WA INTERIM RECOVERY PLAN NO. 231

SALTMAT

(*ROYCEA PYCNOPHYLLOIDES*)

RECOVERY PLAN

Department of Environment and Conservation
Kensington

Australian Government

GOVERNMENT OF WESTERN AUSTRALIA

Department of Environment and Conservation
Our environment, our future

FOREWORD

Recovery Plans (RPs) and Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

Plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of plans and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This plan results from a review of, and replaces Phillimore *et al*. (2002) *Saltmat (Roycea pycnophylloides*): *Background and summary of actions*.

This plan will remain in force until withdrawn or replaced. It is intended that, if the species is still listed as threatened in Western Australia, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan, which was given regional approval on 29 November 2006 and was approved by the Director of Nature Conservation on 19 December 2006, was updated on the 18 March 2010. The allocation of staff time and provision of funds identified in this plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

This plan was written and endorsed as an IRP in Western Australia, and it is also the National Recovery Plan for this Ecological Community as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Information in this plan is accurate as at March 2010.

PLAN PREPARATION

This plan was prepared by Robyn Luu[1], Kim Kershaw[2], Bethea Loudon[3] and Andrew Brown[4].

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ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this plan:

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Cover photograph by Phil Roberts.

CITATION

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SUMMARY

Scientific Name:	***Roycea pycnophylloides***	**Common Name:**	Saltmat
Family:	Chenopodiaceae	**Flowering Period:**	October to April
DEC Region:	Wheatbelt	**DEC Districts:**	Great Southern, Yilgarn and Avon-Mortlock
Shires:	Cunderdin, Kent, Kondinin, Lake Grace, Kulin, Bruce Rock, Kellerberrin	**Recovery Teams:**	Merredin, Narrogin and Katanning

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Perth, Western Australia; Western Australian Herbarium (2009) FloraBase - The Western Australian Flora. Department of Environment and Conservation, Perth, Western Australia. http://florabase.dec.wa.gov.au/; Leigh, J., Boden, R. and Briggs, J. (1984) Extinct and Endangered Plants of Australia. The MacMillan Company of Australia Pty Ltd, South Melbourne; Phillimore, R., Stack, G., & Brown, A. (2002) *Saltmat (Roycea pycnophylloides): Background and summary of actions,* Department of Conservation and Land Management, Perth, Western Australia; Harris, A. (2004) Population Characteristics of *Roycea pycnophylloides* (Saltmat), A framework for monitoring change, an unpublished report to the former Western Australian Threatened Species and Communities Unit (WATSCU), now part of Species and Communities Branch.

Current status: *Roycea pycnophylloides* was declared as Rare Flora in October 1996 and is ranked as Vulnerable (VU) in Western Australia against World Conservation Union (IUCN 2001) Red List criteria B2ab(iii). The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act).

There are 18 populations and over 1.5 million plants with little evidence of recent decline. However, due to its habitat being subject to rising salinity and inundation, there is potential for the species to become threatened in the future and populations are being monitored to assess their conservation status on an ongoing basis. The main threats to the species are salinity, prolonged waterlogging, road and firebreak maintenance, grazing and vehicle disturbance.

Description: *Roycea pycnophylloides* is a mat-like subshrub with numerous, hairy, more or less parallel branchlets. The leaves are about 2 mm long, stalkless, bluish-grey, spirally arranged and tightly overlapping, more or less concave with membranous edges and minute hairs. The inconspicuous green flowers are held in the upper leaf axils or at the ends of the stems. Male and female flowers are on separate plants and appear between October and April (Brown *et al*. 1998). The fruit is fleshy, 1-2 mm long hidden in the leaf axils and contains a single fleshy seed less than 1 mm in length.

Habitat requirements: *Roycea pycnophylloides* is endemic to the Wheatbelt area of Western Australia where it grows in seasonally wet grey-brown clay soils in open flats near the margins of salt lakes.

Habitat critical to the survival of the species, and important populations: Habitat critical to the survival of the species includes the area of occupancy of important populations; areas of similar habitat surrounding important populations i.e. rises above saline flats in white to pale brown sand over sandy clay, these areas providing potential habitat for natural range extension and allowing pollinators to move between populations; and additional occurrences of similar habitat that may contain the species or be suitable sites for future translocations.

Benefits to other species/ecological communities: Population 7 is located within a Threatened Ecological Community (TEC) that is ranked as Endangered (EN) in Western Australia, and *Ptilotus fasciculatus* (EN) is listed as an associated species. In addition, other declared rare and priority flora occur in the wider habitat of the species. Recovery actions implemented to improve the quality or security of the habitat of *Roycea pycnophylloides* are likely to improve the status of the TEC and other rare and priority flora.

International Obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The species is not listed under the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES). In addition, it is not listed under any other specific international treaty and this plan does not affect Australia's obligations under these international agreements.

