capecare
Your One Link for South West Aged Care

15 November 2012

Office of the Environmental Protection Authority
Level 4, The Atrium
168 St Georges Terrace
Perth WA 6000
For the Attention: Amy Sgherza

Dear Amy

ARMSTRONG RESERVE, DUNSBOROUGH, URBAN AND COMMERCIAL DEVELOPMENT (ASSESSMENT NO. 1808) – PUBLIC ENVIRONMENTAL REVIEW.

I refer to your correspondence dated the 6th November 2012 concerning the Office of the Environmental Protection Authority's (OEPA) identification and summary of the pertinent environmental issues from the public submissions and requesting Capecare provide a response to the issues particularly as they relate to the ongoing management of the remainder of the reserve outside of the proposed development envelope.

Attached is Capecare's responses to the pertinent environmental issues provided by the OEPA.

I am anticipating that the responses are adequate to fulfil the needs of the OEPA in finalising their report to the EPA. However should this not be the case then please advise what further information is required.

Yours sincerely

Greg Holland

Chief Executive Officer

Capecare
20 Ray Avenue
Busselton WA 6280
ABN 77 630 179 279

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1. **Please advise if fire management will form part of the proposed Environmental Management Plan (EMP) for the reserve as set out on page 73 of the PER. If so, could you please explain how fire management will be implemented in a manner that achieves the two principle objectives of the EMP (on page 72).**

Capecare confirms that fire management will form part of the proposed EMP.

In terms of conserving the natural habitat of the Western Ringtail Possum within the proposed development envelope, Section 6.6 of the Fire Management Plan (FMP) (Fireplan WA, 2012), approved by the City, DEC and FESA, does not mandate the removal of all native vegetation from within the Building Protection Zone (BPZ). Capecare is committed to retaining habitat and significant trees that are identified following the detailed engineering/architectural design phase, that meet the requirements of the BPZ and that can be retained.

While the FMP approved for implementation within the proposed development envelope will apply to that portion of the site, additional fire management protocols will be developed within the EMP for the remainder of the site. The protocols will be consistent with the City of Busselton's approved fire management policies and reserve management plans that are currently being implemented to protect the conservation and landscape values of the relevant reserves.

With respect to explaining how fire management will be implemented in a manner to achieve the principle objectives of the EMP it is necessary to understand the fire management hierarchy that exists within the City and how it is applied to individual reserves that have Council adopted environmental management plans.

In 2005, the City adopted a *Bushfire Strategic Plan* that recognised the statutory obligations of the City. In order to maximise the effectiveness of the bushfire organisation the Shire noted that cooperative liaison between the Shire, the volunteer bushfire brigades, FESA and the then Department of Conservation and Land Management (now Department of Environment and Conservation – DEC) was maintained and enhanced.

Appendix 2 of the *Bushfire Strategic Plan* comprises the City's *Bush Fire Protection Strategy* (Shire of Busselton, 2005) which is an overview of Council's potential risk from bushfire/wildfire occurrence and aims at addressing protection strategies. Section 8.5 of the document lists the responsibilities of the City. The following responsibilities taken from the list are integral to understanding how the City's fire management practices take into consideration the City's environmental policies:

15. In line with environmental conditions and guidelines (Reserve Management Plans) take steps in ensuring that fuel reduction takes place on selected Shire Managed Reserves as prescribed within the Management Plans and the *Busselton Environment Strategy* (2004) (Actions 6.1 and 6.3).
16. Take steps to ensure that firebreaks are maintained on Shire Managed Reserves in accordance with the *Busselton Environment Strategy* (2004) (Action 6.3) and the individual specific Reserve Management Plans.
20. Take steps to ensure hazard reduction burning is carried out strategically and on a variable rotation and in balance with public safety and environmental considerations, in accordance with FESA (Fire Services Learning Manual 3.17) and the Shire Environmental Strategy Plan (2004).
21. With regard to 20, the Fire Prevention Officer is to take steps to prepare an overall hazard reduction burning 1:25000 Scale Fire Services Operations Graphic Map for the whole of the Shire. This will be prepared in liaison with CALM, FESA, the Shire Environmental Officer and

other interest groups within the community and will provide an overview of fuel ages and an approved rotational prescribed burning program for the whole district over the next 10 years.

51. Carry out as necessary ongoing liaison with the Shire Senior Environmental Officer and CALM Officers regarding bush fire protection strategies and how they interface with environmental strategies.

In the above, reference is made to the *Busselton Environment Strategy* (2004) with particular attention to Actions 6.1 to 6.3 to ensure that the City's annual fire management and fire protection activities are consistent with Council's adopted environmental management criteria and consistent with public safety requirements are prescribed in the *Bush Fires Act 1954* (as amended). The *Busselton Environment Strategy* (2004) has an objective to 'achieve adequate levels of fire threat and risk management without compromising environmental values' and that fires management is also considered in the preparation of individual reserve management plans for bushland reserves managed by the City.

The following information pertains to Actions 6.1 -6.3 and their associated Outcomes:

Action 6.1: Develop environmental management criteria for fire management identifying appropriate frequency intervals, seasonal factors and setbacks from sensitive areas.

Outcome: The incorporation of environmental factors into fire management and controlled burns in the Shire in a manner consistent with environmental values and fire threat and risk.

Action 6.2: Assess annual fire management activities undertaken by the Shire and the VBFB's to ensure consistency with environmental management criteria.

Outcome: Ensuring environmental criteria developed for fire management activities are achieving measurable benefits to the environment.

Action 6.3: Continue to incorporate fire management planning for bushland reserve management plans using "Fire Management Planning for Urban Bushland (FESA, 2000) as a guide.

Outcome: Increased consideration of conservation and environmental values for fire management activities associated with bushland reserves.

In 2009, the City approved the *Reserves Fire Management Plan* (Strategen, 2009) which has as a key objective to 'prepare an overall management program that will reduce fire hazards, enhance community safety and preserve environmental values'. The City's reserves have been classified into four Land Management Units (LMU), depending upon their location within the City and the vesting purpose of the land. One of the four LMU's is 'Conservation and Landscape Reserves' which comprises those reserves that are managed for their intrinsic conservation of flora and fauna values in addition to the landscape attributes they contain. The document further notes that 'a number of these reserve management plans contain management actions that preclude prescribed fire hazard reduction burning as a technique for wildfire risk mitigation' (refer to section 4 of that document).

The *Marri and Armstrong Reserves Management Plan* prepared for the City in 2009 is such a plan (Green Iguana, 2009). Section 4.7 of the Plan concerns Fire Management having as its objective:

To manage fire within the Reserves to provide protection from wildfire to human life and property as a priority, while also protecting, maintaining and enhancing biodiversity where possible.

With respect to Section 4.7.5 Protection of Rare Flora and Fauna, the Plan notes that under the provisions of the Wildlife Conservation Act (1950), the Conservation and Land Management Act (1984) and the Environment Protection and Biodiversity Conservation act (1999), approval must be sought from the DEC, the State Minister for the Environment, EPA and the Commonwealth Minister, before any prescribed burn can occur in the vicinity of any Declared Rare Flora (DRF) or specially protected fauna species. It is anticipated that this would apply to the issue of fire management within the EMP.

Correspondence provided by the City (Peter Malavisi, email correspondence dated 13 November 2013) stated that:

…while the Marri Reserve Management Plan has been endorsed by the Council the Armstrong Reserve component has not and probably that part of the management plan should be revised to accommodate the site post development and then it will need to return to the Council for endorsement. Timelines for this should be post issue of a planning consent. In saying this I don't expect that there would be any significant change to the existing management plan recommendations.

In previous discussions with the City, Capecare advised that wherever practicable as many of the existing (but yet to be endorsed by Council) management plan recommendations as apply to Marri Reserve would be incorporated into the EMP thereby protecting the environmental values within the remainder of the site due to its vesting as "Landscape Protection" and vested in the City.

2. **The success of your proposed environmental commitments and management for the remainder of the reserve relies partly on the effective participation of the City of Busselton. While the OEPA understands that there has been extensive discussions between you and the City of Busselton during the preparation of the PER, the OEPA requests that you obtain written confirmation from the City that it agrees with the overall management proposed for the reserve. The EPA did not receive a submission from the City of Busselton during the public submission period.**

On the 5th November 2012, the City of Busselton provided a submission to the OEPA (email correspondence from Peter Malavisi, Acting Senior Development Planner) which was subsequently forwarded to Capecare.

The City's submission (refer to **Attachment A**), while supporting the 2 for 1 offset proposed by Capecare, noted that within the locality of Dunsborough most of the reserves already have considerable vegetation, however there are areas around the Dunsborough foreshore and possibly Toby's Inlet requiring rehabilitation but the resulting quality and type of vegetation would not necessarily be especially similar to that being removed, an additional offset could be considered to factor/cater for this anomaly. The City suggested that Appendix 8 of the PER be examined for other areas the City considers could be used for offset planting.

The City suggested that to assist in the provision of adequate offsets changes could be made to the draft management plan for Armstrong Reserve (i.e. Marri and Armstrong Reserves Management Plan 2009) which accommodates the proposed development along with implementation of any recommendations identified in a revised plan, in particular removal weeds and some localized

revegetation which could occur outside of the development footprint. In response to this suggestion, Capecare submits that as noted in the PER document (refer to section 7), the proposed EMP will include a weed eradication program and revegetation of degraded areas within the site.

The environmental offset strategy identified in Section 8 of the PER document includes rehabilitating 1.8 ha of an off-site location which is identified as Reserve 31645 Caves Road, Dunsborough. This reserve is one of the reserves identified by the City in Appendix 8. Subsequent to receiving the City's submission, Capecare's environmental consultant, accompanied by Mr Graham Sly (Total Horticultural Services) who undertakes rehabilitation projects for the City, visited the proposed offset site (Reserve 31645) to assess the capacity of the site to take the 700 Peppermints and 1.8 ha of understorey planting that are proposed to be installed. As a result of the site visit, Capecare was advised that the site will be able to take some of the quantities required to be installed but not all. A site visit was also undertaken of Reserve 43008 located at the corner of Caves Road and Cape Naturaliste Road, Dunsborough). Capecare has been advised that this reserve is very prospective for planting out the excess Peppermints and understorey that Reserve 31645 cannot cater for particularly given the existing Peppermint woodland vegetation contained within the reserve and the slope of the land.

Following the meeting held with the Officers of the OEPA held on the 12th November 2013, Capecare liaised with the City with respect to obtaining written confirmation that the City agrees with the overall management proposed for the reserve. On behalf of the City, Mr Peter Malavisi (Acting Senior Development Planner) has provided correspondence to Capecare confirming that it is prepared to take over responsibility for the balance of the site after Capecare's initial three year management period (refer to **Attachment B**).

3. The OEPA requests further information regarding the roles of the Department of Regional Development and Lands and the City of Busselton in the proposed change of land use of the remainder of the reserve from 'Recreation' to 'Landscape Protection' (pages 68 and 86), and also the likely timing and steps for this process to occur.

