National Recovery Plan for the Bead Glasswort *Tecticornia flabelliformis*

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Government of South Australia

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Our environment, our future

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This Recovery Plan has been developed with the involvement and cooperation of a range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

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Cover photograph: Bead Glasswort *Tecticornia flabelliformis* by Oberon Carter.

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Summary

The Bead Glasswort *Tecticornia flabelliformis* is a poorly-known, small perennial shrub that is widely distributed across southern Australia, where it occurs in low-lying seasonally inundated clay and salt pans. The species has been recorded from about 30 locations across this range, but population size and condition for most sites is unknown. Current threats include weed invasion, mining and ongoing habitat degradation and destruction. The species is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999. It is also listed as Vulnerable under the South Australian *National Parks and Wildlife Act* 1972 and as Threatened under the Victorian *Flora and Fauna Guarantee Act* 1988. In Western Australia, the species is not listed as Threatened, but is listed as poorly known and requiring further survey. This national Recovery Plan for the Bead Glasswort is the first recovery plan for the species, and details its distribution, habitat, threats and recovery objectives and actions necessary to ensure its long-term survival. Note that this species was originally listed under its former name *Halosarcia flabelliformis*, but all Australia species in *Halosarcia* were subsequently incorporated in the genus *Tecticornia* (Shepherd & Wilson 2007).

Species Information

Description

The Bead Glasswort *Tecticornia flabelliformis* of the family Chenopodiaceae is a small, compact, deep-rooted, succulent shrub growing to 30 cm high and 40 cm diameter, with ascending branches. The articles (i.e. segments of jointed stems) of uppermost branches are narrowly obovoid to barrel-shaped, 5–10 mm long and 2.5 mm wide, dull or glossy; lobes are very obtuse to almost truncate, and margins are entire or minutely and irregularly toothed. The inflorescence comprises a terminal spike to 5 cm long; opposite bracts free from each other, margins entire or crenulate; flowers free; perianth truncate at apex; the flowers reduced to stamens or styles protruding from succulent bracts. Fruiting perianth and pericarp membranous, translucent, whitish or pale brown; seed is broadly elliptic to squarish, 1.2-1.8 mm long, falling enclosed in perianth, testa thin, mid-brown. Plants flower and fruit between January and May. Seeds generally smooth, with several rows of minute tubercules around the margins (description from Wilson 1986; Walsh 1996).

Species of *Tecticornia* are notoriously difficult to distinguish in the field, especially without fruiting material. At least ten species of *Tecticornia* occur within the known range of *T. flabelliformis* and at least three, including *T. nitida*, *T. pergranulata* and *T. syncarpa*, have been recorded within stands of *T. flabelliformis*. Most species vary greatly in size, shape and colour, and the most consistent distinguishing feature is the seeds. Known habitat preferences for some *Tecticornia* species may also be useful in distinguishing taxa in the field.

Distribution

The Bead Glasswort is endemic to, and widely distributed across, southern Australia, occurring in Western Australia in the Coolgardie IBRA bioregion (*sensu* DEH 2000), in South Australia in the Eyre Yorke Block, Flinders Lofty Block and Murray Darling Depression bioregions, and in Victoria in the Murray Darling Depression bioregion (Figure 1). Maps showing the distribution of *T. flabelliformis* are available from the nature conservation agency in each range State.

Habitat

Bead Glasswort generally grows on the margins of salt lakes and coastal salt marshes over gypsum deposits, and is often associated with other *Tecticornia* species (Scarlett & Parson 1993). However, little is known of precise habitat preferences of the Bead Glasswort, although it generally occurs on periodically (but not regularly) inundated depressions on clay (occasionally sandy) soils, often (but not always) in saline areas. At one site in Western Australia the species grows with just one other *Tecticornia* species on the evaporation pan of a salt lake. At another Western Australian site plants have been reported to occur with *Podolepis*

capillaris, *Atriplex nana* and *Hakea preissii* on the foreshore of a lake over dull orange sands, while at a third site plants occur in samphire shrubland on a clay salt flat (WA Herbarium data).

South Australia has the greatest number of reported populations but there is little information on habitat associations. At Arno Bay on the Eyre Peninsula plants have been reported to occur in low lying areas that are not inundated regularly, while at Port Parham plants occur in samphire shrubland, forming a band on wet, blue-grey, fine silty muds (SA Herbarium data). Populations at St Kilda and Adelaide grow in salt pans within mineral soils with a pH of 7.9–8.1 and high chlorinate levels (Coleman & Cook 2005).