Role and interests of indigenous people: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites of Aboriginal significance are known at or near populations of the species. However, the involvement of the indigenous community has been sought to determine any issues or interests identified in the plan. Opportunities for indigenous roles in the recovery of the species will be encouraged and may exist through cultural interpretation and awareness of the species. Continued liaison between DEC and the indigenous community will identify areas in which

collaboration will assist implementation of recovery actions.

Social and economic impacts: The implementation of this recovery plan may result in some social or economic impact. Some populations are located on private property and in areas leased for mining and their protection may potentially affect farming and mining activities. Recovery actions will involve liaison and cooperation with all stakeholders with regard to these areas.

Affected interests: Stakeholders potentially affected by the implementation of this plan include the Shire of Kent and the owners of private land.

Evaluation of the Plan's Performance: DEC will evaluate the performance of this Recovery plan in conjunction with the Yilgarn, Avon-Mortlock and Great Southern Districts Threatened Flora Recovery Teams. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

Existing Recovery Actions
These actions have been or are currently being implemented in tandem with the development of this recovery plan:

1. Land managers have been notified of the location and threatened status of the species.
2. Declared Rare Flora (DRF) markers were installed at Subpopulation 2b in April 2001 and were replaced with new markers in February 2004.
3. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.
4. Population 14 occurs on private property that has been registered with the Land for Wildlife program (DEC) and the remnant has been made into a conservation block through the WWF-Australia Woodland Watch Program.
5. Population 7 of *Roycea pycnophylloides*, also occurring on private property, was fenced in 2002 and 2004 to prevent access by stock (10 ha).
6. Surveys have been carried out and a number of new populations of *Roycea pycnophylloides* have been found.
7. In December 1997, ninety-two cuttings of what were thought to be *Roycea pycnophylloides* were taken by staff at the Botanic Gardens and Parks Authority (BGPA) for propagation trials. However the species was misidentified and cuttings were taken from *Wilsonia humilis*.
8. Two seed collections were made from Population 2 in February 2004 and are currently stored in DEC's TFSC. The seed has yet to be processed.
9. Research into the population characteristics of *Roycea pycnophylloides* was undertaken in 2003/2004 by staff from the former Conservation and Land Management (CALM) Western Australian Threatened Species and Communities Unit, now part of DEC Species and Communities Branch (Harris 2004).
10. A review of the monitoring bore network located on the Mortlock River Flats in Cunderdin (Population 7), was initiated in 2002 (Geo and Hydro Environmental Management Pty Ltd 2002).
11. In September 2000, soil samples were taken from the first 5 cm of soil below the surface crust in Subpopulation 2a. These results establish a base-line for future monitoring.
12. Staff from DEC Great Southern and Yilgarn Districts annually monitor all populations of this species for population size and threats.
13. The Merredin, Narrogin and Katanning Districts Threatened Flora Recovery Teams are overseeing the implementation of this Recovery plan and will include information on progress in their annual report to DEC Corporate Executive and funding bodies.

Recovery Plan Objective: The objective of this Recovery plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the species in the wild.
Recovery criteria
Criteria for success: The number of mature plants and populations remain stable, and the level of soil salinity is maintained or decreased over the life of the plan.
Criteria for failure: The number of mature plants or populations decline, and the level of soil salinity increases over the life of the plan.

Recovery actions

1. Coordinate recovery actions.
2. Map habitat critical to the species' survival.
3. Conduct further surveys.
4. Collect seed and cuttings.
5. Fence Population 1.
6. Monitor populations.
7. Monitor salinity and groundwater levels.
8. Control rabbits.
9. Obtain biological and ecological information.
10. Promote awareness.
11. Achieve long-term protection of habitat.
12. Liaise with relevant land managers.
13. Review the plan and assess the need for further recovery actions

1. BACKGROUND

History

Roycea pycnophylloides was first collected from east of Meckering by C.A. Gardner in 1945. A small population still occurs in about the same area today but occupies a highly degraded saline flat and is unlikely to survive long-term. A second population was discovered in the Pingrup area by Steve Hopper[1] and Andrew Brown in 1985 and a third population was found during a survey conducted by Mattiske Consulting in January 1995. As there were just three populations known at the time, the species was declared as rare flora in October 1996 and ranked as Critically Endangered (CR) in December 1997. No further populations were found until Mike Lyons[2] located plants during the 'Botanical Survey of the Wheatbelt' in 1999-2002. Further surveys undertaken by Diana Papenfus[3] between October and November 2003 resulted in the discovery of a further seven new populations in the Kondinin, Kelleberrin and Bruce Rock Shires (Papenfus 2003). Two other populations were discovered during opportunistic surveys in 2003.

There are currently 18 populations of *Roycea pycnophylloides* known, which together total over 1.5 million plants. Many of these populations are in the conservation estate and, given that there is little evidence of decline and few immediate threats, the species is not currently considered a high priority for immediate recovery action. However, due to its habitat being subject to rising salinity and inundation there is potential for the species to become threatened in the future and populations are being monitored to assess their conservation status on an ongoing basis.