The following information has been provided to Capecare by Mr Ron Pumphrey (Manager, South West, Department of Regional Development and Lands) in email correspondence dated 13 November 2013:

All the land the subject of the proposal (including Reserve 31645 proposed for rehabilitation) is either Crown land or other land under the *Land Administration Act 1997 (LAA).* Any dealing in the land is subject to the approval of the Minister for Lands (or delegate). The LAA is administered by the Department of Regional Development and Lands (RDL).

The Minister for Lands has previously provided conditional support for the development of an aged care facility within the area the subject of this proposal. The conditional approval required Capecare to seek environmental approval and rezoning of the land to enable the proposed development of aged care facilities. The Minister's conditional approval supports the transfer of title required for development under section 75 of the LAA. Final approval of the Minister to the transfer will be required. In this respect given the City of Busselton (City) supports the rezoning and has committed to achieve this through an omnibus amendment to its TPS 20, RDL will (following environmental approval being in place) seek the Ministers approval to proceed with the transfer.

RDL notes the intention that the development area be limited to 1.28 hectares with the balance of the area being retained as a reserve under City management to protect the remnant vegetation. I,

as a delegated officer of the Minister, will support the necessary changes to the balance of the land so that it can be reserved for the purpose of "Landscape Protection" with a management order under the LAA being granted to the City.

RDL will also support the use of Reserve 31645 as part of the Environmental Offset Strategy.

The transfer of land to Capecare and creation of the new "Landscape Protection" reserve will require the following actions:

- Formal submission and advice from Capecare of environmental approval together with its response to the Ministers conditional 2004 approval and request to proceed;
- Formal confirmation from the City as to its position with respect to the changes in tenure arrangements;
- RDL will seek the Minister's approval to the transfer of the identified site for development. Note: this will require agreement between Capecare and RDL on the conditions that will be placed on the title and also for RDL to seek valuation advice prior to seeking the Ministers approval. Approvals for other changes in the affected land tenure will also be processed in this stage. Note: the CWA has previously agreed to surrender its current title for the changes to occur;
- In parallel RDL will arrange through Capecare the cadastral survey of the site to provide a deposited plan to enable the land tenure changes to be implemented;
- When a deposited plan is available final transfer documentation for the aged acre site will be prepared by RDL for execution by Capecare and the Minister. RDL will prepare all other documentation to effect land tenure changes;
- The transfer of land to Capecare and creation of the new "Landscape Protection" reserve will happen concurrently through lodgement of all documentation with Landgate for registration. One will not occur without the other.

There is considerable work to be completed and given that early in the new year we will proceed to 'caretaker government' some final approvals maybe delayed. However, other actions can progress. The transfer of titles should be finalised by the middle of 2013 if not earlier.

4. The OEPA in its email of 2 November 2012 (from Hans Jacob to Bernadette Van der Wiele) provided advice on the information that it requires to complete the assessment on the potential impacts of the proposal on the potentially rare species of *Ctenotus* skink. Please include the response to this issue in your response to submissions.

ECOSCAPE – Attachment C

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

During the meeting held with Officers of the OEPA on the 12th November 2012, it was requested that information also be provided with respect to the *Caladenia viridescens* (Dunsborough Spider Orchid) potentially located within the proposed development envelope.

On the 6th November 2012 Mr Peter Hanly (Senior Regional Planning Officer, South West Region, Department of Environment and Conservation) provided shapefiles with the GPS positions for the photographs and samples of *Caladenia viridescens* obtained by Andrew Brown (Senior Botanist, South West Region, DEC) to Capecare. The locations of these individuals and those identified during

a site visit undertaken on the 26th October 2012 by Dr Paul van der Moezel on behalf of Capecare and found within the adjacent Marri Reserve, are identified on **Attachment D**.

In terms of whether the plants will be impacted by the proposed development, the plant or plants located at 3 and 3a will not be impacted by development as they are well away from the development envelope. The plant or plants located at 2 and 2a located just outside of the proposed development envelope could be managed during the construction process and retained *in situ*. Given the location of plant 1 is within the proposed development envelope it is likely that this plant would be damaged during construction.

As a result, Capecare proposes that given the timing of both the environmental and planning approvals process are likely to take up to 12 months that a targeted survey for *Caladenia viridescens* could be undertaken during the next flowering season (i.e. September-October 2013) with a view to undertaking a translocation program if required. Within the *Interim Recovery Plan No. 213 Dunsborough Spider Orchid* (*Caladenia viridescens*) *2005-2010* (CALM, 2005) translocation of the species is a recognised management measure identified.

ATTACHMENT A
CITY OF BUSSELTON – RE OFFSETS STRATEGY

City of Busselton submission - Armstrong reserve PER

From: **Sgherza, Amy** (Amy.Sgherza@epa.wa.gov.au)
Sent: Wednesday, 7 November 2012 10:06:10 AM
To: Bernadette Van der Wiele (bernadette.vdw@hotmail.com)

Hi Bernadette,

Please see below submission from the City of Busselton.

Kind Regards,

Amy Sgherza

Environmental Officer

Planning & Infrastructure Assessments Branch

Office of the **Environmental Protection Authority**

The Atrium, Level 8, 168 St Georges Terrace, Perth

Locked Bag 33, Cloisters Square, Perth WA 6850

direct: 08 6467 5424 I reception: 08 6467 5600 I fax: 08 6467 5556

email: amy.sgherza@epa.wa.gov.au I web: www.epa.wa.gov.au

Please note I only work Mondays and Wednesdays.

From: Pete Malavisi [mailto:Pete.Malavisi@busselton.wa.gov.au]
Sent: Monday, 5 November 2012 3:01 PM
To: Sgherza, Amy
Subject: Re: Aged Care Facility Development Armstrong reserve Dunsborough Assessment 1808 Public Environmental Re...

Hi Amy

my apologies for not getting these comments to you sooner.

The City has been liaising with Cape Care for several years in relation to the development of this site.

Officer support has been provided by the City for the proposed development at the identified site and I can confirm that discussions and information provided by the City is generally consistent with what has been provided in the report.

In stating the City would like to make the following comments in relation to the offsets proposed.

The proponent has identified that they will be clearing up to 9,020sqm, Cape Care is proposing an offset of 18,000sqm, the City is generally suportive of a minimum of 2 for 1 offset proposed and generally prefers like for like (vegetation type) and for the offsets to be located as close as possible to where the clearing is being undertaken.

Unfortunately in this situation there are several constraints to this occuring, there are limited sites available within a reasonable distance to where the development is occuring. Cape Care have identified Reserve 31645 for revegetation but physical size of this reserve and existing vegetation on this reserve suggest that there may only be a capacity for planting of approx 0.6 ha.

Most of the reserves in Dunsborough already have considerable vegetation, there are areas around the Dunsborough foreshore and possibly Toby's Inlet but the resulting quality and type of vegetation would not necessarily be especially similar to that being removed, an additional offset could be considered to factor/cater for this anomaly. see Appendix 8 for other areas the City considers could be used for offset planting.

Smaller parcels of revegetation are subject to more difficult management until they are established. The City also expects that because of some of this revegetation occuring in more sensitive areas such as the foreshore and Toby's Inlet that these areas may be more susceptible to vandalism and hence require closer monitoring and replacements than in other areas further away from the public eye as such.

In noting the above the City reitierates its support at Officer level for the proposed development and is keen to engage with the proponent to secure relevant offsets but confirms also that the City has limited resources to carry out surveillance/monitoring until any revegetation becomes established.

Other considerations to assist in offsets could be changes to the draft management plan for Armstrong Reserve which accommodates the proposed development along with implementation of

any recommendations identified in a revised plan, in particular removal weeds and some localized revegetation which could occur outside of the development footprint.

On a final point consideration could also be given to the installation of possum rope/ladder across Naturaliste Tce connecting Armstrong Reserve and Marri Reserve.

Should you have any further enquiries and wish further advice from the City then please do not hesitate to contact me.

regards

Pete Malavisi

Acting Senior Planner

p: (08) 9781 0345
Pete.Malavisi@busselton.wa.gov.au

City of Busselton
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"Events Capital of Regional WA"

ATTACHMENT B
CITY OF BUSSELTON – RE MANAGEMENT OF SITE

City of Busselton
Geographe Bay

Our Ref:

Your Ref:

Enquiries: Pete Malavisi
Ph 9781 0345 pete.malavisi@busselton.wa.gov.au

Capecare
20 Ray Avenue
Busselton WA 6280

14 November 2012

Attention: CEO Greg Holland

Dear Mr Holland

TO WHOM IT MAY CONCERN – PROPOSED AGED CARE DEVELOPMENT ON PART OF ARMSTRONG RESEVE, DUNSBOROUGH

The City of Busselton confirms that the City is prepared to take over responsibility for the balance of the site after Capecare's initial 3 year management period and that the City will put through a formal request to the Department of Regional Development and Lands to change the purpose of the reserve from 'Recreation" to "Landscape Protection".

The City of Busselton advises the proposed development is still subject to a development application and due process in that assessment.

Should you require any additional information then do not hesitate to contact me.

Yours sincerely

Pete Malavisi
ACTING SENIOR DEVELOPMENT PLANNER

ATTACHMENT C
CTENOTUS - DISTRIBUTION

Armstrong Reserve, Dunsborough

Ctenotus ora Potential Impact Assessment

Ray Village Aged Services (Inc.) trading as Capecare

science+design

Armstrong Reserve, Dunsborough, *Ctenotus ora* Potential Impact Assessment
Our Reference:
8722-2582-10R
Ecoscape (Australia) Pty Ltd
ABN 70 070 128 675

Quality Assurance

Ecoscape (Australia) has implemented a comprehensive range of quality control measures on all aspects of the company's operation and has Quality Assurance certification to ISO 9001.

An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed by senior members of the consultancy team and signed off prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Limitations Statement

This report has been exclusively drafted for the needs of Ray Village Aged Services (Inc.) trading as Capecare . No express or implied warranties are made by Ecoscape (Australia) Pty Ltd regarding the research findings and data contained in this report. All of the information details included in this report are based upon the existent land area conditions, research provided and obtained, and so forth at the time Ecoscape (Australia) Pty Ltd conducted its analysis into the area. Ecoscape (Australia) Pty Ltd will not be responsible for the application of its recommended strategies by Ray Village Aged Services (Inc.) trading as Capecare

Please note that the strategies devised in this report may not be directly applicable towards another company's needs or any other specific land area requiring management strategies. We would also warn against the environmental dangers of adapting this report's strategies to another land area which has not been researched and analysed by Ecoscape (Australia) Pty Ltd. Instead, please contact Ecoscape (Australia) Pty Ltd to provide a tailored report for your area's needs. Otherwise, Ecoscape (Australia) Pty Ltd accepts no liability whatsoever for a third party's use of, or reliance upon, this specific report.