In Victoria, the four sites are on the margins of salt lakes on gypsum-bearing clays, either as monospecific stands or with other *Tecticornia* species (Venn 1999). The micro-distribution of various *Tecticornia* species may correlate with particular positions in the landscape according to their apparent tolerance of, or preference for, particular salinity levels (Browne 1982). There is a suggestion that *T. flabelliformis* may occur on the lowest ground subject to longer inundation (Browne 1982), hence its occasional occurrence in isolated monospecific stands.

A proposed recovery action is to more clearly define habitat critical to the survival of the species.

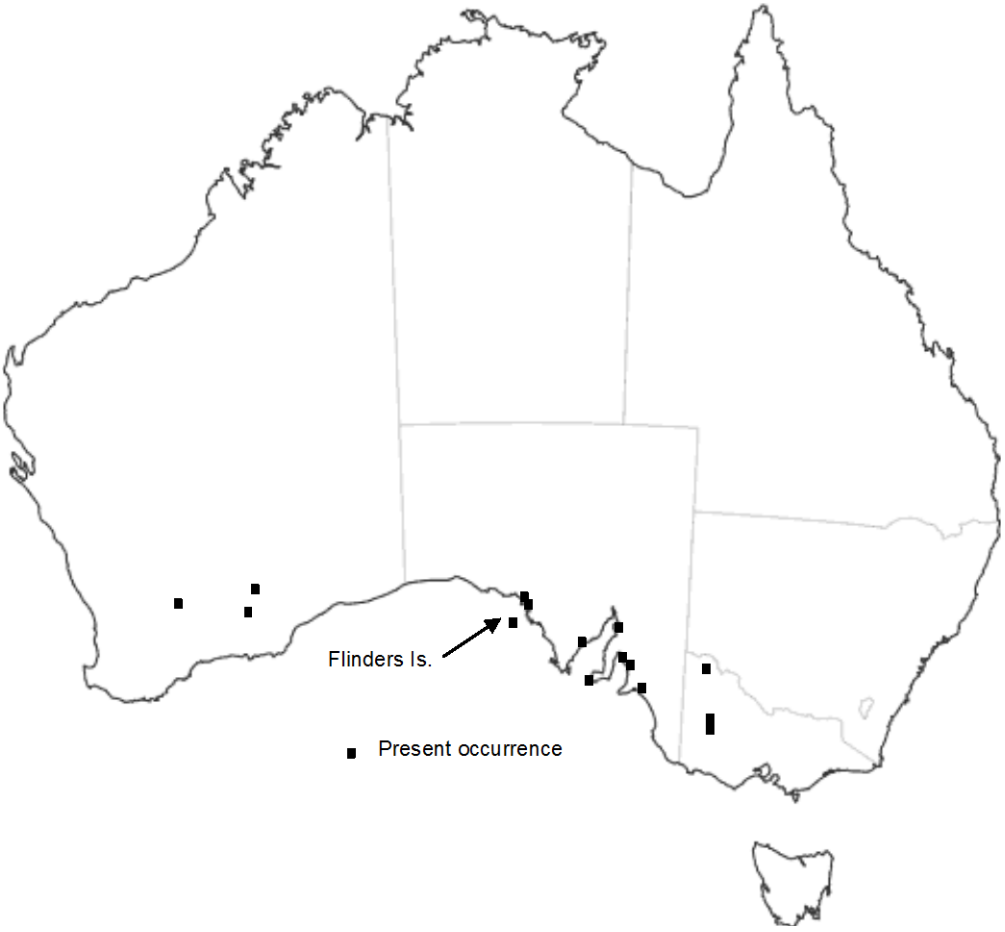

Figure 1. Distribution of *Tecticornia flabelliformis*

Population Information

The Bead Glasswort is currently known from about 35 locations across its total range, with most occurring in South Australia. However, there is virtually no information on current status and abundance at most sites. Field assessments are required to obtain estimates of population size. Location information for range States is summarised as follows:

Western Australia

Tecticornia flabelliformis has been recorded from three sites, all near Kalgoorlie:

- Widgiemooltha (1997); unallocated Crown Land; reported as 'locally common'.
- Lake Baladjie Nature Reserve (1994); abundance not known.
- Lake Yindarlgooda (1993); unallocated Crown Land; reported as 'occasional'.

