Action Plan for Mount Compass Oak-bush

(*Allocasuarina robusta*)

Prepared by Joe Quarmby

2011 - 2016

Government of South Australia
Department of Environment
and Natural Resources

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Summary

Allocasuarina robusta is a nationally endangered shrub, endemic to the Fleurieu Peninsula in South Australia. It generally grows in low-lying wet heath or open eucalypt woodland with a heath understorey, often near the margins of swamps and watercourses in sandy loam soils. It is often associated with critically endangered Swamps of Fleurieu Peninsula. It is currently known from 24 populations, with a total population size of approximately 1200 plants. Most sub-populations are very small, and comprise entirely of mature plants.

The majority of populations occur in degraded roadside vegetation, and are subject to a range of threats which are causing population decline. The main threats to the species are habitat loss and fragmentation, livestock grazing, road works, herbicide spraying, and weed invasion.

It is imperative that all existing populations of *A. robusta* are protected, and measures are taken to maintain and enhance populations. This plan aims to improve the conservation status of *A. robusta* by increasing the size and number of populations, and improving the protection and condition of habitat.

The priority actions in this plan include:

- inform key stakeholders to ensure awareness of the species
- install roadside markers and implement protective measures
- collect and preserve seed from all sub-populations
- undertake targeted weed control programs at priority sites
- propagate and plant seedlings into existing sub-populations
- re-establish large populations within reserves, and
- establish a recovery team to coordinate implementation

Population augmentation will be an integral part of the recovery program for this species. There is limited potential for seedling recruitment in most populations, and it is therefore planned to propagate and plant seedlings into existing populations. A translocation plan has been prepared and is included in Appendix 1 of this document.

Population summary reports with specific information and management recommendations for each sub-population are included in Appendix 3.

Contents

Figures and Tables

1. Species information

1.1 Description

Allocasuarina robusta is an erect, rigid shrub which grows to between 0.2 and 3.5 m in height. It has thin, smooth and rounded needles up to 20 cm long, which are divided into segments (7-12 mm long) with 5-7 non-overlapping teeth. Plants usually produce both male and female flowers. It has cones that are stalkless or on short stalks (Wilson and Johnson 1989).

Allocasuarina robusta has several closely related species, which occasionally grow together (Wilson and Johnson 1989). It can be difficult to distinguish from co-occurring species, especially *A. mackliniana* ssp. *mackliniana*, *A. striata* and *A. muelleriana* ssp. *muelleriana*. Genetic studies found that *A. robusta* is distinct from these species, and is most genetically similar to *A. paludosa* (Otewell & Quarmby 2009), which occurs in the south-east region of South Australia and in Victoria.

1.2 Conservation status

Allocasuarina robusta is listed as endangered in Australia under the *Environment Protection and Biodiversity Conservation Act 1999*. The species is listed because its geographic distribution is restricted and precarious for its survival (TSSC 2006ej). *A. robusta* is also listed as endangered in South Australia under the *National Parks and Wildlife Act 1972*.

1.3 Distribution

Allocasuarina robusta is endemic to South Australia. It has a very restricted distribution on the Fleurieu Peninsula, and is confined to 172 km² in the Yundi, Mount Compass and Hindmarsh Valley areas (refer to Map 1). Its current distribution is highly fragmented as a result of habitat clearance and stock grazing, and is largely restricted to isolated roadside remnants.

It is likely that *A. robusta* previously occupied a much larger area within its current range. Many of the separate remnant populations are likely to have been previously connected. Herbarium records also indicate that the species has disappeared from several locations including Nangkita, Blackfellows Creek, Myponga, Kuitpo, Yankalilla, and Inman Hills, which has resulted in a retraction of the species' range (refer to Map 1).

1.4 Population size

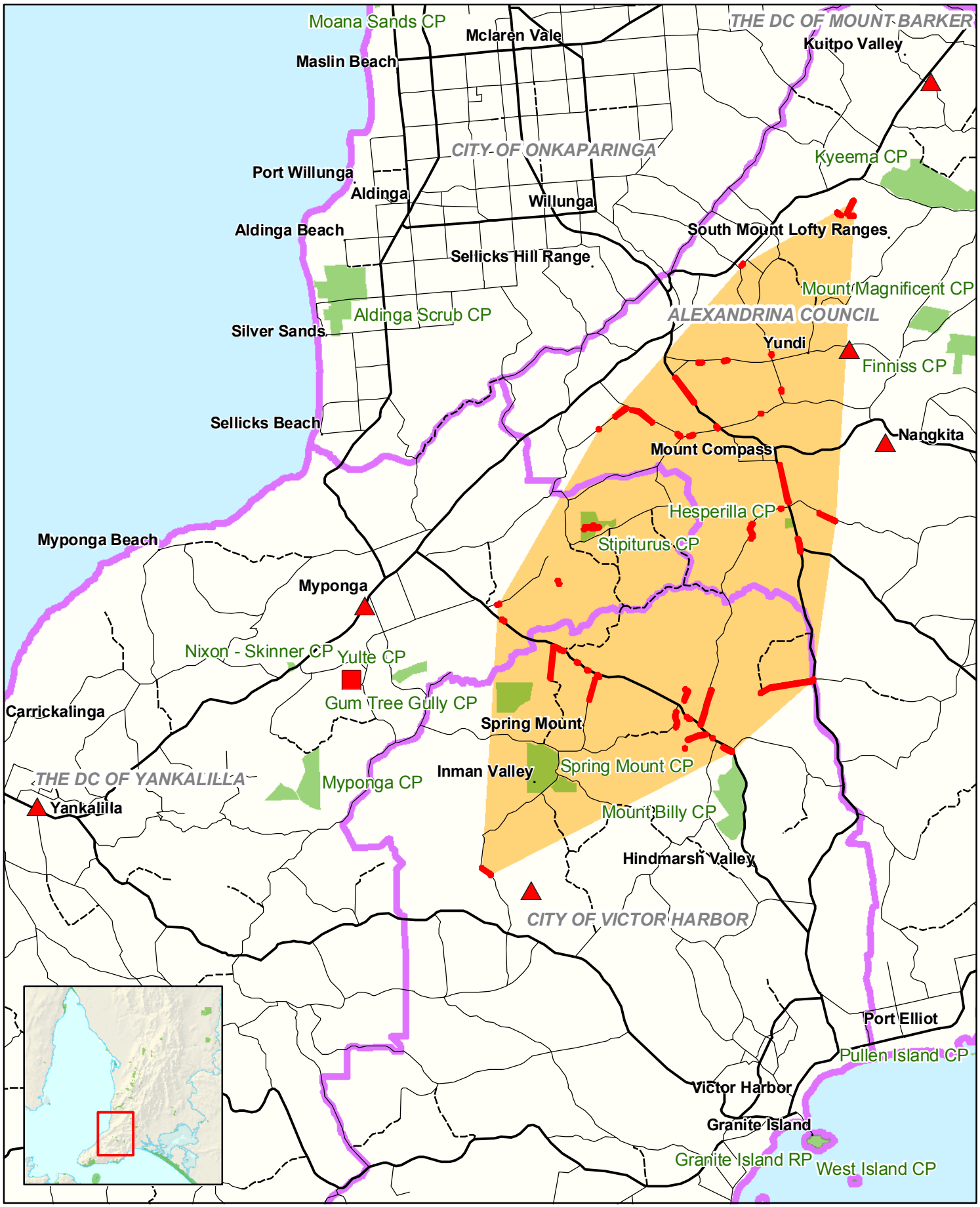
There are currently 26 known 'populations'[1] of *A. robusta* containing a total of approximately 1200 plants (refer to Table 1). The majority of populations are very small (<20 plants) and are at risk of extinction. Only seven populations of *A. robusta* currently contain more than 50 plants. The largest population occurs in the Hindmarsh Valley, around Hindmarsh Falls reserve and several interconnected roadsides (Population 22).

