Thick-margined Leucopogon

(*Leucopogon marginatus*)

RECOVERY PLAN

Department of Environment and Conservation
Kensington

Australian Government

Government of Western Australia

Department of Environment and Conservation
Our environment, our future

FOREWORD

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.

IRPs 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 Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible.

This IRP will operate from May 2008 to April 2013 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Endangered (EN) this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was given Regional approval on 10 April 2008 and approved by the Director of Nature Conservation on 30 May 2008 The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate as at May 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

IRP PREPARATION

This Interim Recovery Plan was prepared by Alanna Chant[1] and Gillian Stack[2].

1 Conservation Officer, DEC's Geraldton District, PO Box 72, Geraldton, WA 6531.
2 Project Officer, Species and Communities Branch, DEC, Locked Bag 104, Bentley Delivery Centre, 6983.

ACKNOWLEDGMENTS

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

Jenny Borger	Consultant Botanist, Moora District, DEC
Gina Broun	Former Conservation Officer, Moora District, DEC
Andrew Brown	Threatened Flora Coordinator, Species and Communities Branch, DEC
Alex Chapman	Research Scientist, WA Herbarium, DEC
Andrew Crawford	Technical Officer, Threatened Flora Seed Centre, DEC
Anthony Desmond	Program Leader Nature Conservation, Midwest Region, DEC
Val English	Principal Ecologist, Species and Communities Branch, DEC
Mike Hislop	Consultant, WA Herbarium, DEC
Michael Jones	Horticulturalist, Botanic Gardens and Parks Authority
Mark Ooi	Research Associate, Department of Environment and Conservation NSW

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information. Thanks also to DEC's Species and Communities Branch and the private land holders who provided information on altered contact details, new land divisions and assistance in locating new and old populations in the field.

Cover photograph by Alanna Chant

CITATION

This Recovery Plan should be cited as:

Department of Environment and Conservation (2009) Thick-margined Leucopogon (*Leucopogon marginatus*) Recovery Plan, Department of Environment and Conservation, Western Australia.

SUMMARY

Scientific Name:	*Leucopogon marginatus*	**Common Name:**	Thick Margined Leucopogon
Family:	Epacridaceae	**Flowering Period:**	July - August
DEC Region:	Midwest	**DEC District:**	Geraldton, Moora
Shires:	Mullewa, Greenough, Three Springs	**Recovery Team:**	Geraldton and Moora District Threatened Flora Recovery Teams
NRM Region:	Northern Agricultural		

Illustrations and/or further information: Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia.* Department of Environment and Conservation, Western Australia. Blackall, W. E. and Grieve, B. J. (1981) *How to Know Western Australian Wildflowers* IIIB, 2nd ed: p 345. University of Western Australia Press, Nedlands; Brown, A., Thomson-Dans, C. and Marchant, N. (Eds) (1998) *Western Australia's Threatened Flora*, Department of Conservation and Land Management, Western Australia; Brown, E. (1997) Unpublished illustration and description; DEC (2008) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora*. Department of Environment and Conservation, Western Australia. http://www.calm.wa.gov.au/science/; Elliot, W. R. and Jones D. L. (1993) *Encyclopaedia of Australian Plants Suitable for Cultivation* 6: pp. 167. Lothian Publishing Company, Melbourne; Fitzgerald, W. V. (1904) *Leucopogon marginatus*, *Journal of the Western Australian Natural History Society*, 2(1):27.

Current status: *Leucopogon marginatus* was declared as Rare Flora under the *Wildlife Conservation Act 1950* in October 1996 and was ranked as Endangered (EN) under World Conservation Union (IUCN 1994) Red List criterion D in 2000 as less than 250 individuals were known at that time. The main threats are inappropriate fire regimes, vegetation clearing, rabbits, weeds, road and firebreak maintenance and gravel removal. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Description: *Leucopogon marginatus* is a dwarf shrub 40-60 cm tall with smooth, young growth and erect, smooth stems. This species is distinguished from others by the crisp, undulate and membranous margins of the leaf, and the white bearded flowers that appear in the upper leaf axils in groups of one to three per stalk. The lance-like pointed leaves are dark green, overlapping and embrace the stem (Brown *et al.* 1998).

Habitat requirements: *Leucopogon marginatus* is currently known over a range of 100 km from east of Geraldton, south to the Arrino Sandplain. The species is found on white, pale yellow or grey-brown sand over laterite, in open scrub and dense low heath with *Allocasuarina humilis*, *Jacksonia nutans*, *Daviesia daphnoides*, *Hakea prostrata*, *H. trifurcata*, *Acacia blakelyi*, *Hibbertia hypericoides*, *Eremaea beaufortioides*, *Banksia scabrella*, *B. prionotes*, *Grevillea candelabroides* and *Melaleuca* sp.