South Australia

Tecticornia flabelliformis has been recorded from about 28 sites in South Australia, from near Adelaide to Fowlers Bay in the west (BDBSA 2011; D. Fotheringham pers. comm. 2011; S. Detmar, pers. comm. 2011):

- Innes National Park (6 sites) (1988 - 2011); Sites vary in abundance (observations recorded as: common but scattered (1988), 1 plant only (1998), > 50 (1998), > 1000 (1998), confined to 1m x 4m (2004), not common (2008) and locally common (2011)).
- Calca Peninsula, Eyre Peninsula (2011); abundance unknown; private property.
- Port Parham and Webb Beach (2007); localised, common; land tenure partly Heritage Agreement, partly Crown land.
- Arno Bay (2007); locally common, often the only species within small areas up to 0.5 ha; land tenure partly Heritage Agreement, partly Crown land.
- Sceale Bay Conservation Park and adjacent property (2006); abundance not known, tenure not known.
- Flinders Island (2 sites) (2006); approximately 3000; land tenure at one site Heritage Agreement, the other site a Sanctuary.
- Wills Creek Conservation Park, near Price township, Yorke Peninsula (2006); abundant but restricted to one site.
- Fowlers Bay Conservation Park (2005); abundance not known.
- Baird Bay (2005); abundance not known, Crown land.
- Venus Bay area (2002); abundance not known, Crown land.
- West Coast Road, Yorke Peninsula (2002); abundance not known, Crown land
- Lower Light (2001); abundance not known, Crown land.
- Middle Beach (2001); abundance not known, Crown land.
- Port Prime (2001); land tenure and abundance not known.
- Thompson's Beach (2001); abundance not known, two private properties.
- Cape Bauer, Streaky Bay, (2000); abundance not known, Crown land.
- Fishermans Bay (1999); locally common, private property.
- Smoky Bay (1998); abundance not known, partly private property and partly Crown land.
- St Kilda (1993); 200 plants recorded, land tenure not known.
- Point Jarrold Flora and Fauna Research Reserve (1993); land tenure partly Sanctuary, partly Crown land, abundance not known.
- Acraman Creek Conservation Park (1991); > 200 plants recorded.
- Nadia Landing, west of Ceduna (1990); locally common; private property.
- Torrens Island Conservation Park, Adelaide (2 sites) (1988 -1989); 100 recorded at one site and1000 at the second site.
- Boothill Station Road, Yorke Peninsula (1988); locally common, Crown land.

Pobke (2011) estimates the total abundance of the 10 Eyre Peninsula populations of *T. flabelliformis* to be 10,000 individuals (including the sites of Fowlers Bay CP, Nadia Road, Smoky Bay, Acraman Ck CP, Cape Bauer, Sceale Bay CP, Baird Bay, Venus Bay, Flinders Island and Arno Bay). A population of *T. flabelliformis* was recorded at Garden Island, near Torrens Island in the 1980's, however this population was buried by landfill in 1994.

Victoria

Tecticornia flabelliformis is known from three sites, all of which are public land parks or reserves managed by Parks Victoria:

- Murray-Sunset National Park (Raak Plain); ~1000 plants across 6–8 ha in 1981; ~100 plants in 1999 (Venn 1999).

- Mitre Lake Flora & Fauna Reserve; >4,000 plants along 2.5 km of shoreline (Venn 1999).
- Olivers Lake Flora & Fauna Reserve; >2,000 plants along 0.5 km of shoreline (Venn 1999).

Likely extinct populations include Grass Flat (Telfer) Swamp Flora and Fauna Reserve (no plants have been seen here for 8 years) and a private property located nearby now converted to agriculture. The numbers of plants at these sites is unknown but the populations were known to be small and scattered over several hectares (Venn 1999).

Decline and Threats

Virtually nothing is known of the former distribution and abundance of the Bead Glasswort, and there is little information on decline and threats for much of its range. Historically, many samphire shrublands in south-eastern Australia have been damaged or destroyed by stock grazing, mining for gypsum or salt, rubbish dumping, vehicle movement and rising water tables from land clearing, and it is likely that habitat, plants and perhaps populations have been lost to these activities. Often these shrublands were seen as a wasteland of little value. The population in the Murray Sunset National Park (Vic) has apparently declined from about 1,000 plants to about 100 plants over two decades, although the cause of this is unknown. There has been some assessment of population status and threats in Victoria (Venn 1999) and threats to populations on the Eyre Peninsula in South Australia (Pobke 2011), but no information is available for other sites. Current major threats include:

Weed invasion
Introduced weeds including Spear Thistle *Cirsium vulgare*, Saffron Thistle *Carhamus lanatus* and Boxthorn *Lycium ferocissimum* threaten some Victorian populations (Venn 1999).

