



Smiths Beach Project Targeted Orchid Survey Report

Smiths 2014 Pty Ltd

148384 | 59550

21 April 2023



We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.



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Abbreviations

Term	Definition
°C	Degrees Celsius
BC Act	Biodiversity Conservation Act 2016
cm	centimetres
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environment and Conservation
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GPS	Global Positioning System
ha	hectares
km	kilometres
m	metres
mm	millimetres
P	Priority flora
T	Threatened flora
WAH	Western Australian Herbarium
WANOSCG	Western Australian Native Orchid Study and Conservation Group

Executive Summary

Smiths 2014 Pty Ltd proposes to develop Lot 4131 Smiths Beach Road, Yallingup to deliver a sensitively designed coastal tourism village (the Proposal). The Proposal is located within the City of Busselton, Western Australia, approximately 31 kilometres (km) west of Busselton and covers an area of 40.53 hectares (ha). JBS&G were engaged to provide support for the environmental impact assessment process and to prepare the referral supporting documentation.

The WA Environmental Protection Authority (EPA) has determined that the Proposal will be assessed at the level of 'Public Environmental Review', under Part IV of the WA Environmental Protection Act 1986 (EP Act). The then-Commonwealth Department of Agriculture, Water and Environment (now Department of Climate Change, Energy, the Environment and Water [DCCEEW]) has determined that the Proposal is a 'controlled action' under the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) (referral 2021/9141). Consideration of the potential impact to listed threatened species contributed to both determinations.

A flora and vegetation survey of the proposal's development footprint (hereafter: Survey Area) was undertaken by Emerge Associates in 2018, with a reconnaissance survey in August and a detailed survey in late November: no threatened flora and one priority species were recorded. While the timing of that survey was appropriate for detecting most species, the detailed survey is considered to have potentially been too late to allow detection of some conservation-significant orchid species that finish flowering in September or October. Consequently, a targeted survey for threatened orchid species during their optimal flowering period was undertaken, and is reported here.

A comprehensive ground survey of the Survey Area was performed in accordance with published State and Commonwealth guidelines by two experienced personnel on 22-24 September 2022. The entire Survey Area was searched on foot with all vegetation types systematically traversed in slow parallel transects five to ten metres apart. The survey targeted nine threatened orchid species and two priority-listed orchid species. Of these, four threatened and one priority species were previously determined as having a likelihood of occurrence in the Survey Area of "possible" (Emerge Associates 2019) and the rest were either classified as "unlikely" to occur, or were not considered in the previous report.

No threatened orchid taxa were observed during the survey, although apparent suitable vegetation, soil and geology is present. One Priority listed taxon, *Caladenia nivalis* P2, was recorded (a total of 18 plants from 10 point locations).

Annual rainfall and monthly rainfall totals preceding the survey and the timing of the survey were considered suitable to support the presence of flowering plants of the targeted orchid species had they occurred in the Survey Area. Given the thorough search effort, the suitable seasonal conditions and the fact that no threatened orchid species were recorded, it is considered unlikely that any threatened orchids occur in the Survey Area. Consequently, the Proposal is unlikely to pose a risk to any threatened orchid taxa. Furthermore, the Proposal is unlikely to pose a risk to the population of *Caladenia nivalis* P2 identified during the survey as all observed individuals of this species within the Survey Area are located in the area proposed for addition to the Leeuwin-Naturaliste National Park.