Description

Roycea pycnophylloides is a mat-like subshrub with numerous hairy, more or less parallel branchlets. Leaves are sessile, about 2 mm long, bluish-grey, fleshy, more or less concave, membranous with minute hairs, spirally arranged and overlapping. The inconspicuous green flowers are held in the upper leaf axils or at the ends of the stems. The species is predominantly dioecious (male and female flowers on separate plants), although male and female flowers have occasionally been observed to occur on a single plant. Male flowers have four or five orange-red stamens opposite the perianth segments. Female flowers have long, maroon styles that are divided into two or three parts. Flowering occurs from October to April. The fruit is fleshy, 1-2 mm long hidden in the leaf axils and contains a single fleshy seed less than 1 mm in length (Brown *et al*. 1998).

Roycea pycnophylloides differs from *R. spinescens* in its lack of spines and the overlapping leaves on its stems (Brown *et al*. 1998).

Distribution and habitat

Roycea pycnophylloides occurs in the Avon, Yilgarn and Lockhart catchments of the central and southern Wheatbelt region of Western Australia. Plants grow along shorelines or on slight rises above open saline flats and major drainage channels in white to pale brown sand over sandy clay, either on their own or within nearby fringing vegetation (Harris 2004).

Roycea pycnophylloides is associated with other halophytic species including *Atriplex nana, A. hymenotheca, Carpobrotus* sp., *Cryptandra pungens, Didymanthus roei, Disphyma crassifolium, Drosera salina, Gunniopsis* sp., *Frankenia glomerata, Tecticornia indica* subsp. *bidens, T. halocnemoides, T. leptoclada* subsp. *inclusa, T. pterygosperma* subsp. *pterygosperma, Ptilotus fasciculatus, Sarcocornia globosa, S. blackiana* and *Wilsonia humilis* in areas that are fringed by *Eucalyptus sargentii, Melaleuca thyoides* and *M. pentagona.*

Population 7 of *Roycea pycnophylloides* is located on a threatened ecological community (TEC) the 'Salt Flats Plant Assemblages of the Mortlock River East Branch' (English and Blyth 1999). This community comprises braided channels (up to 2 km wide), flats, wash-lines and sandy rises (up to 2m high) stretching 39 km along the

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[3] Diana Papenfus, former Project Officer, in CALM's Threatened Species and Communities Unit (Now DEC's Species and Communities Branch)

Mortlock River (East) from Meckering eastwards to 8 km west of Tammin. A mosaic of plant communities assorted by elevation occurs on the river flats. The area represents the most extensive braided saline drainage line in this part of the SW agricultural zone. There are only 14 occurrences of this community covering 6310 hectares and a large majority of it is located on private property and is highly modified.

Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. E. of Meckering	Avon-Mortlock	Cunderdin	Freehold	Private Property	Landholders
2a. Chinocup (Nature Reserve)	Great Southern	Kent	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
2b. Chinocup	Great Southern	Kent	Unvested Reserve	Road reserve	Shire of Kent
2c. Chinocup	Great Southern	Kent	Freehold	Private Property	Landholders
3. Kondinin (Nature Reserve)	Great Southern	Kulin	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
4. Lake King (Nature Reserve)	Great Southern	Lake Grace	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
5. Chinocup (Nature Reserve)	Great Southern	Kent	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
6. NE of Lake Grace	Great Southern	Lake Grace	Unvested Reserve	Government Requirements	Department of Land Information
7. E of Mortlock River	Avon-Mortlock	Cunderdin	Freehold	Private Property	Landholders
8. W of Pingaring (Nature Reserve)	Great Southern	Kulin	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
9. SW of Pingaring (Nature Reserve)	Great Southern	Lake Grace	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
10. Mount Caroline (Nature Reserve)	Yilgarn	Kellerberrin	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
11. Mount Caroline (Nature Reserve)	Yilgarn	Kellerberrin	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
12a. Hyden (Nature Reserve)	Great Southern	Kondinin	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
12b. Hyden (Nature Reserve)	Great Southern	Kondinin	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
13. Kwolyin (Nature Reserve)	Yilgarn	Bruce Rock	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
14. E of Mt Caroline	Yilgarn	Kellerberrin	Freehold	Private Property (Conservation reserve)	Landholders
15. Kondinin	Great Southern	Kondinin	Unvested Crown land	Un-allocated Crown Land	Department of Land Information
16a. S of Mt Caroline	Yilgarn	Kellerberrin	Freehold	Private Property	Landholders
16b. S of Mt Caroline	Yilgarn	Kellerberrin	Freehold	Private Property	Landholders
17. Lake Magenta (Nature Reserve)	Great Southern	Lake Grace	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
18. SW of Quairading (Nature Reserve)	Avon-Mortlock	Quairading	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC

Populations in **bold text** are considered to be Important Populations

Biology and ecology

Staff from the DEC Species and Communities Branch researched plant size and vigour, reproductive characteristics and soil characteristics, and developed a framework for monitoring changes in five different locations (Populations 2, 4, 5, 7 and 9) in 2003/2004 (Harris 2004). This study concluded the following:

- Although population and plant numbers have increased significantly through surveys, plants occupy a highly specialised habitat that is now very restricted within the largely cleared agricultural areas and is also highly threatened by rising saline water tables.
- Roots of *Roycea pycnophylloides* plants are capable of storing reserves and evidence of resprouting was observed. These characteristics enable the recovery of the species from disturbance events and also enable it to endure periods of unfavourable growing conditions.
- *Roycea pycnophylloides* plants that were observed throughout the study sites were healthy with 92 to 99% of plants having 100% live canopies.
- Fruit production was low throughout all study sites, however the proportion of viable seed produced was 44.8%.
- Results of soil analysis varied between sites from 205 mSm^{-1} to 525 mSm^{-1} (Harris 2004).

Salt levels in soil samples taken in 2000 from Subpopulation 2a ranged between 1.66 and 3.4 mS/cm. Hunt and Gilkes (1992) suggest that salt levels between 0.8 to 1.6 mS/cm are tolerated by only a few salt tolerant plants, whereas a level greater than 1.6 mS/cm results in the death of most plants except saltbush. The salt level of the soil at Population 2 was 1.66 mS/cm. However, plants appeared quite healthy. This suggests that *Roycea pycnophylloides* is relatively salt tolerant. Plants at another two locations where salt levels were nearly double that of those of Population 2 were not as healthy, suggesting that very high levels of salt are not tolerated. Increasing salinity may have severe implications for all populations in the future.

The response to frequent or hot fires is unknown. However, it was noted that satellite imagery available since 1985 did not show fire scars in any of the areas where *Roycea pycnophylloides* populations are located and it is therefore unlikely that hot or frequent fires would occur within the plants' habitat.

Roycea pycnophylloides is mostly dioecious, and occasionally both male and female flowers have been observed on the same plant. Inflorescences are produced from October to April and fruits mature in late March. Each female flower may form one fruit that produces one seed (Harris 2004).

Differences occur in the growth form of the species. Both clumping and mat-forming growth habits have been observed, with differences possibly related to the age of the plants, i.e. clumping plants with thicker taproots may be older (Harris 2004).

Crawling insects and ants have been observed as plentiful within populations of *Roycea pycnophylloides* however specific pollinators have not been recorded (Harris 2004).

Investigations of soil stored seed have not been undertaken, however observations of seedlings growing in the canopies of *Roycea pycnophylloides* plants suggest that seeds may be held within fruits until conditions for germination are favourable or that seeds are trapped below the parent plant. The period of time needed for germination and the conditions favourable for their germination is not known and requires further research (Harris 2004).

Threats

Roycea pycnophylloides was declared as Rare Flora in October 1996 and is ranked as Vulnerable (VU) in Western Australia against World Conservation Union (IUCN 2001) Red List criteria B2ab(iii). The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

There are 18 populations and over 1.5 million plants with little evidence of recent decline. However, due to its habitat being subject to rising salinity and inundation, there is potential for the species to become threatened in the future and populations are being monitored to assess their conservation status on an ongoing basis. The main

threats are salinity, prolonged waterlogging, road and firebreak maintenance, grazing and vehicle disturbance. Three weed species have been recorded from the area of populations. However, all occurred in low numbers and are not considered a threat to the species.

- **Rising saline water tables and prolonged waterlogging** resulting from broad scale clearing of the catchment for agriculture may potentially impact on all populations. The species grows along shorelines, and in slight rises above open saline flats and along major drainage channels. Any increase in water logging and salinity in these areas as a result of extensive past land clearing is a potential threat to all populations, particularly those with little vegetation buffer. For example Harris (2004) found that plants impacted by substantially increased salt loads are not surviving, indicating that hydrological changes could lead to species decline. Distinct from major hydrological changes, short term seasonal inundation appears to be a natural event in all populations and is not believed to be detrimental. This was observed at subpopulation 2b in October 2003 where plants that were underwater continued to flower. These threats may impact differently at each population but if not addressed may lead to habitat degradation and species decline in the medium to long term.
- **Road and firebreak maintenance** is a threat to some populations and includes grading (either by removal of plants or by covering plants with soil), chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Some of these actions also encourage weed invasion.
- **Grazing** and trampling by rabbits, kangaroos and livestock is a threat to a number of populations. Rabbits have been observed at some populations and plant damage due to grazing has also been noted. Soil disturbance, weed invasion and the addition of nutrients are secondary effects of animal movement in areas inhabited by the species.
- **Vehicle disturbance** has in the past been a threat to Population 1. Several tracks have been observed going through the population. This has the potential to damage the plants and associated vegetation.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. of adult plants	Condition	Threats
1. East of Meckering	Private Property	1988 20 1990 20 1995 12 2009 1	Poor	Hydrological changes, vehicle disturbance
2a. Chinocup	Nature Reserve	1985 2000+ 1993 8000+ 2000 *1,481,250	Healthy/ Moderate	Hydrological changes
2b. Chinocup	Road Reserve	2000 *see 2a	Healthy/ Moderate	Hydrological changes, road maintenance
2c. Chinocup	Private Property	2000 *see 2a	Healthy/ Moderate	Hydrological changes, firebreak maintenance
3. Kondinin	Nature Reserve	1999 29,700+ 2000 20+ 2009 3000	Healthy	Hydrological changes
4. Lake King	Nature Reserve	2000 25	Healthy	Hydrological changes
5. Chinocup	Nature Reserve	2000 100+	Healthy	Hydrological changes
6. North east of Lake Grace	Unvested Reserve	2000 20+	Healthy	Hydrological changes
7. East of Mortlock River	Private Property	2000 15+ 2006 100+ 2009 15	Moderate	Hydrological changes
8. West of Pingaring	Nature Reserve	2001 200+ 2001 3780	Healthy/ Moderate	Hydrological changes, rabbits