Direct all inquiries to: **Ecoscape (Australia) Pty Ltd**
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table of contents

list of figures

list of tables

list of maps

acknowledgements

Ecoscape wishes to acknowledge the City of Busselton for allowing access to Armstrong Reserve for the purpose of conducting surveys.

We also thank the following people for discussion and sharing of information during research and preparation of this report:

- Geoff Kay and J. Scott Keogh, Australian National University
- Paul Doughty, Western Australian Museum
- Rob Browne-Cooper, Eco Logical Australia
- Brad Maryan, Biologic Environmental Survey
- Mike Bamford, Bamford Consulting Ecologists

summary

Ctenotus ora, the 'Coastal Plains Skink', is a recently described species of medium sized skink with a restricted range in the south-west of Western Australia, most of which has been cleared for agriculture and urban development. It cannot reliably be distinguished from the more widespread *C. labillardieri* except by DNA sequences, but the two species appear to have disjunct distributions.

C. ora is considered to be of high conservation significance (recently listed as Priority 1 by the Western Australian Department of Environment and Conservation). It is thought to be dependent on sandy substrates, appears to have low population density where it occurs, and populations are fragmented both by the discontinuous distribution of sandy soils, and of remnant vegetation providing suitable habitat. Any clearing of suitable habitat within the range of this species could have at least temporary and potentially significant impacts on local populations, because of the low population density and prior fragmentation of habitat by urban and agricultural development.

Review of locality records of museum specimens and survey reports indicates that additional populations of '*Ctenotus labillardieri*' occur outside and between the known ranges of either species, and potentially represent *C. ora*. The identity of populations on and adjacent to the Whicher Scarp (northern margin of Blackwood Plateau) may be important in assessment of impact, because this area represents a large area of contiguous woodland habitat where the resident species (whichever that is) is likely to be secure.

The identity of the *Ctenotus* species at Armstrong Reserve, Dunsborough, has yet to be confirmed genetically but it is likely to be *C. ora*. Maps are constructed indicating the estimated distribution of suitable habitat within Armstrong Reserve, based on vegetation structure (as related to known capture sites, and behavioural and ecological data on other *Ctenotus* species), and at local up to regional scales based on the distribution of sandy soil types and existing remnant vegetation. These maps indicate that the Dunsborough population is likely to extend to several contiguous blocks of bushland as well as Armstrong Reserve, but may be effectively isolated from larger areas of occupied habitat to the east and west. The proposed development area does not break any existing linkages that might be important to a population of *C. ora*.

1.0 introduction

Ray Village Aged Services (Inc.) trading as Capecare is a not-for-profit community organisation which delivers aged care services to the south-west region of Western Australia. Capecare has identified Armstrong Reserve, Dunsborough, as a possible site for the development of an aged care facility. The proposal is currently subject to a Public Environmental Review (EPA Assessment No. 1808).

Subsequent to a meeting at the OEPA on 26/09/2012 regarding the identification of a *Ctenotus* sp. skink trapped, photographed and released at Armstrong Reserve during the Level 2 Fauna Survey in 2011 (Ecoscape 2012), Hans Jacob (OEPA) provided the following questions and points for consideration by the proponent Capecare:

- What is the distribution of the *C. ora*'s preferred habitat within Armstrong Reserve, in the Dunsborough area and on the Swan Coastal Plain (using existing information about habitat distribution)? This is to place the loss of *C. ora* habitat in an appropriate context.
- What are the likely indirect impacts of the development on the species and can the threats and pressures from the development be managed and contained to the development footprint?
- Are there opportunities to include ongoing management measures for the species in the management plan for the reserve? For example, the placement of logs (especially Banksias) and other woody debris from the area of the development into the habitat proposed to be retained. Fire management which takes into account the protection of specialised microhabitat requirements of *C. ora*.

In order to address these questions, Ecoscape conducted a desktop assessment and a targeted habitat survey for the newly recognised species of conservation concern, *Ctenotus ora* Kay & Keogh, 2012. An additional individual of the *Ctenotus* species (presumed to be *C. ora*, but yet to be confirmed by genetic tests) was also obtained in Armstrong Reserve and accessioned to the Western Australian Museum in November 2012.

2.0 Summary of data on target species

***Ctenotus ora* Kay & Keogh, 2012 (Coastal Plains Skink)**

Conservation status

DEC Priority 1 (not announced, but listed as such on licence issued 1 November 2012)

Taxonomic status and relationships

The genus *Ctenotus* is a highly diverse clade (ie all descendants of a single common ancestor) of medium-sized, mostly robust and strong-limbed skinks (Scincidae, Lygosominae, *Sphenomorphus* Group). It contains at least 98 species distributed throughout mainland Australia (except the south-east corner) and southern New Guinea, the common ancestor of which diverged from their nearest relative *Lerista* (an almost equally diverse genus, most of whose species are elongate burrowers with reduced limbs) approximately 20 million years ago (Greer 1989;Rabosky *et al.* 2007).

The *Ctenotus labillardieri* species group (Storr 1974;Storr 1975) has been defined in a way that does not imply all members are genealogically closely related, but includes one or more of the most 'basal' genetic branches within the genus (Rabosky *et al.* 2007). All members of this species group are restricted to near-coastal southern Western Australia (Ehmann 1992;Kay & Keogh 2012;Storr 1974;Wilson & Swan 2010), and some have very restricted or fragmented distributions, e.g. *C. lancelini* (Lancelin Island Skink, listed under the *EPBC Act 1999* and Schedule 1 of the *WC Act 1950*), *C. delli* (Darling Range Heath Ctenotus, DEC P4), and *C. gemmula* (Jewelled South-west Ctenotus, isolated Swan Coastal Plain population DEC P3).

Ctenotus ora is the first new member of this species group to have been described since 1975. It is morphologically very similar to some individuals of *C. labillardieri*, but shown by analysis of mitochondrial and nuclear DNA sequences to be more closely related to *C. lancelini,* while all populations of *C. labillardieri* share more recent common ancestry with each other (Kay & Keogh 2012). *Ctenotus labillardieri, C. ora, C. lancelini, C. gemmula*, and probably *C. delli* form a closely related 'core' group; the relationships of *C. delli* are uncertain, as no tissue sample has been available for DNA comparison (Kay & Keogh 2012). *Ctenotus youngsoni* and *C. catenifer* have been considered members of the same species group (Storr 1974;Storr 1975) but are somewhat more distantly related to the core group (Kay & Keogh 2012), and the Shark Bay species *C. youngsoni* belongs to a separate genetic lineage with northern/arid-zone species *C. rubicundus*, *C. strauchii*, and *C. pantherinus* (Rabosky *et al.* 2007). *Ctenotus catenifer* has not been included in phylogenetic studies other than Kay & Keogh (2012), so its affinities are less clear but can be excluded from the *C. labillardieri* core group.

Diagnosis of *C. ora*

The critical section of the taxonomic description (Kay & Keogh 2012) reads:

Diagnosis. *Ctenotus ora* is distinguished from sister taxon *C. lancelini* by its smaller size, generally darker colouration and lack of vertebral stripes (see Ford 1969). It is distinguishable from *C. gemmula*, *C. delli* and *C. catenifer* by a continuous white dorsolateral line, and from *C. youngsoni* by its smaller size and sharper dorsal patterning (Figure 5). *C. ora* can be distinguished from *C. labillardieri* by its smooth copper-brown dorsum and absence of white specks above the dorsolateral line.

However, *C. labillardieri* also often has a 'smooth' dorsum without lighter or darker spots (typical of northern parts of the range; Storr *et al.* 1999), so that not all individuals can be distinguished by these characters. A principal components analysis of 'continuous' characters of external morphology indicates some separation of *C. ora* from other species in the second component, summarising shape and meristics, but there is extensive overlap in ranges of both continuous and categorical variables (Kay & Keogh 2012). Thus, there is currently no way to distinguish the two species based on intrinsic morphological features, but only by reference to molecular or locality data. This in no way invalidates or questions the separate specific status of *C. ora*, but points to the practical difficulty of identification when dealing with animals in the field as well as written records, photographs, or preserved specimens.

Known distribution and recorded habitat

Based on only five specimens identified as *Ctenotus ora*, the species is apparently restricted to the southern Swan Coastal Plain and Cape Naturaliste area, as far north as Pinjarra and south as far as Yallingup (Kay & Keogh 2012). There has been growing awareness among a few zoologists of the distinctiveness and patchy distribution of coastal plain '*C. labillardieri*', as mentioned in some previous reports and reviews (Bamford *et al.* 2010;Bush *et al.* 1995;How *et al.* 2009;Wilson & Swan 2010) but apparently no individuals have been recognised as distinct from *C. labillardieri* at the time of collection. It is thought to occur in very low densities across its range, in contrast to neighbouring *C. labillardieri* populations, which may occur in high densities associated with granite outcrops in the Darling Range (Bush *et al.* 1995;Kay & Keogh 2012;Orange 2005).

The common name suggested by Kay & Keogh may be misleading, as two of the five specimens are from the Cape Naturaliste area, west of the Dunsborough Fault and not actually on the coastal plain (the type locality is approximately 100 m above sea level). The alternative of '**Geographe Bay Skink**' can be suggested.

This species seems to have a preference for sandy substrates with low vegetation (including heath) in open *Eucalyptus/Corymbia* woodland over *Banksia* (Kay & Keogh 2012). Individuals have been found sheltering under *Banksia* logs on white sand, and trapped in eucalypt woodland with Banksia or Peppermint mid-storey, or heath (Bamford et al. 2010;DEC 2012). Photographs of suitable *Ctenotus* habitat at the approximate collecting locations of the holotype and one paratype specimen are given in **Figure 6** and **Figure 7** (**Appendix 2**).

Likely additional records within known range

The genetic study of Kay and Keogh (2012) did not demonstrate any sympatry or overlap between *C. ora* and *C. labillardieri*, and was thus consistent with complete separation in geographic range and habitat (**Figure 1**). This suggests that any specimens previously identified as *C. labillardieri* (or *C. delli*, in one case) recorded from the southern Swan coastal plain and Cape Naturaliste area are likely to belong to *C. ora*. By assuming this to be the case, a number of additional WAM specimens and fauna survey records can be attributed to the new species. It should be noted that there are considerable areas in the south-west bioregion where one or more *Ctenotus* species are likely to occur (or have occurred historically) but are not represented by available records (**Figure 2**), so that any attempt to draw a realistic distribution map depends on interpolation and extrapolation. For example, there are very few records on the Blackwood Plateau, so that potential contact or separation of *C. ora* and *C. labillardieri* in this area has not been documented.

Specimen and fauna survey data that may pertain to *C. ora* are given in **Table 1** (Appendix and mapped in **Figure 3**, including all specimens reported in *NatureMap* (DEC 2012) as *C. labillardieri* or *C. delli* but occurring within or adjacent to the geographic range of *C. ora*. These include four additional WAM specimens from the Cape Naturaliste area and three (poorly localised) from east of Lake Clifton, and fauna survey records (without vouchers) from Bunbury, Kemerton Industrial Park, and Point Grey. Two records from Smiths Beach, just south of the Yallingup paratype locality (ATA Environmental 2007), are not included in the *NatureMap* database.