1. Introduction

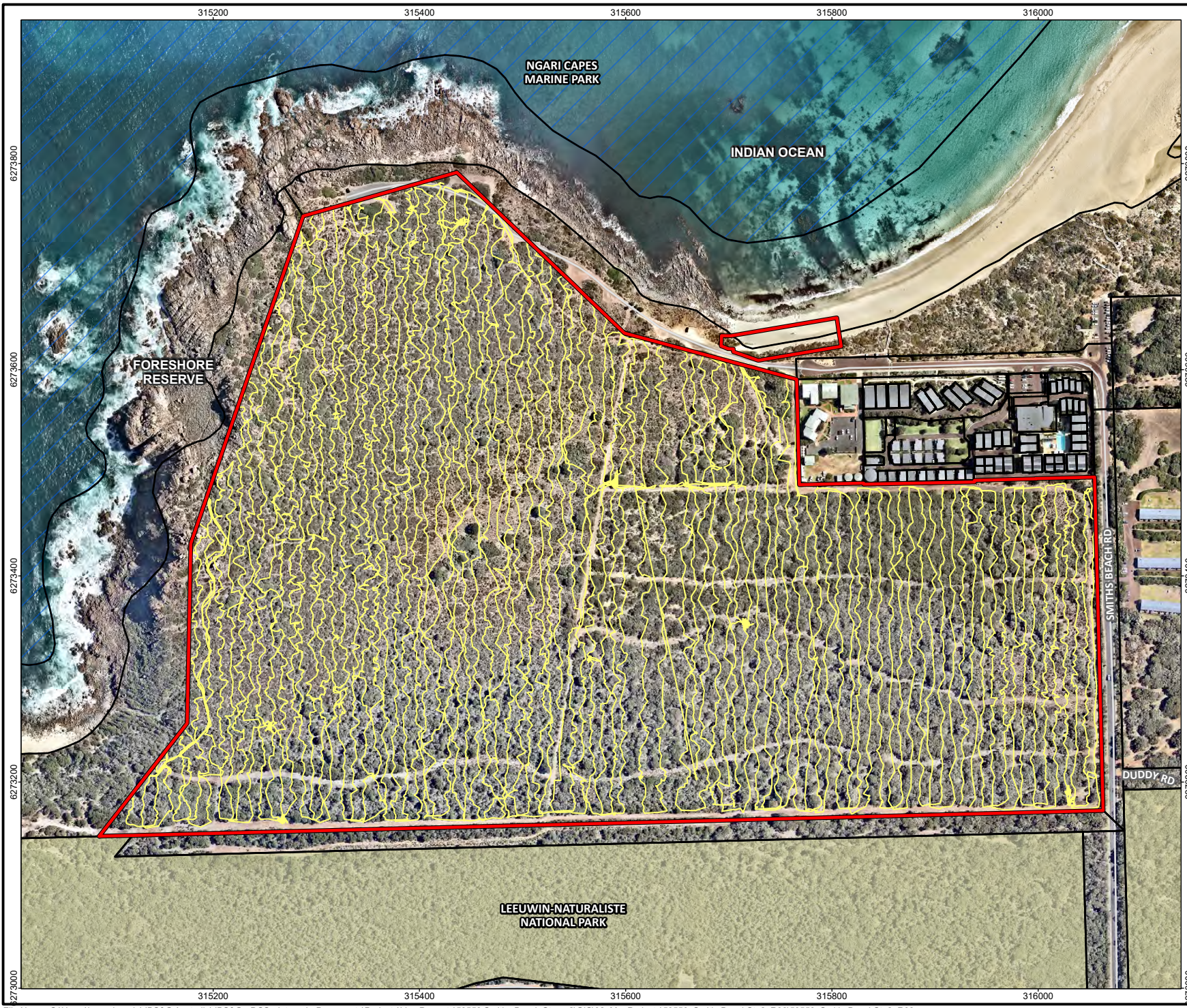
1.1 Background

Smiths 2014 Pty Ltd (the Proponent) proposes to develop Lot 4131 Smiths Beach Road, Yallingup to establish a sensitively-designed coastal tourism village (the Proposal). The Proposal is located within the City of Busselton, Western Australia, approximately 31 kilometres (km) west of Busselton and covers an area of 40.53 hectares (ha). The proposal area is bound by Smiths Beach Road to the east, freehold land with short-stay accommodation to the north-east, foreshore reserves and beyond them the Indian Ocean to the north and west, and the Leeuwin Naturaliste National Park to the south (Figure 1); the proposed areas for clearing and vegetation modification within the development envelope are shown in Figure 2. JBS&G were engaged by the Proponent to provide support for the environmental impact assessment process and to prepare the referral supporting documentation.

The Proposal is presently being assessed by the Environmental Protection Authority under Part IV of the Environmental Protection Act 1986 (EP Act) as a Public Environmental Review with a proponent-prepared Environmental Scoping Document (ESD). The proposal is also being assessed by the Department of Climate Change, Energy, the Environment and Water as a controlled action under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) as it impacts matters of national environmental significance. The Proposal is being assessed as an accredited bilateral assessment, with the relevant controlling provisions being 'Listed threatened species and ecological communities (section 18 and 18A of the EPBC Act)'.

A flora and vegetation survey of the Survey Area was undertaken by Emerge Associates in late November 2018 with no threatened flora recorded, one Priority 4 species recorded (*Banksia sessilis* var. *cordata*), and two State-listed priority ecological communities recorded ('low shrublands on acidic grey-brown sands' and '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge'). However, the timing of the survey was identified as a limitation, stated as being later than ideal to allow for the detection of some orchid species that finish flowering in September or October, including the threatened species *Caladenia caesarea* subsp. *maritima* and *C. excelsa* (Emerge Associates 2019).

To support the environmental impact assessment a targeted survey of the Survey Area for threatened orchid species was undertaken.



- Legend**
- Development envelope
 - Cadastral boundary
 - Legislated lands and waters (DBCA - 011)
 - Marine Park
 - National Park
 - Survey transects
 - Minor road



Job No: 59550
 Client: Smiths 2014 Pty Ltd
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Scale 1:5,000 at A4

Coord. Sys. GDA2020 MGA Zone 50

**Lot 4131 Smiths Beach Road
 Yallingup, WA**

**DEVELOPMENT ENVELOPE AND
 SURVEY EFFORT**

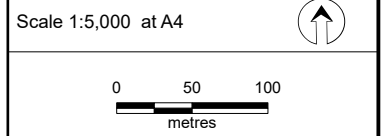
FIGURE 1



- Legend**
- Development envelope
 - Proposed full clearing
 - Proposed modified areas
 - Universal access ramp
 - Cadastral boundary
 - Conservation significant Orchids
 - *Caladenia nivalis*
 - Minor road



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 Client: Smiths 2014 Pty Ltd
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Coord. Sys. GDA2020 MGA Zone 50

**Lot 4131 Smiths Beach Road
 Yallingup, WA**

**PROPOSAL COMPONENTS AND
 CONSERVATION-SIGNIFICANT ORCHID
 LOCATIONS**

FIGURE 2

1.2 Objective

The objective of the survey was to ascertain the presence or otherwise of threatened or priority-listed orchid species within the Survey Area. To maximise the chances of observing any of the targeted species present, an intensive targeted ground survey was conducted during early spring: the ideal flowering time for all of the relevant species.

1.3 Species targeted

An overview of the species targeted in this survey is presented in Table 1. They are further detailed below.