Mining
Salt and gypsum mining have led to the destruction of *T. flabelliformis* plants, habitat and potential habitat in Victoria (Venn 1999) and may be a threat in South Australia (Pobke 2011).

Altered hydrology
Tecticornia flabelliformis is tolerant of seasonal inundation, but rising water tables or rising sea levels could lead to excessive and prolonged flooding that may be a threat to populations, especially given the apparent narrow ecotonal band occupied by the species (Venn 1999). Sea level rise associated with climate change may also pose a threat (Pobke 2011). Similarly, draining sites or prolonged drought may dry out sites, threatening the species. Water harvesting occurs near some sites in South Australia and may be a threat by leading to drying of sites (Pobke 2011).

Grazing
Victorian (and some South Australian) sites have been historically heavily grazed by sheep for extended periods (Venn 1999), although this has now largely ceased. Many sites remain close to farms and thus remain potentially threatened by wandering livestock. Grazing by introduced rabbits and hares may also threaten some populations, while grazing by goats is considered unlikely to be a threat.

Disturbance
Many sites where *T. flabelliformis* grows are accessible by vehicles, and samphire shrublands are particularly susceptible to physical damage from vehicle movement, especially during wet conditions. Vehicle movement has damaged stands in Victoria (Venn 1995) and at Fowlers Bay in South Australia (Pobke 2011). Other sites have been damaged by, or are susceptible to, rubbish dumping or other disturbance, often as the areas are perceived as having little value (Venn 1995; Pobke 2011).

Recovery Information

Existing Conservation Measures

A number of conservation measures have been undertaken for *T. flabelliformis*, including:

- Inclusion in a recovery plan for 25 threatened plant taxa on the Eyre Peninsula, South Australia (Pobke 2011).
- Fencing of saltmarsh containing *T. flabelliformis* and cancellation of grazing and salt extraction licenses for Mitre Lake and Olivers Lake (Vic) sites.
- Reservation of Mitre Lake, Olivers Lake (Vic), Sceale Bay, Acraman Creek and Fowlers Bay (SA) sites for conservation purposes.
- Protection of the private land portion of the Grass Flat Swamp site (Vic) by a conservation covenant through the *Trust for Nature* (Victoria).

Recovery Objectives

The overall objective of recovery is to minimise the probability of extinction of *T. flabelliformis* in the wild and to increase the probability of important populations becoming self-sustaining in the long term. Within the life span of this Recovery Plan (5 years), the specific objectives of recovery for *T. flabelliformis* are to:

1. Verify taxonomy and determine distribution, abundance and population structure
2. Determine habitat requirements
3. Ensure that key populations and their habitat are protected and managed
4. Manage threats to populations
5. Identify key biological characteristics
6. Determine growth rates and viability of populations
7. Establish a seedbank
8. Build community support for conservation

Program Implementation and Evaluation

This Recovery Plan guides recovery actions for *T. flabelliformis* and will be implemented and managed by the relevant nature conservation agency in each State, supported by other agencies, educational institutions, regional natural resource management authorities and community groups as appropriate. Technical, scientific, habitat management or education components of the Recovery Plan will be referred to specialist groups on research, *in situ* management, community education and cultivation as required. Contact will be maintained between the State agencies on recovery issues concerning *T. flabelliformis*. The Recovery Plan will run for a maximum of five years from the date of its adoption under the EPBC Act, and will be reviewed and revised within five years of the date of its adoption by agencies responsible for implementation.

Recovery Actions and Performance Criteria

Action	Description	Performance Criteria
Specific Objective 1: Verify taxonomy and determine distribution, abundance and population structure		
1.1	Confirm taxonomic classification according to key morphological characteristics to enable a more accurate determination of distribution, abundance & status **Responsibility: DEC, DEH, State Herbaria**	• Taxonomic identity of all SA & WA purported *T. flabelliformis* populations verified.
1.2	Undertake surveys to determine the area and extent of populations, the number, size and structure of populations, and inference or estimation of population change. **Responsibility: DEC, DEH, DSE, PV**	• 15 current population sites searched & mapped for population size, condition and habitat.
Specific Objective 2: Determine habitat requirements		
2.1	Survey known habitat and collect floristic and environmental information relevant to community ecology and condition.	• Species/habitat specific survey design prepared. • Habitat critical to survival mapped for 15 extant populations.