Two specimens provisionally identified as *C. ora* have been recorded in Armstrong Reserve, Dunsborough; details are given in **Section 3**.

Possible range extensions, north and south

Beyond the coastal strip from Pinjarra to Yallingup, there are two areas in which populations reported as *Ctenotus labillardieri* occur on the Swan Coastal Plain, but were neither sampled genetically nor included in the morphological study of Kay & Keogh (2012), and hence lie outside the range of both C. labillardieri and C. ora shown in **Figure 1**. Summaries of these records are also included in **Table 1** and mapped in **Figure 3**. They are not assumed here to represent *C. ora*, but also should not be assumed to be *C. labillardieri* without either molecular evidence or discovery of morphological diagnostic criteria applicable to individuals.

There are records of eight WAM specimens identified as *C. labillardieri* from the Perth area below the Darling Scarp, from Herne Hill to Gosnells, and west as far as Kewdale. None of these specimens was collected after 1986; the existence of a Perth population would certainly have been known to museum zoologists, but has not been mentioned in local or State-level field guides (Bush *et al.* 1995;Storr *et al.* 1999), suggesting it has been assumed to be extinct. Identity of these lizards might be determined in future by applying 'ancient DNA' methods to museum specimens (not guaranteed to work, eg Schander & Halanych 2003) or from fresh specimens if a population does persist in

remnant bushland within this range (eg around Perth Airport). Because the closest relative of *C. ora*, *C. lancelini*, occurs north of Perth, their common ancestor presumably had a continuous distribution along the coastal plain and there is no reason to rule out recent presence of *C. ora* in the Perth area.

Populations identified as *C. labillardieri* have also been recorded from several locations along the Whicher Scarp, in the north-east between Gwindinup and Capel River (Bamford & Bamford 2000;Bancroft & Bamford 2008), and south-east of Busselton (Harewood 2012). The Whicher Scarp diverges from the Darling Scarp near Wokalup and forms a parabolic curve (northern margin of Blackwood Plateau) approaching the coast at Dunsborough. Vegetation and faunal communities on the scarp have features of both the Southern Jarrah Forest and Swan Coastal Plain Bioregions. The landscape is undulating with lateritic soils high in the landscape, but extensive sandy and sandy loam soils in valleys. The vegetation is broadly Jarrah/Marri woodland typical of the Southern Jarrah Forest, but there are coastal plain elements in some areas where sands are deep (Bancroft & Bamford 2008;Keighery *et al.* 2008). The western part of the scarp has been largely cleared, and the remaining forest has been subject to logging, but the few trapping surveys carried out in the area have found '*C. labillardieri*' to be relatively abundant. Without genetic evidence, there is no basis for assuming that these populations are actually *C. labillardieri* rather than *C. ora*.

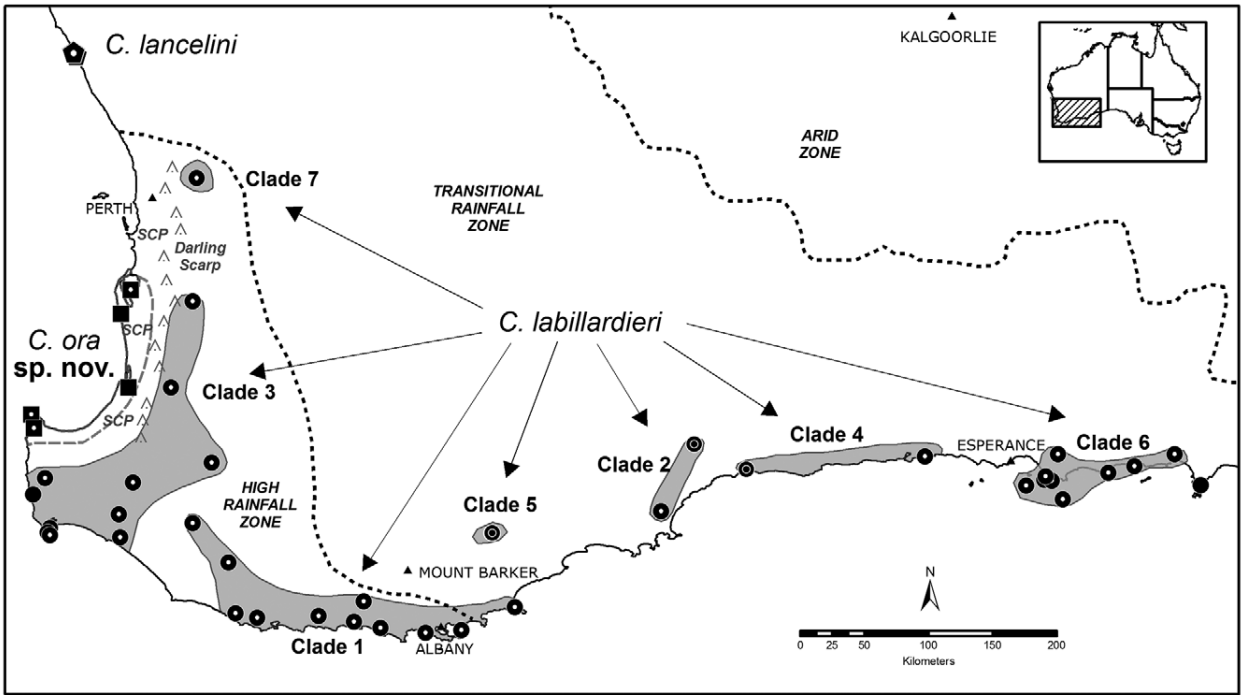

Figure 1. Distribution of *Ctenotus ora, C. lancelini*, and seven distinct clades comprising *C. labillardieri* (figure 1 of Kay & Keogh 2012)

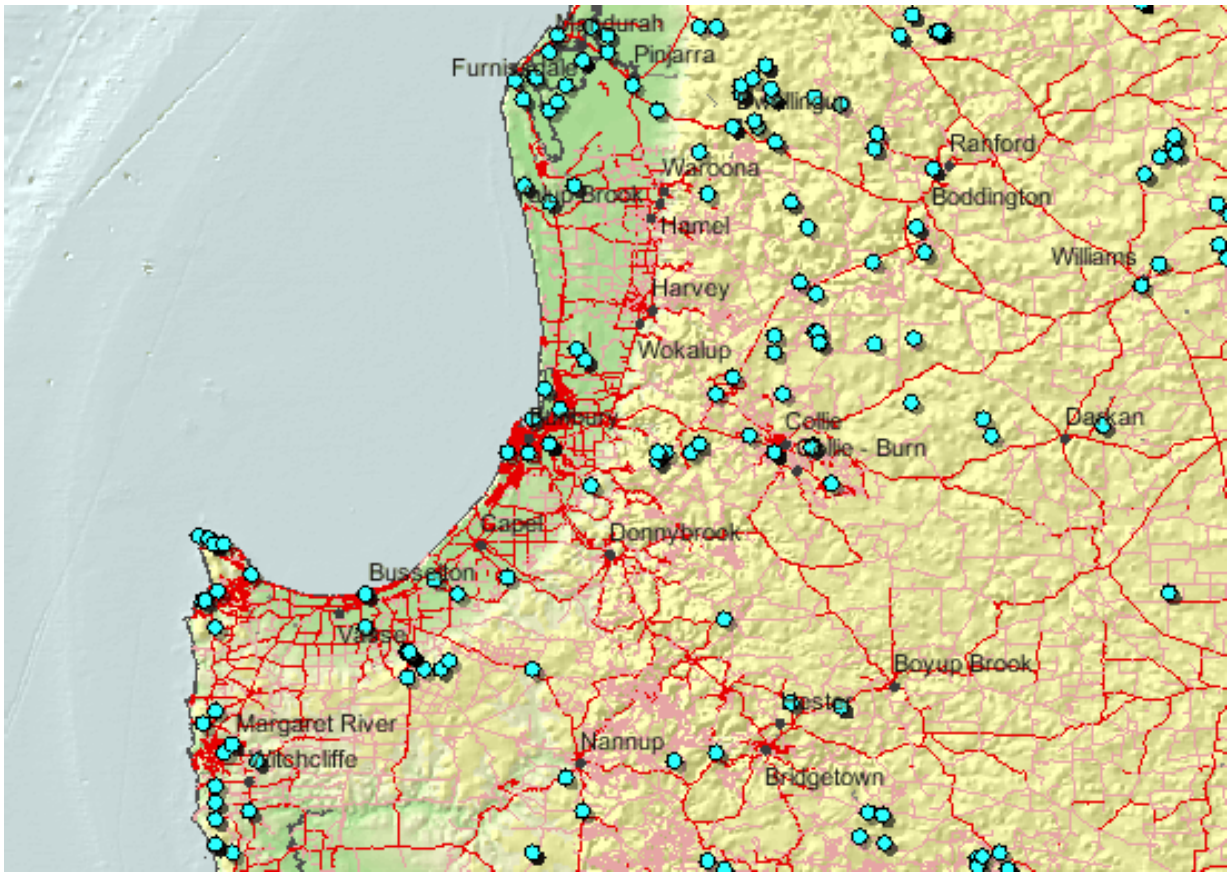

Figure 2. Southern Swan Coastal Plain and adjacent areas, showing localities for all species of Ctenotus recorded in NatureMap (DEC 2012)