Table 1 Species targeted in the survey

Species name	Common name	State listing	Federal listing	Habitat	Flowering period	Likelihood of occurrence based on Emerge 2019 desktop assessment
Threatened species						
<i>Caladenia busselliana</i>	Bussell's Spider Orchid	CR	EN	Sandy loam and winter-wet swamps.	Sep-Oct	Unlikely
<i>Caladenia caesarea</i> subsp. <i>maritima</i>	Cape Spider-orchid	CR	EN	Loam, granite and rock outcrops.	Aug-Sep	Possible
<i>Caladenia huegelii</i>	Grand Spider Orchid	CR	EN	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-Oct	Possible
<i>Caladenia procera</i> Hopper & A.P.Br.	Carbunup King Spider Orchid	CR	CR	Jarrah, Marri and Peppermint woodland on alluvial sandy-clay loam flats with <i>Anigozanthos manglesii</i> .	Sep-Oct	(not considered)
<i>Caladenia viridescens</i>	Dunsborough Spider-orchid	CR	EN	Well-drained, lateritic sandy loam soils in marri (<i>Eucalyptus calophylla</i>) and peppermint (<i>Agonis flexuosa</i>) woodlands or coastal heath over a range of only 12 linear kilometres in the Dunsborough area.	mid-Sept to late Oct	Possible
<i>Drakaea elastica</i>	Glossy-leaved Hammer Orchid	CR	EN	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter wet swamps.	late Sept to late Oct	Unlikely
<i>Thelymitra variegata</i> (Lindl.) F.Muell.	Queen of Sheba	CR	-	Sandy soils in Banksia and Jarrah woodland.	Aug - Sept	(not considered)
<i>Caladenia excelsa</i> Hopper & A.P.Br.	Giant Spider Orchid	EN	EN	hilltops, slopes, swales and low plains in deep pale yellow, white or grey sandy soils; found among dense low shrubs in Banksia, Jarrah	Late Sept to Nov	Possible

Species name	Common name	State listing	Federal listing	Habitat	Flowering period	Likelihood of occurrence based on Emerge 2019 desktop assessment
				and Marri woodlands (DEWHA 2008).		
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	EN	VU	Occurs in infertile grey sands, in Banksia, Jarrah and Common Sheoak woodland or forest, usually found in cleared fire breaks or open sandy patches that have been disturbed.	late Sept to late Oct	Unlikely
Priority species						
<i>Caladenia nivalis</i>	Crystalline Spider Orchid	P2	-	Coastal granite outcrops between Cape Naturaliste and Moses Rock	Sep-Oct	Possible
<i>Caladenia speciosa</i> <i>Hopper & A.P.Br.</i>	Sandplain White Spider Orchid	P4	-	Banksia woodland with scattered Jarrah.	Sep-Oct	(not considered)

Threatened species

Caladenia busselliana CR (Bussell's Spider Orchid)

Caladenia busselliana is ranked critically endangered under the Western Australian Biodiversity Conservation Act 2016 (BC Act), and endangered under the EPBC Act (DBCA 2022). *C. busselliana* grows to 20-30 cm high, with a single pale green hairy leaf measuring 10-20 cm in length and 0.5-1 cm wide, and having irregular red-purple blotches on the basal third (Hopper and Brown 2001). The pale yellow flowers possess a pale labellum (rather than maroon) with red calli and maroon fringe. Flowers are typically 6-10 cm in length and 5-8 cm wide (without an odour), appearing from September to October (Hopper and Brown 2001; Hoffman et al. 2019) with the peak occurring between mid-September and late October. The habitat of *C. busselliana* comprises Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*) woodland often on the margins of winter wet swamps (Commonwealth of Australia 2013); associated species include *Anigozanthos viridis*, *Caladenia paludosa* and occasionally *C. viridescens* (DEC 2008b).

Caladenia caesarea subsp. *maritima* CR (Cape Spider Orchid)

Caladenia caesarea subsp. *maritima* is ranked critically endangered under the BC Act, and endangered under the EPBC Act. *C. caesarea* subsp. *maritima* grows to 15-20 cm high, with a pale green leaf 6-9 cm long and 0.2-0.4 cm wide and the basal third usually with irregular red-purple blotches. The flowers are yellow and brown, measuring 5-6 cm in length and 4-5 cm wide, with a long narrow labellum featuring prominent brown stripes (Hopper and Brown 2001; Hoffman et al. 2019); flowers possess a faint floral odour reminiscent of burning metal (Hopper and Brown 2001). Plants usually occur in clumps in shallow pockets of red-brown sandy loam amongst granite outcropping near the coast, or very occasionally under dense thickets of *Calothamnus graniticus* in deeper soils surrounding the granite outcrops. Associated species include *Calothamnus graniticus*, *Hakea trifurcata*, *Darwinia citriodora*, *Gastrolobium spinosum* and *Acacia pulchella*. A single outlying population further north near Ludlow is known from Tuart forest where plants grow in an open herbaceous understorey. Flowering takes place between mid-August and September (DEC 2010; Hopper and

Brown 2001), with the peak flowering period being August to early September (Commonwealth of Australia 2013).

***Caladenia huegelii* CR (Grand Spider Orchid)**

Caladenia huegelii is ranked critically endangered under the BC Act, and endangered under the EPBC Act (DBCA 2022). *C. huegelii* grows to 25–60 cm in height and has a single pale green, hairy leaf with the basal third usually irregularly blotched with red-purple, measuring 10–18 cm in length and 0.7–1.2 cm wide. The flowers are pale greenish-cream with suffusions, lines and spots of red-maroon varying in intensity; the sepals ending in slender light brown to yellow clubs. Characteristic of *C. huegelii* is the large labellum with a uniformly dark maroon tip, prominently channelled when viewed from the front, and the particularly long fine fringe (that often splits toward the apex) extending well above the column. Flowers are usually 7–12 cm in length and 7–10 cm in width, without an odour (Brown et al. 1998; Hopper and Brown 2001; Hoffman et al. 2019). This orchid prefers deep grey-white sand, usually associated with the Bassendean sand-dune system, in mixed woodlands of Jarrah (*Eucalyptus marginata*), Candlestick Banksia (*Banksia attenuata*), Holly Banksia (*B. ilicifolia*) and Firewood Banksia (*B. menziesii*) with scattered trees of Sheoak (*Allocasuarina fraseriana*) and Marri (*Corymbia calophylla*). Plants have on occasion been recorded on the Spearwood system (DEWHA 2009). Peak flowering period is mid-September to October (Commonwealth of Australia 2013).