There is an unconfirmed, recent record of *A. robusta* from near Myponga that requires validation (BDBSA 2011). It is also possible that additional populations exist in remnant vegetation on private land, however the species is unlikely to persist in paddocks heavily grazed by livestock.

Refer to Maps 2 and 3 for the location of each population in the local government areas.

[1] 'Populations' were spatially defined by grouping individuals within a 250 metre radius. Some populations have been further divided into 'sub-populations' for management purposes.

Map 1 - Distribution of *Allocasuarina robusta*



Allocasuarina robusta sub population

Historical record

Unconfirmed record

Extent of occurence

Local Govt Areas (LGA)

N

0 2 4 6 8 10

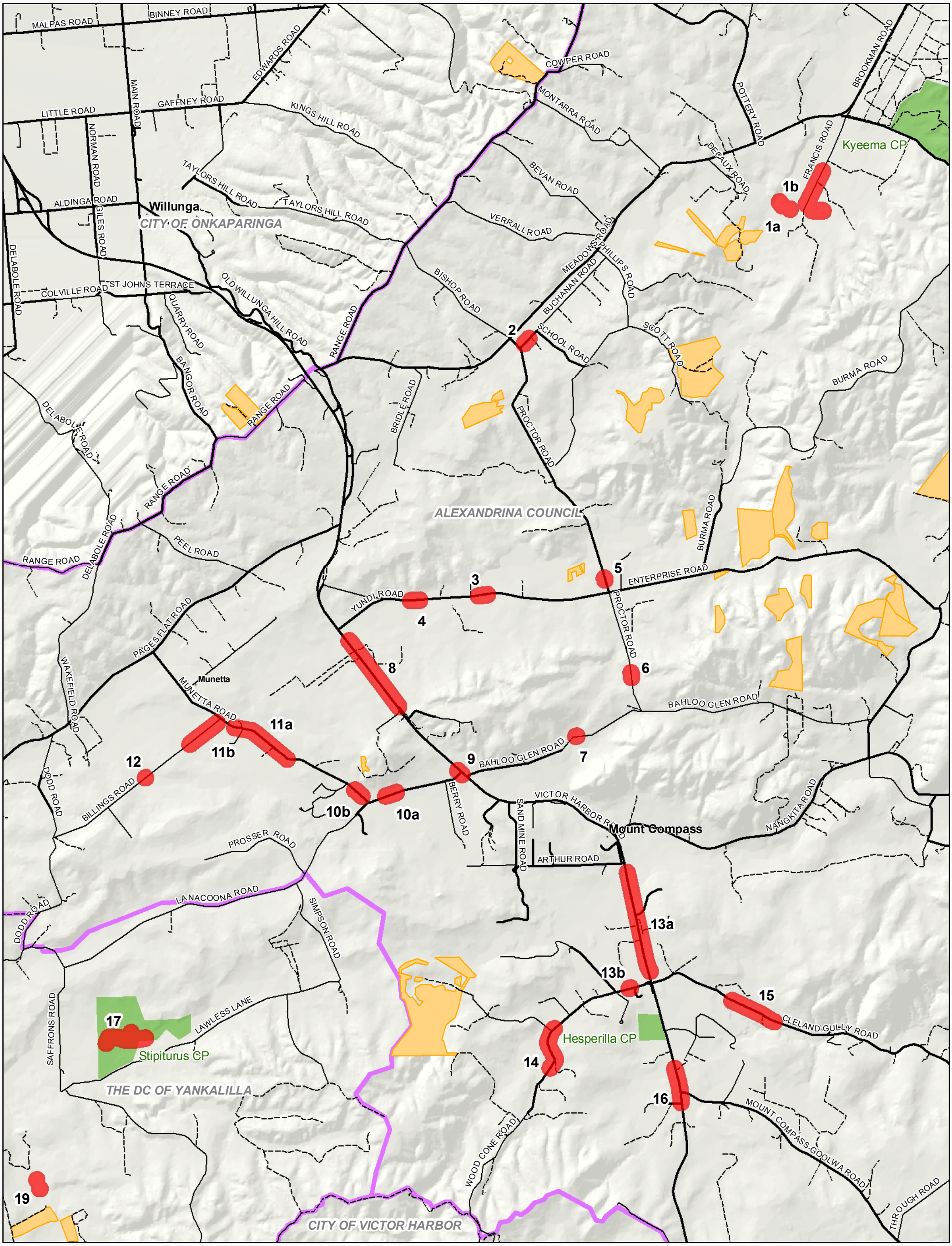
Kilometres

Government of South Australia
Department of Environment and Natural Resources

Table 1. List of current sub-populations of *Allocasuarina robusta*.