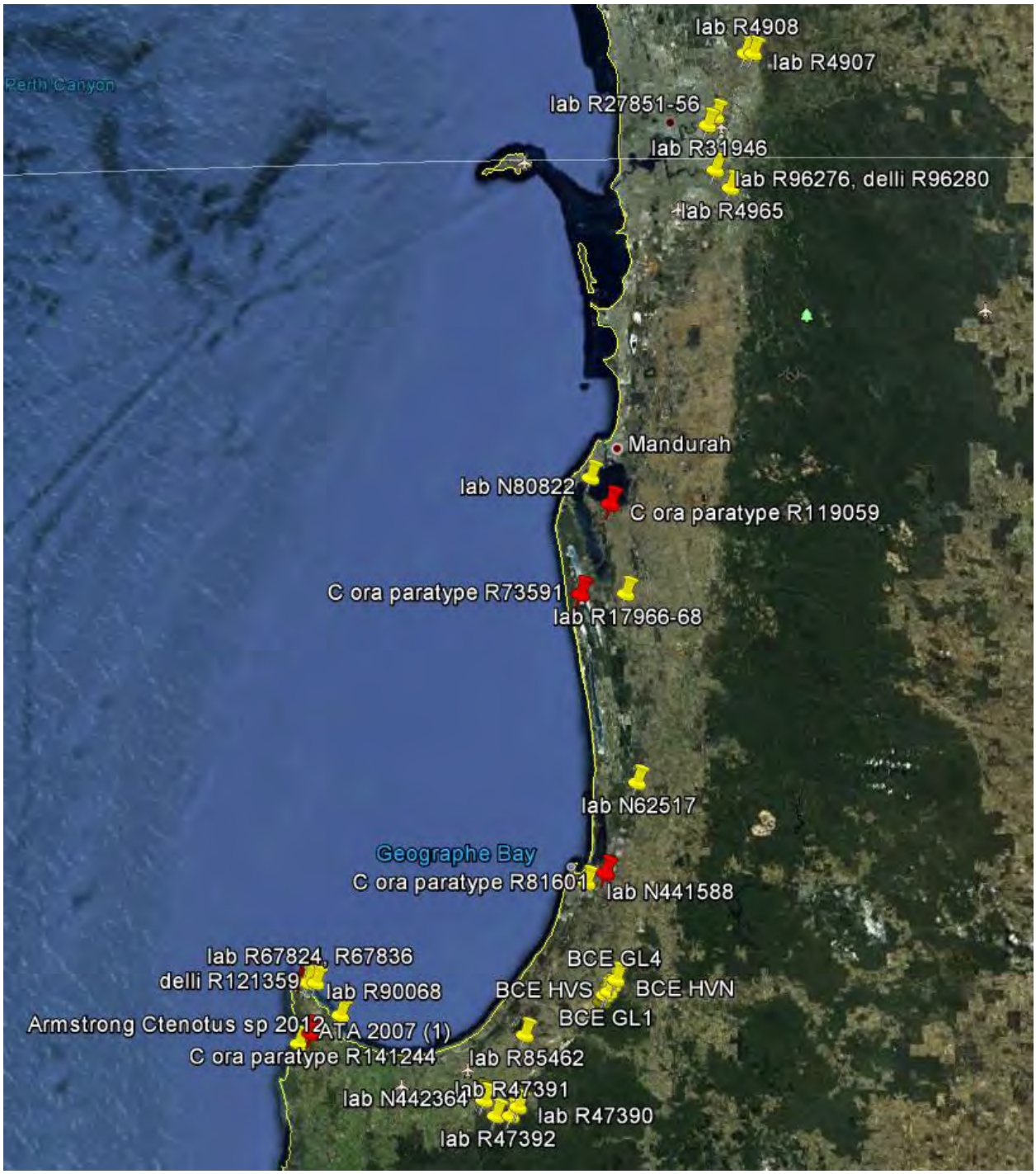

Figure 3. Localities of *Ctenotus ora* type specimens (red pins) and other records possibly of this species (yellow). Imagery: Google Earth

3.0 *Ctenotus* in Armstrong Reserve

A specimen trapped, photographed and released at on 16 September 2011 as part of a Level 2 fauna survey (Ecoscape 2012) (**Figure 4**) had a snout-vent length approximately 63 mm, slightly greater than reported in any of Kay & Keogh's sample of *Ctenotus ora*. It may have entered the trap on the previous day, as the trap was cleared at 11:20 am and had last been checked 24 hours earlier. During this interval, temperature at the Cape Naturaliste BoM station was between 15.3 and 18.0°C (Bureau of Meteorology 2012). The trap was located in the northern part of the reserve, in a partly grassy clearing within vegetation assessed by Ecoscape (2010) as type AfCcErBILOF (Peppermint, Marri, Flooded Gum and Banksia low woodland or open forest).

A second specimen was recently (11 November 2012) trapped in the southern part of the Reserve adjacent to the fence of the Shire works depot, in vegetation assessed by Ecoscape (2010) as type CcAfMxOF (Marri, Peppermint, and mixed species low woodland or open forest). A skink consistent with *Ctenotus* was seen fleeing to cover (sticks and leaf litter around the base of a small Peppermint) at 12:10 pm, and a funnel trap was then set at the site, with short fences along the edge of the litter pile (**Figure 8, Appendix 2**). When checked at 2:39 pm the trap contained an adult *Ctenotus* and also a Morethia lineoocellata, both of which had heavy burdens of red mites attached around axilla and behind base of hindlimb (cover image and **Figure 5**).

The recently collected *Ctenotus* specimen will be accessioned to the Western Australian Museum collection and sampled for DNA comparison to confirm specific identity. The two Armstrong Reserve specimens differ in various details of colour and pattern. Some of these may reflect temporal variation related to season, the ecdysis cycle and/or reproductive condition, such as being generally darker and having a pale buff rather than lemon-yellow ventral surface.

Neither specimen has a plain or 'smooth' copper-brown dorsum as considered diagnostic for the species , but both have dark flecks forming two distinct longitudinal series (paravertebral lines) as in some *C. labillardieri*. This feature is also present in a specimen photographed by Brad Maryan, identified as *C. ora* and featured in electronic news stories in late October (eg ABC Science 2012). It is unlikely (in a skink) that black pattern elements would be rapidly lost in alcohol-preserved specimens, so if the Dunsborough specimens are C. ora the species is variable in this character.

No other captures or positive sightings of this species or any other *Ctenotus* were made during either survey, so no attempt is made here to assess their relative or absolute abundance.

Figure 4. *Ctenotus* sp. Captured and released at Armstrong Reserve in September 2011

Figure 5. *Ctenotus* sp. Captured at Armstrong Reserve in November 2012

4.0 Potential distribution of *Ctenotus ora*

To place the loss of *C. ora* habitat in Armstrong Reserve in an appropriate context, it is necessary to assess the extent and distribution of its habitat:

- within the Reserve, to determine what would be lost vs retained at a site where *Ctenotus* (presumed to be *C. ora*) is known to occur
- in the Dunsborough area relevant to a local population that is potentially viable in the long term, and current or past linkages to other areas of habitat in the region
- in the complete range of the species, comprising the Cape Naturaliste area and southern Swan Coastal Plain.

Map 1 shows the estimated extent of habitat currently suitable for *Ctenotus* within Armstrong Reserve, and its intersection with the proposed development area. Trap locations are also shown, indicating sites where *Ctenotus* was recorded in either the 2011 or 2012 surveys. Areas considered unsuitable are those where either the canopy or understorey vegetation is closed, so that sunlight does not regularly reach exposed soil or leaf litter, or areas that are completely cleared. This distinction does not correspond with those used in mapping vegetation type or condition in previous surveys, but the *Melaleuca*-dominated vegetation type (MrErAflOF in Ecoscape 2010) is generally lower-lying, wetter and thicker than other types, and correlates with closed and unsuitable habitat.

The presence of logs on the ground was examined as a potential habitat indicator during November 2012, but is not utilised in any quantitative way here. Such interpretation would have to consider numerous variables affecting the habitat value of individual logs (species, age since fall, size, insolation, wetness, surrounding vegetation etc); freshly cut sticks (potentially including dumped garden waste) may be as important a resource as massive, damp old logs. The distribution of logs was assessed by photographing as many as possible using a GPS-capable camera and plotting photo locations on a map. There do seem to be more, or more suitable logs in more open areas, but this is partly due to factors such as the progressive death of *Banksia* due to dieback, and accessibility of open habitat near roadsides for disposal of loppings.

Maps 2-4 use a different approach to estimating extent of potential habitat, based on the recorded association of *C. ora* specimens, including those at Armstrong Reserve, with sandy soils, and with open forest or woodland vegetation (usually *Eucalyptus* and/or *Corymbia* over *Banksia* and/or*Agonis*, with open heath or sedge understorey). Because this description fits most of the vegetation that occurs on sandy soils in the region, these maps use the intersection of only two data layers, representing sandy soils and remnant native vegetation.

Map 2 covers the Dunsborough area, showing Armstrong Reserve, Marri Reserve, and a similar-sized area of remnant vegetation on the western side of Cape Naturaliste Road, as a nearly continuous red

area at the centre. All three areas were traversed during the November 2012 survey, and considered to contain equally suitable *Ctenotus* habitat. As skinks the size of *Ctenotus* are able to cross roads (though less frequently than larger species like *Egernia kingii*, which was observed crossing Naturaliste Terrace during the survey), it is considered likely that a single population of *C. ora* currently occupies these three adjacent patches of habitat. The map shows that this area of habitat was historically continuous with the coastal Quindalup dune system (extending south-east), but narrowly separated from more patchily distributed areas of sandy soil extending south and west. Due to clearing, all three linkages are now broken, with multiple gaps of several hundred metres between remnant patches. These gaps are likely to have effectively isolated the Dunsborough *Ctenotus* population, although some individuals may be able to utilise marginal habitats and survive road crossings to move between fragments occasionally.

Map 3 shows that the three linkages meeting at Dunsborough connect westward to large areas of suitable habitat extending from Cape Naturaliste to Yallingup (where there are two definitive and six likely records of *C. ora*), eastward to significant remnant patches of Peppermint-dominated woodland along the coast, and south-south-east along Whicher Scarp, where remnant habitat is more fragmented but contains numerous blocks of similar size to that at Dunsborough.

Map 4 zooms out to the complete distribution range of *C. ora* (but excluding the Perth area) and indicates that large and nearly continuous areas of remnant potential habitat, with scattered records known or likely to represent *C. ora*, exist in coastal areas between Busselton and Mandurah. As shown in **Figure 2** (**Section 2** above), records of *Ctenotus* throughout this area are unevenly distributed and contain large gaps; consequently, they are unlikely to fully or accurately represent the actual distribution of any species, so that the poor knowledge of *C. ora*'s distribution at this scale is not exceptional.

These maps show that the complex and fragmented geometry of (presumed) potential habitat for *C. ora* is not only due to historic clearing, but also to the patchy distribution of suitable soil types in a geologically complex bioregion. They also show that there are extensive areas of protected habitat where the species is known to occur and likely to be more or less continually distributed (Cape Naturaliste to Yallingup, Bunbury to Dawesville), and another large area where the identity of *C. labillardieri* species-group populations has yet to be determined (Whicher Scarp).

The proposed development area of Armstrong Reserve does not break any linkages within existing or potential habitat at either a local or regional scale, and represents a very small proportion of the area known or likely to be occupied by *Ctenotus ora*.

references

ABC Science. 2012. *New species of Australian lizard found*. Available from: <http://www.abc.net.au/science/articles/2012/10/29/3620983.htm>.

ATA Environmental 2007, *Vertebrate Fauna Assessment, Smiths Beach, Yallingup*, Unpublished report for Canal Rocks Pty Ltd, 2006/50.

Bamford, M. J. & Bamford, A. R. 2000, *Proposed Gwindinup Mineral Sands Mine: Fauna Surveys; August and December 1999*, Prepared for Cable Sands WA, Bunbury.

Bamford, M. J., Huang, N., Bancroft, W., & Bamford, M. 2010, *Level 2 Fauna Assessment of Remnant Vegetation at the Proposed Point Grey Marina*, Report prepared for RPS.

Bancroft, W. & Bamford, M. J. 2008, *Fauna values of Bemax's Happy Valley mineral sands deposit*, Prepared for Bemax Resources Limited, Bunbury.

Bureau of Meteorology. 2012. Climate Data Online. 2012.