***Caladenia procera* CR (Carbunup King Spider Orchid)**

Caladenia procera is ranked critically endangered under the BC Act, and critically endangered (“facing an extremely high risk of extinction in the wild in the immediate future”) under the EPBC Act (DBCA 2022). This orchid has one to four greenish-lemon yellow to creamy yellow stiffly held flowers (10–14 cm long, 8–12 cm wide), with prominently clubbed yellow-brown sepals and a dark maroon-tipped labellum that has a two-toned fringe (pale lemon and maroon). The sepals and petals may have dull maroon to pink fine lines or small patches of colour on them. Plants are solitary or occur in small clumps, growing to 35–90 cm in height with a single pale green leaf, 20–45 cm long and 0.6–1.4 cm wide. It prefers alluvial sandy-clay loam flats in Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*) and Peppermint (*Agonis flexuosa*) woodland (Hopper and Brown 2001; Liddelow 2006; Hoffman et al. 2019). Flowering occurs from September to early November (Hoffman et al. 2019) with the peak flowering period occurring from mid-September to late October (Commonwealth of Australia 2013).

***Caladenia viridescens* CR (Dunsborough Spider Orchid)**

Caladenia viridescens is ranked critically endangered (“facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines” (DBCA 2024)) under the BC Act, and as endangered (“facing a very high risk of extinction in the wild in the near future”) under the EPBC Act (DBCA 2022). Characterised by its pale green flowers and narrow dark maroon labellum and fringe, plants grow to 25–40 centimetres (cm) in height and possess a pale green leaf 15–20 cm long and 0.5–0.8 cm wide (the basal third having irregular red-purple blotches). An individual plant may produce up to three flowers, measuring 5–8 cm in length and 5–7 cm in width with no floral odour (Hopper and Brown 2001). *C. viridescens* prefers well-drained lateritic and sandy soils in Marri (*Corymbia calophylla*) and Peppermint (*Agonis flexuosa*) woodlands in association with *Caladenia brownii*, or coastal heath containing *Calothamnus graniticus* subsp. *graniticus* and *Hakea trifurcata*. Plants have occasionally been observed growing in swampy areas favoured by *Caladenia busselliana* (DEC 2008a; Hoffman et al. 2019). Plants flower from September to October (Hoffman et al. 2019), with the peak flowering period occurring mid-September to late October (Commonwealth of Australia 2013).

***Drakaea elastica* CR (Glossy-leaved Hammer Orchid)**

Drakaea elastica is ranked critically endangered under the BC Act, and endangered under the EPBC Act (DBCA 2022). This hammer orchid is distinguished by its bright glossy green heart-shaped leaf, 2–2.5 cm long and 1.5–

2 cm wide, conspicuous between July and August but starting to wither by the time the plant flowers. The flower, measuring 3-4 cm long and 0.4-0.5 cm wide, also has a prominently hairy upper labellum lobe. Plants grow to 12-30 cm high, flowering from late September to late October, occasionally to early November. *D. elastica* prefers bare patches of deep sand, light leaf litter or sparse understorey under dense vegetation in low-lying areas alongside winter-wet swamps, water courses and flats, in Banksia (*Banksia menziesii*, *B. attenuata* and *B. ilicifolia*) woodland or Spearwood (*Kunzea glabrescens*) thickets (DEC 2009; Commonwealth of Australia 2013; Hoffman et al. 2019; Brown et al. 1998).

***Thelymitra variegata* CR (Queen of Sheba)**

Thelymitra variegata has recently had its listing upgraded to critically endangered under the BC Act, though it is not presently listed under the EPBC Act. This orchid is distinguished by its distinctively coloured flowers (mauve with pink and yellow markings and purple blotches), and spiral leaf. Plants grow to 10-35 cm in height, with the leaf measuring 4-9 cm in length and 0.5-1 cm in width, and the flowers 3-5 cm wide. *T. variegata* grows in sandy soils in Banksia and Jarrah (*Eucalyptus marginata*) woodland, flowering from August to September (Hoffman et al. 2019).

***Caladenia excelsa* EN (Giant Spider Orchid)**

Caladenia excelsa is ranked endangered (“facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines” (DBCA 2024)) under the BC Act, and endangered under the EPBC Act (DBCA 2022). It is a large creamy white spider orchid with long pendulous petals and sepals tinged yellow-green at the tips, distinguished from other similar spider orchids in having a red labellum. Flowers measure 15-30 cm in length and 7-15 cm wide, emitting a faintly sweet odour. Plants grow to 45-90 cm in height, with a leaf 20-35 cm long and 0.6-1.2 cm wide that is pale green with the basal third having irregular red-purple blotches (Hopper and Brown 2001; Hoffman et al. 2019). Peak flowering occurs from late September to early November (Commonwealth of Australia 2013). *C. excelsa* occurs on deep grey sandy soils in Banksia woodlands with scattered Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) (Hopper and Brown 2001).

***Drakaea micrantha* EN (Dwarf Hammer Orchid)**

Drakaea micrantha is ranked as endangered under the BC Act, and as vulnerable (“facing a high risk of extinction in the wild in the medium term future”) under the EPBC Act (DBCA 2022). It is a small-flowered hammer orchid growing to 15-30 cm in height, with flowers 1.2-2.5 cm long and 0.3-0.5 cm wide. Flowering occurs from September to October (Hoffman et al. 2019). The leaf of *D. micrantha* is heart-shaped, silvery-grey in colour with prominent green veins and approximately 1 cm long and 1 cm wide. Plants grow in Banksia, Jarrah (*Eucalyptus marginata*) and Sheoak (*Allocasuarina fraseriana*) woodland or forest on bare open areas of grey sand, often under thickets of Spearwood (*Kunzea glabrescens*) (Brown et al. 1998; Hoffman et al. 2019). The peak flowering period is early September to October (Commonwealth of Australia 2013).