Pop. No.		Sub-population Name	Yr. last recorded	No. of plants	Land tenure
1	a	Meadows Creek	2009	100	Roadside (Alexandrina Council)
	b	Francis Rd	2011	70	Roadside (Alexandrina Council)
2		Buchanan Rd	2011	15	Roadside (Alexandrina Council)
3		Yundi Rd	2011	22	Roadside (Alexandrina Council)
4		Yundi Rd	2011	6	Roadside (Alexandrina Council)
5		Proctor Rd	2011	13	Roadside (Alexandrina Council)
6		Proctor Rd	2011	11	Roadside (Alexandrina Council)
7		Bahloo Glen Rd	2011	7	Roadside (Alexandrina Council)
8		Victor Harbour Rd	2011	111	Roadside (DTEI/Alexandrina Council)
9		Victor Harbour Rd/Lancoona Rd intersection	2011	6	Roadside (DTEI/Alexandrina Council)
10	a	Lancoona Rd	2011	13	Roadside (Alexandrina Council)
	b	Munetta Rd	2011	6	Roadside (Alexandrina Council)
11	a	Munetta Rd	2011	16	Roadside (Alexandrina Council)
	b	Billings Rd	2001	15	Roadside (Alexandrina Council)
12		Billings Rd	2011	6	Roadside (Alexandrina Council)
13	a	Victor Harbor Rd	2011	70	Roadside (DTEI/Alexandrina Council)
	b	Woodcone Rd	2011	6	Roadside (Alexandrina Council)
14		Woodcone Rd	2011	22	Roadside (Alexandrina Council)
15		Cleland Gully Rd	2011	18	Roadside (Alexandrina Council)
16		Victor Harbour Rd/Goolwa Rd intersection	2011	20	Roadside (DTEI/Alexandrina Council)
17		Stipiturus CP	2011	65+	DENR
18		Lawless Lane	2011	2	Roadside (District Council of Yankalilla)
19		Lawless Lane swamp	2010	9	Private
20		Hindmarsh Valley Rd	2011	9	Roadside (DTEI/DC of Yankalilla)
21	a	Hammond Rd	2011	89	Roadside (City of Victor Harbour)
	b	Hindmarsh Valley Rd/Hammond Rd intersection	2011	15	Roadside (DTEI/City of Victor Harbour)
	c	Hindmarsh Valley Rd	2011	12	Roadside (DTEI/City of Victor Harbour)
	d	Hindmarsh Valley Rd	2011	4	Roadside (DTEI/City of Victor Harbour)
	e	Hindmarsh Valley Rd/Spring Mount Rd intersection	2011	15	Roadside (DTEI/City of Victor Harbour)
	f	Spring Mount Rd	2011	35	Roadside (City of Victor Harbour)
22	a	Cressbrook Rd	2011	14	Roadside (City of Victor Harbour)
	b	Attrill Rd	2011	22	Roadside (City of Victor Harbour)
	c	Haskett Rd	2011	112	Roadside (City of Victor Harbour)
	d	Hindmarsh Valley Rd	2011	6	Roadside (DTEI/City of Victor Harbour)
	e	Hindmarsh Falls Reserve	2011	3	City of Victor Harbour
	f	Hindmarsh Falls Rd	2011	101	Roadside (City of Victor Harbour)
	g	Hindmarsh Valley Rd	2011	1	Roadside (DTEI/City of Victor Harbour)
	h	Hindmarsh Valley Rd	2011	38	Roadside (DTEI/City of Victor Harbour)
23		Leane Rd	2011	99	Roadside (City of Victor Harbour)
24		Mt Alma Rd	2011	8	Roadside (City of Victor Harbour)
			TOTAL	**1212**	

Map 2 - Distribution of *Allocasuarina robusta* in the DC Alexandrina



Allocasuarina robusta sub population

DENR Reserves

Veg Heritage Agreements

Local Govt Areas (LGA)