Bush, B., Maryan, B., Browne-Cooper, R., & Robinson, D. 1995. *A Guide to the Reptiles and Frogs of the Perth Region* Perth, University of Western Australia Press.

Chapman, A. & Dell, J. 1975, "Reptiles, amphibians and fishes," in *Records of the Western Australian Museum, Supplement 1: A Biological Survey of Cape Le Grand National Park*, pp. 34-38.

Department of Environment and Conservation. 2012. *NatureMap*. Available from: <http://naturemap.dec.wa.gov.au/default.aspx>.

Ecoscape (Australia) Pty Ltd 2010, *Armstrong Reserve, Dunsborough - Flora and Vegetation Assessment*, Prepared for Ray Village Aged Services (Inc), 6678-2279-09R.

Ecoscape (Australia) Pty Ltd 2012, *Armstrong Reserve Level Two Fauna Survey*, Report prepared for Ray Village Aged Services (Inc) trading as Capecare, 7925-2582-11R .

Ehmann, H. 1992. *Encyclopedia of Australian animals: Reptiles* Sydney, Angus and Robertson.

Goodyear, S.E. & Pianka, E.R. 2011. Spatial and temporal variation in diets of sympatric lizards (genus *Ctenotus*) in the Great Victoria Desert, Western Australia. *Journal of Herpetology*, vol. 45, pp. 265-271

Greer, A.E. 1989. *The biology and evolution of Australian lizards* Chipping Norton NSW, Surrey Beatty.

Harewood, G. 2012, *Phase 1 and 2 Seasonal Fauna Surveys, Yoongarillup Mineral Sands Project*, Report for Doral Mineral Sands Pty Ltd, SF 008335.

Heatwole, H. 1976. *Reptile Ecology* St Lucia Qld, University of Queensland Press.

How, R.A., Maryan, B., & Stevenson, C.A. 2009. An assessment of herpetofauna on near-coastal landforms between Dawesville and Binningup, southern Swan Coastal Plain. Prepared for Western Australian Department of Environment and Conservation., vol. WAMTZ/2009/DB,

Kay, G.M. & Keogh, J.S. 2012. Molecular phylogeny and morphological revision of the *Ctenotus labillardieri* (Reptilia: Squamata: Scincidae) species group and a new species of immediate conservation concern in the southwestern Australian biodiversity hotspot. *Zootaxa*, vol. 3390, pp. 1-18

Keighery, B. J., Keighery, G. J., Webb, A., Longman, V. M., & Griffin, E. A. 2008, *A Floristic Survey of the Whicher Scarp*, Department of Environment and Conservation, Perth.

Orange, P. 2005, "Reptiles & Frogs," in *Guide to the Wildlife of the Perth Region*, S. J. Nevill ed., Simon Nevill Publications, Perth, pp. 124-165.

Pike, D.A., Pizzatto, L., Pike, B.A., & Shine, R. 2008. Estimating survival rates of uncatchable animals: the myth of high juvenile mortality in reptiles. *Ecology*, vol. 89, no. 3, pp. 607-611

Rabosky, D.L., Donnellan, S.C., Talaba, A.L., & Lovette, I.J. 2007. Exceptional among-lineage variation in diversification rates during the radiation of Australia's most diverse vertebrate clade. *Proceedings of the Royal Society B*, vol. 274, no. 1628, pp. 2915-2923. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2291154/

Read, J.L. 1998. The ecology of sympatric scincid lizards (*Ctenotus*) in arid South Australia. *Australian Journal of Zoology*, vol. 46, pp. 617-629

Schander, C. & Halanych, K.M. 2003. DNA, PCR and formalinized animal tissue - a short review and protocols. *Organisms Diversity & Evolution*, vol. 3, pp. 195-205

Storr, G.M. 1974. The genus *Ctenotus* (Lacertilia, Scincidae) in the South-west and Eucla divisions of Western Australia. *Journal and Proceedings of the Royal Society of Western Australia*, vol. 56, no. 3, pp. 86-93

Storr, G.M. 1975. The genus *Ctenotus* (Lacertilia, Scincidae) in the Kimberley and North-west divisions of Western Australia. *Records of the Western Australian Museum*, vol. 3, no. 3, pp. 209-243

Storr, G.M., Smith, L.A., & Johnstone, R.E. 1999. *Lizards of Western Australia. I. Skinks* Perth, Western Australia, Western Australian Museum.

Taylor, J.A. 1986. Food and foraging behaviour of the lizard, *Ctenotus taeniolatus*. *Australian Journal of Ecology*, vol. 11, pp. 49-54

Wilson, S.K. & Swan, G. 2010. *A Complete Guide to Reptiles of Australia*, Third edn, Sydney, New Holland.

Maps

324000

Jingarie Pl

Cygnet Cove

Gifford Rd

Naturaliste Tce

Armstrong Pl

T01
T02
T03
T04
T05
T06
T07
T08
T09
T10
T11
T12
T13
T14
T15
F01
F02

LEGEND

- Trap Sites
- Trap Sites - *Ctenotus ora* caught
- Retirement Village Development Footprint
- Study Area

***Ctenotus ora* micro-habitat**

- Outside of Developmwnt Footprint
- Inside of Development Footprint

GDA 1994 MGA Zone 50

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DATE: 11-12 PROJECT NO: 2582-10

SCALE:1:950 @ A3

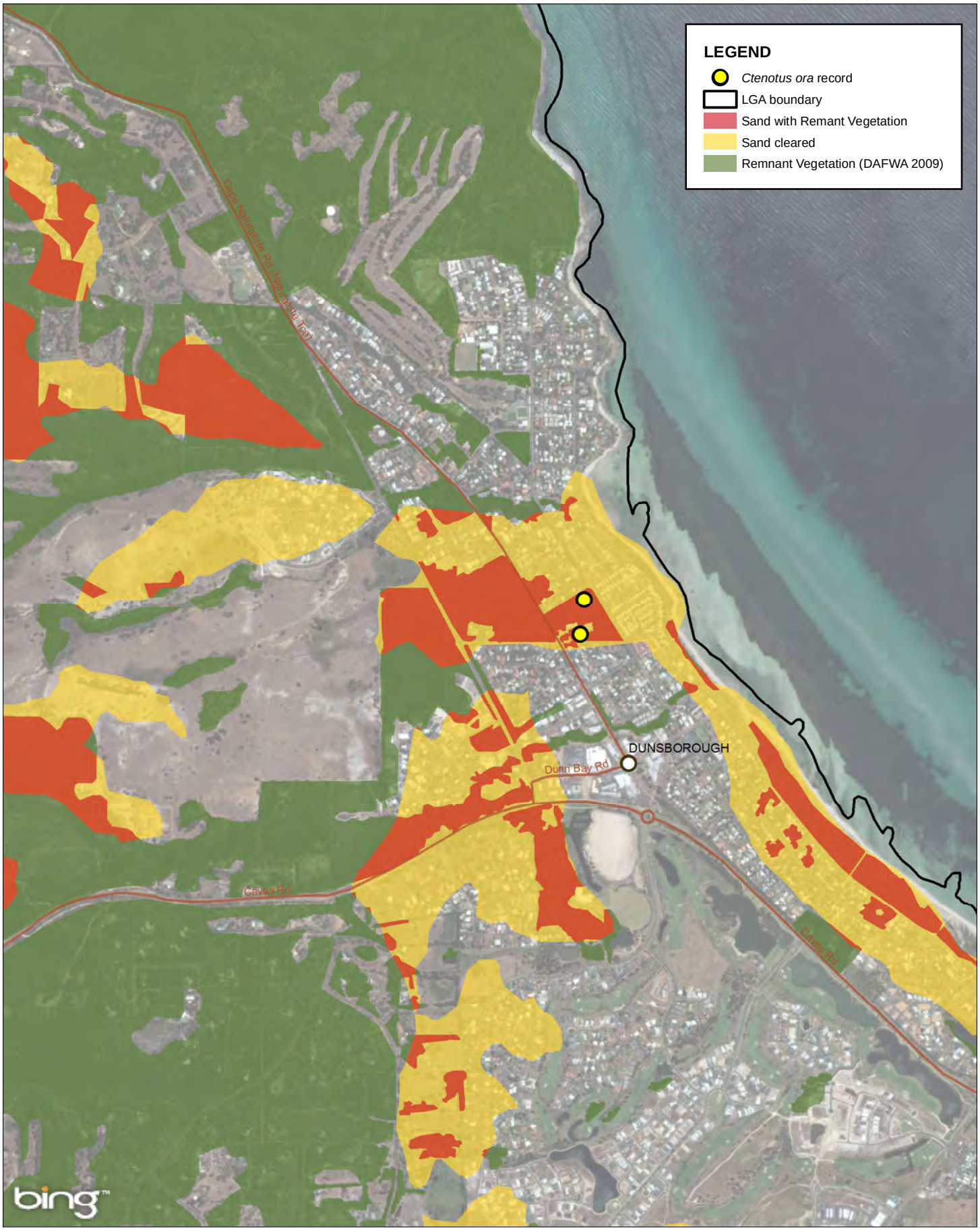
0 25 50 m

ARMSTRONG RESERVE DUNSBOROUGH *CTENOTUS ORA* POTENTIAL IMPACT ASSESSMENT

CLIENT: RAY VILLAGE AGED SERVICES INC.

***CTENOTUS ORA* MICRO-HABITAT**

MAP 1



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ARMSTRONG RESERVE DUNSBOROUGH

