the area to feed. The area subject to the MRS amendment was referred under the EPBC Act and resulted in a "Not a Controlled Action" decision (4 July 2014). Significant extents of Black Cockatoo habitat occur locally and regionally and clearing within the application area represents < 1% of the foraging habitat available. Significant habitat will not be cleared within the application area. The geotechnical investigation will result in clearing of 3.9 ha of potential Black-striped Snake and Quenda habitat, both of which are P3 species, with substantial areas of habitat in the remainder of BF site 325 and nearby conservation areas. The remaining portion of BF site 325 is approximately 169 ha. Total clearing amounts to 3.9 ha of native vegetation which is unlikely to impact biological diversity in the local area. For the purpose of MRS amendment 1270/41, a NPO has been developed that comprises the acquisition of land into the conservation estate and rehabilitation of 5 ha of degraded vegetation within BF 325, adjacent to the Ocean Reef Marina Development area. The NPO was developed in accordance with State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region (SPP 2.8). A suitable offset site that achieves the site selection criteria outlined in the NPO has been identified and acquired. DevelopmentWA is also committed to ensuring the rehabilitation component of the NPO is undertaken. A Rehabilitation Plan is being prepared and will be submitted as part of the subdivision application process. The proposed clearing footprint 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. Furthermore, the clearing required as part of the Development been offset through the NPO as part of the MRS amendment to enable the Development.	
(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora	A total of 137 vascular plant taxa which are representative of 105 plant genera and 43 plant families were recorded within the area surveyed by Mattiske (2013). Of the 137 plant taxa recorded within the survey area, 49 species (36%) were introduced. The high percentage of introduced species is considered to reflect the fragmentation of the application area, historical clearing and dumping of refuse, as well as proximity to residential areas. No Threatened flora species have been identified within the application area during surveys, including the most recent spring survey undertaken by Mattiske (2013). Mattiske (2013) recorded two state listed Priority flora species within the area surveyed:	The proposed clearing is not at variance with this principle

Principle	Assessment	Conclusion
	• *Grevillea* sp. Ocean Reef (Priority 1[4]) • *Conostylis bracteata* (Priority 3[5]). *Grevillea* sp. Ocean Reef is less well conserved and this is the only known population of the Ocean Reef species in the database of the Western Australian Herbarium. However, the mapped locations of *Grevillea* sp. Ocean Reef occur outside of the application area (Mattiske 2013). *Conostylis bracteata* is present within the application area however this species is relatively common and the proposed clearing is unlikely to alter the conservation status of this species. Test pit locations will avoid this species where possible. Clearing for the geotechnical investigation will be guided by an Construction Management Plan which will include the following measures: • clear demarcation of investigation locations (inclusive of test pit, spoil stockpiles and access tracks) • where possible existing tracks will be used to access the investigation sites • vegetation will not be cleared along access tracks; however, it may be disturbed by the tracked excavator during moves between test pit locations • seed and hygiene controls for equipment and personnel • accurate and well-maintained clearing records during and post clearing • cleared vegetation will be placed across cleared areas on completion of the site works.	
(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	Clearing to enable completion of the geotechnical investigation will result in the removal of approximately 3.9 ha of native vegetation. No State listed TECs have been identified as existing within the application area. Three P3 PECs were inferred by Mattiske (2013) to occur within the application area, being: • SCP 24: 'Northern Spearwood shrublands and woodlands' • SCP 29a: 'Coastal shrublands over shallow sands, southern Swan Coastal Plain' • SCP 29b: 'Acacia shrublands on taller dunes, southern Swan Coastal Plain'. DBCA categorises PECs according to their conservation priority, using five categories. The three P3 PECs identified on site are currently listed (DBCA 2019) as '*communities that are known from*	The proposed clearing is unlikely to be at variance with this principle

[4] Species that are considered by DBCA to be 'known from one or a few locations (generally five or less) which are potentially at risk'.
[5] Species that are considered by DBCA to be poorly known and ' known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat'.

<table>
<tr><th>Principle</th><th>Assessment</th><th>Conclusion</th></tr>
<tr><td></td><td>several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation'.

SCP 24: 'Northern Spearwood shrublands and woodlands' is listed (within the approved conservation advice (TSSC 2016)) as a Floristic Community Type (FCT) with relationships to the EPBC Act listed 'Banksia Woodlands of the Swan Coastal Plain' threatened ecological community. However, vegetation within the application area and specifically the clearing footprint for the geotechnical investigation does not contain any of the four diagnostic Banksia species. It therefore does not meet the criteria to be classified as the EPBC Act listed TEC.