Sealed Road

Unsealed Road

Vehicular Track

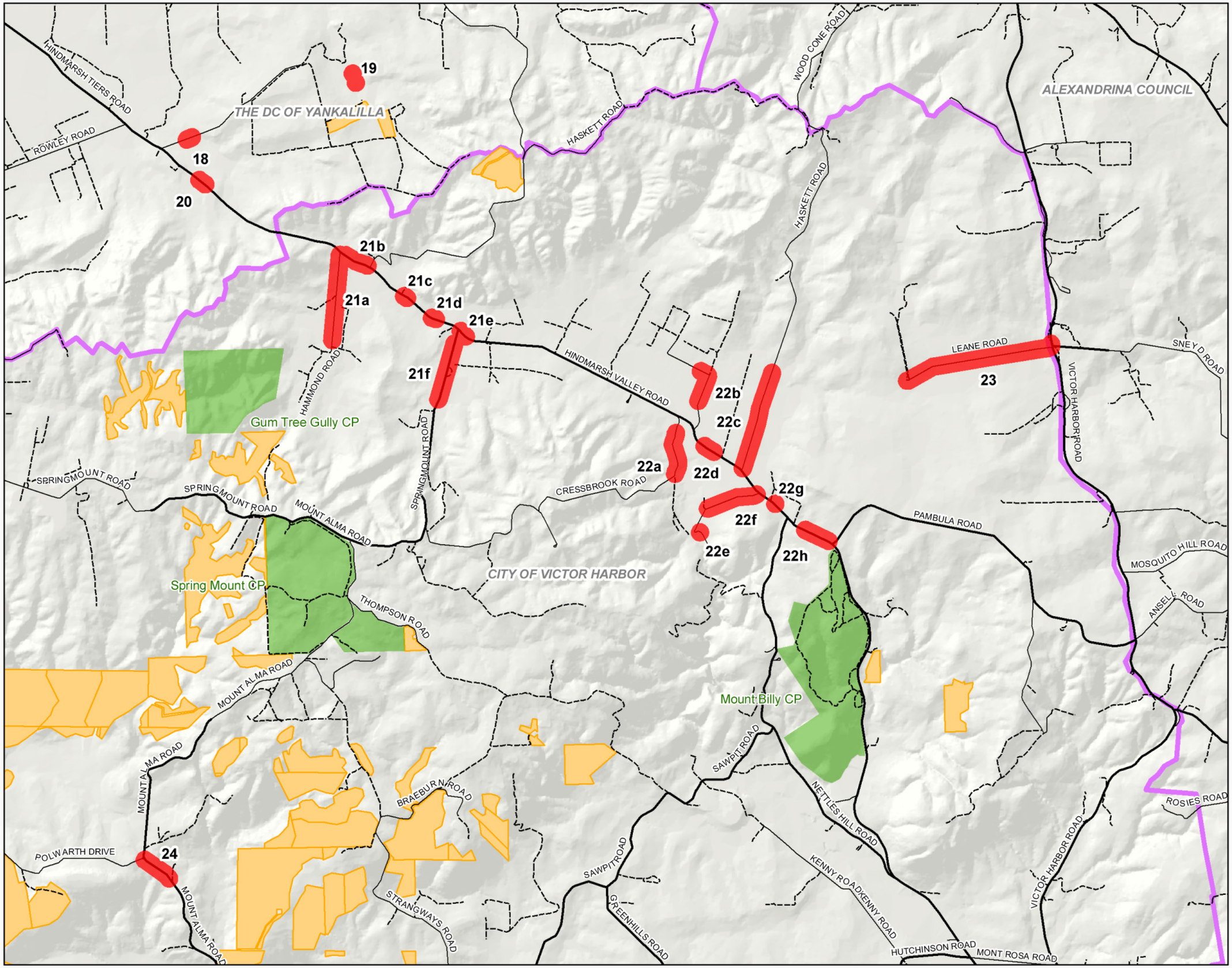
N

0 0.5 1 1.5 2

Kilometres

Government of South Australia
Department of Environment and Natural Resources

Map 3 - Distribution of *Allocasuarina robusta* in the City of Victor Harbour



Allocasuarina robusta sub population
DENR Reserves
Veg Heritage Agreements
Local Govt Areas (LGA)
Sealed Road
Unsealed Road
Vehicular Track

N

0 0.5 1 1.5 2
Kilometres

Government of South Australia
Department of Environment and Natural Resources

It is likely that the population size of A. robusta has declined substantially over the last 50-100 years. Most populations are restricted to roadside remnants, and historical records indicate that numerous populations have become extinct. Several populations have declined in the recent years due to herbicide spraying and incremental vegetation clearance. Furthermore, most populations comprise of old mature plants, and there is limited evidence of seedling recruitment. It is therefore expected that populations will continue to decline.

1.5 Habitat

Allocasuarina robusta generally grows in low-lying wet heath or open eucalypt woodland with a heath understorey, often near the margins of watercourses and swamps (including Swamps of Fleurieu Peninsula, which are listed as critically endangered under the EPBC Act). It is most often associated with *Eucalyptus ovata* and *E. baxteri*, but also occurs with *E. fasciculosa*, *E. cosmophylla* and *E. obliqua*. Associated understorey species typically include *Leptospermum continentale*, *Melaleuca decussata*, *Hakea rostrata*, *Acacia melanoxylon, Xanthorrhoea semiplana*, *Pteridium esculentum*, *Banksia marginata* and *Leptocarpus tenax*. Soils are typically sandy loam, and are often seasonally inundated. Most of this habitat has been cleared and is grazed by stock, and remaining areas are generally weed infested and restricted to roadsides.

1.6 Biology

1.6.1 Growth and longevity

There is little information about the longevity of *Allocasuarina robusta*, however it is thought to be a relatively long-lived species (possibly more than 30 yrs). Most populations comprise of large mature plants, presumably cohorts. There is no evidence of seedling recruitment in most populations in recent years.

1.6.2 Reproductive biology

Allocasuarina robusta is usually monoecious with separate male and female flowers on a single plant, but can sometimes be dioecious, having either only male or female flowers. Flowering occurs sporadically throughout the year, and pollen is dispersed by wind. The fruits of *Allocasuarina* species, referred to as samara (winged nut-fruit), contain a solitary seed which are produced within woody cones. Approximately half of the population (51 percent) were recorded as producing fruit in 2011. However, the proportion of fruiting plants was lower in some sub-populations (e.g. 38 percent at Hindmarsh Falls Rd and Haskett Rd). Seed viability varies between populations and can be quite low, with cut tests of seed from three sub-populations (Stipiturus CP, Lancoona Rd, & Meadows Creek) finding that only 45, 60 and 70 percent had intact embryo and endosperm, respectively (D. Duval pers comm.).

Allocasuarina robusta accumulates a persistent canopy seed bank, and generally only releases seed when a plant dies, or branches are damaged. The seed held in cones is likely to gradually reduce in viabaility as plants age. *A. robusta* seed has no effective dormancy and germinates readily without treatment. Seed dispersal distances for *Allocasuarina* species are usually short, with most seed likely to fall around the base of the parent plant.

1.6.3 Fire response

Little is known about the fire response of *A. robusta*. However, *Allocasuarina* species are generally obligate seed regenerators, and are mostly killed by fire. The retention of seed within cones could potentially provide a large source of seed for regeneration in the post-fire environment. The benefits of fire, however, are likely to be dependent on its frequency. If the interval between fires is too frequent (i.e. less than 5 yrs), there may be insufficient time for regenerating plants to produce seed, however

long intervals between fires are likely to result in a gradual loss of seed viability and eventual senescence of plants.

1.6.4 Genetics

A genetic study on *Allocasuarina robusta* was undertaken in 2009 to assess its relationship to co-occurring and closely related species. The study found that *A. robusta* was genetically distinct from other *Allocasuarina* species in the region (*A. mackliniana* ssp. *mackliniana, A. striata, A. muelleriana* ssp. *muelleriana* and *A. pusilla*). It was found to be most closely related to *A. paludosa*, which occurs in the South-east region of South Australia.

The study also found that genetic diversity (heterozygosity) was slightly lower in *A. robusta* than in other *Allocasuarina* species, but not significantly. There was no evidence of genetic variation between populations (Ottewell & Quarmby 2009 unpublished).

1.7 Threats

1.7.1 Habitat loss and degradation

Broad-scale vegetation clearance across the species' range has resulted in significant loss and fragmentation of *A. robusta* habitat. Remaining *A. robusta* populations are largely confined to roadsides which are often highly modified and infested with weeds. Incremental habitat clearance still occurs in roadside remnants, especially as a consequence of vegetation grooming or mowing, indiscriminate herbicide spraying and road works.

1.7.2 Grazing by livestock

Allocasuarina robusta is very palatable to livestock, and is likely to have been lost from many areas due to grazing. The species no longer occurs in any paddocks that are subject to grazing. Livestock in paddocks adjacent to roadside populations often browse on plants over fences. Some roads are also used to move stock between paddocks, which results in browsing and damage of *A. robusta* populations.

1.7.3 Road works

Road works are a significant threat to all roadside populations. Activities such as road widening, surfacing, grading, infrastructure development (guard rails, culverts, bridges etc), stock piling materials, and vegetation grooming can directly impact on *A. robusta*, and can also remove and degrade habitat. These activities can also increase the spread of weeds and plant pathogens.

