



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

INTERIM RECOVERY PLAN NO. 308

*Grevillea althoferorum* subsp. *fragilis*

**INTERIM RECOVERY PLAN**

**2011-2016**



February 2011  
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.

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 IRPs 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 IRP, which was prepared using Specific Nature Conservation Project funding, will operate from February 2011 to January 2016 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Critically Endangered (CR), this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was given regional approval on 24 January 2011 and was approved by the Director of Nature Conservation on 2 February 2011. The 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 at February 2011.

## IRP PREPARATION

This IRP was prepared by Robyn Luu<sup>1</sup> and Andrew Brown<sup>2</sup>.

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## ACKNOWLEDGMENTS

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

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Anne Cochrane	Senior Research Scientist, Threatened Flora Seed Centre, DEC Science Division
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Marnie Swinburn	Flora Conservation Officer, DEC Perth Hills District
Paul Tholen	Nature Conservation Officer, DEC Perth Hills District

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

Cover photograph by (unknown)

## CITATION

This IRP should be cited as:

Department of Environment and Conservation (2011) *Grevillea althoferorum* subsp. *fragilis* Interim Recovery Plan 2011-2016. Interim Recovery Plan No. 308. Department of Environment and Conservation, Western Australia.

**SUMMARY**

<b>Scientific Name:</b>	<i>Grevillea althoferorum</i> subsp. <i>fragilis</i>	<b>Common Name:</b>	NA
<b>Family:</b>	Proteaceae	<b>Flowering Period:</b>	Spring
<b>DEC Region:</b>	Swan	<b>DEC District:</b>	Perth Hills
<b>Shires:</b>	City of Swan, Chittering	<b>NRM Region:</b>	Swan
<b>Recovery Team:</b>	Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT)		

**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/>.

**Current status:** *Grevillea althoferorum* subsp. *fragilis* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in August 2008. It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 2001) criteria B1ab(iii,v)+2ab(iii,v); C2a(iii,v) based on its extent of occurrence being less than 100 km<sup>2</sup>; area of occupancy being less than 10 km<sup>2</sup>; there being just two fragmented populations with a projected continuing decline in quality of habitat and number of mature individuals; its population size estimated to be less than 250 mature individuals with a continuing projected decline; and 90% of individuals being in one population. *Grevillea althoferorum* is currently listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and this listing covers all subspecies. The main threats to the subspecies are firebreak maintenance, disease, inappropriate fire regimes, clearing, weeds, lack of genetic diversity, trampling and poor recruitment.

**Description:** *Grevillea althoferorum* subsp. *fragilis* is a bluish-green, lignotuberous shrub about 0.3 m high by 0.4 to 1 m wide. Leaf lobes are 0.25 to 0.35 cm wide. The longest terminal spines are 0.5 to 1.5 mm long, brittle and scarcely pungent. The perianth limb is 1 to 1.25 mm wide with white hairs. The pollen-presenter is 0.8 to 1.5 mm long. Flowers are yellow with reddish to reddish-brown buds.

**Habitat requirements:** *Grevillea althoferorum* subsp. *fragilis* is found at the base of the Darling Scarp, growing in greyish-yellow colluvial sand. It forms part of the shrub layer in a *Banksia menziesii* and *B. attenuata* woodland with *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Conostephium pendulum*, other shrubs and herb species.

**Habitat critical to the survival of the subspecies, and important populations:** Given that *Grevillea althoferorum* subsp. *fragilis* 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. althoferorum* subsp. *fragilis* 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 althoferorum* subsp. *fragilis* will also improve the status of associated native vegetation, including an adjacent Threatened Ecological Community.

**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 althoferorum* subsp. *fragilis* is not listed under any specific international treaty and this IRP 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 althoferorum* subsp. *fragilis*. This site is listed as Ellen Brook: Upper Swan (site #3525), a mythological site. Although there are no restrictions on the site, 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. As this is not expected to be completed before the approval of the IRP, Indigenous consultation has been included as a recovery action.