Habitat critical to the survival of the species and important populations: Given that *Leucopogon marginatus* is ranked as EN, it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *L. marginatus* includes the area of occupancy of populations; areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators); additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of habitat of *Leucopogon marginatus* will also protect other Declared Rare Flora (DRF) and Priority Flora. Associated DRF are *Conostylis micrantha* and *Conostylis dielsii* subsp. *teres*. Priority flora include *Grevillea hirtella* (P3), *Grevillea erinacea* (P3), *Baeckea* sp. Walkaway (P3) and *Banksia scabrella* (P4).

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. *Leucopogon marginatus* is not listed under any specific international treaty and this IRP does not affect Australia's obligations under any other international agreements.

Indigenous consultation: The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of known populations of *Leucopogon marginatus*, however, the Yamatji Land and Sea Council, was consulted in order to identify possible indigenous interest in the habitat or recovery of *Leucopogon marginatus* and a representative was invited to become a member of the Geraldton District Threatened Flora Recovery Team.

Social and economic impact: As Populations 14 to 20 and 23 to 26 occur on private property the protection of the species in these areas has the potential to affect future development. Recovery actions refer to continued liaison between

stakeholders.

Evaluation of the plan's performance: The Department of Environment and Conservation, in conjunction with the Geraldton and Moora Districts Threatened Flora Recovery Teams, will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

Completed Recovery Actions

1. Relevant land managers have been made aware of the location and threatened status of the species.
2. Declared Rare Flora (DRF) markers are in place for road and most firebreak populations.
3. Rabbit baiting was conducted at a Nature Reserve population in 1999. Follow-up baiting was undertaken in 2000.
4. New populations have been found as a result of surveys undertaken by staff from DEC's Geraldton District and the WA Herbarium.
5. A botanist contracted to DEC's Moora District in 2005 found six new populations on private property while undertaking a survey of remnant sandplain vegetation.
6. Staff from DEC's Geraldton District have implemented a pre-suppression fire management strategy in a Nature Reserve that contains seven populations of the species.

Ongoing and future recovery actions

1. Staff from DEC's Geraldton District regularly monitor populations of the species and maintain close liaison with relevant land managers.
2. The Geraldton District Threatened Flora Recovery Team (GDTFRT) and Moora District Threatened Flora Recovery Team (MDTFRT) are overseeing the implementation of this IRP and will include information on progress in their annual reports to DEC's Corporate Executive and funding bodies.

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

Criteria for success: The number of populations has increased or the number of individuals within populations have increased by ten percent or more over the five year term of the plan.
Criteria for failure: The number of populations has decreased or the number of individuals within populations have decreased by ten percent or more over the five year term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Map habitat critical to survival of *Leucopogon marginatus*
3. Liaise with relevant land managers and Indigenous groups
4. Monitor populations
5. Implement rabbit control
6. Implement weed control
7. Obtain information on post fire regeneration
8. Develop and implement a fire management strategy
9. Conduct further surveys
10. Collect seed
11. Promote awareness
12. Install markers
13. Review this plan and assess the need for further recovery actions

1. BACKGROUND

History

The type specimen of *Leucopogon marginatus* was collected from the Arrino Sandplains by W.V. Fitzgerald in September 1903. Further collections of the species were made in July 1985 and in August 1986. The species was then not seen again until July 2000, when it was relocated near the 1986 collection following surveys by Geraldton District staff. During the same month staff from the WA Herbarium collected the species in a nearby Nature Reserve. Further surveys by District staff in 2001 and 2003 resulted in four more populations being found in the same nature reserve and, in 2003, the Geraldton Regional Herbarium Group collected the species from two sites on a Water Reserve. Surveys conducted by District staff during 2004 determined that a large population of the species occurred at this site. During July 2005, as part of a Commonwealth Government funded project to implement conservation actions for Threatened Flora in the Geraldton to Shark Bay Sandplain Biodiversity Hotspot, a botanist contracted to DEC discovered six new populations on private property. A further two new populations, one on private property and one in a gravel reserve, were discovered later in 2005/06.

Most known populations have shown declines, although population 14 shows a substantial increase (from 17 plants in 2005 to 360 plants in 2008). A total of 861 individuals in 26 populations are now known over a range of 100 km.

Description

Leucopogon marginatus is a dwarf shrub 40-60 cm tall with smooth young growth and stems. The erect lance-like leaves with crisp membranous margins and sharply pointed tip are dark green, overlap and embrace the stem. The leaves, which are 4-6 mm long with a very short petiole, are distinguished by their concave shape and the longitudinal ridges in their lower portion. The white flowers appear in the upper leaf axils in groups of one to three. At the base of each flower is a bracteole, one third as long as each of the five sepals. This bracteole also has a membranous margin. The corolla forms a tube slightly longer than the calyx. It has five free lobes which are bearded inside and have pointed hairless tips. The oblong anthers are attached near the top of the corolla tube and lack sterile tips. The style is slightly longer than the corolla tube (Brown 1998 unpl.).

