Consultation Document on Listing Eligibility and Conservation Actions

Grevillea bracteosa subsp. *howatharra* (bracted grevillea)

You are invited to provide your views and supporting reasons related to:

1) the eligibility of *Grevillea bracteosa* subsp. *howatharra* (bracted grevillea) for inclusion on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) list of threatened species in the Critically Endangered category; and

2) the necessary conservation actions for the above species.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the EPBC Act or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Draft information for your consideration of the eligibility of this species for listing as Critically Endangered starts at page 3 and information associated with potential conservation actions for this species starts at page 11. To assist with the Committee's assessment, the Committee has identified a series of specific questions on which it seeks your guidance at page 15.

Responses are to be provided in writing either by email to:
species.consultation@environment.gov.au

or by mail to:

The Director
Species Information and Policy Section
Wildlife, Heritage and Marine Division
Department of the Environment
PO Box 787
Canberra ACT 2601

Responses are required to be submitted by 8 November 2016.

General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at: http://www.environment.gov.au/biodiversity/threatened/index.html.

Public nominations to list threatened species under the EPBC Act are received annually by the Department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at: http://www.environment.gov.au/biodiversity/threatened/pubs/guidelines-species.pdf.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at: http://www.environment.gov.au/biodiversity/threatened/nominations.html.

To promote the recovery of listed threatened species and ecological communities, conservation advices and, where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at: http://www.environment.gov.au/biodiversity/threatened/recovery.html.

Information about this consultation process

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment and Energy.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

Grevillea bracteosa subsp*. howatharra*

bracted grevillea

Taxonomy

Conventionally accepted as *Grevillea bracteosa* subsp. *howatharra*

Sub-species Information

Description

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

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

Distribution

Bracted grevillea is known from north and east of Geraldton in Western Australia, from the Moresby Range 27 km north of Geraldton to Northern Gully 30 km east of Geraldton. There are five disjunct populations north and east of Geraldton totalling approximately 326 plants (A. Chant pers. comm. 2015). The subspecies has a restricted range of approximately 30 km^2 (IUCN 2x2km grid). The population at Northern Gully is highly disjunct with the nearest known population more than 24 km away.

Bracted grevillea grows in heavy soils, consisting of clay loam with laterite, in open sunny positions (Olde & Marriot 2008). Associated species include *G. pinaster*, *G*. *petrophiloides* (pink pokers), *Gastrolobium spinosum* (prickly poison), *Banksia fraseri*, *B*. *sessilis* (parrot bush), *Ecdeiocolea monostachya*, *Allocasuarina humilis* (dwarf sheoak), *Pityrodia terminalis* (native foxglove), *Acacia congesta* and *Stenanthemum pomaderroides*.

Table 1: Population locations, numbers of mature adults and key information

Population Number	Location	Land Tenure	Number of mature of adults	Key information
1a	East of Geraldton	Road Reserve: Main Roads Western Australia	36 (2013)	Subpopulations 1a and 1b are situated in Northern Gully 30 km east of Geraldton. The nearest known population is more than 24 km away. Subpopulation 1a consists predominantly of mature and/or senescent individuals.
1b	East of Geraldton	Rail Reserve: Public Transport Authority	Included in 1a count (2013)	Subpopulation 1b consists predominantly of mature and/or senescent individuals.
1c	East of Geraldton	Shire Reserve: Shire of	74 plants (2013)	

Population Number	Location	Land Tenure	Number of mature of adults	Key information
		Geraldton-Greenough		
1d	East of Geraldton	Not specified	24 plants (2013)	Post disturbance regeneration observed post fire and fire break machine activity (A. Chant pers. comm. 2015).
1e	East of Geraldton	Not specified		
2a	North of Geraldton	Shire Road Reserve	83 plants (2013)	Post disturbance regeneration observed following grading (Chant pers. comm. 2015).
2b	North of Geraldton	Freehold	Included in 2a count (2013)	Post disturbance regeneration observed following fire (Chant pers. comm. 2015).
2c	North of Geraldton	Not specified	Included in 2a count (2013)	
3a	North of Geraldton	Nature Reserve: Conservation Commission of WA	13 plants (2014)	Found in Howatharra Conservation Reserve. Subpopulation 3a consists predominantly of mature and/or senescent individuals.
3b	North of Geraldton	Freehold	Included in 3a count (2014)	Subpopulation 3b consists predominantly of mature and/or senescent individuals.
4	North of Geraldton	Freehold	35 plants (2013)	Found in the proposed Moresby Conservation Reserve. Population 4 consists predominantly of mature and/or senescent individuals. There is no active management of this reserve for this species, except a fire break was realigned in 2013 to avoid two seedlings.