1.7.4 Herbicide spraying

Indiscriminate herbicide spraying along roadsides is a serious threat to *A. robusta*. Numerous *A. robusta* populations have been impacted by herbicide spraying in recent years resulting in the damage or death of at least 50 plants (J. Quarmby pers obs.). Herbicide drift from adjoining agricultural land also has the potential to impact on roadside populations.

1.7.5 Weed invasion

Weed invasion is a significant threat to *A. robusta*, especially in roadside populations. Almost all remaining habitat is highly degraded due to weed infestation. Competition from weeds is likely to be impacting on the growth and health of plants, and may also be impeding seedling recruitment. Weeds of most concern are Phalaris, Kikuyu, Cocksfoot, Pines, Gorse, Blackberry, Montpellier Broom, and Bridal Creeper. Garden escapes and inappropriate roadside plantings are also problematic in some sites.

Many of the weeds in roadside populations (e.g. Phalaris, Kikuyu and Cocksfoot) have spread from adjoining agricultural land. Increased nutrients and moisture in run-off from adjoining agricultural land

are also likely to be exacerbating weed incursion in roadside populations. Weeds present at each sub-population are listed in Appendix 3.

1.7.6 Utilities management

Many roadsides containing *A. robusta* are also used as electricity, telecommunication and water easements and are regularly subject to vegetation pruning and earthworks, which have the potential to impact on *A. robusta*.

1.7.7 Altered fire regimes

It is possible that fire may play an important role in promoting seedling recruitment in *A. robusta*. The exclusion of fire from *A. robusta* populations could be a significant factor limiting seedling recruitment, and may have a substantial long-term impact on the viability of populations. However, fire could potentially exacerbate weed growth, especially in degraded roadsides, which could limit or prevent recruitment of *A. robusta*.

1.7.8 Phytophthora

The plant pathogen *Phytophthora cinnamomi* (Pc) has been detected near several sites containing *A. robusta* (eg along Victor Harbour Rd), and is present throughout the range of the species. A recent study testing the susceptibility of several South Australian flora to Pc classed *A. robusta* as highly susceptible (McKay & Facelli 2011 unpublished), however there currently are no populations showing symptoms of dieback. Pc can also impact substantially on associated species such as *Eucalyptus baxteri, E. obliqua, Xanthorrhoea semiplana* and *Banksia marginata*.

All activities that involve movement of soil, water and plant material have the potential to cause the spread of Phytophthora. Activities of particular concern with regard to *A. robusta* include road works, utilities management, revegetation, mowing and brushcutting, and stock movement.

1.7.9 Herbivory

Browsing by herbivores (e.g. kangaroos, rabbits, hares and deer) is a threat to *A. robusta*. There is evidence of browsing by kangaroos on seedlings planted along Victor Harbour Road, which may present a significant issue for future translocations. It is also likely that natural seedling recruitment may also be impeded by herbivore browsing.

1.7.10 Rubbish dumping

Many roadside populations are subject to rubbish dumping, which degrades habitat, and has potential to smother, bury and damage plants. Rubbish dumped in roadsides also often contains plant propagules, which can spread and compete with *A. robusta*.

2. Recovery objectives and performance criteria

2.1 Overall objective

The overall objective of this action plan is to improve the conservation status of *A. robusta* by increasing the size and number of populations, and improving the protection and condition of habitat.

2.2 Recovery objectives and performance criteria

Recovery objective 1. Maintain or increase the size of all extant *A. robusta* sub-populations
Performance Criteria 1a. All currently known sub-populations are extant in 2016 1b. At least 75 percent of sub-populations have increased in size by 2016 1c. The population size of the species totals at least 2500 plants in 2016
Recovery objective 2. Increase the current number of *A. robusta* sub-populations
Performance Criteria 2a. At least one additional sub-population is established by 2016
Recovery objective 3. Preserve the genetic diversity of the species
Performance Criteria 3a. A representative collection of seed from all sub-populations is in long-term storage by 2014
Recovery objective 4. Improve the quality of *A. robusta* habitat
Performance Criteria 4a. The condition of habitat is improved for at least eight priority sub-populations by 2016
Recovery objective 5. Increase the area and protection of *A. robusta* habitat
Performance Criteria 5a. All roadside sub-populations are included in the roadside marker scheme by 2013 5b. At least one additional sub-populations is formally protected by 2014
Recovery objective 6. Involve the community and government agencies in the recovery program
Performance Criteria 6a. Community and local and state government agencies are actively involved in the recovery program by 2013

3. Recovery actions

3.1 Previous actions

Previous recovery actions for *A. robusta* include:

- Seed was collected from several sub-populations for the Millennium Seed Bank (Lancoona Rd 2004, Stipiturus CP 2008, and Meadows Creek 2009).
- Targeted surveys for the species were conducted from 2008 – 2010 by DENR. An attempt was made to relocate and assess all previously recorded sub-populations. Numerous new sub-populations were also discovered during these surveys.
- A genetic study was conducted in 2009 to investigate the taxonomic distinctiveness of the species. The genetic diversity and structure of *A. robusta* was also examined.
- Weed control has been undertaken at several sites with *A. robusta* in recent years, but has not necessarily been targeted towards conservation of the species.

3.2 Recommended recovery actions

Action 1. Protect and manage populations

1.1 Inform landholders of the presence and management requirements of *A. robusta*
All relevant landholders and local and state government agencies need to be made aware of the presence and management requirements of *A. robusta*. Landholders adjacent to roadside populations should also be notified of relevant populations. Landholders and other relevant bodies should also be encouraged to participate in the recovery program.

Delivery groups: DENR (TFE), MDB NRM, AMLR NRM

1.2 Undertake targeted weed control programs at priority sites
Weed control programs should be implemented at priority sites (e.g. Stipiturus CP, Meadows Creek, Francis Rd, Hindmarsh Falls Rd, Haskett Rd, Leane Rd, Hammond Rd, and Victor Harbour Rd). In the short-term works at these sites should be targeted towards controlling weeds in the immediate vicinity of *A. robusta*. The long-term aim should be to improve and maintain habitat condition, by preferentially increasing native species abundance and diversity. Considerable care must be taken to avoid off-target herbicide damage to *A. robusta* and other native species when undertaking weed control (refer to weed management guidelines in Appendix 2).

Weed control is also required at other smaller populations, but with a focus on controlling weeds that are an immediate threat to the species. Detailed recommendations for each population are outlined in the population summaries in Appendix 3.

