



Government of **Western Australia**
Department of **Environment and Conservation**

INTERIM RECOVERY PLAN NO. 335

Grevillea bracteosa subsp. *howatharra*

INTERIM RECOVERY PLAN

2013–2018



February 2013
Department of Environment and Conservation
Kensington

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: 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 Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered taxa, always within one year of endorsement of that rank by the Minister.

This plan, which was prepared using Specific Nature Conservation Project funding, will operate from February 2013 to January 2018 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Critically Endangered, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 18 January 2013 and was approved by the Director of Nature Conservation on 7th February 2013. The 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.

Information in this plan was accurate at February 2013.

PLAN PREPARATION

This plan was prepared by Robyn Luu¹ and Andrew Brown².

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ACKNOWLEDGMENTS

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

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Alanna Chant	Flora Conservation Officer, DEC Geraldton District
Anne Cochrane	Senior Research Scientist, Threatened Flora Seed Centre, DEC Science Division
Monica Hunter	Ecologist, DEC Species and Communities Branch
Catherine Page	Acting District Manager, DEC Geraldton District
Amanda Shade	Assistant Curator (Nursery) Botanic Gardens and Parks Authority

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and DEC Species and Communities Branch for assistance.

Cover photograph by Gemma Phelan.

CITATION

This plan should be cited as:

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SUMMARY

Scientific name: *Grevillea bracteosa* subsp. *howatharra*
Family: Proteaceae
DEC region: Midwest
Shires: Chapman Valley, Greenough
Recovery team: Geraldton District Threatened Flora Recovery Team (GDTFRT)

Common name: NA
Flowering period: Spring
DEC district: Geraldton
NRM region: Northern Agricultural
IBRA regions: Avon Wheatbelt, Geraldton Sandplains.
IBRA subregions: Avon Wheatbelt P1, Geraldton Hills

Distribution and habitat: *Grevillea bracteosa* subsp. *howatharra* is known from north and east of Geraldton. The subspecies grows in heavy soils, consisting of clay loam with laterite, in open sunny positions (Olde and Marriot 2008).

Habitat critical to the survival of the species, and important populations: Given that *Grevillea bracteosa* subsp. *howatharra* is ranked as Critically Endangered, it is considered that all known habitat for wild populations is critical to the survival of the subspecies, and that all wild populations are important populations. Habitat critical to the survival of *G. bracteosa* subsp. *howatharra* 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 subspecies or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Conservation status: *Grevillea bracteosa* subsp. *howatharra* is declared as Rare Flora (DRF) under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered in WA under World Conservation Union (IUCN 2001) criteria B1ab(iii,v)+2ab(iii,v) due to its extent of occurrence being less than 100km²; area of occupancy being less than 10km²; and there being five fragmented populations with a projected continuing decline in the quality of habitat and number of mature individuals. The subspecies is not currently listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the subspecies are road, rail, track and firebreak maintenance, grazing, trampling, rabbits, insecure land tenure, gravel extraction, inappropriate fire regimes, poor recruitment and weeds.

Existing recovery actions: The following recovery actions have been or are currently being implemented:

1. Relevant stakeholders have been made aware of the existence of this subspecies and its locations.
2. DRF markers have been installed at Populations 1 and 2.
3. Surveys for *Grevillea bracteosa* subsp. *howatharra* have been undertaken.
4. In January 2010, the status and aspects of the ecology of the subspecies were assessed by Nick Casson (Casson 2010).
5. Seed from *Grevillea bracteosa* subsp. *howatharra* collected from Population 1 in February 2000, November 2001 and November 2007 is stored in DEC Threatened Flora Seed Centre (TFSC) at -18°C.
6. In 2005, disturbance plots were installed at Subpopulations 1b, 2a and 2b by DEC staff.
7. Staff from DEC Geraldton District regularly monitor populations.
8. DEC, with assistance from the GDTFRT, is overseeing the implementation of threatened flora recovery/management in the Geraldton District, which also incorporates implementation of this plan.

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

Recovery criteria

Criteria for success: At least one additional population is discovered or established and/or the number of mature individuals have increased by 20 per cent or more over the term of the plan.

Criteria for failure: The number of mature individuals has decreased by 20 per cent or more over the term of the plan.