Leucopogon marginatus populations surveyed during 2005 were found to contain individuals that are considerably larger (up to 170cm in height) than those recorded in published descriptions.

Leucopogon marginatus is allied to *L. obtectus* and *L. crassiflorus* differing from the former in its foliage shape and from the latter in foliage and inflorescence shape (Fitzgerald 1904). *L. marginatus* is not considered a true *Leucopogon* as it lacks sterile anther tips, has an axillary rather than a terminal inflorescence, has a long corolla tube relative to the calyx length and has a longer style. It is likely that it will be transferred to a new genus (Mike Hislop pers. comm.).

Leucopogon marginatus has previously been confused with *L. sulcatus* ms which grows in the Bruce Rock, Merredin, Southern Cross and Forrestania areas. In the area where *L. marginatus* is now known to occur it could be confused with *L. hamulosus* and *L.* sp. Arrino (Mike Hislop pers. comm.).

Distribution and habitat

Leucopogon marginatus is currently known over a range of 100 km from east of Geraldton, south to the Arrino Sandplain. The species is found on white, pale yellow or grey-brown sand over laterite, in open scrub and dense low heath with *Allocasuarina humilis*, *Jacksonia nutans*, *Daviesia daphnoides*, *Hakea prostrata*, *H. trifurcata*, *Acacia blakelyi*, *Hibbertia hypericoides*, *Eremaea beaufortioides*, *Banksia scabrella*, *B. prionotes*, *Grevillea candelabroides* and *Melaleuca* sp.

Summary of population land vesting, purpose and management

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. Erangy Springs	Geraldton	Mullewa	Unknown	Unknown	
2. Burma Road	Geraldton	Greenough	Unvested Reserve	Road Reserve	Shire of Greenough
3. Sandsprings Road	Geraldton	Greenough	Unknown	Unknown	
4. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
5. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
6. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
7. E of Geraldton	Geraldton	Greenough	Main Roads Western Australia	Water	Main Roads Western Australia
8. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
9. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
10. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
11. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
12. Burma Road	Geraldton	Greenough	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
13. W of Eradu	Geraldton	Greenough	Main Roads Western Australia	Road Reserve	Main Roads Western Australia
14. NE of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
15. NE of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
16. NE of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
17. NE of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
18. NE of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
19. NE of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
20. N of Arrino	Moora	Three Springs	Freehold	Private Property	Land holder
21. E of Arrino	Moora	Three Springs	Main Roads Western Australia	Gravel Reserve	Main Roads Western Australia
22. Greenough	Geraldton	Greenough	Water Authority	Water	Water Authority
23. Greenough	Geraldton	Greenough	Freehold	Private Property	Land holder
24. Allanooka Springs	Geraldton	Greenough	Freehold	Private Property	Land holder
25. SW of Burma Road	Geraldton	Greenough	Freehold	Private Property	Land holder
26. N of Sandsprings Road	Geraldton	Greenough	Freehold	Private Property	Land holder

All populations are considered important populations.

Biology and ecology

The genus *Leucopogon* is a member of the Ericaceae (previously Epacridaceae) family and contains approximately 160 species, mostly Australian but also some found in Malaysia, New Caledonia, New Zealand and the Pacific Islands. They occur in a variety of habitats from sub-alpine areas to coastal heaths. The greatest representation is in south-western WA, where there are approximately 100 species (Elliot and Jones 1993).

Many members of the Epacridaceae family are killed by fire and are re-seeders (Keighery 1995). Populations of *Leucopogon marginatus* that were burnt during a wildfire in January 2005 contained no resprouting plants in September the same year. In 2000 *L. marginatus* was recorded from an area that had been burnt in 1996, suggesting that it regenerates successfully from seed after fire and that mature flowering individuals are present within four years. A study investigating dormancy breaking cues for three *Leucopogon* species indicates that fresh seeds studied are dormant at release (Ooi *et al.* unpublished paper). They have underdeveloped embryos and primary dormancy was overcome by seasonal temperature changes. Fire cues did not break primary dormancy but smoke could enhance germination once this dormancy was overcome (Ooi *et al*. unpublished paper).

The pollinators of *Leucopogon marginatus* are as yet unknown. *Leucopogon* species have unspecialized flowers and are mainly pollinated by bees, but are also visited by a range of other insects including flies, wasps,

butterflies and moths. The fruits are fleshy drupes that are mostly animal dispersed, usually after ingestion by birds (Keighery 1995).

Most genera in the family contain species that are susceptible to *Phytophthora cinnamomi* (dieback). However, *P. cinnamomi* is considered a relatively low risk to *Leucopogon marginatus* (Keighery 1988) due to its habitat consisting of well-drained soils and its location within the 300–400 mm rainfall zone.