Population Number	Location	Land Tenure	Number of mature of adults	Key information
5a	North of Geraldton	Freehold	5 plants (2014)	
5b	North of Geraldton	Freehold	Included in count for 5a (2014)	

Cultural Significance

There is one identified site of Aboriginal significance within the vicinity of Population 1 at Northern Gully, 30 km east of Geraldton, which is a water source (Department of Indigenous Affairs' Aboriginal Heritage Sites Register). There are no restrictions on the site and access to the area is open. Input and involvement in management of the site is being sought through the South West Aboriginal Land and Sea Council and the Department of Indigenous Affairs.

Relevant Biology/Ecology

There is little known about the biology and ecology of the bracted grevillea.

Plants reach maturity within one to two years. Subpopulation 1a has been monitored for a period of 16 years and the majority of plants within this subpopulation have been mature throughout this period, with little evidence of new recruitment. This suggests that plants live for over 16 years (A. Chant pers. comm. 2015).

The subspecies is recorded to flower during August to October or December (WAH 1998).

Threats

Table 2: Threats in approximate order of severity of risk, based on available evidence

Threat factor	Threat type	Threat status	Evidence base
Road, rail, track and firebreak maintenance (grading road reserves, spraying of chemicals, construction and maintenance of drainage channels and mowing of roadside vegetation).	Known	Past; possibly also current and future	Threat to subpopulations 1a, 1b 1c, 2a and 2b. Subpopulation 3a and Population 4 occur on lands managed by the Crown for conservation. Subpopulations 5a and 5b occur on private managed land which is proposed to become a conservation reserve; however, the majority of this population was lost to herbicide application (A Chant pers. comm. 2015). All other populations are found on land that is not reserved or managed for the purpose of conservation and is of poor and deteriorating quality (A. Chant pers. comm. 2015).
Rabbits (*Oryctolagus cuniculus*) (grazing, damage plants and habitat through digging, erosion, the addition of nutrients and introduction of weed seeds).	Known	Past and current	This threat is variable geographically and temporally (A. Chant pers. comm. 2015). New recruits are more likely to be threatened by weeds and rabbits at all sites, although plants reach maturity within one to two years so this increased threat is short-term.

Threat factor	Threat type	Threat status	Evidence base
Poor recruitment.	Known	Current and future	Poor recruitment is likely to be an ongoing threat and is difficult to manage with limited resources. This threat is more difficult to manage at populations which have insecure tenure (all populations except for 3a and 4) (A. Chant pers. comm. 2015).
Gravel extraction.	Potential	Future	Threat to subpopulation 1c. Plants may be accidentally damaged or removed during this process. Gravel extraction was a potential threat to Population 5, however liaison with the land manager is expected to have reduced this threat and the area is proposed to be reserved (A. Chant pers. comm. 2015).
Too infrequent fires or fires too soon after fire-induced regeneration.	Potential	Current	The appropriate fire regime for this subspecies is not fully understood. The fire regime currently being experienced by some populations is one where the fire interval is too long and thus many plants within some populations are senescent. Some subpopulations have had more recent fire with plants being younger at these locations. Too frequent or infrequent fires are likely to be an ongoing threat and are difficult to manage with limited resources. This threat is considered variable, however, as it is more difficult to manage at populations which have insecure tenure (all populations except for 3a and 4) (A. Chant pers. comm. 2015).
Grazing, trampling increased nutrient levels from droppings due to livestock.	Known	Past and potential future	Grazing has occurred in the past at populations outside conservation reserves.
Weeds (suppress early plant growth by competing for soil moisture, nutrients and light, and increase fire the hazard due to high fuel loads).	Known	Current and future	Weeds are likely to be a reduced threat at populations 1d and 1e but ongoing at other sites (populations 1a, 1b, 2a, 2b and 2c). Weeds are not significant threat at populations 3, 4 and 5 (A. Chant pers. comm. 2015). In particular grassy weeds that exacerbate the fire regime which then increases nitrification promoting further growth of weeds.