CTENOTUS ORA POTENTIAL IMPACT ASSESSMENT

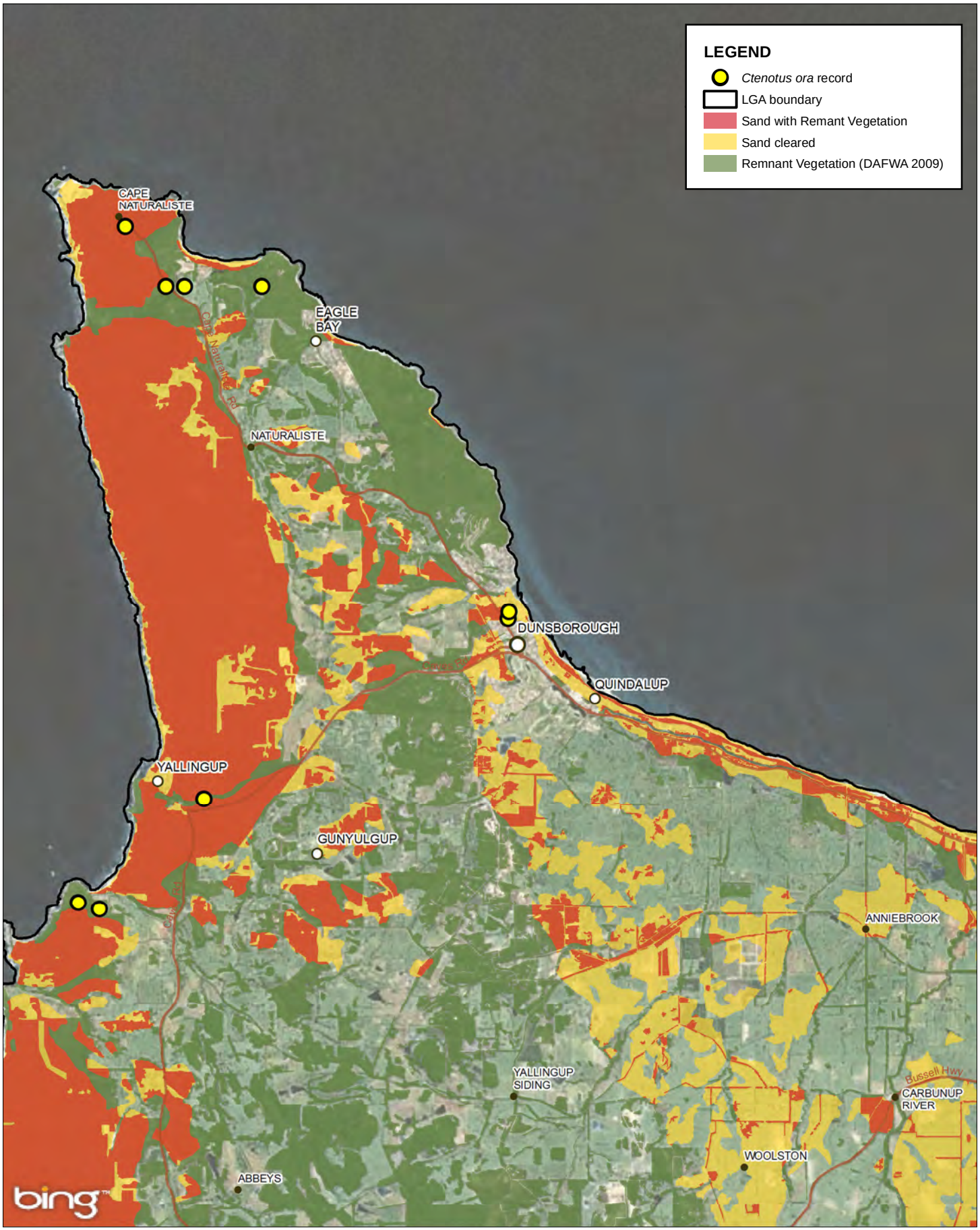
CLIENT: RAY VILLAGE AGED SERVICE INC.

LOCAL LINKAGES

Scale 1:25,000 @ A4

0 200 400 600 800 m

MAP 2



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ARMSTRONG RESERVE DUNSBOROUGH

CTENOTUS ORA POTENTIAL IMPACT ASSESSMENT

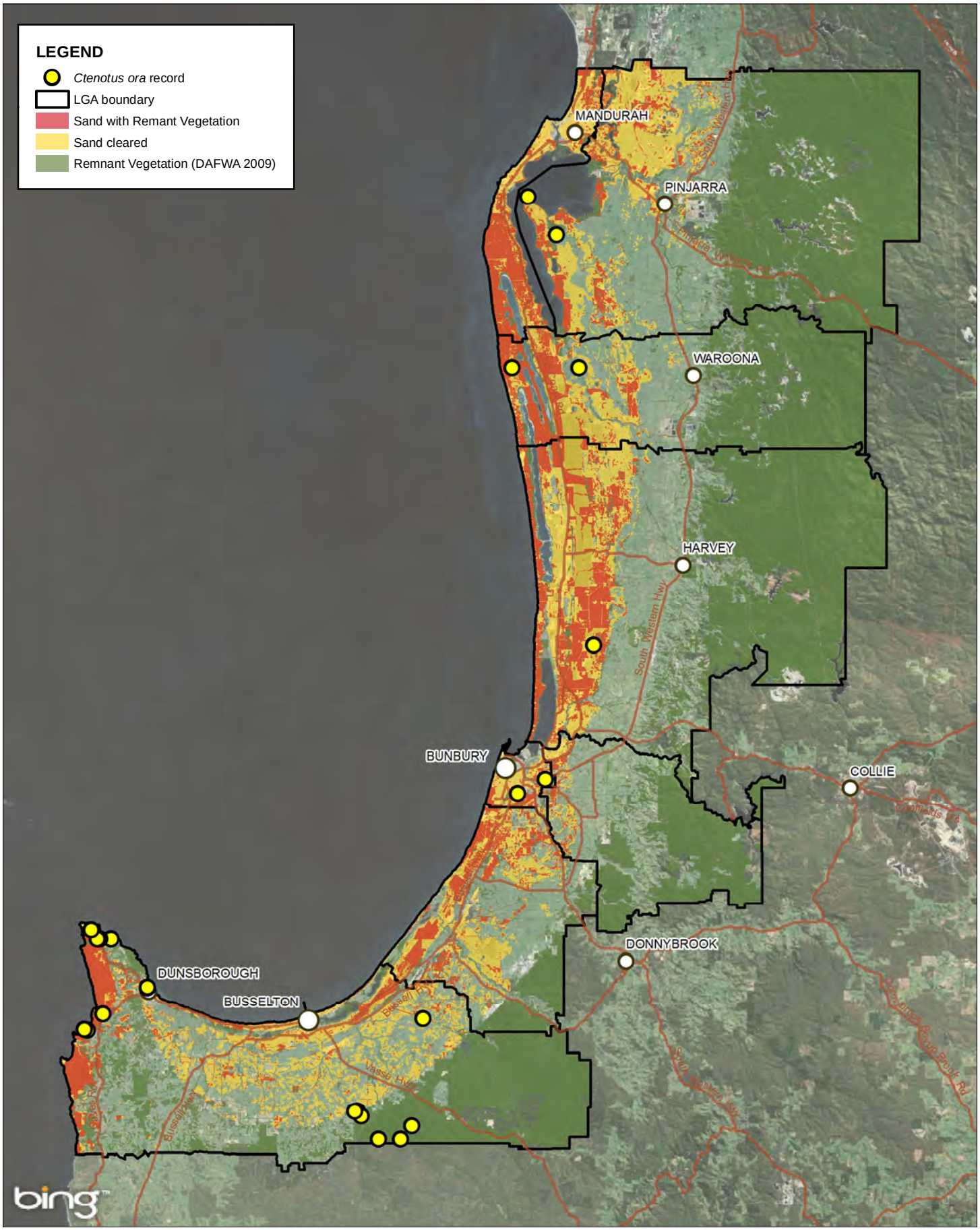
CLIENT: RAY VILLAGE AGED SERVICE INC.

CAPE NATURALISTE LINKAGES

Scale 1:125,000 @ A4

0 1 2 3 4 km

MAP 3



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CTENOTUS ORA POTENTIAL IMPACT ASSESSMENT

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SOUTHERN SCP LINKAGES

Scale 1:850,000 @ A4

0 10 20 30 km

MAP 4

appendix one: *Ctenotus* ecology and behaviour

This section is placed outside the main text because it is not based on data referring directly to *Ctenotus ora*, but is used in estimating the distribution of preferred habitat.

Greer (1989) describes typical behaviour of these lizards as follows: "*Ctenotus* are generally diurnal, sun-loving and largely terrestrial, although some species will climb in hummock grass or, occasionally, low shrubs […] after a particularly attractive prey item. They generally run fairly hot, having average active body temperatures of 30 to 38°C […]. When actively foraging, they move "nervously" through the habitat investigating likely hiding places for prey, occasionally pausing to look around or to bask, and dashing to cover at the slightest sign of danger."

The records of body temperatures of active individuals in the field, and preferred temperatures in laboratory gradients, fall in the 30 to 38°C range for all tropical and arid-zone species (including the nocturnal *C. pantherinus* at 33°C; Greer 1989) but an average of 25°C was reported in *C. taeniolatus* by Heatwole (1976) in the Armidale-Tamworth area (NSW highlands). No field activity or preferred temperatures have been reported for members of the *C. labillardieri* group, but they are likely to be lower than tropical and arid species. Activity does occur at ambient temperatures below 20°C (eg at Armstrong Reserve), but lizards are able to operate at temperatures well above that of the surrounding air by basking (eg Heatwole 1976), which is facilitated by dark colours that predominate in the *C. labillardieri* group. *Ctenotus* habitats are characterised by relatively open vegetation, often including expanses of nearly bare rock or soil. While *C. labillardieri* can inhabit wet Karri forest (Bush *et al.* 1995), they would be dependent on sunlight reaching the ground through breaks in the canopy.

Ctenotus generally shelter in shallow burrows dug under rocks, soil crusts, or other relatively flat and exposed cover (Ehmann 1992;Greer 1989); this facilitates passive thermoregulation (thigmothermy) when the cover object is warmed by sunlight. For species preferring or requiring high body temperatures for activity, this is generally advantageous relative to burrowing under large and poorly heat-conducting items such as logs, or in sites not reached by direct sun. *Ctenotus labillardieri* and *C. ora* have both been recorded under logs (Bush *et al.* 1995;Kay & Keogh 2012), consistent with relatively low body temperatures in these species.

Some *Ctenotus* species are dietary specialists (for example on termites), but most are generalist feeders on small invertebrates obtained by a combination of sit-and-wait (ambush) and active searching, and a few species ingest some plant material (Goodyear & Pianka 2011;Read 1998;Taylor 1986). Diets have not been reported for members of the *C. labillardieri* group.

All *Ctenotus* as far as known are oviparous (egg-laying), with clutch size related to maternal body size; 2-4 eggs per clutch have been reported in *C. labillardieri*, and 2 in *C. gemmula* (Chapman & Dell 1975;Greer 1989). Sexual maturity in *Ctenotus* usually occurs in the lizard's second year (sometimes earlier), and adults live for several years on average so that they make up the majority of the population at most times (Greer 1989;Pike *et al.* 2008).

appendix two: *Ctenotus ora* habitat photos

Figure 6. Cape Naturaliste carpark, vicinity of *Ctenotus ora* holotype locality, and view to south

Figure 7. Yallingup Brook, vicinity of *Ctenotus ora* paratype locality

Figure 8. Armstrong Reserve, trap site F01 (1 *Ctenotus* and 1 *Morethia*, 11 November 2012)

Figure 9. Armstrong Reserve, trap site F02 (vicinity of 2011 *Ctenotus* locality)

Figure 10. Marri Reserve, trap site F03 (no captures)

Figure 11. Marri Reserve, trap site F04 (5 *Morethia* and 2 *Acritoscincus*)

Appendix three: *Ctenotus ora/labillardieri* specimen summary

Table 1. *Ctenotus labillardieri/ora* specimen data. Records identified by WAM registration or NatureMap ID.