9. South west of Pingaring	Nature Reserve	2001 200+ 2001 1100	Healthy/ Moderate	Hydrological changes
10. Mount Caroline	Nature Reserve	2003 260	Healthy	Hydrological changes, grazing (rabbits and kangaroos)
11. Mount Caroline	Nature Reserve	2003 49	Poor	Hydrological changes, grazing (rabbits and kangaroos)
12a. Hyden	Nature Reserve	2003 3000	Healthy	Hydrological changes, grazing (rabbits and kangaroos)
12b. Hyden	Nature Reserve	2003 3000	Healthy	Hydrological changes, grazing (rabbits and kangaroos)
13. Kwolyin	Nature Reserve	2003 300	Moderate / poor	Hydrological changes, grazing (rabbits and kangaroos)
14. East of Mt Caroline	Private Property	2003 900 2006 1000+	Healthy/ Moderate	Hydrological changes, grazing (rabbits and kangaroos)
15. Kondinin	Unallocated Crown Land	2003 700+	Healthy	Hydrological changes, grazing (rabbits and kangaroos)
16a. South of Mt Caroline	Private Property	2003 23	Moderate	Hydrological changes, grazing (rabbits and kangaroos)
16b. South of Mt Caroline	Private Property	2003 31	Moderate	Hydrological changes, grazing (rabbits and kangaroos)
17. Lake Magenta	Nature Reserve	2003 not counted ~1,000's to 1,000,000's	Healthy	Hydrological changes
18. SW of Quairading	Nature Reserve	2002 not counted		Hydrological changes

Populations in **bold text** are considered to be Important Populations; * = total for subpopulations combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Proposed developments and on-ground works (clearing, firebreaks etc) in the immediate vicinity of habitat critical to the survival of *Roycea pycnophylloides* will require assessment. Works should not be approved unless the proponents can demonstrate that activities will not be detrimental to the species, its habitat or potential habitat, or the local hydrology (surface and ground water).

Habitat critical to the survival of the species, and important populations

Habitat critical to the survival of the species includes the area of occupancy of important populations; areas of similar habitat surrounding important populations (i.e. rises above saline flats in white to pale brown sand over sandy clay, these areas providing potential habitat for natural range extension and allowing pollinators to move between populations); and additional occurrences of similar habitat that may contain the species or be suitable sites for future translocations.

It is thought that some populations are more important to the species' ongoing survival than others. These are the larger populations (Populations 2, 8, 9 and 17), those on conservation estate (2, 3, 4, 5, 8, 9, 10, 11, 12, 13 and 17) and those at the extremes of its range (1, 4, 15 and 17). On the basis of this it appears that most of the populations are important. This will need to be reappraised when further survey for new populations has been completed and also after the results of genetic studies are known.

Benefits to other species/ecological communities

Population 7 of *Roycea pycnophylloides* occurs on a Threatened Ecological Community (TEC) 'Salt Flats Plant Assemblages of the Mortlock River (East Branch)' that is ranked as Endangered in Western Australia. The associated species *Ptilotus fasciculatus* and wider habitat species *Frankenia parvula* and *Centrolepis caespitosa* are listed as DRF under Western Australia's *Wildlife Conservation Act 1950* and Endangered under the EPBC Act. Other WA priority flora that occur in the wider habitat of populations include *F. bracteata* (Priority 1), *Drosera salina* (Priority 2), *Sarcocornia globosa* (Priority 3), *Hopkinsia anoectocolea* (Priority 3), *Angianthus micropodioides* (Priority 3), *Blennospora phlegmatocarpa* (Priority 3) and *Frankenia glomerata* (Priority 3). Recovery actions implemented to

improve the quality or security of the habitat of *Roycea pycnophylloides* are likely to improve the status of the TEC associated with Population 7 and the rare and priority flora listed above.

International Obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The species is not listed under the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES). In addition, it is not listed under any other specific international treaty and this plan does not affect Australia's obligations under these international agreements.

Role and interests of indigenous people

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites of Aboriginal significance are known at or near populations of the species covered by this plan.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs has been sought to identify groups with a cultural connection to land that is important for the species' conservation and to determine any indigenous management responsibilities for the land or issues or interests in the plan. Opportunities for indigenous roles in the recovery of the species will be encouraged and may exist through cultural interpretation and awareness of the species.

Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impacts

The implementation of this recovery plan has the potential to cause social or economic impacts as some populations are located on private property (Population 7) and others are in areas leased for mining (Population 6 and adjacent to Population 12). Recovery actions will involve liaison and cooperation with all stakeholders with regard to these areas.

Affected interests

Stakeholders potentially affected by the implementation of this plan include the Shire of Kent, as managers of the road reserve habitat of Subpopulation 2b and the owners of private land where populations 1, 7, 14 and subpopulations 2c, 16a and 16b occur.

Evaluation of the Plans Performance

DEC will evaluate the performance of this plan in conjunction with the Yilgarn and Great Southern Districts Threatened Flora Recovery Teams. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Recovery Plan Objective: The objective of this Recovery plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the species in the wild.

Recovery criteria

Criteria for success: The number of mature plants and populations remain stable, and the level of soil salinity is maintained or decreased over the life of the plan.

Criteria for failure: The number of mature plants or populations decline, and the level of soil salinity increases over the life of the plan.

3. RECOVERY ACTIONS

Existing recovery actions

Relevant land managers have been formally notified of the presence and threatened nature of *Roycea pycnophylloides* on their land. The notification details the Declared Rare status of the species and the associated legal responsibilities.

Declared Rare Flora (DRF) markers at Subpopulation 2b were replaced with new markers in February 2004. These alert road maintenance workers to the presence of each population, and enable them to take appropriate care. Dashboard stickers and posters describing the significance of DRF markers have also been produced and distributed.

Population 14 occurs on private property in an area that has been registered with DEC's Land for Wildlife program. The area has also been made a conservation block through the WWF-Australia Woodland Watch Program (H. Adamson[4] pers. communication).
Population 7 of *Roycea pycnophylloides*, which also occurs on private property, was fenced between 2002 and 2004 to prevent access by stock (10 ha).

A number of successful surveys have been carried out during which new populations of *Roycea pycnophylloides* were found. These include:

- The discovery of a new population in Kondinin Salt Marsh Nature Reserve during "A review of botanical values on a range of Gypsum Dunes in the Wheatbelt of Western Australia" by Mattiske Consulting (1995).
- The discovery of seven new populations in the Kondinin, Kelleberrin and Bruce Rock Shires during a 1999-2002 'Botanical Survey of the Wheatbelt' and
- Two additional populations located during opportunistic surveys by DEC District Staff in 2003.

In December 1997 ninety-two cuttings of what was thought to be *Roycea pycnophylloides* were taken by staff at the Botanic Gardens and Parks Authority (BGPA) for propagation trials. The species was misidentified and was in fact *Wilsonia humilis* (A. Shade[5] personal communication).

Very little seed has been collected for this species. Staff from DEC's Great Southern District and Threatened Flora Seed Centre (TFSC) visited Subpopulation 2a in March 2000 and collected material to look for seeds/fruiting bodies microscopically. No seeds/fruit were found. In October 2003 more than fifty female plants from Subpopulation 2a were marked to collect seed in the future. The plants were in full flower in early October 2003 and finished flowering in late October 2003. Two collections of the species were made from the site in February 2004 and are currently stored in DEC's TFSC. The seed has yet to be processed (A. Cochrane[6] unpublished data).

Research into the population characteristics of *Roycea pycnophylloides* was undertaken in 2003/2004 by staff from the former Department of CALM Threatened Species and Communities Unit (Harris 2004). The aim of this project was to establish a quantitative monitoring framework to obtain baseline data on population dynamics and species growth characteristics and for detecting changes in population abundance, health, life stage structure and reproductive potential. The project established a long term monitoring system, investigated growth habits and plant size and vigour and assessed reproductive and soil characteristics for five of the seventeen populations.

[4] Heather Adamson, former Land for Wildlife Officer, DEC's Yilgarn District (formerly Merredin District)
[5] Amanda Shade, Horticulturalist, Botanic Gardens and Park Authority
[6] Anne Cochrane, Senior Research Scientist, DEC's Threatened Flora Seed Centre

A review of the monitoring bore network located on the Mortlock River Flats in Cunderdin, where *Roycea pycnophylloides* occurs (Population 7), was initiated in 2002 (Geo and Hydro Environmental Management Pty Ltd 2002). This project aimed to:

- Review construction and condition of monitoring bores and data sets relating to water quality and depths.
- Collect monitoring bore data over four seasonal visits from 2002-2003.
- Survey aquifer properties through slug and pump tests.
- Investigate the effects of local tree planting on recharge rates and throughflow to Mortlock drainage line.
- Install four to eight further monitoring bores in summer 2003.