	Responsibility: DEC, DEH, DSE, PV	
2.2	Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference. **Responsibility: DEC, DEH, DSE**	• Potential habitat surveyed in 5 locations. • Predictive model for potential habitat developed & tested at 5 sites.
Specific Objective 3: Ensure that key populations and their habitat are protected and managed appropriately		
3.1	Protect populations on unreserved public land. **Responsibility: DEH**	• Management agreements or similar in place for 5 populations on unreserved public land. • Actions to protect species incorporated in relevant management plans.
3.2	Protect populations on private land. **Responsibility: DEH, DSE**	• Voluntary agreements in place for 4 populations on private land.
Specific Objective 4: Manage threats to populations		
4.1	Investigate and control threats from pest plants. **Responsibility: DEH, PV**	• Reduction in cover of weeds at and near all treated sites.
4.2	Investigate and control threats from grazing animals. **Responsibility: DEH, PV**	• Degree of grazing threat determined for important populations. • Boundary fences surrounding *T. flabelliformis* sites maintained to exclude livestock, in co-operation with private landholders. • Reduction in damage by pest animals (notably rabbits and hares) at and near all treated sites.
4.3	Investigate and control the threat of direct damage by disturbance. **Responsibility: DEC, DEH, PV**	• Impact of vehicle movement monitored and reduced where required through either fencing or road access control.
Specific Objective 5: Identify key biological characteristics		
5.1	Evaluate current reproductive status, seed bank status, longevity, fecundity and recruitment levels. **Responsibility: DEH, DSE**	• Reproductive ecology and regenerative potential quantified for four representative sites. • Seed bank potential quantified for 10 representative sites.
5.2	Identify key stimuli for seed germination requirements. **Responsibility: DEH, DSE**	• Stimuli for recruitment identified. • Management strategies identified to maintain, enhance or restore processes fundamental to reproduction and survival.
Specific Objective 6: Determine the growth rates and viability of populations		
6.1	Measure and monitor population trends and responses against recovery actions by collecting demographic information including abundance, recruitment and mortality and timing of life history stages. **Responsibility: DEH, DSE**	• Techniques for monitoring developed and implemented. • Population growth rates determined and Population Viability Analysis completed for 5 populations.
Specific Objective 7: Establish a seed bank		
7.1	Establish a seed bank and determine seed viability. **Responsibility: DEH, DSE, State Herbaria**	• Seed from 10 extant populations in storage.
Specific Objective 8: Build community support for conservation		
8.1	Identify opportunities for community involvement in the conservation of the Bead Glasswort. **Responsibility: DEC, DEH, PV**	Community nature conservation and Landcare groups aware of the species and support its conservation.

Abbreviations: DEC – Department of Environment and Conservation (WA); DEH – Department for Environment and Heritage (SA); DSE – Department of Sustainability and Environment (Vic); PV – Parks Victoria

Management Practices

The philosophy of the strategy for recovery is habitat conservation, restoration and management combined with an understanding of the ecological and biological requirements of *T. flabelliformis*. The emphasis is on using knowledge to better implement *in situ* management

techniques that protect populations and promote regeneration and recruitment. To achieve this, recovery actions are primarily structured to (i) acquire baseline data, (ii) assess habitat condition including ecological and biological function, (iii) protect populations to maintain or improve population growth and (iv) to engage the community in recovery actions. On-ground site management will aim to mitigate threatening processes and thereby insure against extinction. Major threats requiring management include accidental destruction, land clearance, competition from pest plants, and grazing by pest animals. A range of strategies will be necessary to alleviate these threats including weed control, fencing, and control of pest animals.