Assessment of available information in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers)
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the followin

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

The total population of 326 mature individuals occurs in five separate populations (locations) with a total of 12 subpopulations (A. Chant pers. comm. 2015). All populations are either north or east of Geraldton. Four of the subpopulations are found on either in road, rail or gravel reserves, five within private property, and two within a nature reserve. Data on each of the subpopulations and past reduction are present below:

Population/subpopulation Number	**Year/no. plants 2002-2004**	**Year/no. plants 2006-2007**	**Year/no. plants 2009-2010**	**Year/no. plants 2013-2014**
1a		2006/34 [6 dead]	2010/29 [5 dead]	2013/36*
1b	2004/77	2006/28	2010/31 [5 dead]	(included in total provided for 1a)
1c	2002/30		2010/75(2)	2013/74
1d				2013/24
2a	2004/30	2006/76 (20) [10 dead]	2009/62	2013/83*
2b	2004/12		2010/12	(included in total provided for 2a)

Population/subpopulation Number	Year/no. plants 2002-2004	Year/no. plants 2006-2007	Year/no. plants 2009-2010	Year/no. plants 2013-2014
2c				(included in total provided for 2a)
3a			2010/11*	2014/13
3b			2010/11*	(included in total provided for 3a)
4	2004/90		2010/52	2013/35
5a		2007/9	2010/42	2014/5
5b			2010/76 [5 dead]	(included in total provided for 5a)

* total for subpopulations combined
() number of seedlings

The total number of plants has decreased due to loss of individuals – Population 1 was recorded as approximately 500 mature plants in 1991 and the most recent record for this site is now 36 plants. The current total population is 326 which is less than the total for the one single location known in 1991. Population 5 was first recorded as 90 plants in 2004 and the most recent data for this population demonstrate that it has been reduced to five plants due to herbicide spray drift killing the plants (A. Chant pers. comm. 2015). The listing guidelines for this criterion consider decline over the longer of 10 years or three generations. Survey data from monitoring of subpopulation 1a suggest that plants live for over 16 years. This is the maximum known age but does not equate to generation length. The monitoring data indicate a decline in some populations and a variable pattern in others. The data therefore appear to be inconclusive in showing a rate of decline to meet the threshold levels for this criterion.

A number of threats are impacting upon the species (as outlined in the threats section above). However, there are insufficient data available to quantitatively determine past and future rates of decline across all populations.

The data presented above appear to be insufficient to demonstrate the subspecies' eligibility for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2.	Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
		Critically Endangered Very restricted	**Endangered Restricted**	**Vulnerable Limited**
B1.	Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**
B2.	Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:				
(a)	Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(b)	Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c)	Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations;(iv) number of mature individuals			

Evidence:

The extent of occurrence (EOO) has been calculated 30 km^2, using the IUCN convex hull method (Department of the Environment 2015). The area of occupancy (AOO) has been calculated at 40 km^2 using the IUCN 2x2km grid method (Department of the Environment 2015).

Over a period of 10 years the number of known populations has increased from two to five populations as a result of increased survey effort. There is a projected continuing decline in the area, extent and/or quality of habitat due to the impacts from road, rail, track and firebreak maintenance, rabbit browsing, insecure land tenure, gravel extraction and poor recruitment. Although Subpopulation 3a (11 plants in 2010) occurs in the Howatharra Nature Reserve, there is no active management of this reserve for this subspecies (Brooker pers. comm. 2015).

The data presented above appear to demonstrate that the subspecies is eligible for listing as **Critically Endangered based on B1ab(iii,v)** in having a 'very restricted' extent of occurrence of less than 100 km^2, and due to the disjunct populations, and projected decline in the quality of the habitat and number of mature individuals.

However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3.	Population size and decline			
		Critically Endangered Very low	**Endangered Low**	**Vulnerable Limited**
Estimated number of mature individuals		**< 250**	**< 2,500**	**< 10,000**
AND either (C1) or (C2) is true				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 10% in 10 years or 3 generations (whichever is longer)**
C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on			

	at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

There is currently a total of 326 mature individuals recorded (A. Chant pers. comm. 2015) which is a 'low' number of mature individuals (i.e. <2500) for the purposes of this criterion.

There has been an observed decline in the quality of habitat and therefore a projected decline in the number of mature individuals in the population.

The data presented above appear to demonstrate that the species is eligible for listing as **Endangered based on C2(a)(i)** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	**Endangered Very Low**	**Vulnerable Low**
Number of mature individuals	**< 50**	**< 250**	**< 1,000**

Evidence:

There are a total of 326 mature individuals (A. Chant pers. comm. 2015). This is less than <1000 which is 'low' for the purposes of this criterion.