Priority species

***Caladenia nivalis* P2 (Exotic Spider Orchid)**

Caladenia nivalis is listed as Priority flora (P) (“species that may possibly be threatened species that do not meet the criteria for listing under the BC Act due to insufficient survey or are otherwise data deficient”) (DBCA 2020) and ranked P2 (DBCA 2022) (poorly-known species known from few locations, some of which are on conservation lands) (DBCA 2020). *C. nivalis* grows to 12-20 cm in height and has a leaf 10-18 cm long and 0.4-1.5 cm wide. The flowers are white to pale pink with stiffly held petals and sepals, measuring 6-8 cm in length and 5-8 cm in width, the sepals often slightly clubbed and light brown in colour. The labellum has a distinctive dark red apex and short fringe. Plants grow on or near coastal granite outcropping in low heath, or occasionally in Peppermint (*Agonis flexuosa*) woodland, in loam or sand (Western Australian Herbarium (WAH) 2023;

Liddelow 2006; Hoffman et al. 2019). *C. nivalis* flowers from September to October (Hoffman et al. 2019), with the peak flowering in late September (Liddelow 2006).

***Caladenia speciosa* P4 (Sandplain White Spider Orchid)**

Caladenia speciosa is ranked Priority 4 (DBCA 2022) (“Rare, Near Threatened and other species in need of monitoring”) (DBCA 2020). A large-flowered white spider orchid suffused with pink (having sepals and petals with pale maroon to pink fine lines and calli), and a long dark pink and white labellum fringe that is often split. Plants grow to 35-60 cm in height, have a pale green leaf 15-25 cm long and 0.5-1.2 cm wide (basal third irregularly blotched red-purple), and flowers 12-18 cm long and 10-15 cm wide from September to October (Hopper and Brown 2001; Hoffman et al. 2019). *C. speciosa* grows in Banksia woodland with scattered Jarrah (*Eucalyptus marginata*), or in Tuart (*E. gomphocephala*) woodland on sand (Hopper and Brown 2001).

1.4 Climate and seasonal conditions

The southwest of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. Rainfall records from Cape Naturaliste weather station (Bureau of Meteorology station number 9172) located approximately 13 km north of the Survey Area were used to ascertain local rainfall preceding the survey (Figure 3). A total of 811 mm of rainfall was received in the 12 months between September 2021 and the end of August 2022: 12 mm above the long-term mean of 798 mm (1904 to 2022). The rainfall in the three months prior to the survey (June to August) was 29.3 mm below the long-term average for the same period (Bureau of Meteorology 2022).

The mean maximum temperature in the three months prior to the survey ranged between 16.4 °C and 17.4 °C; 0.8 °C to 1.5 °C higher than the long-term mean for the same period. The mean maximum temperature for the month of September was 17.4 °C: 1.7 °C higher than the long-term average. Daily maximum temperatures during the survey ranged from 16 °C to 20 °C, with 5.4 mm of rainfall experienced over the three days (Bureau of Meteorology 2022). Daytime conditions during the survey ranged from sunny to cloudy and light westerly winds, to overcast with light rain.