Delivery groups: DENR (TFE, Fleurieu District), AMLR NRM, MDB NRM, CCSA (FPSRP), DTEI, CVH, AC, YC, TPAG, FOP, GWLAP, TFL

1.3 Install roadside markers and implement protective measures
All *A. robusta* populations along roadsides should be included in significant roadside sites, and roadside markers should be installed. The locations and management requirements of *A. robusta* populations in roadsides should be included in databases, plans and GIS layers related to significant roadside sites. All staff and contractors involved with road works and maintenance should be made aware of the presence of *A. robusta* to prevent accidental damage to plants (eg herbicide spray drift, road grading, slashing etc).

Delivery groups: DTEI, CVH, AC, YC, MBD NRM

1.4 Identify and nominate habitat areas to be protected for conservation
Opportunities to protect *A. robusta* habitat under conservation covenant or agreement should be identified and discussed with landholders and management authorities. While the species predominantly occurs within roadsides, there are areas of potential habitat in adjacent properties that would be suitable for species re-establishment and formal protection.

Delivery groups: DENR (TFE), CCSA (FPSRP), AMLR NRM, MDB NRM

1.5 Undertake an experimental burn within Stipiturus Conservation Park
An experimental burn should be conducted within a portion of the population in Stipiturus CP in an attempt to promote seedling recruitment. A detailed burn plan and risk assessment should be prepared prior to undertaking the burn.

Delivery groups: DENR (FMU, Fleurieu District, TFE), CCSA (FPSRP)

1.6 Implement management strategies to prevent the spread of *Phytophthora*
All activities with the potential to spread *Phytophthora* into *A. robusta* populations need to adhere to strict management and hygiene procedures. In particular, *Phytophthora* management procedures need

to be implemented for all road works and utilities management near *A. robusta* populations. It is also vital that strict hygiene measures are implemented when implementing on-ground recovery actions, especially translocation.

Delivery groups: DENR (TFE, Fleurieu District), AMLR NRM, MDB NRM, CCSA (FPSRP), DTEI, CVH, AC, YC, TPAG, FOP, GWLAP, TFL

Action 2. Preserve seed and augment populations

2.1 Collect seed from all sub-populations

Seed should be collected from all *A. robusta* sub-populations for long-term storage at the Adelaide Botanic Gardens. Additional seed should be collected for translocation purposes. Immediate priority should be given to collecting seed from small roadside sub-populations that are at imminent risk of extinction.

Ideally seed should be sourced from all reproductive plants, with the aim of capturing the majority of genetic variability represented within the sub-population. To prevent over-collection, no more than 10 percent of cones from a plant should be taken per year. Any seed collection from *A. robusta* requires a permit from DENR.

Delivery groups: DENR (TFE), ABG (SCC)

2.2 Propagate and plant seedlings into existing sub-populations

All existing *A. robusta* populations should be augmented by planting seedlings to supplement natural recruitment. Priority should be given to augmenting small roadside populations that are at immediate risk of extinction. There are also opportunities to expand some populations by planting into suitable habitat in adjoining areas or adjacent properties. All translocation activities should be in accordance with the Translocation Proposal (refer to Appendix 1), and in consultation with DENR.

Delivery groups: DENR (TFE, Fleurieu District), DTEI, CVH, AC, YC, CCSA (FPSRP), AMLR NRM, MDB NRM, TPAG, FOP, GWLAP, TFL

Action 3. Establish additional populations

3.1 Establish large populations in reserves

There is potential to establish a large population of *A. robusta* in the recently proclaimed Hesperilla Conservation Park (part of Square Waterhole). While there are no *A. robusta* plants remaining in the park due to previous grazing, there is a relatively large area that is suitable for re-introducing the species. Other reserves should also be considered (e.g. Kyeema CP). Refer to the Translocation Proposal in Appendix 1 for further details.

Delivery groups: DENR (TFE, Fleurieu District), AMLR NRM, MDB NRM, TPAG, FOP, GWLAP

3.2 Identify additional locations to establish populations

Opportunities to establish additional planted populations outside of roadsides should be identified. Ideally these areas would be substantial enough to support large populations, and would need to be appropriately managed and protected. The translocation plan should be amended to include any additional sites.

Delivery groups: DENR (TFE), CCSA (FPSRP), CVH, AC, YC, AMLR NRM, MDB NRM, CCSA (FPSRP), TPAG, TFL, GWLAP

Action 4. Search for additional sub-populations

4.1 Undertake targeted surveys in areas of suitable habitat

Targeted surveys should be conducted in areas of potential habitat within known range of the species. While the potential for discovering large populations is limited, there may still be a few additional populations especially in remnant vegetation on private land.

Delivery groups: DENR (TFE), CCSA (FPSRP), AMLR NRM, MDB NRM

Action 5. Involve the community

5.1 Establish a recovery team

A recovery team should be established, comprising of representatives from relevant local and state government agencies, landholders, non-government organisations, and community groups. The team should oversee the management of the species and the implementation of this plan.

Delivery groups: DENR (TFE, Fleurieu District), CCSA (FPSRP), CVH, AC, YC, AMLR NRM, MDB NRM, TPAG, FOP, DTEI, GWLAP, TFL

5.2 Encourage and support community participation

The recovery program should be promoted through media articles, fact sheets etc and community involvement in activities such as weed control, translocation and monitoring should be encouraged and supported.

Delivery groups: DENR (FTE), AMLR NRM, MDB NRM, TPAG, FOP, GWLAP, TFL

Note: Recommended management actions for each sub-population are contained within the population summaries in Appendix 3.

Delivery Groups

ABG – Adelaide Botanic Gardens

AC – Alexandrina Council

AMLR NRM – Adelaide & Mount Lofty Ranges Natural Resource Management Board

CCSA – Conservation Council of South Australia

CVH – City of Victor Harbour

DENR - Department for Environment and Natural Resources

DTEI – Department for Transport, Energy and Infrastructure

FTE – Threatened Flora Ecologist

FMU – Fire Management Unit

FOP – Friends of Parks

FPSRP – Fleurieu Peninsula Swamp Recovery Program

GWLAP – Goolwa to Wellington Local Action Plan Association

MDB NRM – Murray Darling Basin Natural Resource Management Board

SCC – Seed Conservation Centre

TFL – Trees for Life

TPAG – Threatened Plant Action Group

YC – Yankalilla Council

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Appendix 1. Translocation Proposal for *Allocasuarina robusta*

Summary

This translocation proposal aims to augment existing sub-populations of *Allocasuarina robusta* by propagating and planting seedlings. It also proposes to re-establish a large planted sub-population in Hesperilla Conservation Park. Translocation is intended to occur in conjunction with other recovery actions for the species (as outlined in the main body of this plan). This translocation proposal has been prepared following the Guidelines for the Translocation of Threatened Plants in Australia (Vallee et al 2004).