Recovery actions

- | | |
|--------------------------------|---|
| 1. Coordinate recovery actions | 10. Long term protection of habitat |
| 2. Monitor populations | 11. Fire management strategy |
| 3. Fencing | 12. Liaise with land managers and Indigenous groups |
| 4. Disturbance monitoring | 13. Promote awareness |
| 5. Disturbance trials | 14. Obtain biological and ecological information |
| 6. Weed control | 15. Map habitat critical to the survival of <i>Grevillea bracteosa</i> subsp. <i>Howatharra</i> |
| 7. Rabbit control | 16. Review this plan and assess the need for further recovery actions |
| 8. Further surveys | |
| 9. Collect seed and cuttings | |

1. BACKGROUND

History

Grevillea bracteosa was first collected by James Drummond in 1884-85 with subsequent collections made from two disjunct areas - near Miling and near Geraldton. Distinct forms of the species were found in each area and Olde and Marriott recognised these by naming them subsp. *bracteosa* and subsp. *howatharra* in 2008.

Until rediscovered in Howatharra Reserve by Nick Casson in 2010 (Casson 2010), *Grevillea bracteosa* subsp. *howatharra* had not been seen in the area since it was originally collected in 1977. It is thought that a combination of grazing and fire may have caused the subspecies to decline.

A number of the *Grevillea bracteosa* subsp. *howatharra* populations occur in habitat that is threatened by maintenance activities. The southern side of the railway service track at Population 1 had been widened in 1992 destroying some plants, and nearly half the plants at Population 2 were destroyed in 2002 when the road was widened and a dam constructed on private property. The subspecies is currently known from five populations comprising approximately 390 mature individuals.

Description

Grevillea bracteosa is an open, non-lignotuberous shrub, up to 2m high, with pink, purple and white flowers (Western Australian Herbarium (1998–)). The inflorescence of subspecies *howatharra* is 2cm wide and moderately dense. The leaves are 8.5 to 10mm long and 4.5 to 5mm wide. The main floral axis is 8 to 12mm long. The flower stalks are 3 to 5.75mm long and pistil 16 to 21mm long (Olde and Marriott 2008).

Grevillea bracteosa subsp. *howatharra* is distinguished from *G. bracteosa* subsp. *bracteosa* by its wider inflorescences, floral bracts and pedicels, and its thicker style end (Olde and Marriott 2008).

Illustrations and/or further information

Olde, P.M. and Marriott, N.R. (2008) Recognition of new taxa in *Grevillea* (Proteaceae: Grevilleoideae) from south-west Western Australia. *Nuytsia* 18: 223-234; Western Australian Herbarium (1998–) *FloraBase* – *The Western Australian Flora*. Department of Environment and Conservation. <http://florabase.dec.wa.gov.au/>.

Distribution and habitat

Grevillea bracteosa subsp. *howatharra* is known from north and east of Geraldton. The species grows in heavy soils, consisting of clay loam with laterite, in open sunny positions (Olde and Marriot 2008). Associated species include *Grevillea pinaster*, *G. petrophiloides*, *Gastrolobium spinosum*, *Banksia fraseri*, *B. sessilis*, *Ecdeiocolea monostachya*, *Allocasuarina humilis*, *Pityrodia terminalis*, *Acacia congesta* and *Stenanthemum pomaderroides*.

Table 1. Summary of population land vesting, purpose and manager

Pop. no. & location	DEC district	Shire	Vesting	Purpose	Manager
1a. East of Geraldton	Geraldton	Geraldton - Greenough	MRWA	Road reserve	MRWA
1b. East of Geraldton	Geraldton	Geraldton-Greenough	Public Transport Authority	Rail reserve	Brookfield Rail
1c. East of Geraldton	Geraldton	Geraldton - Greenough	Shire of Geraldton-Greenough	Gravel reserve	Shire of Geraldton-Greenough
2a. North of Geraldton	Geraldton	Chapman Valley	Unvested	Road reserve	Shire of Chapman Valley
2b. North of Geraldton	Geraldton	Chapman Valley	Freehold	Private property	Landowners
3a. North of Geraldton	Geraldton	Geraldton –	Conservation	Nature reserve	DEC

		Greenough	Commission of WA		
3b. North of Geraldton	Geraldton	Geraldton-Greenough	Freehold	Private property	Landowners
4. North of Geraldton	Geraldton	Chapman Valley	Freehold	Private property	Landowners
5a. North of Geraldton	Geraldton	Chapman Valley	Freehold	Private property	Landowners
5b. North of Geraldton	Geraldton	Chapman Valley	Freehold	Private property	Landowners

Populations in **bold text** are considered to be important populations. MRWA = Main Roads Western Australia

Biology and ecology

There is little known about the biology and ecology of *Grevillea bracteosa* subsp. *howatharra*, and recovery actions refer to a need for research.