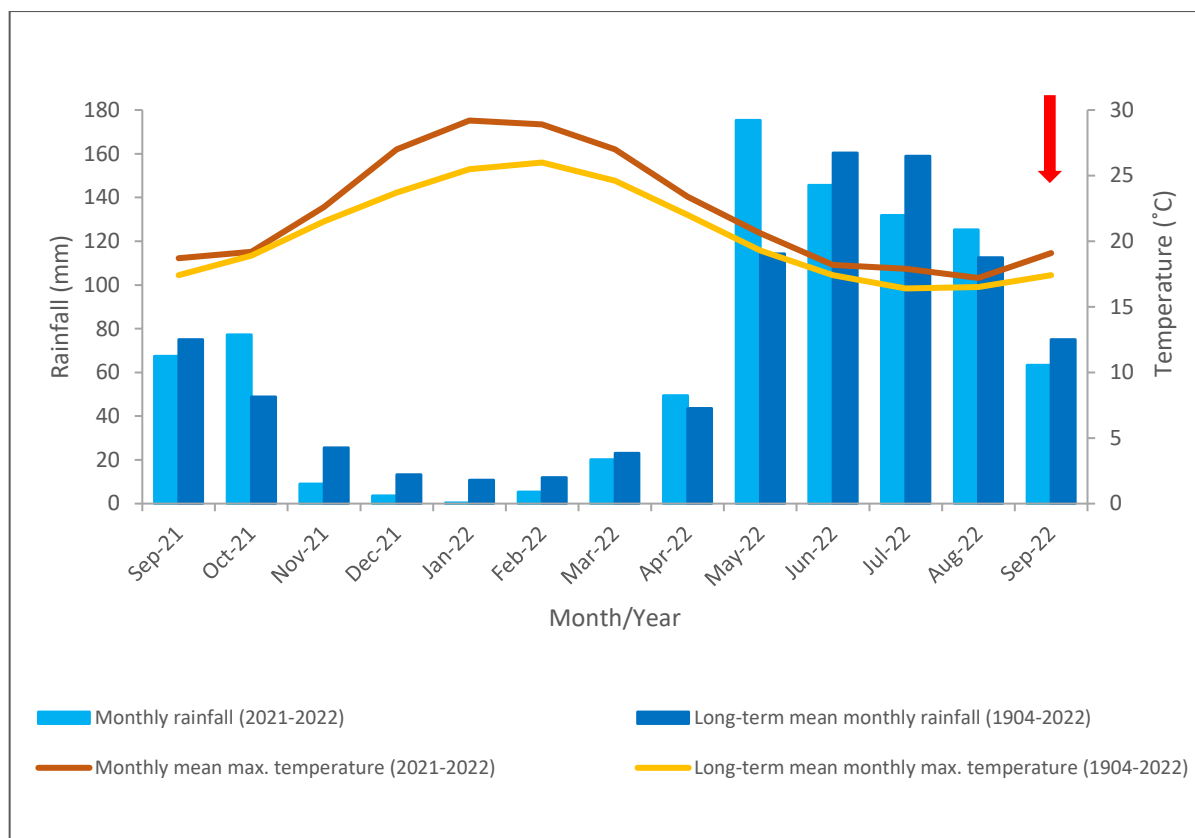


Figure 3 Monthly rainfall and temperatures at Cape Naturaliste weather station

1.5 Geomorphology, soils and topography

The Survey Area lies in the Jarrah Forest bioregion and within the Southern Jarrah Forest subregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Commonwealth of Australia, 2012). This subregion comprises the southern part of the Darling Plateau, where it broadens and slopes gently to the southern coastline, being dissected by multiple rivers (Beard 1990). Generally, the soils within the Southern Jarrah Forest subregion comprise laterite gravels but clay/loam soils occur in the eastern portion where the Plateau is flatter and drainage is poor (DEC 2002).

The Survey Area lies on the northern tip of the Leeuwin-Naturaliste Ridge; a unique geological feature approximately 93 km in length, between Cape Naturaliste in the north and Cape Leeuwin in the south. The elevation of the Survey Area ranges from 55 m in relation to the Australian height datum (mAHD) on the central southern side of the site to 5 mAHD on the north western side of the site according to WALIA (2019).

The Department of Primary Industries and Regional Development (DPIRD, 2018) soil landscape mapping dataset for Western Australia (DPIRD 2018), which places the site within the following four soil landscapes:

- 'Wilyabrup granitic headland phase' which occurs in the western portion of the site and is described as 'areas on the west coast dominated by granitic outcrop'.
- 'Wilyabrup exposed slopes phase' which occurs in the central and north-eastern portions of the site and is described as 'low slopes (gradients generally 5-10%) exposed to strong winds off ocean'.
- 'Gracetown exposed slopes phase' which occurs in the south central portion of the site and is described as 'moderate slopes (gradients 10-15%) on the west coast exposed to prevailing wind directly off the ocean, with deep and shallow yellow brown siliceous sands over limestone (i.e. Spearwood Sands).'
- 'Wilyabrup gentle slope phase' which occurs in the south-eastern portion of the site and is described as 'gradients 5-10%'.

2. Methodology

2.1 Personnel

The targeted orchid survey was conducted by two experienced personnel, Principal Botanist Bethea Loudon and Ecologist Hannah Dlugi. Bethea has over 20 years' experience undertaking flora and vegetation surveys throughout Western Australia and has undertaken many surveys for conservation-significant orchid species over this time. Hannah has two years' experience in environmental management and ecological surveys, including vegetation surveys and searches for *Caladenia huegelii* T. Both personnel have experience across the Swan Coastal Plain, Jarrah Forest and Warren bioregions, and are considered to have the expertise to conduct a targeted orchid survey. Bethea and Hannah hold current and relevant licencing applicable to the survey and collection of native flora (Table 2).

Table 2 Personnel authorisations

Personnel	Role	Flora taking (biological assessment)	Authorisation to take or disturb threatened species
Bethea Loudon	Principal Botanist	FB62000049-2	TFL 140-2122
Hannah Dlugi	Ecologist	FB62000448	TFL 2223-0003

2.2 Guidance and resources for methodology and identification

The survey was conducted in accordance with the following guidelines and documents:

- Draft Survey Guidelines for Australia's Threatened Orchids (Commonwealth of Australia 2013)
- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority 2016)
- A Guide to Native Orchids of South Western Australia (Liddelow 2006).
- Orchids of South-West Australia, Fourth edition (Hoffman et al 2019).
- FloraBase (WAH 2023) website
- Western Australian Native Orchid Study and Conservation Group website (WANOSCG 2022)
- New taxa of *Caladenia* (Orchidaceae) from south-west Western Australia (Brown & Brockman, 2015)
- Approved Conservation Advice for *Caladenia excelsa* (Giant Spider-orchid) (DEWHA 2008).
- Bussell's Spider Orchid (*Caladenia busselliana*) Recovery Plan (DEC 2008b)
- Cape Spider Orchid (*Caladenia caesarea* subsp. *maritima*) Recovery Plan. Interim Recovery Plan No. 232 (DEC 2010)
- Grand Spider Orchid (*Caladenia huegelii*) Recovery Plan (DEWHA 2009)
- Carburnup King Spider Orchid (*Caladenia procera*) Interim Recovery Plan 2011-2016. Interim Recovery Plan No. 316 (DEC 2011)
- Dunsborough Spider Orchid (*Caladenia viridescens*) Recovery Plan (DEC 2008a)
- Glossy-leafed Hammer Orchid (*Drakaea elastica*) Recovery Plan (DEC 2009).

2.3 Field survey

The targeted orchid survey was conducted from 22-24 September, including mobilisation and demobilisation to Perth. A comprehensive field survey was undertaken in which the entire Survey Area was searched, which took approximately 25 hours (50 personnel hours). The survey was conducted in line with recommended survey methods outlined in the Survey Guidelines for Australia's Threatened Orchids (Commonwealth of Australia 2013), and Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). All available literature was consulted prior to the survey to ensure both personnel were familiar with the appearance, key features and habitat preferences of the targeted species, and to be able to differentiate common taxa.