Threats

The main threats are inappropriate fire regimes, vegetation clearing, rabbits, weeds, road and firebreak maintenance and gravel removal.

- **Inappropriate fire regimes** during the reproductive phase of *Leucopogon marginatus* may result in low/nil seedling recruitment. High fire frequency may also lead to a degradation of the habitat of *L marginatus* and this is covered under action 8.
- **Vegetation clearing** threatens several populations of *Leucopogon marginatus* on private property. An application to clear portions of the remnant has been submitted to the Department of Environment however this is unlikely to affect the population. Liaison with the property owners will be ongoing to protect the plants. This is covered under action 3.
- **Grazing by livestock** threatens several populations on private property and is covered under action 3.
- **Edge effects** affect populations that are restricted to narrow road reserves. These include increased wind speed, fertiliser and herbicide spray drift and runoff, modified hydrology and altered disturbance regimes. Liaison with relevant parties to prevent this are covered under action 3.
- **Rabbits** (*Oryctolagus cuniculus*) are impacting populations on a Nature Reserve. Rabbits do not appear to graze adult plants but the habitat is subject to digging in some areas.
- **Weed infestation** has increased along the boundaries of a Nature Reserve where several populations of *Leucopogon marginatus* occur.
- **Road, firebreak, powerline and fenceline maintenance** threatens several populations.
- **Gravel extraction** is a threat to Population 21 and is covered by action 3.

Summary of population information and threats

Pop. No. & Location	DEC District	Land Status	Year/No. plants	Condition	Threats
1. Erangy Springs	Geraldton	Unknown	1985 0 2000 0 2004 0 2008 0	Unknown	Road maintenance, weeds
2. Burma Road	Geraldton	Shire Road Reserve	2000 1 2001 1 2002 0 2004 0 2008 0	Moderate/Poor	Roadworks, inappropriate fire regimes, edge effects
3. Sandsprings Road	Geraldton	Unknown	1986 ? 2008 0	Unknown	
4. Burma Road	Geraldton	Nature Reserve	2000 2004 2 2005 ? 2004 0	Healthy	Rabbits, inappropriate fire regimes
5. Burma Road	Geraldton	Nature Reserve	2000 50+ 2004 50+ 2005 0 2008 0	Burnt	Inappropriate fire regimes, rabbits
6. Burma Road	Geraldton	Nature Reserve	2000 39 2005 0 2008 0	Healthy (burnt)	Firebreak maintenance, rabbits, inappropriate fire regimes
7. E of Geraldton	Geraldton	Water Reserve	2003 14 2004 145 2005 145 2008 2	Healthy	Track maintenance, inappropriate fire regimes, powerline maintenance

Pop. No. & Location	DEC District	Land Status	Year/No. plants	Condition	Threats
8. Burma Road	Geraldton	Nature Reserve	2003 10 2005 10 2008 0	Healthy	Inappropriate fire regimes
9. Burma Road	Geraldton	Nature Reserve	2003 60+ 2005 ? 2008 0	Healthy (burnt)	Inappropriate fire regimes
10. Burma Road	Geraldton	Nature Reserve	2003 9 2005 0 2008 0	Healthy (burnt)	Inappropriate fire regimes
11. Burma Road	Geraldton	Nature Reserve	2003 35 2005 35 2008 35	Healthy	Inappropriate fire regimes
12. Burma Road	Geraldton	Nature Reserve	2004 58 2008 0	Healthy	Inappropriate fire regimes
13. W of Eradu	Geraldton	Main Roads Road Reserve	2003 1 2005 1 2008 1	Moderate	Road maintenance, inappropriate fire regimes, edge effects
14. NE of Arrino	Moora	Private Property	2005 17 2008 360	Healthy	Vegetation clearing, inappropriate fire regimes, grazing
15. NE of Arrino	Moora	Private Property	2005 21 2008 21	Healthy	Vegetation clearing, livestock grazing, inappropriate fire regimes
16. NE of Arrino	Moora	Private Property	2005 400 2008 55	Healthy	Inappropriate fire regimes, grazing, vegetation clearing
17. NE of Arrino	Moora	Private Property	2005 55 2008 65	Healthy/Moderate	Vegetation clearing, grazing, weeds, inappropriate fire regimes
18. NE of Arrino	Moora	Private Property	2005 4 2008 5	Healthy	Weeds, inappropriate fire regimes
19. NE of Arrino	Moora	Private Property	2005 100 2008 4	Healthy	Grazing, vegetation clearing, inappropriate fire regimes
20. N of Arrino	Moora	Private Property	2005 4 2008 4	Moderate	Weeds, edge effect, inappropriate fire regimes
21. E of Arrino	Moora	Gravel Reserve	2006 300+ 2008 300	Healthy	Gravel removal, inappropriate fire regimes
22. Greenough	Geraldton	Water Reserve	2008 1	Moderate	Unknown
23. Greenough	Geraldton	Private Property	2008 2	Moderate	Unknown
24. Allanooka Springs	Geraldton	Private Property	2008 0	Unknown	Unknown
25. SW of Burma Road	Geraldton	Private Property	2008 0	Unknown	Unknown
26. N of Sandsprings Road	Geraldton	Private Property	2008 6	Unknown	Unknown

All Populations are considered important Populations.