Detailed information about the species' distribution, biology and ecology, threats, and recovery actions are outlined in the main body of this plan.

Translocation objectives

- To prevent the imminent extinction of small isolated *A. robusta* sub-populations
- To increase the size and area of existing *A. robusta* sub-populations
- To improve the genetic diversity of small sub-populations
- To improve the age structure and viability of existing sub-populations
- To increase the number of large secure sub-populations

Justification for translocation

Translocation is considered necessary to achieve the stated objectives of this proposal. The majority of sub-populations are extremely small and confined to roadsides, and many are at imminent risk of extinction. Most sub-populations are cohorts of mature plants, and natural seedling recruitment is extremely limited. Threat abatement, and habitat protection and restoration, while being important for the long-term recovery of the species, are unlikely to prevent immediate loss and decline of small populations. The use of fire to stimulate seedling recruitment requires investigation, but is not a feasible management option for most roadside populations. Only one sub-population is currently protected in the reserve system, and therefore establishing additional populations in conservation reserves is an important strategy for the long-term survival of the species.

Whilst many existing sub-populations are subject to a range of threats and habitat is often in poor condition and limited in area, translocation into these sites is still likely to be successful. *A. robusta* is relatively easy to propagate from seed, and seedling establishment is expected to be high with adequate site preparation and management (similar to other *Allocasuarina* species). Once plants are established they should be able compete with weed growth, and are expected to be relatively long-lived. The options for establishing additional populations in conservation areas are limited, however attempts will be made to identify and secure suitable areas for future translocations.

Translocation Methodology

Seed collection and storage

Mature unopened cones will be collected from numerous plants in all known sub-populations. To prevent over-collection, no more than 10 percent of cones from a plant will be taken. An attempt will be made to source seed from all reproductive plants in each sub-population, with the aim of capturing the majority of genetic variability represented within the population. Seed from each sub-population will be kept in separate bags, and clearly labelled (including the sub-population name, date, and number of source plants).

Seed collection can occur at any time of year. After collection, the cones will be kept in dry, warm conditions to release the seed. Seeds will then be cleaned, and any lacking endosperm will be discarded. Seeds will then be dried until appropriate moisture content is achieved, and enclosed in air-tight packets. Seed packets will be stored in cool, dry conditions until required for propagation.

Seedling propagation

Allocasuarina robusta seed germinates readily without pre-treatment. Seeds will be sown into tubes with a pasteurised potting mix. This should occur in November-December to be ready for planting out in June-July the following year. Seedlings from each sub-population will be grown and labelled separately. Strict phytosanitary procedures will be followed throughout propagation.

Recipient sites and population targets

Augmenting existing sub-populations

It is proposed to plant seedlings into all known sub-populations of *A. robusta* (31 sites in total). The target number of plants for each sub-population is outlined in Table 1. This includes significantly increasing the number of plants in Stipiturus CP, with a target of 500 transplants. It is intended to stage all the plantings over several years. This will create a multi-aged structure in the translocated populations, and should also reduce the chance that the translocation should fail due to an unfavourable season or event.

Re-establishment

It is also proposed to re-establish a large population within Hesperilla Conservation Park. There are numerous historical records of *A. robusta* for this area (known as 'Square Waterhole') however the species is no longer present in the park, presumably due to historical grazing. While much of the suitable habitat in the park has been previously grazed and is degraded, it is still currently considered the best option for establishing an additional viable population. The initial target is to establish a population of at least 500 plants. This should occur in conjunction with planting other appropriate shrub and understorey species.

Source populations

It is intended to source material for translocation from sub-populations within a 5 kilometres radius of recipient sites. This aims to increase the genetic diversity of small populations, and maintain or enhance the diversity of larger sub-populations. It is important that the number of seedlings used from each population is proportional to the size of the source population, to prevent genetic swamping. Recommended source populations for each site are listed in Table 1.

Table 1. Target number of transplants for each sub-population

Pop. No.		Sub-population Name	Current no. plants	*Target no. transplants	Source sub-population/s
1	a	Meadows Creek	100	100	1a, 1b, 2
	b	Francis Rd	70	50	1a, 1b, 2
2		Buchanan Rd	15	30	1a, 1b, 2, 3, 4, 5, 6, 8
3		Yundi Rd	22	30	2, 3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 13a
4		Yundi Rd	6	30	2, 3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 13a
5		Proctor Rd	13	30	2, 3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 13a
6		Proctor Rd	11	30	2, 3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 13a, 13b, 14, 15
7		Bahloo Glen Rd	7	20	3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a,

					11b, 13a, 13b, 14, 15, 16
8		Victor Harbour Rd	111	100	2, 3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 13a, 13b, 14
9		Victor Harbour Rd/Lancoona Rd intersection	6	30	3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 13a, 13b, 14, 15
10	a	Lancoona Rd	13	30	3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 13a, 13b, 14, 17
	b	Munetta Rd	6	20	3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 13a, 13b, 14, 17
11	a	Munetta Rd	16	30	3, 4, 5, 6, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 13a, 17
	b	Billings Rd	15	20	3, 4, 7, 8, 9, 10a, 10b, 11a, 11b, 12, 17
12		Billings Rd	6	20	3, 4, 8, 9, 10a, 10b, 11a, 11b, 12, 17
13	a	Victor Harbor Rd	70	100	3, 4, 5, 6, 7, 8a, 8b, 13a, 13b, 14, 15, 16
	b	Woodcone Rd	6	20	3, 4, 5, 6, 7, 8a, 8b, 13a, 13b, 14, 15, 16
14		Woodcone Rd	22	30	5, 6, 7, 8a, 8b, 9, 13a, 13b, 14, 15, 16
15		Cleland Gully Rd	18	50	5, 6, 7, 8a, 8b, 13a, 13b, 14, 15, 16
16		Victor Harbour Rd/Goowla Rd intersection	20	50	5, 6, 7, 8a, 8b, 13a, 13b, 14, 15, 16, 22c
17		Stipiturus CP	65+	1000	8a, 8b, 9, 17, 18, 19, 20, 21a, 21b, 21c, 21d
18		Lawless Lane	2	20	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21f, 21e
19		Lawless Lane swamp	9	30	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21f, 21e
20		Hindmarsh Valley Rd	9	30	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21f, 21e
21	a	Hammond Rd	89	50	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22d
	b	Hindmarsh Valley Rd/Hammond Rd intersection	15	20	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22d
	c	Hindmarsh Valley Rd	12	30	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e
	d	Hindmarsh Valley Rd	4	20	17, 18, 19, 20, 21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f
	e	Hindmarsh Valley Rd/Spring Mount Rd intersection	15	30	18, 19, 20, 21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f
	f	Spring Mount Rd	35	50	18, 19, 20, 21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f
22	a	Cressbrook Rd	14	30	21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f,