The appearance of young, healthy plants at Subpopulation 2a following grading and Subpopulation 2b following a wildfire event, suggests that *Grevillea bracteosa* subsp. *howatharra* may regenerate following disturbance.

Conservation status

Grevillea bracteosa subsp. *howatharra* is declared as Rare Flora (DRF) under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered in WA under World Conservation Union (IUCN 2001) criteria B1ab(iii,v)+2ab(iii,v) due to its extent of occurrence being less than 100km²; area of occupancy being less than 10km²; and there being five fragmented populations with a projected continuing decline in the quality of habitat and number of mature individuals. The subspecies is not currently listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

Threats

The main threats to the subspecies are:

- **Road, rail, track and firebreak maintenance.** Threats include grading road reserves, spraying of chemicals, construction and maintenance of drainage channels and mowing the roadside vegetation to improve visibility.
- **Grazing and trampling.** Stock may graze *Grevillea bracteosa* subsp. *howatharra* and impact on the habitat through trampling. An increased nutrient level from droppings is also likely and may encourage weed invasion.
- **Rabbits (*Oryctolagus cuniculus*).** Rabbits may directly graze plants and also damage plants and habitat through digging, erosion, the addition of nutrients and introduction of weed seeds.
- **Insecure land tenure.** With the exception of Populations 3 and 4, and Subpopulation 5b which occur on conservation reserves, populations of *Grevillea bracteosa* subsp. *howatharra* are found on land that is not reserved for the purpose of conservation and is of poor and deteriorating quality.
- **Gravel extraction.** This is a possible future threat to Subpopulation 1c of *Grevillea bracteosa* subsp. *howatharra* as the taxon may be damaged or removed during this process.
- **Inappropriate fire regimes.** Although it is thought that plants germinate from soil-stored seed following fire, fire should where possible be prevented from occurring in the area of populations, except where it is being used as a recovery action. Fire may also facilitate weed invasion and when it occurs should be followed up with appropriate weed control.
- **Poor recruitment.** This is observable in all populations of the subspecies.
- **Weeds.** Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also increase the fire hazard due to high fuel loads.

The intent of this plan is to provide actions that will deal with immediate threats to *Grevillea bracteosa* subsp. *howatharra*. Although climate change may have a long-term effect on the subspecies, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. no. & location	Land status	Year / no. of plants	Current condition	Threats
1a. East of Geraldton	MRWA road reserve	2006 34 [6 dead] 2010 29 [5 dead]	Moderate/ disturbed	Road maintenance, rabbits, weeds, poor recruitment
1b. East of Geraldton	Rail reserve	2004 77 2006 28 2010 31 [5 dead]	Moderate/ disturbed	Rail maintenance, rabbits, weeds, poor recruitment
1c. East of Geraldton	Shire reserve	2002 30 2010 75 (2)	Healthy	Gravel extraction, poor recruitment, grazing and trampling, rabbits
2a. North of Geraldton	Shire road reserve	2004 30 2006 76 (20) [10 dead] 2009 62	Healthy/ disturbed	Road maintenance, weeds, poor recruitment
2b. North of Geraldton	Private property	2004 12 2010 12	Burnt	Inappropriate fire regimes, poor recruitment
3a. North of Geraldton	Nature reserve	2002 ? 2010 *11	Healthy	Rabbits, poor recruitment, inappropriate fire regimes
3b. North of Geraldton	Private property	2010 *11	Healthy	Grazing and trampling, rabbits, poor recruitment, inappropriate fire regimes
4. North of Geraldton	Private property	2004 90 2010 52	Healthy	Inappropriate fire regimes, weeds, poor recruitment, rabbits
5a. North of Geraldton	Private property	2007 9 2010 42	Moderate	Firebreak maintenance, grazing and trampling, poor recruitment, weeds
5b. North of Geraldton	Private property	2010 76 [5 dead]	Moderate	Firebreak maintenance, poor recruitment, rabbits

Note: * = total for subpopulations 2a and 3b combined; () = number of seedlings. MRWA = Main Roads Western Australia

Guide for decision-makers

Section 1 provides details of current and possible future threats. Development and/or land clearing in the immediate vicinity of *Grevillea bracteosa* subsp. *howatharra* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that their actions will not have a significant negative impact on the subspecies, its habitat or potential habitat or on the local surface hydrology, such that drainage in the habitat of the subspecies would be altered.