**Social and economic impacts:** The implementation of this recovery may cause some social and economic impact as one population occurs on private property which has subdivision approval, and the protection of the subspecies at this site may potentially affect future development. Recovery actions refer to continued liaison between stakeholders with regard to this area.

**Affected interests:** The occurrence of a *Grevillea althoferorum* subsp. *fragilis* population on private property will have implications for the property owners.

**Evaluation of the Plan's Performance:** The DEC in conjunction with the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) 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 four years of implementation.

**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. Declared Rare Flora (DRF) markers have been installed at Population 1.
3. Ninety-five seeds collected from *Grevillea althoferorum* subsp. *fragilis* Population 1 during visits in 1997, 2003, 2005, 2006, 2007, 2008 and 2009, are stored in DEC's Threatened Flora Seed Centre (TFSC) at -18°C.
4. The Botanic Gardens and Parks authority (BGPA) have nine plants of *Grevillea althoferorum* subsp. *fragilis* in their Conservation Garden.
5. *Grevillea althoferorum* subsp. *fragilis* plants germinated by the BGPA have been sent to DEC's Science Division for testing for susceptibility to the plant pathogen *Phytophthora cinnamomi* (dieback).
6. Staff from DEC's Perth Hills District regularly monitor populations.
7. The SRTFCRT 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.

**IRP Objective:** The objective of this IRP 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:** The number of populations have increased and/or the number of mature individuals have increased by twenty percent or more over the term of the plan.

**Criteria for failure:** The number of populations have decreased and/or the number of mature individuals have decreased by twenty percent or more over the term of the plan.

### Recovery actions

1. Coordinate recovery actions
2. Long term protection of habitat
3. Liaison
4. Disease hygiene
5. Further surveys
6. Monitor populations
7. Disturbance trials
8. Weed control
9. Kangaroo management strategy
10. Collect seed and cuttings
11. Fire management strategy
12. Translocation
13. Promote awareness
14. Biological and ecological information
15. Nominate for listing under the EPBC Act
16. Map habitat critical to the survival of the subspecies
17. Review this IRP

## 1. BACKGROUND

### History

*Grevillea althoferorum* was first collected by E.A. Griffin in 1978 with subsequent collections made from two disjunct areas, south of Eneabba and Bullsbrook. Olde and Marriott named plants from these two areas as separate subspecies in 2008.

A survey in 2007 by a private consultancy resulted in the discovery of a new population of *Grevillea althoferorum* subsp. *fragilis* on private property. Just one plant was found.

*Grevillea althoferorum* subsp. *fragilis* is known from two populations, one of which occurs along a firebreak in a Nature Reserve and the other on private property which has subdivision approval. The taxon is currently known from an estimated 129 mature individuals.

### Description

*Grevillea althoferorum* subsp. *fragilis* is a bluish-green, lignotuberous shrub about 0.3 m high by 0.4 to 1 m wide. Leaf lobes are 0.25 to 0.35 cm wide. The longest terminal spines are 0.5 to 1.5 mm long, brittle and scarcely pungent. The perianth limb is 1 to 1.25 mm wide with white hairs. The pollen-presenter is 0.8 to 1.5 mm long. Flowers are yellow with reddish to reddish-brown buds (Olde and Marriott 2008).

There are two geographically and morphologically distinct populations of *Grevillea althoferorum*. The most southerly, *G. althoferorum* subsp. *fragilis* is distinguished from *G. althoferorum* subsp. *althoferorum* by its smaller leaf lobes, shorter leaf spines, brittle and scarcely pungent terminal spines, and shorter perianth limb which has white hairs compared with creamy (Olde and Marriott 2008). The subspecies is named from the Latin *fragilis* which means brittle, referring to the brittle spines terminating the leaf lobes (Old and Marriott 2008).