Results so far indicate:

- Minor elevation of dunes can provide a haven for biodiversity and biomass productivity as they maintain outward drainage of their watertable;
- Land degradation is occurring as a result of salinity, often accompanied by changes in acidity and sodicity of soils and groundwater in specific locations;
- Fringing vegetation does not mitigate salinity and protecting river flats should include engineering measures to adjust both surface and subsoil hydrology;
- Active interventions, such as channels, banks of additional soil around dunes, selective evaporator areas, and pumping stations, to improve protection of particular areas of high conservation interest should be used (Geo and Hydro Environmental Management Pty Ltd 2003-2004).

In September 2000, soil samples were taken from the first 5 cm of soil below the surface crust in Subpopulation 2a. The pH was measured using the CSIRO/Inoculo Soil pH Test Kit and salinity was measured by mixing the soil with distilled water (1:5), filtering the water and measuring the salinity level using a TDScan1 (a Total Dissolved Solids or Conductivity tester). Results were: Sample 1) pH 7, salinity 1.66 mS/cm; 2) pH 7.5, 3.4mS/cm; 3) pH 7, 2.7 mS/cm. These results establish a base-line for future monitoring of pH and salinity at this site.

Staff from DEC's Yilgarn, Avon-Mortlock and Great Southern Districts regularly monitor populations of this species.

The Yilgarn, Avon-Mortlock and Great Southern Districts Threatened Flora Recovery Teams (YDTFRT, AMDTHRT & GSDTFRT) are overseeing the implementation of this Recovery plan and will include information on progress in their annual report to DEC Corporate Executive and funding bodies.

Future Recovery Actions

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken. The following recovery actions are roughly in order of descending priority; influenced by their timing over the term of the Plan. This does not suggest that 'lower' priorities should not be implemented if funding becomes available or if an opportunity arises to complete the action.

1. Coordinate recovery actions

The Yilgarn, Avon-Mortlock and Great Southern Districts Threatened Flora Recovery Teams will continue to coordinate recovery actions for *Roycea pycnophylloides* and other Declared Rare Flora in their District. They will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost:	$2,000 per year

2. Map habitat critical to the species' survival

It is a requirement of the EPBC Act that spatial data relating to habitat critical to survival of the species be determined where practicable. Although habitat critical to the species' survival is described in Section 1, the areas as described have not yet been mapped and that will be redressed under this action. If any additional populations are located, then total habitat will also be determined and mapped for these locations.

Action: Map habitat critical to the species' survival
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $4,000 in the first year

3. Conduct further surveys

Further surveys by DEC staff and community volunteers will be conducted during the flowering period of this species (October to April). This will include a number of sites that have been identified in previous surveys as containing the species or containing potential habitat for the species and more extensive surveys of the drainage systems where this species is known to occur. Summaries of areas surveyed will be sent to Species and Communities Branch and also retained at the relevant District office as a record, even if the species is not found.

Action: Conduct further surveys
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $7,200 per year

4. Collect seed and cuttings

It is necessary to store germplasm as a genetic resource, ready for use in translocations and as an *ex situ* genetic 'blueprint' of the species. The germplasm stored will include seed and live plants in cultivation. Previously, few attempts at seed collection were made due to the small size of the species, difficulty in determining female plants and timing for collection. A number of plants have been tagged to alleviate this problem. Collections will be made from all populations to maintain a good representation of the species' genetic diversity. The patterns of viability that emerge from standard tests on seed collected may indicate the need for other recovery actions. For example, if viability is consistently low, it may be appropriate to conduct some hand pollination trials. Cutting collections will also be made if considered necessary.

Action: Collect seed and cuttings
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts, TFSC), through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $3,200 in the first, third and fifth years

5. Fence Population 1

Fencing may be required at Population 1 which is located on private land. The fenced area will ideally include a buffer of surrounding habitat to protect *Roycea pycnophylloides* from vehicle disturbance. Funding assistance for this fencing may be obtained from various sources such as a covenanting scheme.

Action: Fence Population 1
Responsibility: DEC (Avon-Mortlock District) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $2,500 in the first year

6. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed invasion), population stability (expansion or decline), recruitment, longevity and observations of pollinator activity, grazing, seed production and seed predation is essential.

Action: Monitor populations
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $2,000 per year

7. Monitor salinity and groundwater levels

Monitoring bores have been installed at Population 7 of *Roycea pycnophylloides* to monitor groundwater and salinity levels. A monitoring plan will be developed to identify existing bores and determine key populations that require detailed monitoring and the installation of groundwater monitoring bores. Soil salinity and pH readings will also be taken annually during winter (as per methods used in Harris 2004). Soil samples may be collected using an auger to provide a soil profile. The monitoring results will continue to be examined and the implications for management determined.