Total clearing amounts to 3.9 ha of native vegetation which is unlikely to impact biological diversity across the application area or at a local or regional scale.</td><td></td></tr>
<tr><td>(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</td><td>The application area comprises two pre-European vegetation associations: Guilderton_1007 and to a lesser extent Guilderton_129.

It is estimated that the clearing footprint for the geotechnical investigation is approximately 20% of the total clearing footprint for the application area as a whole. This equates to approximately 3.9 ha within a larger area of some 19.53 ha of native vegetation. The following table summarises the extent of remaining of these vegetation associations.

<table>
<tr><th>Characteristic</th><th>Guilderton_129 (ha)</th><th>Guilderton_1007 (ha)</th></tr>
<tr><td>Total pre-1750 extent</td><td>9074.45</td><td>25375.49</td></tr>
<tr><td>Total current extent</td><td>8718.40</td><td>18129.90</td></tr>
<tr><td>% of Total pre-1750 extent remaining</td><td>96%</td><td>71.5%</td></tr>
</table>

The application area lies within a constrained area of the Swan Coastal Plain however, the vegetation complexes will be retained at well above the 10% threshold.

Clearing will occur within a large contiguous remnant patch of vegetation. Clearing 3.9 ha within the application area does not represent a significant impact to native vegetation at the site and in the adjacent BF 325.</td><td>The proposed clearing is unlikely to be at variance with this principle</td></tr>
<tr><td>(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland</td><td>The Development comprises sandy calcareous soils (Safety Bay Sands) locally overlying variably cemented limestone of the Tamala Formation (Golders 2015, Strategen 2015a). Vegetation and flora surveys within the application area between 2000 and 2013 have not identified any</td><td>The proposed clearing is at not at variance with this principle</td></tr>
</table>

Principle	Assessment	Conclusion
	watercourses or wetlands that may be impacted by the proposed geotechnical investigations and associated clearing.	
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	Clearing of native vegetation to enable completion of the geotechnical investigation will result in the removal of approximately 3.9 ha of native vegetation. This equates to approximately 20% of native vegetation (19.53 ha) within the application area. The application area is located in an area underlain by highly permeable sandy calcareous soils locally overlying variably cemented limestone with some voids (karsts). Infiltration of rainwater and stormwater in this area is typically very effective and efficient with little or no evidence of flooding (and erosion). Where possible the investigation works will be undertaken in areas of existing disturbance to further reduce the area of native vegetation to be cleared. To minimise erosion and land degradation, access tracks between test pit locations will not be cleared of vegetation being disturbed by the tracked excavator. Cleared vegetation will be placed back across cleared areas on completion of the geotechnical investigation to minimise erosion and prevent unauthorised and un-necessary access. Given its extent and purpose, the proposed clearing footprint is unlikely to give rise to soil erosion, salinity, nutrient export, acidification, waterlogging or flooding.	The proposed clearing is unlikely to be at variance with this principle
(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	BF 325 comprises an area of approximately 195.3 ha. MRS Amendment (MRS 1270/41) has formally removed 26 ha (the Development area) from BF 325. The remaining portion of BF site 325 is approximately 169.3 ha. Environmental values within the remaining portion of BF 325 are unlikely to be significantly impacted as a result of clearing activities that will be completed to the east of the BF 325. In addition, the impact on BF 325 will be minimised by implementation of an Environmental Management Plan which will include the following measures: • clear demarcation of investigation locations (inclusive of test pit, spoil stockpiles and access tracks) • where possible existing tracks will be used to access the investigation sites • vegetation will not be cleared along access tracks; however, it may be disturbed by the tracked excavator during moves between test pit locations • seed and hygiene controls for equipment and personnel • accurate and well-maintained clearing records during and post clearing • cleared vegetation will be placed across cleared areas on completion of the site works. Where possible test pits will be located in areas that have been previously disturbed or cleared.	The proposed clearing is unlikely to be at variance with this principle