### Distribution and habitat

*Grevillea althoferorum* subsp. *fragilis* occurs at the base of the Darling Scarp in greyish-yellow colluvial sand in *Banksia* low woodland. It forms part of the shrub layer in a *Banksia menziesii* and *B. attenuata* woodland with *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Conostephium pendulum*, other shrubs and herb species. The population is in a conservation reserve adjacent to agricultural land (Department of Environment and Conservation 2003).

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

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
<b>1. North of Bullsbrook</b>	Perth Hills	City of Swan	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
<b>2. North of Bullsbrook</b>	Perth Hills	Chittering	Freehold	Private Property	Landowners

Populations in **bold text** are considered to be important populations.

### Biology and ecology

Just 0.15% of *Grevillea althoferorum* subsp. *fragilis* flowers set fruit. Burne *et al.* (2003) found this was due to reduced amounts of viable pollen on the stigmas. In addition, no evidence of a soil seed bank was found and sexual recruitment was absent.

It is not certain how *Grevillea althoferorum* subsp. *fragilis* responds to fire. Burne *et al.* (2003) stated that the presence of lignotubers at Population 1 indicates that the subspecies resprouts following removal of above-ground plant material through disturbances such as fire or grazing. However, observations made in 2010 by Nick Casson found that the subspecies did not appear to be a disturbance opportunist, as it had not responded to disturbance along a firebreak with the general density in this area similar to that further down slope.

All 19 *Grevillea althoferorum* subsp. *fragilis* plants tested for susceptibility to the plant pathogen *Phytophthora cinnamomi* (dieback) died indicating that the subspecies is very susceptible.

## Threats

*Grevillea althoferorum* subsp. *fragilis* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in August 2008. It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 2001) criteria B1ab(iii,v)+2ab(iii,v); C2a(iii,v) based on its extent of occurrence being less than 100 km<sup>2</sup>; area of occupancy being less than 10 km<sup>2</sup>; there being just two fragmented populations with a projected continuing decline in quality of habitat and number of mature individuals; its population size estimated to be less than 250 mature individuals with a continuing projected decline; and 90% of individuals being in one population. *G. althoferorum* is currently listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Endangered and this listing covers all subspecies. The main threats to the subspecies are firebreak maintenance, disease, inappropriate fire regimes, clearing, weeds, lack of genetic diversity, trampling and poor recruitment.

- **Firebreak maintenance activities** threaten Population 1 and its habitat. In 2008 damage to the subspecies and the surrounding vegetation occurred during firebreak maintenance. Grading may directly damage plants and also encourage weed invasion. Although DRF markers are installed at the site and serve to alert people working in the vicinity to the presence of DRF, DEC staff should be present during maintenance works to ensure that appropriate protective measures are implemented.
- **Disease** is a threat to Population 1. Dieback, caused by the plant pathogen *Phytophthora megasperma*, occurs in the immediate vicinity of Population 1. The subspecies is also highly susceptible to *Phytophthora cinnamomi*. The *Banksia* woodland habitat that occurs at this site is also susceptible.
- **Inappropriate fire regimes** are a threat to all populations of *Grevillea althoferorum* subsp. *fragilis*. It is thought that occasional fire is needed for reproduction. However, fire may facilitate weed invasion and should be followed up with appropriate weed control.
- **Clearing** for subdivision development is a threat to Population 2 on private property. Subdivision approval to small rural living lots across the site has been given, which may potentially result in the destruction of the population.
- **Weeds** are considered a threat to Population 1 of *Grevillea althoferorum* subsp. *fragilis*. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also increase the fire hazard due to the easy ignition of high fuel loads.
- **Lack of genetic diversity** is evident within populations and may affect the evolutionary adaptability of the subspecies. The subspecies may be adapted to its current environmental conditions, but if these conditions change, it may have limited ability to adapt.
- **Trampling** by kangaroos is a threat to one population. The boundary of the reserve is being used by the kangaroos to transit to farmland, thereby creating well-worn paths. Kangaroos may impact on the habitat by digging, trampling and breaking foliage and also spreading disease. An increased nutrient level in the soil from droppings is also likely and may encourage weed invasion.
- **Poor recruitment** is observable in all populations of the subspecies.