					22h, 23
	b	Attrill Rd	22	50	21a, 21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
	c	Haskett Rd	112	50	21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
	d	Hindmarsh Valley Rd	6	20	21b, 21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
	e	Hindmarsh Falls Reserve	3	50	21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
	f	Hindmarsh Falls Rd	101	20	21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
	g	Hindmarsh Valley Rd	1	20	21c, 21d, 21e, 21f, 22a, 22b, 22c, 22d, 22e, 22f, 22g, 22h, 23
	h	Hindmarsh Valley Rd	38	20	21e, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
23		Leane Rd	99	50	16, 22a, 22b, 22c, 22d, 22e, 22f, 22h, 23
24		Mt Alma Rd	8	20	21a, 21f, 24
25		Hesperilla CP		500	5, 6, 7, 8a, 8b, 13a, 13b, 14, 15, 16
			1212	**2930**	**TOTAL = 4142**

*This is an initial target, which may be increased based at some sites on success rates and resource availability.

Site preparation

Most sites will require some preparation prior to planting. This is likely to involve spot-spraying introduced perennial grasses with herbicide in the locations selected for tube-stock planting in the summer-autumn prior to planting. It may be necessary to slash some perennial grass species (Phalaris, Cocksfoot etc) a few weeks prior to spraying in some sites. Selective herbicide should be used when spraying grasses (i.e. Fusilade). It is important that site disturbance is minimised, and off-target damage to native species is avoided. Additional threats to the recipient sites will also be addressed in conjunction with the translocation (as outlined in the action plan).

Translocation logistics

Timing of planting

It is aimed to plant the target number of seedlings into at least 10 sub-populations in the first year (2012), and the remainder in the following years (2013-2015). Planting will occur in early winter (June-July). However, it is not expected that all seedlings will survive, and therefore additional plantings may be required in subsequent years to achieve target numbers. Initial priority will be given to augmenting small populations and increasing the size of the population in Stipiturus CP.

Sorting and Planting

The required mix of seedlings will be selected from the different source populations, ensuring that the number of seedlings from each population is proportional to the size of the source population. It may be easier to sort out the seedlings in the nursery, prior to transporting them to the sites.

Seedlings will be laid out randomly in the recipient sites prior to planting, taking advantage of natural gaps in the vegetation, or according to where pre-treatment of perennial weed grasses has occurred. Holes will be dug in a way that inflicts minimal damage on the surrounding vegetation and soil structure. Seedlings are not expected to require watering in after planting, however watering may be necessary if

soil moisture is insufficient. Strict disease hygiene measures will be followed throughout the translocation.

Guarding

Plastic tree guards will be placed around plants to protect them against herbivores, frost and competition from weeds. Wire mesh cages may be required in some sites if kangaroo These will be removed when the plants have achieved sufficient size and woody growth to survive grazing and competition from perennial weed grasses.

Maintenance

Ongoing control of introduced perennial grasses and other weeds around the transplants will be undertaken as necessary. Slashing weed growth around plants may be necessary in some sites to reduce biomass in the short-term. Follow-up herbicide spraying is also expected to be necessary in some sites.

Monitoring and evaluation

Detailed records will be kept of all planting activities including planting dates, numbers of plants, site maps etc. It is also planned to monitor the survival and condition of planted individuals. In general this will involve regular assessments of the number of transplants that have survived, their health, and whether flowers or fruits have been produced.

Permits

An application for a Scientific Research Permit will be submitted, including all activities related to this translocation.

Resources and funding

Funding for this project will be sought from a range of sources including the AMLR NRM Board, MDB NRM Board, Native Vegetation Council, and Urban Forest Biodiversity Project.

Appendix 2. Weed management guidelines

General notes

- Only highly skilled bushcare operators should undertake weed control in *A. robusta* populations.
- Extreme care must be taken when spraying herbicide in the vicinity of all *Allocasuarina robusta* populations.
- Always use methods/herbicides that minimise the risk of off-target damage to *A. robusta* and other native species.
- Always factor in the need for follow-up, and potential for secondary weed incursion.

Table: Recommended control methods for priority weeds

Weeds	Control season	Method	Herbicide	Notes
Phalaris, Cocksfoot, Perennial veldt-grass, Rice millet	Autumn-spring	Slash, then spot spray re-growth	Fusilade	Only spray when actively growing
Kikuyu, Couch-grass, Paspalum	Spring-summer	Spot spray	Fusilade	Only spray when actively growing
Blackberry	Summer-autumn	Cut & swab	Glyphosate	Cut & swab amongst *A. robusta*
		Spot spray	Triclopyr	
Bridal creeper	Spring	Spot spray	Metsulfuron methyl	Use surfactant
Scabious	All year	Spot spray	Glyphosate or Metsulfuron methyl	Use surfactant
Dog rose	Summer	Cut & swab	Glyphosate	
Gorse	All year	Cut & swab	Glyphosate	
		Spot spray	Triclopyr	Use surfactant
Montpellier broom	All year	Hand-pull		Hand-pull or cut & swab amongst *A. robusta*
		Cut & swab	Glyphosate	
		Spot spray	Triclopyr	
Radiate pine	All year	Ringbark, cut at base, or hand-pull		
Prunus sp.	Spring-summer	Cut & swab	Glyphosate	
Sweet pittosporum	All year	Hand-pull, cut & swab, or drill & fill	Glyphosate	Drill & fill larger plants
Boneseed	All year	Hand-pull, or cut & swab	Glyphosate	
Desert Ash	Spring-autumn	Hand-pull or drill & fill	Glyphosate	
Bulbil watsonia	Spring	Wipe, or cut & swab	Glyphosate	Use surfactant for wiping
Blue periwinkle	Winter-spring	Slash, then spray regrowth	Glyphosate	Use surfactant

All herbicide information is intended as a guide, and does not replace legal obligations regarding herbicide use. In all cases read the label before using herbicide.

Appendix 3. Population Summaries