Specimen	Locality	Date	Easting (m)	Northing (m)	Accuracy (m)	Elevation (m)	Distance to shore (km)	Notes
WAM R131983 (holotype)	**Cape Naturaliste** [33°32`21"S, 115°01`13"E]	04/11/1997	316181	6287183	27	100	0.68	Under Banksia log in open Eucalypt woodland over Banksia on white sand
R73591 (paratype)	**Yalgorup National Park** [32°50`00"S, 115°39`00"E]	02/11/1980	373647	6366383	16100	6	1.65	Marri over heath on sand
R81601 (paratype)	**Eaton** [33°21`00"S, 115°42`00"E]	06/09/1982	379037	6309156	3220	14	3.5	
R119059 (paratype)	**Lake Mealup** (15km WSW Pinjarra) [32°40`00"S, 115°43`00"E]	09/10/1993	379664	6384938	1610	10	2.7	Under Banksia log on white sand; photo probably of this specimen in Bush et al (1995) p.119
R141244 (paratype)	**Yallingup Brook** [33°38`39"S, 115°02`15"E]	08/04/2000	318001	6275569	27	63	1.3	
R90068 'lab'	[**Cape Naturaliste**] 5.5 km NE [NW!] Meelup [Beach]	26/10/1985	317033	6285998	134	42	0.8	
R67824 'lab'	1 km E Willanup Spring, **Cape Naturaliste**	12/11/1979	317413	6286005	1610	31	0.65	
R67836 'lab'	1 km E Willanup Spring, **Cape Naturaliste**	10/11/1979	317413	6286005	1610	31	0.65	
R121359 'delli'	**Cape Naturaliste** [approx 33°33`00"S, 115°03`01"E]	24/11/1994	~318990	~6286035	N/Av	48	0.55	Location approximate, DEC Priority species
R17966 'lab'	**E of Lake Clifton**	06/03/1960	383007	6366501	8050	5	5.6	
R17968 'lab'	**E of Lake Clifton**	06/03/1960	383007	6366501	8050	5	5.6	

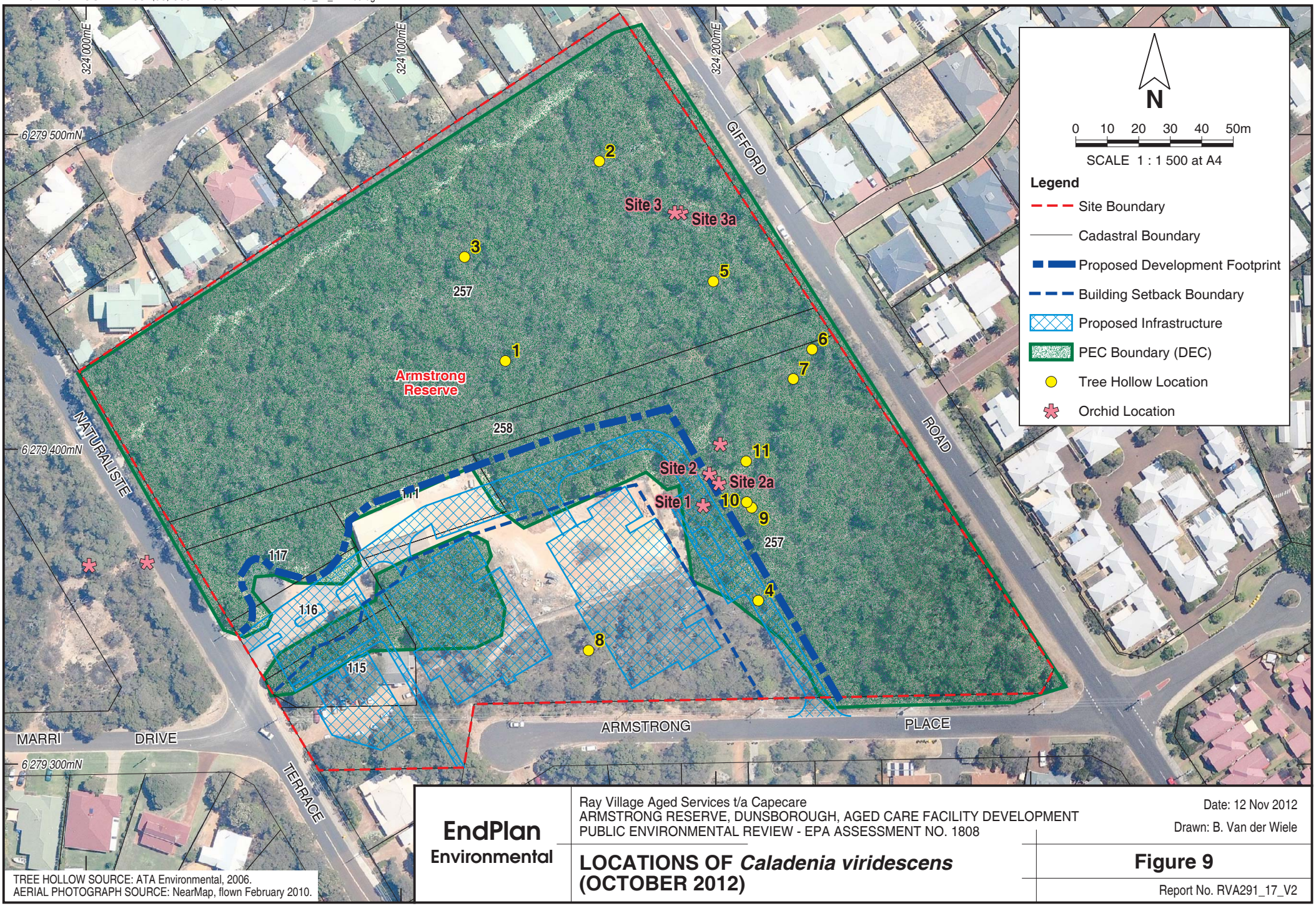
Specimen	Locality	Date	Easting (m)	Northing (m)	Accuracy (m)	Elevation (m)	Distance to shore (km)	Notes
R17967 'lab'	**E of Lake Clifton**	06/03/1960	383007	6366501	8050	5	5.6	
R47392 'lab'	**Ridge Road Busselton**	04/10/1974	356520	6258939	1600	132	19.4	
R47391 'lab'	**Witcher Road Busselton**	04/10/1974	359602	6258985	1610	150	20.6	
R47390 'lab'	**Hills Road Busselton**	17/10/1974	361121	6260860	1610	167	19.7	
Ecoscape 2011 256502	**Armstrong Reserve** (trap 15)	16/09/2011	324157	6279486	3	8	0.3	*Eucalyptus/Corymbia* over *Banksia* and *Agonis* over open heath/sedgeland on sand
Ecoscape 2012	**Armstrong Reserve** (F01)	11/11/2012	324147	6279340	3	11	0.4	*Eucalyptus/Corymbia* over *Banksia* and *Agonis* over open heath/sedgeland on sand
J Sansom 2012 'lab' 441588	**Bunbury**	02/05/2012	375173	6307121	100	21	3.9	SWIT Remnant bushland
G Harewood 2009 'lab' 62517	**Kemerton** Industrial Park	25/11/2009	385506	6327815	100	23	8.2	
BCE 2009 80822	**Point Grey**	03/11/2009	375592	6390273	100	2	0.22	*Eucalyptus rudis* and Melaleuca Dampland
ATA 2007 (not in NMap) x1	**Smiths Beach** Locality 2	11-12/2005	315482	6273416	~200	37	0.3	Open coastal heath (ATA Environmental 2007)
ATA 2007 (not in NMap) x5	**Smiths Beach** Locality 3	11-12/2005	315917	6273295	~200	38	0.3	Peppermint / Eucalypt woodland (ATA Environmental 2007)
BCE 2000 (not in NMap) x 3	**Gwindinup** Locality 1	12/1999	379000	6284100	~200			Whicher Vegetation Complex in sandy valley

Specimen	Locality	Date	Easting (m)	Northing (m)	Accuracy (m)	Elevation (m)	Distance to shore (km)	Notes
BCE 2000 (not in NMap) x 4	**Gwindinup** Locality 4	12/1999	380600	6286150	~200			Boundary of Whicher and Cartis Vegetation Complex on sandy slope/valley
BCE 2007 (not in NMap) x 2	**Happy Valley North**	11/2007	381298	6287286				
BCE 2007 (not in NMap) x 2	**Happy Valley South**	11/2007	379831	6284781				
BCE 2007 (not in NMap) x 4	**Control North**	11/2007	378973	6283746				
BCE 2007 (not in NMap) x 13	**Control South**	11/2007	378385	6282747				
G Harewood 2011 'lab' 442125	**Yoongarillup Mineral Sands Project** (funnel traps) – TS1.09	02/12/2011	353747	6262683	100			
442114	TS1.08	03/12/2011	353745	6262702	100			
442377	TS3.06	03/12/2011	354074	6262137	100			
442136	TS2.01	03/12/2011	353212	6262804	100			
442065	TS1.04	03/12/2011	353721	6262789	100			
442632, 442633	TS5.09	04/12/2011	353585	6262598	100			
442095, 442096	TS1.06	04/12/2011	353734	6262753	100			
442482	TS4.05	04/12/2011	353717	6262235	100			
442399, 442400	TS3.07	04/12/2011	354067	6262159	100			

Specimen	Locality	Date	Easting (m)	Northing (m)	Accuracy (m)	Elevation (m)	Distance to shore (km)	Notes
442066	TS1.04	04/12/2011	353721	6262789	100			
442193	TS2.02	04/12/2011	353210	6262783	100	61	14.6	
442571	TS5.03	04/12/2011	353523	6262760	100			
442483	TS4.05	05/12/2011	353717	6262235	100			
442364	TS3.05	05/12/2011	354081	6262109	100	92	15.55	
442546	TS5.01	06/12/2011	353516	6262816	100	58	14.7	
442453	TS4.03	06/12/2011	353697	6262194	100			
442634	TS5.09	06/12/2011	353585	6262598	100			
442572	TS5.03	08/12/2011	353523	6262760	100			
442416	TS3.08	09/12/2011	354049	6262168	100			
442105	TS1.07	09/12/2011	353734	6262735	100			
442401	TS3.07	10/12/2011	354067	6262159	100			
442032	TS1.10	10/12/2011	353748	6262658	100			
442566, 442547	TS5.01	10/12/2011	353516	6262816	100			
442592	TS5.05	10/12/2011	353539	6262721	100			

ATTACHMENT D
CALADENIA VIRIDESCENS LOCATIONS

PINPOINT CARTOGRAPHICS (08) 9562 7136 RVA291_17_V2-F09.dgn



TREE HOLLOW SOURCE: ATA Environmental, 2006.
AERIAL PHOTOGRAPH SOURCE: NearMap, flown February 2010.

EndPlan Environmental

Ray Village Aged Services t/a Capecare
ARMSTRONG RESERVE, DUNSBOROUGH, AGED CARE FACILITY DEVELOPMENT
PUBLIC ENVIRONMENTAL REVIEW - EPA ASSESSMENT NO. 1808

LOCATIONS OF *Caladenia viridescens* (OCTOBER 2012)

Date: 12 Nov 2012
Drawn: B. Van der Wiele

Figure 9

Report No. RVA291_17_V2