The intent of this plan is to provide actions that will deal with immediate threats to *Grevillea althoferorum* subsp. *fragilis*. 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
1. North of Bullsbrook	Nature Reserve	1995 30 1999 151 [1 dead] 2002 145 2006 149 2008 161 (9) [6 dead] 2010 128	Healthy	Firebreak maintenance, disease, inappropriate fire regimes, weeds, lack of genetic diversity, trampling, poor recruitment
2. North of Bullsbrook	Private Property	2007 1	Healthy	Clearing, inappropriate fire regimes, lack of genetic diversity, poor recruitment

Note: () = number of seedlings.

### 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 althoferorum* subsp. *fragilis* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that these 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 subspecies, and important populations

Given that *Grevillea althoferorum* subsp. *fragilis* 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. althoferorum* subsp. *fragilis* 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 althoferorum* subsp. *fragilis* will also improve the status of associated native vegetation. The subspecies occurs approximately 400 m from a Threatened Ecological Community (TEC).

**Table 3: Threatened Ecological Community (TEC) in which *Grevillea althoferorum* subsp. *fragilis* occurs adjacent to**

Community Name	Conservation status (WA)	Conservation Status (EPBC Act)
Herb rich saline shrublands in clay pans (SCP07)	Vulnerable	Endangered (at the species level)

For a description of the PEC categories see DEC (2007)

### 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 althoferorum* subsp. *fragilis* is not listed under any specific international treaty and this IRP 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 althoferorum* subsp. *fragilis*. This site is listed as Ellen Brook: Upper Swan (site #3525), a mythological site. There are no restrictions on the site.

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. As this is not expected to be completed before the approval of the IRP, further consultation has been included as a recovery action to ensure there has been Indigenous engagement in relation to the recovery actions posed in this plan.

### **Social and economic impacts**

The implementation of this recovery plan may potentially cause some significant adverse social and economic impact as one population of *Grevillea althoferorum* subsp. *fragilis* occurs on private property which has subdivision approval and the protection of the subspecies at this site may potentially affect future development. Recovery actions refer to continued liaison between stakeholders with regard to this area.

### **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**

The DEC in conjunction with the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) 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**

### **Objective**

The objective of this Interim Recovery Plan (IRP) 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:** The number of populations have increased and/or the number of mature individuals have increased by twenty percent or more over the term of the plan.

**Criteria for failure:** The number of populations have decreased and/or the number of mature individuals have decreased by twenty percent or more over the term of the plan.

## **3. RECOVERY ACTIONS**

### **Existing recovery actions**

Relevant stakeholders have been made aware of the existence of this subspecies and its locations. These notifications detail the current status of the subspecies as Declared Rare Flora (DRF) and the associated legal obligations in regards to its protection.

Declared Rare Flora (DRF) markers have been installed along the firebreak at Population 1. These serve to alert people working in the vicinity to the presence of DRF.

Ninety-five seeds collected from *Grevillea althoferorum* subsp. *fragilis* Population 1 in 1997, 2003, 2005, 2006, 2007, 2008 and 2009 are stored in DEC's Threatened Flora Seed Centre (TFSC) at  $-18^{\circ}\text{C}$ . An initial germination rate of 50% was recorded. There is insufficient seed to conduct repeat testing.

Botanic Gardens and Parks Authority (BGPA) originally had two clones of *Grevillea althoferorum* subsp. *fragilis*. One was sourced from cutting material taken from Population 1 in 1997, and the other from seed germinated by the TFSC during trials, sourced from Population 1 on 26 November 1997. Originally there were nine plants grown from cuttings but all of them have died. There has been variable success with cuttings, with



strike rates between 20% and 90%. It is thought that this may be at least partly attributable to the quality of propagation material. As for plants grown from seed germinants, the originals have died but subsequent cuttings from those plants were made. Currently one plant approximately eight years old is growing in the Conservation Garden, plus another eight younger ones from cuttings done over the past two years, also in the Conservation Garden.