The data presented above appear to demonstrate that the species is eligible for listing as **Vulnerable** under this criterion. However, the purpose for this consultation is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	**Endangered Near future**	**Vulnerable Medium-term future**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% in 100 years**

Evidence:

As population viability analysis has not been undertaken, there are insufficient data to demonstrate whether the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Conservation Actions

Recovery Plan

A decision about whether there should be a recovery plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

Primary Conservation Actions

Conservation and Management Priorities

Habitat loss disturbance and modifications

- Ensure land managers are aware of the subspecies' occurrence and provide protection measures against key and potential threats.
- Assess the environmental impacts of development and/or land clearing in the immediate vicinity of bracted grevillea. 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.
- Maintain declared rare flora markers which have been installed on road and rail reserves at populations 1 and 2 to alert maintenance crews that the area is an Environmentally Significant Area and that they should not undertake road maintenance activities between the markers (without consulting the relevant Parks and Wildlife flora officer). The significance of these markers is promoted to Shires and Main Roads WA through posters, dashboard stickers and stubby holders that illustrate DRF markers[i] and explain their purpose. However, these measures are sometimes less effective where staff/operator changes occur and can therefore not be guaranteed long term (A. Chant pers. comm. 2015).
- Maintain fencing which has been constructed around Population 1c, which occurs in a reserve used for gravel extraction.
- Undertake revegetation projects to expand and connect populations of bracted grevillea. A 2014-2015 project on Yanget Station aimed to re-establish 15 ha of native vegetation in the Northern Agricultural Zone of WA, in a local catchment area which has <2% of vegetation remaining. This revegetation will improve the extent and connectivity of habitat for three threatened flora species on Yanget Station, near Geraldton in Western Australia. This includes connecting two small subpopulations of the bracted grevillea, and improving an area of potential habitat for the Endangered *Chorizema humile* (prostrate flame pea) and *Wurmbea tubulosa* (long-flowered nancy). This will also include restoring riparian vegetation along a degraded creek line.
- Subpopulations 1d and 1e have benefitted from rehabilitation planting which will provide continuous native vegetation between the two sites and potentially allow for an increase in population size (A. Chant pers. comm. 2015).

Invasive species (including threats from grazing, trampling, predation)

- Maintain fencing which has been constructed around subpopulations 3b and 5a, which occur on private property, to protect them from grazing and trampling.
- Subpopulations 1d and 1e have been fenced to exclude stock in early 2014 to reduce the impact of grazing and trampling (A. Chant pers. comm. 2015).
- If monitoring demonstrates that the threat posed by rabbits at populations 1 and 4 and subpopulation 5b is high, rabbit control measures should be implemented. Control should be undertaken in summer months when less green feed is available as an alternative food source (DPAW 2013; A. Chant pers. comm. 2015). Rabbit control has been carried out to benefit populations 4 and 5 and subpopulations 1d and 1e.

- Monitor and control weeds within and around the populations of bracted grevillea. Control actions may include: determining which weeds are present and mapping their extent; controlling invasive weeds by hand removal and spot spraying; monitoring success of weed control treatment; and reporting on threat abatement success. Weed control has previously been successfully carried out by student volunteers (DPAW 2013 2013; A. Chant pers. comm. 2015).

Impacts of domestic species

- If livestock grazing occurs in the area, manage total grazing pressure at sites where the bracted grevillea is known to occur through exclusion fencing or other barriers.

Breeding, propagation and other ex-situ recovery action

- Maintain seed from bracted grevillea in storage. Seed has been collected from most populations and is stored in the Western Australian Parks and Wildlife Threatened Flora Seed Centre.
- Collect cuttings to establish a living collection.
- Investigate the feasibility of a translocation program for the species.

Land tenure

- Known for all populations except for subpopulation 3a which occurs in a nature reserve and Population 4 which occurs on Crown land proposed as a conservation reserve. Insecure land tenure affects the likelihood of management of land areas for conservation purposes. Populations on insecure land tenure are also more likely to be accidently damaged by unaware land managers.
- Review the conservation status of land that supports each population and investigate the possibility of purchase and/or of land tenure change.

Fire

- Ensure that fires do not occur within populations before an accumulation of a seed bank large enough to replace the number of fire-killed standing plants.
- Ensure that fires do not occur in winter or spring, avoiding the exposure of sub-mature seedlings recruits to desiccating conditions over summer.
- Ensure that intervals between successive fires take into account the longevity of the standing plant population.