The Survey Area was systematically traversed on foot by two personnel walking in slow parallel transects five to 10 metres apart to ensure observation of individual orchids. Approximately 55 km of transects were conducted through all vegetation types, with traverse speeds very low at times due to dense vegetation, particularly in the south and west.

All orchids encountered were inspected closely to determine likely identification and potential for representation of any of the targeted species. Where orchids were believed to represent or showed similarities to targeted species, the following information was captured:

- location (co-ordinates) of individual plants recorded using a global positioning system (GPS);
- number of plants;
- measurements of the flower and leaf dimensions;
- habitat including vegetation type and condition, soil and geology; and
- photographs of the plant, its flower, leaf and habitat.

A specimen was then collected (leaf and flower only, no below-ground parts) for later verification, and additional searching conducted around the location in order to locate any further plants.

2.4 Survey limitations

There were no significant limitations to the survey being able to achieve its objectives. The survey was undertaken by two suitably experienced botanists. The entire Survey Area was searched intensively with all potential habitat surveyed. Survey method and effort was considered adequate for the purpose of identifying the targeted significant orchid species.

Seasonal conditions at the time of the survey were considered excellent due to the above average rainfall experienced in the 12 months prior to the survey, and mild daytime maximum temperatures. Although the rainfall between June and August 2022 (402.6 mm), was slightly below the long-term average (431.9 mm) for the same period, rainfall in May (175.4 mm) and August (125.2 mm) was above the long-term average for the same months (114.3 mm and 112.5 mm respectively). These higher rainfall events and above average annual rainfall would have assisted in the maintenance of soil moisture levels required for tuber production, vegetative growth and flowering of orchid species preceding the survey: flowering is influenced by environmental conditions including the amount of rainfall received during winter and spring (Batty *et al.* 2006).

Daytime ambient temperatures during the growing season were only slightly above the long-term average. Mean maximum temperatures leading up to the September survey were consistent with the general trend of increasing mean maximum temperatures recorded over time at Cape Naturaliste (Bureau of Meteorology 2022). Seasonal conditions were therefore not a limiting factor to this survey.

The timing of the survey was optimal for the flowering of all targeted species should they have been present, with most taxa flowering between September and October. *Caladenia caesarea* subsp. *maritima* has an earlier

flowering period (August to September), however no orchid plants were encountered that had finished flowering.

Occasional orchid plants were observed during the survey whereby only leaves were present, or the flowers had likely been consumed by a herbivore. Based on the leaves and stems of common taxa recorded by the survey, it is likely these vegetative plants represented common entities, namely *Caladenia latifolia* and *C. applanata* subsp. *applanata*, rather than any of the threatened species listed in Section 1.2.

3. Results

3.1 Vegetation

Vegetation type and condition was previously mapped by Emerge Associates (2019), with 13 native plant communities identified ranging in condition from Completely Degraded to Excellent. Observations during the targeted orchid survey broadly identified the following vegetation types and condition:

- *Corymbia calophylla* low woodland to open forest over *Xanthorrhoea preissii* mid open shrubland over *Darwinia citriodora*, *Dodonaea ceratocarpa* and *Hibbertia hypericoides* low shrubland on orange sandy clay gravelly loam in the far east (Good to Excellent) (Plate 1);
- *Agonis flexuosa* low open forest over **Zantedeschia aethiopica* mid isolated clumps of forbs to forbland over *Hibbertia cuneiformis* and *Xanthorrhoea preissii* low isolated shrubs over *Cheilanthes austrotenuifolia* low isolated clumps of ferns on grey-brown sand in the central east (Degraded to Very Good) (Plate 2);
- *Eucalyptus marginata* and/or *Corymbia calophylla*, *Banksia attenuata* and *Agonis flexuosa* low open woodland to low forest over *Spyridium globulosum* tall isolated clumps of shrubs over *Xanthorrhoea preissii* and *Macrozamia riedlei* mid isolated clumps of shrubs over *Hibbertia cuneiformis* and *Lysiandra calycina* low isolated clumps of shrubs on grey brown sand in the central west (Very Good to Excellent) (Plate 3);
- *Acacia saligna*, *Hibbertia cuneiformis* and *Dodonaea ceratocarpa* mid shrubland on grey brown sand in the central north (Good to Very Good) (Plate 4);
- *Melaleuca huegelii* and *Hakea oleifolia* tall open shrubland over *Spyridium globulosum* and *Diplolaena dampieri* mid shrubland on grey brown sand in the central south (Very Good to Excellent) (Plate 5);
- *Melaleuca lanceolata* and *M. huegelii* tall closed shrubland on grey brown sand with limestone rocks in the far south west (Excellent);
- *Melaleuca lanceolata* and *Hakea oleifolia* tall shrubland over *Kunzea ciliata*, *Spyridium globulosum* and *Acacia cochlearis* mid shrubland over *Pimelea ferruginea* and *Dodonaea ceratocarpa* low isolated clumps of shrubs on grey brown sand in the south west (Excellent) (Plate 6); and
- *Kunzea ciliata*, *Leucopogon parviflorus* and *Spyridium globulosum* mid closed shrubland over *Dodonaea ceratocarpa* low open shrubland on brown sandy loam with granite outcropping in the west (Excellent) (Plate 7).



Plate 1: Vegetation in the far east of the Survey Area (JBS&G)



Plate 2: Vegetation in the central east of the Survey Area (JBS&G)



Plate 3: Vegetation in the central west of the Survey Area (JBS&G)



Plate 4: Vegetation in the central north of the Survey Area (JBS&G)



Plate 5: Vegetation in the central south of the Survey Area (JBS&G)



Plate 6: Vegetation in the south west of the Survey Area (JBS&G)



Plate 7: Vegetation in the west of the Survey Area (JBS&G)

Based on information gathered from available resources (Section 5.2), the vegetation types present in the Survey Area represent potentially suitable habitat for *Caladenia viridescens*, *Caladenia excelsa*, *Caladenia nivalis* P2, *Caladenia procera* T, *Caladenia speciosa*, and *Thelymitra variegata*. The vegetation has some potential but less likely to represent suitable habitat for *Caladenia caesarea* subsp. *maritima* T, *Caladenia huegelii* T, and *Drakaea micrantha* T.