Principle	Assessment	Conclusion
	Access tracks between test pit locations will not be cleared with vegetation being trampled by the tracked excavator. Cleared vegetation will be placed back across cleared areas on completion of the geotechnical investigation to minimise erosion and prevent un-necessary access.	
(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 application area is located in an area underlain by highly permeable sandy calcareous soils locally overlying variably cemented limestone with some voids (karsts). Infiltration of rainwater and stormwater in this area is typically very effective and efficient with little or no evidence of flooding (and erosion). Clearing within the application area is not expected to result in sediment or nutrient impacts to wetlands, soil acidity, or increased salinity. Clearing of 3.9 ha of vegetation is not expected to substantially affect hydrological processes that could affect groundwater quality (i.e. salinity or acidity) within the application area. To mitigate the potential for indirect impacts, measures will be adopted to minimise and mitigate the risk of erosion, sediment runoff (to the adjacent marine environment) and associated impacts to surface waters. These include: • clear demarcation of investigation locations (inclusive of test pit, spoil stockpiles and access tracks) • where possible existing tracks will be used to access the investigation sites • vegetation will not be cleared along access tracks; however, it may be disturbed by the tracked excavator during moves between test pit locations • seed and hygiene controls for equipment and personnel • accurate and well-maintained clearing records during and post clearing • cleared vegetation will be placed across cleared areas on completion of the site works.	The proposed clearing is not at variance with this principle
(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	The application area is located in an area underlain by highly permeable sandy calcareous soils locally overlying variably cemented limestone with some voids (karsts). Infiltration of rainwater and stormwater in this area is typically very effective and efficient with little or no evidence of flooding (and erosion). The clearing for the geotechnical investigation will occur on a grid and locally impact approximately 20% of the uncleared native vegetation within the Development. Where possible the (uncleared) access tracks will be formed along the contours and not downslope to minimise the occurrence and impacts of overload flow following a rainfall event and associated erosion. The investigation works will be undertaken in areas of existing disturbance to further reduce the area of native vegetation to be cleared to the extent possible. Cleared vegetation will be placed back across cleared areas on completion of the geotechnical investigation to minimise erosion and prevent unauthorised and un-necessary access.	The proposed clearing is not at variance with this principle

4. Conclusion

DevelopmentWA proposes to develop the Ocean Reef Marina as a world class recreational, residential, boating and tourist development. The Local Preferred Concept Plan boundary encloses an area of 61 ha, including land and sea at Ocean Reef, Western Australia. The terrestrial portion of the Concept Plan has an area of approximately 42 ha (the Development area). To facilitate the engineering design of the Development a geotechnical investigation is to be carried out across the Development to determine the presence, location and nature of any karst features with in the Tamala limestone that underlies the Development area. Clearing and/or disturbance of up to 3.9 ha of native vegetation within an application area of 30.5 ha is required to facilitate these investigations (or 20% of the 19.53 ha of native vegetation across the application area).

Until gazettal of MRS Amendment 1271/40 the land component of the Proposal area was almost entirely within Bush Forever site 325 (BF 325) (including the existing boat harbour), except for the portion associated with the Water Corporation's ocean outfall from the Beenyup Waste Water treatment plant.

For the purpose of MRS amendment 1270/41, a NPO was developed that comprises the acquisition of land into the conservation estate and rehabilitation of 5 ha of degraded vegetation within BF 325, adjacent to the Ocean Reef Marina Development area. The NPO was developed in accordance with State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region (SPP 2.8). A suitable offset site that achieves the site selection criteria outlined in the NPO has been identified and acquired. DevelopmentWA is also committed to ensuring the rehabilitation component of the NPO is undertaken. A Rehabilitation Plan is being prepared and will be submitted as part of the subdivision application process. The clearing required as part of the Development has therefore been offset through the NPO.

In addition, the following measures are proposed to reduce, minimise and mitigate the impacts.

- clear demarcation of investigation locations (inclusive of test pit, spoil stockpiles and access tracks
- seed and hygiene controls for equipment and personnel
- accurate and well-maintained clearing records during and post clearing
- cleared vegetation will be placed across cleared areas on completion of the site works.

The findings of the assessment against the ten clearing principles are presented in Table 4.1 below.

Table 4.1: Summary of Clearing Assessment

Clearing Principle	Finding
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity	The proposed clearing is unlikely be at variance with this principle
(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 is unlikely be at variance with this principle
(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora	The proposed clearing is not at variance with this principle
(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community	The proposed clearing is unlikely be at variance with this principle
(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	The proposed clearing is unlikely be at variance with this principle
(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 is not at variance with this principle

Clearing Principle	Finding
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	The proposed clearing is unlikely be at variance with this principle
(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	The proposed clearing is unlikely be at variance with this principle
(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 proposed clearing is not at variance with this principle
(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	The proposed clearing is unlikely be at variance with this principle

5. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. 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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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-JBS&G 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.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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