Stakeholder Engagement

- Staff from Parks and Wildlife Geraldton District will liaise with land managers to ensure that populations of bracted grevillea are not accidentally damaged or destroyed.
- Consult with Indigenous communities to determine if there are any issues or interests in areas that are habitat for the subspecies.
- Review the conservation status of land that supports populations and investigate the possibility of purchase and/or a change of land tenure investigated.
- Encourage the formation of conservation covenants for populations on private land.
- Promote the importance of biodiversity conservation and the protection of bracted grevillea 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, 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.
- Liaise with stakeholders, to ensure that populations of the bracted grevillea are not accidently damaged or destroyed, has been successful in developing good relationships and will result in reduction in this threat in the current to longer term.
- Notify landholders and land managers about populations of bracted grevillea that occur on the lands they manage or own (DPAW 2013; A. Chant pers. comm. 2015).

- The Geraldton Herbarium Group has been actively involved in recovery actions for the bracted grevillea, including conducing survey and monitoring for all populations except one, over a period of several years. The Geraldton District Threatened Flora and Communities Recovery Team oversee the recovery actions for this species.

Survey and Monitoring priorities

- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Monitoring of weed invasion, habitat degradation, hydrology, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential.
- Continue disturbance monitoring at subpopulations 1b, 2a and 2b. The implementation of recovery disturbance trials is dependent on information gained from monitoring. Disturbance plots have been installed by Parks and Wildlife staff to study the response of this subspecies to disturbance, including driving over by machinery, partial grading and fire (DPAW 2013; A. Chant pers. comm. 2015).
- Monitor survival and recruitment at each population. Several populations consist of predominantly mature and/or senescent individuals (subpopulations 1a, 1b, and populations 3 and 4). As such, conditions for recruitment do not seem to be present at these sites, and may require management actions.
- Survey areas of potential habitat for the presence of bracted grevillea during its flowering period. Record the presence or absence of the species in each surveyed area to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, and technically feasible, encourage volunteers from the native orchid society, local community, landcare groups, wildflower societies and naturalists clubs to be involved.
- Conduct surveys along roads and in nature reserves near known populations to locate new populations/subpopulations.

Information and Research priorities

- Improved knowledge of the biology and ecology of the subspecies will provide a scientific basis for management of bracted grevillea in the wild. An understanding of the following is necessary for effective management:
    - 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;
    - determination of reproductive strategies, phenology and seasonal growth;
    - investigation of the mating system and pollination biology;
    - investigation of population genetic structure, levels of genetic diversity and minimum viable population size; and
    - the impact of changes in hydrology in the habitat.

- Map habitat critical to the survival of the subspecies. If additional populations are located, then habitat critical to their survival will also be determined and mapped.
- Conduct disturbance trials to stimulate germination of bracted grevillea seed in the wild, if required. Any disturbance trials will need to be undertaken in conjunction with weed control.
- Collect seed to ensure that the genetic diversity of the subspecies is captured. Cuttings will also be collected to establish a living collection.
- Propagate plants in readiness for translocation to suitable secure habitat, and undertake translocation in accordance with the national translocation protocols of Vallee et al., (2004). Monitor the translocation, especially during the establishment phase.
- Determine which weeds are present and map their distribution.

References cited in the advice

Department of Environment and Conservation (2013) *Grevillea bracteosa* subsp. *howatharra* Interim Recovery Plan 2013–2017. Interim Recovery Plan No.335. Department of Environment and Conservation, Western Australia.

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

Other sources cited in the advice

Alanna Chant pers. comm. (2015). Conservation Officer (Flora) Geraldton District. Western Australian Department of Parks and Wildlife.

Western Australian Herbarium (1998). *FloraBase − The Western Australian Flora*. Department of Environment and Conservation. Viewed: 22 June 2016 Available on the Internet at: http://florabase.dec.wa.gov.au/.

Collective list of questions – your views

Change in status/rate of change

1. Is the information used to identify the nationally threatened status of the subspecies robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.

2. Does the current and predicted rate of decline seem reasonable? Do you consider that the way this has been derived is appropriate? If not, please provide justification of your response.

General

3. Can you provide additional data or information relevant to this assessment?

4. Have you been involved in developing this nomination? If so, in what capacity?

Threats

5. Do you agree that the threats listed are correct and that their combined effect on the species is significant?

6. To what degree are the identified threats likely to impact on the subspecies in the future?

7. What threats are impacting on different populations, how variable are the threats and what is the relative importance of the different populations?

8. Can you provide additional or alternative information on past, current or potential threats that may adversely affect this subspecies at any stage of its life cycle?

9. Can you provide supporting data/justification or other information for your responses to these questions about threats?