3.2 Significant species

No threatened orchid taxa were observed during the survey, although apparent suitable vegetation, soils and geology is present. One Priority listed taxon, *Caladenia nivalis* P2, was recorded. Survey effort as depicted by GPS tracklogs¹ is presented in Figure 1.

Three orchid specimens were collected during the survey for verification; one that was believed to be *Caladenia nivalis* P2, and two with similarities to *C. viridescens* T. The collections were submitted to the Western Australian Herbarium taxonomic identification service (ACC/2926/E), and subsequently identified by Dr Andrew Brown, orchid specialist, as:

- BLHD01 - *Caladenia applanata* subsp. *applanata* (Broad-lipped Spider Orchid)
- BLHD02 - *Caladenia nivalis* P2
- BLHD03 - *Caladenia applanata* subsp. *applanata*.

Caladenia nivalis P2 occurs on coastal granite outcrops in heath along the west coast between Wilyabrup and Cape Naturaliste, and is represented by 12 vouchered specimens at the Western Australian Herbarium (WAH 2023). A total of 18 plants (Plate 8) were recorded from 10 point locations in the survey area, occupying an area of approximately 70 metres (m) x 10 m (Figure 2). Plants occurred in the northwest corner of the survey area in *Kunzea ciliata*, *Leucopogon parviflorus*, *Spyridium globulosum* and *Eutaxia myrtooides* mid to mid closed shrubland over *Dodonaea ceratocarpa*, *Pimelea ferruginea* and *Rhagodia baccata* low isolated clumps of shrubs to low open shrubland, occasionally over *Lepidosperma calcicola* low isolated clumps of sedges, on brown sandy loam on a lower slope (Plate 9: *Caladenia nivalis* (P2) habitat, Smiths Beach (JBS&G)). All records are located within the section of private land proposed to be transferred to the Leeuwin-Naturaliste National Park (Figure 2).

¹ Due to a technical issue, 1.3 km of tracklog was not recorded by one GPS (Figure 1) however the area in question was indeed searched/surveyed.



Plate 8: *Caladenia nivalis* (P2) flower and leaf, Smiths Beach (JBS&G)



Plate 9: *Caladenia nivalis* (P2) habitat, Smiths Beach (JBS&G)

Table 3 Location of *Caladenia nivalis* P2, Smiths Beach

Waypoint	Number of Plants	Co-ordinates (WGS 84, Zone 50)	
		Easting (m)	Northing (m)
1	2	315437	6273739
2	1	315438	6273742
3	2	315441	6273745
4	2	315392	6273755
5	1	315391	6273755
6	3	315390	6273755
7	2	315391	6273751
8	3	315395	6273751
9	1	315397	6273745
10	1	315371	6273749

Caladenia applanata subsp. *applanata* is a common taxon, occurring on the west and south coasts of Western Australia between Cape Naturaliste and Two Peoples Bay, recorded from sand dunes, and granite or limestone outcrops (WAH 2023).

A small number of orchid plants were not able to be accurately identified due to the absence of flowering material. It is considered unlikely that these plants represent any threatened species, with leaf and/or stem characters consistent with known common taxa recorded.

Common orchid species observed during the survey include:

- *Caladenia attingens* subsp. *attingens* (Forest Mantis Orchid)
- *Caladenia bicalliata* subsp. *bicalliata* (Limestone Spider Orchid)
- *Caladenia flava* subsp. *flava* (Cowslip Orchid)
- *Caladenia latifolia* (Pink Fairy Orchid) - most common taxon observed across the Survey Area
- *Diuris jonesii* (Dunsborough Donkey Orchid)
- *Eriochilus* sp. (leaves only) (Bunny Orchid)
- *Lyperanthus serratus* (Rattle Beaks)
- *Prasophyllum ?elatum* (Tall Leek Orchid)
- *Pterostylis vittata* (Banded Greenhood)
- *Pterostylis* sp. (Snail Orchid)
- *Thelymitra* spp. (three different leaf shapes, buds only) (Sun Orchids).

4. Discussion and conclusions

Annual rainfall and monthly rainfall totals preceding the survey and the timing of the survey were considered suitable to support the presence of flowering plants of the targeted orchid species had they occurred in the Survey Area. The Survey Area is considered to have been adequately surveyed to meet the requirements of the targeted orchid survey scope and objectives.

A small number of orchid plants were not able to be accurately identified due to the absence of flowering material. It is considered unlikely that these plants represent any threatened species, with leaf and/or stem characters consistent with known common taxa recorded.

Based on search effort, suitable seasonal conditions and inability to locate any threatened orchid species, it is considered that the threatened taxa as listed in Section 1.2, are unlikely to occur in the Survey Area. This conclusion is supported by the lack of threatened orchids observed during previous surveys within the study area (Keating and Trudgen 1986; Maunsell and Partners Pty Ltd. 1987; Bennett Environmental Consulting 2001; ATA Environmental 2007a; as quoted in Emerge Associates 2009).

The Proposal is unlikely to pose any risk to any of the threatened orchid taxa identified in Section 1.2, with the survey being comprehensive, and no threatened orchid taxa recorded during the survey. The Proposal is unlikely to pose any risk to the population of *Caladenia nivalis* P2 identified during the survey, with all plants located in any area of bushland proposed for addition to the Leeuwin-Naturaliste National Park.

5. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

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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