Guide for decision-makers

The above table provides details of current and possible future threats. Proposed actions in the immediate vicinity of populations or within the defined habitat critical to the survival of *Leucopogon marginatus* require assessment for the potential for a significant level of impact.

Habitat critical to the survival of *Leucopogon marginatus* and important populations

Given that *Leucopogon marginatus* is ranked as Endangered, it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *L. marginatus* includes the area of occupancy of populations; areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators); additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of habitat of *Leucopogon marginatus* will also protect other Declared Rare Flora (DRF) and Priority Flora. Associated DRF are *Conostylis micrantha* and *Conostylis dielsii* subsp. *teres.* Priority flora include *Grevillea hirtella* (P3), *Grevillea erinacea* (P3), *Baeckea* sp. Walkaway (P3) and *Banksia scabrella* (P4).

Conservation-listed flora species occurring in habitat of *Leucopogon marginatus*

Species name	Conservation Status (Western Australia)	Conservation Status (EPBC Act)
Conostylis micrantha	DRF, Critically Endangered	Endangered
Conostylis dielsii subsp. *teres*	DRF, Critically Endangered	Endangered
Grevillea hirtella	Priority 3	
Grevillea erinacea	Priority 3	
Baeckea sp. Walkaway	Priority 3	
Banksia scabrella	Priority 4	

For a description of the priority categories see Atkins (2006)

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. *Leucopogon marginatus* is not listed under any specific international treaty and this IRP does not affect Australia's obligations under any other international agreements.

Indigenous consultation

The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of known populations of *Leucopogon marginatus*, however, the Yamatji Land and Sea Council, was consulted in order to identify possible indigenous interest in the habitat or recovery of *Leucopogon marginatus* and a representative was invited to become a member of the Geraldton District Threatened Flora Recovery Team. Where no role is identified for the indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.

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

Social and economic impacts

As Populations 14 to 20 occur on private property the protection of the species in these areas has the potential to affect future development. Recovery actions refer to continued liaison between stakeholders.

Affected Interests

Stakeholders potentially affected by the implementation of this plan include owners of private property, Main Roads Western Australia and Shires.

Evaluation of the plan's performance

The Department of Environment and Conservation, in conjunction with the Geraldton and Moora Districts Threatened Flora Recovery Teams, will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this IRP is to abate identified threats and maintain or enhance viable *in situ* populations to ensure the long-term preservation of the species in the wild.

Criteria for success: The number of populations has increased or the number of individuals within populations have increased by ten percent or more over the five year term of the plan.

Criteria for failure: The number of populations has decreased or the number of individuals within populations have decreased by ten percent or more over the five year term of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

The Water Corporation, Shire of Greenough, Western Power and owners of private property where populations of *Leucopogon marginatus* have been found have been notified of the plant's presence. The notification details the Declared Rare status of *L. marginatus* and associated legal obligations. Onsite liaison has also occurred between representatives of DEC and the Water Corporation and an environmental consultant to Western Power regarding appropriate management of the populations in a Water Reserve.

Declared Rare Flora (DRF) markers have been installed at all road verge populations and some populations that occur along firebreaks. These markers alert road and rail maintenance workers to the presence of each population, and enable them to take appropriate care.

Geraldton District staff conducted rabbit baiting within the Nature Reserve, which contains several populations of *Leucopogon marginatus*, in 1999 in an attempt to reduce rabbit numbers and their impact on the habitat at those sites. Further baiting was undertaken in 2000. Between 2000 and 2004 rabbit activity was monitored and recorded at a low level, however during 2005 rabbit numbers were recorded as increasing.

Staff from DEC's Geraldton District have undertaken surveys of suitable habitat and discovered new populations of this species.

Staff from DEC's WA Herbarium have searched for *Leucopogon marginatus* and made collections of the species at three locations in a Nature Reserve.

A botanist contracted to DEC's Moora District undertook surveys for *Leucopogon marginatus* in remnant vegetation on private property during 2005. Six new populations were located and liaison has been occurring with the property owners regarding the management of populations and future plans for vegetation clearing.

Ongoing and future recovery actions

Staff from DEC's Geraldton and Moora Districts regularly monitor all populations of this species and maintain liaison with relevant land managers.