Management

10. What planning, management and recovery actions are currently in place supporting protection and recovery of the subspecies? To what extent have they been effective?

11. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the subspecies?

12. Would you recommend translocation as a viable option as a conservation actions for this subspecies?

13. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species?

14. What level of awareness is there with individuals or organisations around the issues affecting the species?

Biological information

15. Can you provide any additional or alternative references, information or estimates on longevity, average life span and generation length?

Population size

16. Has the survey effort for this subspecies been adequate to determine its national adult population size? If not, please provide justification for your response.

17. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Did the estimates measure relative or absolute abundance? Do you accept the estimate of the total population size of the species? If not, please provide justification for your response.

18. Can you provide an estimate of the current population size of mature adults of this subspecies (national extent)? Please provide supporting justification or other information.

    If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of:
☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000
Level of your confidence in this estimate: ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on ☐ 31–50% - more than a guess, some level of supporting evidence ☐ 51–95% - reasonably certain, information suggests this range ☐ 95–100% - high level of certainty, information indicates quantity within this range ☐ 99–100% - very high level of certainty, data are accurate within this range

Evidence of total population size change

19. Are you able to provide an estimate of the total population size during the early 1990s *(at or soon after the start of three generation period)*? Please provide justification for your response.

    If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible subspecies numbers, and also choose the level of confidence you have in this estimate.

Number of mature individuals is estimated to be in the range of:
☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000
Level of your confidence in this estimate: ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on ☐ 31–50% - more than a guess, some level of supporting evidence ☐ 51–95% - reasonably certain, information suggests this range

☐ 95–100% - high level of certainty, information indicates quantity within this range

☐ 99–100% - very high level of certainty, data are accurate within this range

20. Are you able to comment on the extent of decline in the subspecies' total population size over the last approximately 10 years (i.e. three generations)? Please provide justification for your response.

    If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline estimated to be in the range of:				
☐ 1–30%	☐31–50%	☐51–80%	☐81–100%	☐90–100%

Level of your confidence in this estimated decline:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, suggests this range of decline

☐ 95–100% - high level of certainty, information indicates a decline within this range

☐ 99–100% - very high level of certainty, data are accurate within this range

21. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

Current Distribution/range/extent of occurrence, area of occupancy

22. Does the information consider the entire geographic extent and national extent of the subspecies? If not, please provide justification for your response.

23. Has the survey effort for this subspecies been adequate to determine its national distribution? If not, please provide justification for your response.

24. Is the distribution as described valid? If not, please provide justification for your response and provide alternate information.

25. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.

26. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy.

    If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Current extent of occurrence is estimated to be in the range of:

☐ <100 km^2 ☐ 100 – 5 000 km^2 ☐ 5 001 – 20 000 km^2 ☐ >20 000 km^2

Level of your confidence in this estimated extent of occurrence

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Current area of occupancy is estimated to be in the range of:

☐ <10 km^2 ☐ 11 – 500 km^2 ☐ 501 – 2000 km^2 ☐ >2000 km^2

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

Past Distribution/range/extent of occurrence, area of occupancy

27. Do you consider that the way historical distributional information has been estimated is appropriate? Please provide justification for your response.

28. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy.

    If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

Past extent of occurrence is estimated to be in the range of:
☐ <100 km^2 ☐ 100 – 5 000 km^2 ☐ 5 001 – 20 000 km^2 ☐ >20 000 km^2
Level of your confidence in this estimated extent of occurrence
☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
☐ 31–50% - more than a guess, some level of supporting evidence
☐ 51–95% - reasonably certain, data suggests this range of decline
☐ 95–100% - high level of certainty, data indicates a decline within this range
☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

Past area of occupancy is estimated to be in the range of:
☐ <10 km^2 ☐ 11 – 500 km^2 ☐ 501 – 2000 km^2 ☐ >2000 km^2
Level of your confidence in this estimated extent of occurrence:
☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
☐ 31–50% - more than a guess, some level of supporting evidence
☐ 51–95% - reasonably certain, data suggests this range of decline
☐ 95–100% -high level of certainty, data indicates a decline within this range
☐ 99–100% - very high level of certainty, data is accurate within this range

[i] DRF markers are used in Western Australia and are two standardised yellow markers at either end of a site, which are bent to face towards each other, indicating that DRF plants may occur anywhere between the markers, from the road's running surface to the fence. They alert people working in the vicinity to the presence of DRF, and the need to avoid work that may damage vegetation in the area (DEC 2013)