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

Given that *Grevillea bracteosa* subsp. *howatharra* is ranked as Critically Endangered, it is considered that all known habitat for wild populations is critical to the survival of the subspecies, and that all wild populations are important populations. Habitat critical to the survival of *G. bracteosa* subsp. *howatharra* 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 subspecies or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Grevillea bracteosa* subsp. *howatharra* will also improve the status of associated native plant species and ecological communities. Three DRF species and 14 Priority flora taxa which occur in association with *G. bracteosa* subsp. *howatharra* are listed in the table below:

Table 3. Conservation-listed flora species occurring in habitat of *Grevillea bracteosa* subsp. *howatharra*

Species name	Conservation status (WA)	Conservation status (EPBC Act 1999)
<i>Caladenia hoffmanii</i>	Endangered	Endangered

<i>Drummondita ericoides</i>	Vulnerable	Endangered
<i>Eucalyptus blaxellii</i>	Vulnerable	Vulnerable
<i>Lepidosperma</i> sp. Moresby Range	Priority 1	
<i>Leucopogon psammophilus</i>	Priority 1	
<i>Acacia megacephala</i>	Priority 2	
<i>Leucopogon borealis</i>	Priority 2	
<i>Leucopogon</i> sp. Howatharra	Priority 2	
<i>Acanthocarpus parviflorus</i>	Priority 3	
<i>Gastrolobium propinquum</i>	Priority 3	
<i>Geleznowia verrucosa</i> subsp. Kalbarri	Priority 3	
<i>Grevillea triloba</i>	Priority 3	
<i>Leucopogon</i> sp. Moresby Range	Priority 3	
<i>Thryptomene</i> sp. Moresby Range	Priority 3	
<i>Verticordia densiflora</i> var. <i>roseostella</i>	Priority 3	
<i>Acacia guinetii</i>	Priority 4	
<i>Verticordia penicillaris</i>	Priority 4	

For a description of the Priority categories see Smith (2012).

The species occurs within the ‘Plant assemblages of the Moresby Range system’ Priority Ecological Community (PEC).

Table 4: Priority Ecological Community (PEC) in which *Grevillea bracteosa* subsp. *howatharra* occurs or is adjacent

Community name	Conservation status (WA)	Conservation status (EPBC Act 1999)
Plant assemblages of the Moresby Range system	Priority 1	

For a description of the PEC categories see DEC (2012)

International obligations

Although 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, *Grevillea bracteosa* subsp. *howatharra* is not listed under any specific international treaty and this plan does not affect Australia’s obligations under any other international agreements.

Indigenous consultation

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified one site of Aboriginal significance within the vicinity of Population 1 of *Grevillea bracteosa* subsp. *howatharra*. This site is listed as Northern Gully (site #5566), a water source. There are no restrictions of the site and access to the area is open. However, input and involvement is being sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests. Indigenous opportunity for future involvement in the implementation of the recovery plan is included as an action in the plan. Indigenous involvement in management of the land is also provided for under the joint management arrangements in the *Conservation and Land Management Act 1984*.

Social and economic impacts

The implementation of this recovery plan has the potential to cause some social and economic impact. Several *Grevillea bracteosa* subsp. *howatharra* populations occur on private property, Shire, MainRoads WA (MRWA) and Brookfield Rail reserves and the protection of the subspecies at these sites may potentially affect development and asset protection measures. Recovery actions refer to continued liaison between relevant stakeholders.

Affected interests

The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation.

Evaluation of the plans performance

DEC, with assistance from the Geraldton District Threatened Flora Recovery Team (GDTFRT), will evaluate the performance of this plan. 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

Objective

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

Criteria for success: At least one additional population is discovered or established and/or the number of mature individuals have increased by 20 per cent or more over the term of the plan.