The Geraldton District Threatened Flora Recovery Team (GDTFRT) and Moora District Threatened Flora Recovery Team (MDTFRT) are overseeing the implementation of this IRP and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate owners/land managers prior to recovery actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The GDTFRT and MDTFRT will coordinate recovery actions for *Leucopogon marginatus* and other Declared Rare Flora in their districts and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Geraldton and Moora Districts) through GDTFRT and MDTFRT
Cost: $2,000 per year

2. Map habitat critical to survival of *Leucopogon marginatus*

Although habitat critical to the survival of this species is identified in Section 1, all of the areas described have not yet been accurately mapped and will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to survival of *Leucopogon marginatus*
Responsibility: DEC (Geraldton and Moora Districts) through GDTFRT and MDTFRT
Cost: $1,700 in the second year

3. Liaise with relevant land managers and Indigenous groups

Staff from DEC's Geraldton and Moora Districts will continue to liaise with relevant land managers to ensure that populations are not damaged or destroyed. Input and involvement will also be sought from Indigenous groups that have an active interest in areas that are habitat for the species.

Action: Liaise with relevant land managers and Indigenous groups
Responsibility: DEC (Geraldton and Moora Districts) through GDTFRT and MDTFRT
Cost: $2,000 per year

4. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed invasion and plant disease), population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is essential. The visibility of DRF markers will also be monitored to ensure they remain effective. Burnt plants will be monitored for regeneration, and data recorded to advance knowledge of the biology of this species.

Action: Monitor populations
Responsibility: DEC (Geraldton and Moora Districts) through GDTFRT and MDTFRT
Cost: $1,900 per year

5. Implement rabbit control

The level of threat posed by rabbits varies with conditions and rabbit numbers. When monitoring ascertains the threat is high, baiting using 1080 oats should be undertaken.

Action: Implement rabbit control
Responsibility: DEC (Geraldton District) through the GDTFRT; relevant land managers
Cost: $700 in first, third and fifth years

6. Implement weed control

Some populations are believed to be threatened by weeds. Weeds may impact on *Leucopogon marginatus* by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire. All weed control will include a report on the method, timing and success of the treatment.

Action: Implement weed control
Responsibility: DEC (Geraldton District) through the GDTFRT; relevant land managers
Cost: $2,600 per year

7. Obtain information on post fire regeneration

Populations burnt during a 2004/05 summer wildfire will be monitored to record post fire regeneration. Information will be used in developing future fire management plans and disturbance methods.

Action: Obtain information on post fire regeneration
Responsibility: DEC (Geraldton District) through the GDTFRT
Cost: $1,600 in second and fourth years

8. Develop and implement a fire management strategy

It is thought likely that this species requires occasional summer fire for recruitment. However, frequent fires during the flowering and seeding phase (July-October) are believed to be detrimental. A fire management strategy will be developed in consultation with land managers to determine fire control measures and fire frequency.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Geraldton and Moora Districts) and relevant land managers through the GDTFRT and MDTFRT
Cost: $11,200 in first year and $2,700 in subsequent years

9. Conduct further surveys

Further surveys by DEC staff and, where possible, community volunteers will be conducted during the flowering period of the species (July-August).

Action: Conduct further surveys
Responsibility: DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT
Cost: $2,500 in the first, third and fifth years

10. Collect and store seed

Seed should be stored as a genetic resource for future translocations and to provide an *ex situ* conservation collection for the species. Seed collections should be made from all populations to maintain adequate representation of the genetic diversity of the species. The *Germplasm Conservation Guidelines for Australia* produced by the Australian Network for Plant Conservation (ANPC) should be used to guide this process. (Offord & Meagher 2009)

Action: Collect and store seed
Responsibility: DEC (TFSC, Geraldton and Moora Districts) through the GDTFRT and MDTFRT
Cost: $2,400 in the first, third and fifth years

11. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this species 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 has been produced, and includes a description of the plant, its habitat, threats, recovery actions and photos. This will be distributed to the public through DEC's Geraldton and Moora District offices and at the office and library of the Shires of Greenough, Irwin and Three Springs. Such information distribution may lead to the discovery of new populations.

Action: Promote awareness
Responsibility: DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT
Cost: $2,200 in first year, and $1,100 per year in subsequent years

12. Install markers

Several populations along firebreaks require Rare Flora Markers.

Action: Install markers
Responsibility: DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT
Cost: $500 in first year

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

If *Leucopogon marginatus* is still ranked Endangered at the end of the five-year term of this IRP, the need for further recovery actions will be assessed and a revised plan prepared if necessary.