Action: Monitor salinity and groundwater levels
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $10,500 in year one; $17,500 in year two, $10,500 per year thereafter

8. Control rabbits

Rabbits are present at a number of populations and plant damage due to grazing has been noted. It is likely that the presence of rabbits at these sites is detrimental to populations, causing plant damage soil disturbance and increased nutrient levels. Also, the presence of weed seeds in rabbit droppings has the potential to increase weed invasion in the habitat. Baiting will be undertaken in and around these areas.

Action: Control rabbits
Responsibility: DEC (Yilgarn, Avon-Mortlock and Great Southern Districts) through the YDTFRT and AMDTFRT recovery teams
Cost: $1,200 in first, second and third years

9. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Roycea pycnophylloides* will provide a scientific basis for its management in the wild. The five quadrats established at populations 2, 4, 5, 7 and 9 in 2003/2004 will provide a basis for continued monitoring (Harris 2004). An understanding of the following is necessary for effective management:

1. Soil seed bank dynamics, including seedbank location and viability.
2. The role of various disturbances (including fire), competition, rainfall and grazing in germination and recruitment.
3. The pollination biology of the species.
4. The ecology of pollinators.
5. The reproductive strategies, phenology and seasonal growth of the species.
6. The population genetic structure, levels of genetic diversity and minimum viable population size.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Yilgarn, Avon-Mortlock and Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $12,500 per year in the first, second and third years

10. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of *Roycea pycnophylloides* will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet will be produced, and will include a description of the plant, its habitat, threats, recovery actions and photos. This will be distributed to the public through DEC's Yilgarn, Avon-Mortlock and Great Southern District offices and at the offices and libraries of the Shires of Bruce Rock, Cunderdin, Kent, Kondinin, Lake Grace, Kulin and Kelleberrin. Such information may lead to the discovery of new populations.

Action: Promote awareness
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $1,300 in first year; $600 per year thereafter

11. Achieve long-term protection of habitat

Ways and means of improving the security of populations and their habitat will be investigated. On private land, this may include establishing a conservation covenant over the remnant (various agencies). Where a covenant is not accepted, registration through the Land for Wildlife Scheme may be promoted.

Action: Achieve long-term protection of habitat
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $1,500 per year

12. Liaise with relevant land managers

Staff from DEC's Yilgarn, Avon-Mortlock and Great Southern Districts will continue to liaise with relevant land managers and landowners to ensure that populations are not accidentally damaged or destroyed. Input and involvement will continue to be sought from Indigenous groups that have an active interest in areas that are habitat for *Roycea pycnophylloides*.

Action: Liaise with relevant land managers
Responsibility: DEC (Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT, AMDTFRT & GSDTFRT recovery teams
Cost: $900 per year

13. Review the Recovery plan and assess the need for further recovery actions

If *Roycea pycnophylloides* is still ranked VU at the end of the five-year term of this plan it will be reviewed and the need for further recovery actions assessed.

Action: Review the plan and assess the need for further recovery actions
Responsibility: DEC (Species and Communities Branch, Yilgarn, Avon-Mortlock & Great Southern Districts) through the YDTFRT
Cost: $22,700 in the fifth year (if required)

Summary of Recovery action costs

Total DEC:	$73,200
Total Other:	$11,500
Total External Funding:	$126,400
TOTAL COSTS:	**$211,100**

4. TERM OF PLAN

This plan will remain in force until withdrawn or replaced. If the species is still ranked VU after five years, this plan will be reviewed and, if necessary, further recovery actions put in place. The plan was updated in April 2010.

Western Australia

This plan will operate from December 2006 to November 2011 but will remain in force until withdrawn or replaced. If the taxon is still ranked VU (IUCN) in Western Australia after five years, the need for further recovery actions and an update of this plan will be assessed. The plan was updated in April 2010.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION (Leigh, Boden and Briggs 1984)

Roycea pycnophylloides C.A. Gardner is a much-branched subshrub with hairy, more or less parallel branchlets. **Leaves** are densely and spirally arranged and tightly overlapping, ovate-oblong or ovate, stalkless, about 2 mm long, more or less concave, bluish-grey in colour, the edges membranous and with very minute hairs. **Flowers** are green, small and inconspicuous, unisexual, borne either singly in the upper leaf axils or at the ends of the stems with the male and female flowers on separate plants. Individual flowers have an extremely short perianth barely 1 mm long which is deeply divided into 4 or 5 ovate or obovate segments which have membranous and minutely white hairy edges. There are 4 or 5 stamens with large broadly-ovate pink-gold anthers which are arranged opposite the perianth segments. The style is deeply divided into 2 or 3 erect lobes which are longer than the perianth segments. **Fruit** has not been seen.