Criteria for failure: The number of mature individuals has decreased by 20 per cent or more over the term of the plan.

3. RECOVERY ACTIONS

Existing recovery actions

The Shire of Chapman Valley, Main Roads Western Australia, Brookfield Rail, the Shire of Geraldton-Greenough and private property owners have been officially notified about populations of *Grevillea bracteosa* subsp. *howatharra* that occur on lands that they manage or own. These notifications detail the current status of the subspecies as threatened and the associated legal obligations in regards to their protection.

Rare flora markers have been installed at Populations 1 and 2. These serve to alert people to the presence of threatened flora, and the need to avoid work that may damage plants in that area. The significance of these markers is being promoted to Shires and MainRoads WA through posters, dashboard stickers and stubby holders that illustrate DRF markers and explain their purpose.

In 2001, DEC Science Division staff conducted Priority Flora surveys along roads and in a Nature Reserve near Populations 1 and 2 with no new populations located. A new subpopulation (1c) was located in 2002 by Peter Olde (Grevillea Study Group). DEC Geraldton District staff undertook surveys in the Moresby Ranges which resulted in the discovery of Populations 4 and 5. Survey by Nick Casson in 2010 resulted in more plants being located in the vicinity of Population 3.

In 2005, disturbance plots were installed by DEC staff following Subpopulation 1b being driven over by a heavy machine, Subpopulation 2a partly cleared by a grader and Subpopulation 2b burnt in a wildfire. The plots included both disturbed and control areas, and monitoring has occurred periodically since 2006. New recruits have been recorded in the disturbed plots (both burnt and graded areas) as well as one control plot.

Seed from *Grevillea bracteosa* subsp. *howatharra* collected from Population 1 in February 2000 and November 2001 and 2007 is stored in DEC Threatened Flora Seed Centre (TFSC) at -18°C . The seed has yet to be processed and germination tested.

In January 2010, the status and aspects of the ecology of the subspecies were undertaken by Nick Casson (Casson 2010).

Staff from DEC Geraldton District regularly monitor populations.

DEC, with assistance from the GDTFRT is overseeing the implementation of threatened flora recovery/management in the Geraldton District, which also incorporates implementation of this plan.

Future recovery actions

Where recovery actions are to 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

DEC with assistance from the GDTFRT will coordinate recovery actions for *Grevillea bracteosa* subsp. *howatharra* and will include information on progress in its annual report to DEC's Species and Communities Branch and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Geraldton District) with assistance from the GDTFRT
Cost: \$6,000 per year

2. Monitor populations

Monitoring of weed invasion, habitat degradation, hydrology, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential.

Action: Monitor populations
Responsibility: DEC (Geraldton District)
Cost: \$10,000 per year

3. Fencing

Subpopulations 3b and 5a are on private property and may require fencing to protect them from grazing. Subpopulation 1c occurs on a reserve used for gravel extraction and the requirement for fencing needs to be assessed.

Action: Assess the need for fencing and if necessary erect fences in Subpopulations 1c, 3b and 5a
Responsibility: DEC (Geraldton District)
Cost: \$30,000 in year 1 for fencing, \$3,000 per year thereafter for maintenance

4. Disturbance monitoring

Disturbance monitoring at Subpopulations 1b, 2a and 2b will continue. The implementation of recovery disturbance trials is dependent on information gained from monitoring.

Action: Monitor disturbance
Responsibility: DEC (Geraldton District)
Cost: \$4,000 in years 1, 2 and 3

5. Disturbance trials

Disturbance to stimulate germination of *Grevillea bracteosa* subsp. *howatharra* seed in the wild may be required. Records will be maintained for future research. Any disturbance trials will need to be undertaken in conjunction with weed control.

Action: Implement disturbance trials if necessary
Responsibility: DEC (Science Division, Geraldton District)
Cost: \$7,000 in years 3, 4 and 5

6. Weed control

Weeds are a minor threat to Population 2 and control may be required. The following actions will be implemented:

1. Determine which weeds are present and map them.
2. Control invasive weeds by hand removal and/or spot spraying around the *Grevillea bracteosa* subsp. *howatharra* plants when weeds first emerge.
3. Monitor the success of the treatment on weed death, and the tolerance of *Grevillea bracteosa* subsp. *howatharra* and associated native plant species to the treatment.
4. Report on the method and success of the treatment, and its effect on *Grevillea bracteosa* subsp. *howatharra* and associated species.