*Grevillea althoferorum* subsp. *fragilis* plants germinated by BGPA were sent to DEC's Science Division for testing for susceptibility to the plant pathogen *Phytophthora cinnamomi* (dieback). All 19 plants tested died indicating that the subspecies is very susceptible.

Staff from DEC's Perth Hills District regularly monitor the populations.

The SRTFCRT 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.

### Future recovery actions

Where recovery actions 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 SRTFCRT will continue to oversee the implementation of the recovery actions for *Grevillea althoferorum* subsp. *fragilis* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

**Action:** Coordinate recovery actions  
**Responsibility:** DEC (Swan Region) through the SRTFCRT  
**Cost:** \$6,000 per year

#### 2. Long term protection of habitat

The conservation status of land that supports Population 2 will be reviewed and the possibility of purchase, a change of land tenure and/or establishment of a nature conservation covenant investigated.

**Action:** Achieve long term protection of habitat  
**Responsibility:** DEC (Perth Hills District, Land Acquisition Branch) through the SRTFCRT  
**Cost:** \$3,000 per year

#### 3. Liaison

When upgrading firebreaks at Population 1, staff from DEC's Perth Hills District will be present on site and liaise with grader drivers to avoid damage to the subspecies and associated habitat. Liaison with appropriate land managers of Population 2 will take place to ensure that the single known plant is not accidentally damaged or destroyed. Indigenous consultation will be undertaken to determine if there are any issues or interests in areas that are habitat for *G. althoferorum* subsp. *fragilis*.

**Action:** Liaise with contractors, land managers and Indigenous groups  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$2,000 per year

#### 4. Disease hygiene

The susceptibility of *Grevillea althoferorum* subsp. *fragilis* to dieback (*Phytophthora* spp.) is thought to be high. *Phytophthora megasperma* is known to occur very close to Population 1, and the dieback front will be mapped and monitored at least every five years. Dieback hygiene (outlined in Department of Conservation and Land Management 1992b) will be adhered to wherever possible when conducting activities such as maintenance of firebreaks and walking into the population during wet soil conditions. The need for dieback treatment will be assessed through evaluation of the impact of the disease on the habitat and the subspecies.

**Action:** Maintain disease hygiene  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$2,000 per year

## 5. Further surveys

It is recommended that areas of potential suitable habitat be surveyed for the presence of *Grevillea althoferorum* subsp. *fragilis* during its flowering period in spring. All surveyed areas will be recorded and the presence or absence of the subspecies documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, Landcare groups, wildflower societies and naturalists clubs will be encouraged to become involved. In particular, a thorough survey will be undertaken on land containing Population 2.

**Action:** Conduct further surveys  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$5,000 in years 1, 3 and 5

## 6. Monitor populations

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

**Action:** Monitor populations  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$5,000 per year

## 7. Regeneration trials

Natural disturbance events (physical or fire) may be the most effective means of germinating *Grevillea althoferorum* subsp. *fragilis* seed in the wild. Different disturbance techniques should be investigated (i.e. soil disturbance and fire), as well as the application of smoke water, to determine the most appropriate method. Records will need to be maintained for future research. Any disturbance trials will need to be undertaken in conjunction with weed control.

**Action:** Develop and implement regeneration trials  
**Responsibility:** DEC (Science Division, Perth Hills District) through the SRTFCRT  
**Cost:** \$7,000 in years 1 and 3, \$2,000 in years 2, 4 and 5

## 8. Weed control

Weeds are a threat to Population 1 and the following actions will be implemented:

1. Determine which weeds are present and map them.
2. Select appropriate technique; herbicide, mowing or hand weeding.
3. Control invasive weeds by hand removal and/or spot spraying around *Grevillea althoferorum* subsp. *fragilis* plants when weeds first emerge.
4. Revegetation with site specific species is required (in Autumn) to maintain low weed levels.
5. Monitor the success of the treatment on weed death, and the tolerance of *Grevillea althoferorum* subsp. *fragilis* and associated native plant species to the treatment.