Broadscale protection measures applicable to all populations include legal protection of sites, habitat retention and liaison with land managers including private landholders. In addition, searches of known and potential habitat should continue to better define the distributions and size of populations. The Recovery Plan also advocates strategies to fill some of the major gaps in our knowledge to date. These include an understanding of the mechanisms underlying recruitment and regeneration. Successful *in situ* population management will be founded on understanding the relationships between *T. flabelliformis* and associated flora, and its response to environmental processes. These are directly linked to biological function and are thus vital to recovery. Demographic censusing will be necessary to gather life history information and to monitor the success of particular management actions. In addition to the above, *ex situ* conservation measures will be required and will include seed storage. Community participation in recovery actions will be sought, particularly in regard to implementation of on-ground works and raising community awareness of this species.

Affected Interests

The Bead Glasswort occurs on a variety of land tenures including parks and reserves, and in some cases (SA and WA) on unallocated Crown land. Consequently, management is the responsibility of various agencies including the Department of Sustainability and Environment (Vic), Parks Victoria, Department for Environment and Heritage (SA) and Department of Environment and Conservation (WA), who will be responsible for the management of populations under their jurisdiction subject to available resources and other priorities. Several populations occur on private land, and landholders will be encouraged to protect and manage populations of *T. flabelliformis* at these sites. Community involvement in the conservation of *T. flabelliformis* will be encouraged.

Role and Interests of Indigenous People

Indigenous communities on whose traditional lands *T. flabelliformis* occurs have been advised, through the relevant regional Indigenous facilitator, of the preparation of this Recovery Plan and invited to provide comments and be involved in the implementation of the plan.

Biodiversity Benefits

The Recovery Plan includes a number of potential biodiversity benefits for other species and vegetation communities in Victoria, South Australia and Western Australia. Principally, this will be through the protection and management of habitat. The adoption of broad-scale management techniques and collection of baseline data will also benefit a number of other plant species growing in association with *T. flabelliformis*, particularly those species with similar life forms and/or flowering responses. The Recovery Plan will also provide an important public education role as threatened flora have the potential to act as ‘flagship species’ for highlighting broader nature conservation and biodiversity issues such as land clearing, grazing, weed invasions and habitat degradation.

Social and Economic Impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts. Protection of populations on public land will be achieved with minimal disruption to current recreational activities, some of which is currently illegal (such as off-road driving). Populations on private land will be protected through voluntary agreements with landowners, supported by NRM incentives where available.

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	*Description*	*Priority*	*Feasibility*	*Responsibility*	*Cost estimate*					
					Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	**Distribution, abundance**									
1.1	Verify taxonomy	2	100%	DEC, DEH, Herbaria	$5,000	$5,000	$5,000	$0	$0	$15,000
1.2	Surveys	1	100%	DEC, DEH, DSE, PV	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
2	**Habitat requirements**									
2.1	Known habitat	1	100%	DEC, DEH, DSE, PV	$15,000	$15,000	$15,000	$0	$0	$45,000
2.2	Potential habitat	2	75%	DEC, DEH, DSE	$0	$0	$15,000	$15,000	$15,000	$45,000
3	**Habitat protection**									
3.1	Public land	2	75%	DEH	$10,000	$10,000	$5,000	$0	$0	$25,000
3.2	Private land	2	75%	DEH, DSE	$0	$8,000	$6,000	$0	$0	$14,000
4	**Threat management**									
4.1	Pest plants	1	75%	DEH, PV	$15,000	$15,000	$15,000	$10,000	$10,000	$65,000
4.2	Grazing animals	1	75%	DEH, PV	$15,000	$15,000	$15,000	$10,000	$10,000	$65,000
4.3	Vehicle disturbance	1	75%	DEC, DEH, PV	$15,000	$15,000	$15,000	$10,000	$10,000	$65,000
5	**Biological characteristics**									
5.1	Reproductive status	2	75%	DEH, DSE	$10,000	$10,000	$10,000	$5,000	$5,000	$40,000
5.2	Seed germination	2	75%	DEH, DSE	$0	$5,000	$5,000	$5,000	$0	$15,000
6	**Population viability**									
6.1	Censusing	1	75%	DEH, DSE	$15,000	$15,000	$15,000	$10,000	$10,000	$65,000
7	**Seed Bank**									
7.1	Seed bank	3	100%	DEH, DSE, Herbaria	$0	$0	$10,000	$5,000	$5,000	$20,000
8	**Community support**									
8.1	Community extension	3	50%	DEC, DEH, PV	$2,000	$2,000	$2,000	$2,000	$2,000	$10,000
				TOTALS	$107,000	$120,000	$138,000	$77,000	$72,000	$514,000