Action: Undertake weed control
Responsibility: DEC (Geraldton District, Science Division)
Cost: \$6,000 per year, as required

7. Rabbit control

If monitoring ascertains the threat posed by rabbits at Populations 1 and 4 and Subpopulation 5b is high, control measures may be required. Control should be undertaken in summer months when less green feed is available as an alternative food source.

Action: Implement rabbit control if necessary
Responsibility: DEC (Geraldton District) in consultation with relevant land managers
Cost: \$7,000 in years 1, 3 and 5

8. Further surveys

Areas of potential habitat will be surveyed for the presence of *Grevillea bracteosa* subsp. *howatharra* during its flowering period. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, and technically feasible, volunteers from the native orchid society, local community, landcare groups, wildflower societies and naturalists clubs will be encouraged to be involved.

Action: Conduct further surveys
Responsibility: DEC (Geraldton District)
Cost: \$5,000 in years 1, 3 and 5

9. Collect seed and cuttings

Seed has been collected from Population 1, however additional collections are required to ensure the genetic diversity of the species is captured. Cuttings will also be collected to establish a living collection.

Action: Collect seed and cuttings
Responsibility: DEC (Geraldton District, TFSC), Botanic Gardens and Parks Authority (BGPA)
Cost: \$5,000 per year

10. Long term protection of habitat

The conservation status of land that supports populations will be reviewed and the possibility of purchase and/or a change of land tenure investigated. This action will secure habitat on which *Grevillea bracteosa* subsp. *howatharra* can be managed and promote conditions that will result in an increase in the size and health of populations.

Action: Achieve long term protection of habitat
Responsibility: DEC (Geraldton District, Land Acquisition Branch)
Cost: \$3,000 per year

11. Fire management strategy

Fire will if possible be prevented from occurring in the habitat of populations, except where it is being used as a recovery tool. A fire management strategy will be developed that recommends fire frequency, intensity, season, and control measures.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Geraldton District)
Cost: \$10,000 in first year and \$2,000 in subsequent years

12. Liaise with land managers and Indigenous groups

Staff from DEC Geraldton District will liaise with land managers to ensure that populations of *Grevillea bracteosa* subsp. *howatharra* are not accidentally damaged or destroyed. Indigenous consultation will take place to determine if there are any issues or interests in areas that are habitat for the subspecies.

Action: Liaise with relevant land managers and Indigenous groups
Responsibility: DEC (Geraldton District)
Cost: \$2,000 per year

13. Promote awareness

The importance of biodiversity conservation and the protection of *Grevillea bracteosa* subsp. *howatharra* will be promoted to the public. This will be achieved as a consequence of an information campaign using local print and electronic media and by setting up poster displays. An information sheet, which includes a description of the plant, its habitat type, threats, management actions and photos will be produced to support this campaign. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness
Responsibility: DEC (Geraldton District, SCB, Strategic Development and Corporate Affairs Division) with assistance from the GDTFRT
Cost: \$4,000 in year 1 and \$2,000 in years 2-5

14. Obtain biological and ecological information

Improved knowledge of the biology and ecology of the subspecies will provide a scientific basis for management of *Grevillea bracteosa* subsp. *howatharra* in the wild. An understanding of the following is necessary for effective management:

1. The study of the soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival.
2. Determination of reproductive strategies, phenology and seasonal growth.
3. Investigation of the mating system and pollination biology.
4. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
5. The impact of changes in hydrology in the habitat.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Geraldton District)
Cost: \$10,000 per year

15. Map habitat critical to the survival of *Grevillea bracteosa* subsp. *howatharra*

Although habitat critical to the survival of the subspecies is alluded to in Section 1, it has not yet been mapped and will be addressed under this action. If additional populations are located, then habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to the survival of *Grevillea bracteosa* subsp. *howatharra*
Responsibility: DEC (SCB, Geraldton District)
Cost: \$6,000 in year 2

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

If *Grevillea bracteosa* subsp. *howatharra* is ranked as Critically Endangered at the end of the five-year term of this plan, the need for further recovery actions, or a review of this plan 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 District) with assistance from the GDTFRT
Cost: \$3,000 in year 5