Action: Review this plan and assess the need for further recovery actions
Responsibility: DEC (SCB, Geraldton and Moora Districts) through the GDTFRT and MDTFRT
Cost: $1,000 in the fifth year

Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	GDTFRT and MDTFRT	Ongoing
Map habitat critical to the survival of *Leucopogon marginatus*	High	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	2009
Liaise with relevant land managers and Indigenous groups	High	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	Ongoing
Monitor populations	High	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	Ongoing
Implement rabbit control when necessary	High	DEC (Geraldton District) through the GDTFRT	Ongoing
Implement weed control when necessary	High	DEC (Geraldton District) through the GDTFRT	Ongoing
Obtain information on post fire regeneration	High	DEC (Geraldton District) through the GDTFRT	2012
Develop and implement a fire management strategy	High	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	Developed by 2009 with implementation ongoing
Conduct further surveys	High	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	Ongoing
Collect seed	Moderate	DEC (TFSC, Geraldton and Moora Districts) through the GDTFRT and MDTFRT	Ongoing
Promote awareness	Moderate	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	Ongoing
Install markers	Moderate	DEC (Geraldton and Moora Districts) through the GDTFRT and MDTFRT	2009
Review this plan and assess the need for further recovery actions	Moderate	DEC (SCB, Geraldton and Moora Districts) through the GDTFRT and MDTFRT	2013

4. TERM OF PLAN

Western Australia

This IRP will operate from May 2008 to April 2013 but will remain in force until withdrawn or replaced. If *Leucopogon marginatus* is still ranked EN after five years, this IRP will be reviewed and, if necessary, further recovery actions put in place.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* 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

Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia.* Department of Environment and Conservation, Western Australia.

Blackall, W. E. and Grieve, B. J. (1981) *How to Know Western Australian Wildflowers* IIIB, 2nd Ed: pp 345. University of Western Australia Press, Perth.

Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.

Brown, E. (1998) Unpublished illustration and description.

Department of Conservation and Land Management (1994) Policy Statement No. 50 *Setting Priorities for the Conservation of Western Australia's Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1992) Policy Statement No. 44 *Wildlife Management Programs*. Department of Conservation and Land Management, Western Australia.

Department of Environment and Conservation (2008) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora*. Department of Environment and Conservation, Western Australia. http://www.dec.wa.gov.au/science/.

Elliot, W. R. and Jones, D. L. (1993) *Encyclopaedia of Australia Plants Suitable for Cultivation.* pp 147 – 8 Lothian Publishing Company, Melbourne.

Fitzgerald, W.V. (1904) Additions to the West Australian flora by W.V. Fitzgerald, *Journal of the West Australian Natural History Society* 2 (1): 27

Keighery, G. J. (1988) *Dieback Briefing Paper*. 1 Epacridaceae. Department of Conservation and Land Management, Western Australia.

Keighery, G. J. (1995) Phytogeography, Biology & Conservation of Western Australian Epacridaceae. *Annals of Botany* 77: 347 – 355, 1996

Offord, C.A. and Meagher, P.F. 2009. *Plant germplasm conservation in Australia: strategies and guidelines for developing, managing an utilizing ex situ collections.* Australian Network for Plant Conservation Inc., Canberra.

Ooi, M. K. J., Auld, T. D. and Whelan, R. J. (unpublished) Dormancy classification and the fire-centric focus: an example of morphophysiological dormancy and the importance of seasonal temperature cues in a fire-prone region.

Panetta, F.D. and Hopkins, A.J.M. (1991) Weeds in Corridors: Invasion and Management. Pp 341 – 351 in *Nature Conservation 2 The Role of Corridors* ed by D.A. Saunders and R.J. Hobbs. Surrey Beatty and Sons Pty Limited, Chipping Norton, NSW.

World Conservation Union (1994) *IUCN Red List Categories: Version 2.3.* Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

7. TAXONOMIC DESCRIPTION

Appendix One: Taxonomic Description

Brown, E. (1998) Unpublished

Axonanthus marginatus (W.V. Fitzgerald)
BASIONYM: *Leucopogon marginatus* W.V. Fitzgerald, Journal of the West Australian Natural History Society 2 (1): 27 (1904)

TYPE: WESTERN AUSTRALIA: Arrino sandplains. *W.V. Fitzgerald*, Sep 1903: lecto (here chosen): PERTH; isolecto: NSW, PERTH. The PERTH sheet has been chosen as the lectotype because it bears an Herb. W.V. Fitzgerald label in his handwriting. The NSW specimen is marginally better in that it bears an attached flower but the PERTH label more closely matches the protologue.