6. Report on the method and success of the treatment, and effect on *Grevillea althoferorum* subsp. *fragilis* plants and associated species.

**Action:** Undertake weed control and follow up with additional control if required  
**Responsibility:** DEC (Perth Hills District, Science Division) through the SRTFCRT  
**Cost:** \$6,000 per year, as required

## 9. Kangaroo management strategy

A management strategy will be developed where kangaroos are having an impact on the population of *Grevillea althoferorum* subsp. *fragilis* through trampling and breaking of foliage. The strategy will include a survey to determine kangaroo density, monitoring of impacts on the subspecies, and recommendations to reduce the impact.

**Action:** Develop and implement a kangaroo management strategy  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$4,000 in first year; \$2,000 per year thereafter

## 10. Collect propagation material

Seed has been collected from Population 1 by DEC's TFSC however collections are required from Population 2 to ensure the genetic diversity of the subspecies is captured. Cuttings will also be collected to establish a living collection.

**Action:** Collect seed and other material to preserve genetic diversity  
**Responsibility:** DEC (Perth Hills District, TFSC), BGPA through the SRTFCRT  
**Cost:** \$5,000 per year

## 11. Fire management strategy

Fire will 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 (Perth Hills District) through the SRTFCRT  
**Cost:** \$10,000 in first year and \$2,000 in subsequent years

## 12. Translocation

Translocation may be deemed desirable for the conservation of this subspecies if surveys fail to locate new populations. A translocation proposal will be developed and suitable translocation sites selected. Information on the translocation of threatened plants and animals in the wild is provided in DEC's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995), and the Australian Network for Plant Conservation translocation guidelines (Vallee et al 2004). All translocation proposals require endorsement by DEC's Director of Nature Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

**Action:** Start the translocation process, if necessary  
**Responsibility:** DEC (Perth Hills District, Science Division) through the SRTFCRT  
**Cost:** \$5,000 in year 5

## 13. Promote awareness

The importance of biodiversity conservation and the protection of *Grevillea althoferorum* subsp. *fragilis* will be promoted to the public. This will be achieved through an information campaign using local print and electronic media and by setting up poster displays. An information sheet that includes a description of the plant, its habitat

type, threats and management actions, and photos will be produced. Formal links with local naturalist groups and interested individuals will also be encouraged.

**Action:** Promote awareness  
**Responsibility:** DEC (Perth Hills District, SCB, Strategic Development and Corporate Affairs Division) through the SRTFCRT  
**Cost:** \$4,000 in year 1 and \$2,000 in years 2-5

#### 14. Biological and ecological information

Increased knowledge of the biology and ecology of the subspecies will provide a scientific basis for management of *Grevillea althoferorum* subsp. *fragilis* in the wild. Investigations will ideally include:

1. 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, Perth Hills District) through the SRTFCRT  
**Cost:** \$10,000 per year

#### 15. Recognition under the Commonwealth EPBC Act

*Grevillea althoferorum* is listed under the EPBC Act, which covers this subspecies, however, the species-level listing does not enable separate recognition of the status of the two subspecies. Staff from DEC's Species and Communities Branch (SCB) will develop a Species Profile and Threats (SPRAT) for each subspecies and forward them to the Commonwealth Department of the Environment, Water, Heritage and the Arts for review and referral to the Commonwealth Threatened Species Scientific Committee (TSSC) for endorsement of each subspecies separately under the EPBC Act.