Table 5. Summary of Recovery Actions

Recovery Action	Priority	Responsibility	Completion Date
Coordinate recovery actions	High	DEC (Geraldton District) with assistance from the GDTFRT	Ongoing
Monitor populations	High	DEC (Geraldton District)	Ongoing
Fencing	High	DEC (Geraldton District)	Fencing installed by 2013; maintenance ongoing
Disturbance monitoring	High	DEC (Geraldton District)	2017
Disturbance trials	High	DEC (Science Division, Geraldton District)	2017
Weed control	High	DEC (Geraldton District)	Ongoing
Rabbit control	High	DEC (Geraldton District) in consultation with relevant land managers	Ongoing
Further surveys	High	DEC (Geraldton District)	Ongoing
Collect seed and cuttings	High	DEC (Geraldton District, TFSC), BGPA	2017
Long-term protection of habitat	High	DEC (Geraldton District, Land Acquisition Branch)	Ongoing
Fire management strategy	High	DEC (Geraldton District)	Developed by 2013 with implementation ongoing
Liaise with relevant land managers and Indigenous groups	Medium	DEC (Geraldton District)	Ongoing
Promote awareness	Medium	DEC (Geraldton District, SCB, and Strategic Development and Corporate Affairs Division) with assistance from the GDTFRT	Ongoing
Obtain biological and ecological information	Medium	DEC (Science Division, Geraldton District)	2017
Map habitat critical to the survival of <i>Grevillea bracteosa</i> subsp. <i>howatharra</i>	High	DEC (SCB, Geraldton District)	2014
Review this plan and assess the need for further recovery actions	Medium	DEC (SCB, Geraldton District) with assistance from the GDTFRT	2017

4. TERM OF PLAN

This plan will operate from February 2013 to January 2018 but will remain in force until withdrawn or replaced. If the species is still ranked Critically Endangered after five years, the need for further recovery actions will be determined.

5. REFERENCES

- Casson, N. (2010) Observations on the status, and aspects of the ecology, of *Grevillea bracteosa* ssp. *howatharra* (5-7/1/2010). Unpublished Report for Department of Environment and Conservation, Western Australia.
- Conservation and Land Management (1992) Policy Statement No. 44 *Wildlife Management Programs*. Department of Conservation and Land Management, Western Australia.
- 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 Environment and Conservation (2007) *Definitions, categories and criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Western Australia. <http://www.dec.wa.gov.au/management-and-protection/threatened-species/wa-s-threatened-ecological-communities.html>.
- Government of Australia (1999) Endangered Species Protection Act 1999. Government Printer, Canberra.
- International Union for Conservation of Nature (2001) *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- Olde, P.M. and Marriott, N.R. (2008) Recognition of new taxa in *Grevillea* (Proteaceae: Grevilleoideae) from south-west Western Australia. *Nuytsia* 18: 223-234.
- Smith, M. (2012) *Declared Rare and Priority Flora List for Western Australia*. Department of Environment and Conservation, Perth, Western Australia.
- Western Australian Herbarium (1998-) *FloraBase – The Western Australian Flora*. Department of Environment and Conservation. <http://florabase.dec.wa.gov.au/>.

6. TAXONOMIC DESCRIPTION

Grevillea bracteosa subsp. *howatharra*

Olde, P.M. and Marriott, N.R. (2008) Recognition of new taxa in *Grevillea* (Proteaceae: Grevilleoideae) from south-west Western Australia. *Nuytsia* 18: 223-234.

Unit confluence 2cm wide, moderately dense to open; floral bracts 8.5–10mm long, 4.5–5mm wide; floral rachis 8–12mm long; pedicels (3.25–)4–5.75mm long; pistil 16.2–21mm long; ovarian stipe 5–6.5mm long; swollen portion of style-end 2.5–3.25mm long, 1–1.75mm thick.

Key to subspecies:

- Floral rachis 3–5 mm long; pedicels 0.18–2.5 mm long; swollen portion of style-end 0.75 mm thick
 subsp. *bracteosa*
- Floral rachis 8–12 mm long; pedicels (3.25–)4–5.75 long; swollen portion of style-end 1–1.75 thick
 subsp. *howatharra*