An erect, (probably spreading and aparsely branched) shrub; 40 – 60 cm high. Stems thin, erect to spreading; grey brown with an underlying tint of red; rounded; glabrous and with smooth to very slightly striate bark. Branchlets rounded, minutely hispid (hairs less than 0.025 mm long), initially red-brown but outer layers soon dying and becoming grey and peeling off (seems to be retained longer than in sp. aff. Marginatus). Leaves evenly spaced but only present on top 10cm of stems; erect and appressed to stem (in type) to almost horizontal, imbricate, spirally arranged; petiole not particularly well-defined but present. 0.3 – 0.6 mm long, minutely pubescent on adaxial surface and sometimes with a few scattered hairs on the abaxial surface also; lamina ovate with base obtuse to almost truncate, 4.8 – 7.8 mm long, 2.2 – 4.1 mm wide, l:w ratio 1.2 – 2.5, not twisted but often quite concave (when dried), upper leaf surface shiny and glabrous, lower leaf surface dull and with hairs/papillae over the surface and in the deep grooves between the veins, midrib equal to the other veins, 3 main veins with many branches to the margins; leaf margin straight, often hyaline and slightly sinuate (especially on the young seasonal growth and/or basally), minutely ciliate-denticulate (so minute that it is more like a serration); apex acuminate to acute, flat or slightly concave when immature; tip aristate, 0.4 – 0.9 mm long, straight.

Auxiliary inflorescence with erect spike more or less evenly spaced; spikes much shorter than the leaves, virtually sessile with peduncle <1.5mm long, flowers 2 or sometimes 3; rudiment bud-like; usually with sterile bracts at the base of the inflorescence-sterile bracts present; peduncle beneath bracts with a few hairs to 0.3 mm long; flowers sessile, inconspicuous, erect or with one at an angle, white. Bracts very broadly ovate to sub-orbicular, c. 0.7 mm long, c. 1.5 mm wide, apex obtuse, lacking a tip; midrib inconspicuous, thickened throughout length; outer surface minutely hairy especially basally and margins minutely fringed/ciliolate. Bracteoles sub-orbicular, c. 1.1 – 1.2 mm long, c. 1.5 – 1.7 mm wide; apices obtuse, with a minute mucro; midrib slightly keeled (expecially near the apex) to conspicuously keeled, thickened only at the base or somewhat throughout; outer surface glabrous, margins minutely fringed to ciliolate, especially at the apex. Corolla tube cylindrical, slightly longer than the sepals (Fitzgerald 1904) to ± equal, 1.7 – 2.2 mm long, outer and inner surfaces glabrous. Corolla lobes spreading and somewhat recurved at tips, 1.6 – 2.0 mm long, 0.6 – 0.9 mm wide, l:w ratio 2.2 – 3.0, apices acute; outer surface glabrous, inner surface villous throughout apart from a minute tip c. 0.1 mm long where the lobes are joined in bud; hairs c. 0.4 mm long near apex, appearing shorter towards the base of the lobes but this is probably because the hairs are more crisped; lobes varying from slightly longer than the tube to slightly shorter than it, l:w ratio c. 0.9 – 1.1. Stamens half exserted; filaments inserted at base of lobes, length 0.8 – 1.0 mm; anthers attached near apex, 0.8 – 1.0 mm long. Ovary lightly ridged, glabrous, 5 celled; style filiform, 2.2 – 2.5 mm long, glabrous, longer than the tube but obscured by erect portion of corolla lobes; stigma appearing capitate but probably lobed (see Crwden 8507 – 155), 0.2 – 0.5 mm high; nectary composed of distinct scales, c. 0.5 mm high, usually emarginated or bidentate (Fitzgerald 1904) or with upper margin rounded. Immature fruit slightly shorter than the sepals to just exceeding them, ellipsoid, straight, c. 2.0 x 1.5 mm, apex flat, lightly ridged, glabrous.

SUMMARY OF RECOVERY ACTIONS AND COSTS

	Year 1			Year 2			Year 3			Year 4			Year 5		
Recovery Action	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**
Coordinate recovery actions	1500	500		1500	500		1500	500		1500	500		1500	500	
Map habitat critical to survival of *Leucopogon marginatus*				200		1500									
Liaise with relevant land managers and Indigenous groups	1300		700	1300		700	1300		700	1300		700	1300		700
Monitor populations	1300		600	1300		600	1300		600	1300		600	1300		600
Implement rabbit control	400		300				400		300				400		300
Implement weed control	600		2000	600		2000	600		2000	600		2000	600		2000
Obtain information on post fire regeneration				1000		600				1000		600			
Develop and implement a fire management strategy	2200	300	8700	800	300	1600	800	300	1600	800	300	1600	800	300	1600
Conduct further surveys	500	400	1600				500	400	1600				500	400	1600
Collect seed	1000		1400				1000		1400				1000		1400
Promote awareness	1100		1100	1100			1100			1100			1100		
Install markers	500														
Review this plan and assess the need for further recovery actions													400	600	
Total	10400	1200	16400	7800	800	7000	8500	1200	8200	7600	800	5500	8900	1800	8200
Yearly Total	**28,000**			**15,600**			**17,900**			**13,900**			**18,900**		

Ext. = External funds (funding to be sought), Other = funds contributed by volunteer input and BGPA in-kind contribution.

Total DEC: $43,200
Total Other: $5,800
Total External Funding: $45,300
Total Costs: $94,300