**Action:** Nominate *Grevillea althoferorum* subsp. *fragilis* for listing under the Commonwealth EPBC Act  
**Responsibility:** DEC (SCB)  
**Cost:** \$3,000 in year 1

#### 16. Map habitat critical to the survival of *Grevillea althoferorum* subsp. *fragilis*

It is a requirement of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Section 207A) that spatial data relating to critical habitat be determined. Although critical habitat 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 althoferorum* subsp. *fragilis*  
**Responsibility:** DEC (SCB, Perth Hills District) through the SRTFCRT  
**Cost:** \$6,000 in year 2

#### 17. Review this IRP

If *Grevillea althoferorum* subsp. *fragilis* is still ranked as Critically Endangered at the end of the five-year term of this IRP, the need for further recovery actions, or a review of this IRP will be assessed and a revised plan prepared if necessary.

**Action:** Review this IRP and assess the need for further recovery actions

**Responsibility:** DEC (SCB, Perth Hills District) through the SRTFCRT

**Cost:** \$3,000 in year 5

**Table 4. Summary of Recovery Actions**

Recovery Action	Priority	Responsibility	Completion Date
Coordinate recovery actions	High	DEC (Swan Region) through the SRTFCRT	Ongoing
Long-term protection of habitat	High	DEC (Perth Hills District, Land Acquisition Branch) through the SRTFCRT	Ongoing
Liaise with contractors, land managers and Indigenous groups	High	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Disease hygiene	High	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Further surveys	High	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Monitor populations	High	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Regeneration trials	High	DEC (Science Division, Perth Hills District) through the SRTFCRT	2016
Undertake weed control and follow up with additional control if required	High	DEC (Perth Hills District, Science Division) through the SRTFCRT	Ongoing
Kangaroo management	High	DEC (Perth Hills District) through the SRTFCRT	Developed by 2013 with implementation ongoing
Collect propagation material	High	DEC (Perth Hills District, TFSC), BGPA through the SRTFCRT	2016
Fire management	High	DEC (Perth Hills District) through the SRTFCRT	Developed by 2014 with implementation ongoing
Translocation	Medium	DEC (Perth Hills District, Science Division) through the SRTFCRT	Ongoing
Promote awareness	Medium	DEC (Perth Hills District, SCB, and Strategic Development and Corporate Affairs Division) through the SRTFCRT	Ongoing
Obtain biological and ecological information	Medium	DEC (Science Division, Perth Hills District) through the SRTFCRT	2016
Recognition under the Commonwealth EPBC Act	Medium	DEC (SCB)	2012
Map habitat critical to the plants survival	Medium	DEC (SCB, Perth Hills District) through the SRTFCRT	2014
Review this IRP and assess the need for further recovery actions	Medium	DEC (SCB, Perth Hills District) through the SRTFCRT	2016

#### 4. TERM OF PLAN

This IRP will operate from February 2011 to January 2016 but will remain in force until withdrawn or replaced. If the subspecies is still ranked Critically Endangered after five years, the need for further recovery actions will be determined.

#### 5. REFERENCES

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## 6. TAXONOMIC DESCRIPTION

### *Grevillea althoferorum* subsp. *fragilis*

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.

Primary leaf lobes 0.25–0.35(–0.5) cm wide; longest spines of leaves and leaf lobes 0.5–1.5 mm long, brittle, scarcely pungent; perianth 6–7 mm long, 1 mm wide, densely glandular-villous abaxially with white hairs; perianth limb 1.5 mm long, 1–1.25 mm wide; stilar dilation *c.* 0.25 mm wide at its widest point; pollen-presenter distinctly rimmed at base, 0.8–1.5 mm long, 0.35–0.6 mm wide.

Key to subspecies:

Leaf lobes 1–3 cm wide; longest terminal spines 2.5–3.5 mm long, rigid, pungent; perianth limb 1.5–2 mm wide with creamy hairs; pollen-presenter *c.* 0.8 mm long ..... subsp. **althoferorum**

Leaf lobes 0.25–0.35(–0.5) cm wide; longest terminal spines 0.5–1.5 mm long, brittle, scarcely pungent; perianth limb 1–1.25 mm wide with white hairs; pollen-presenter 0.8–1.5 mm long ..... subsp. **fragilis**