

INTERIM RECOVERY PLAN NO. 282

**MASON'S DARWINIA**

*(Darwinia masonii)*

**INTERIM RECOVERY PLAN**

**2008 - 2012**



26 August 2008

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## FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statement numbers 44 and 50 (CALM, 1992 and 1994 respectively) and the draft Policy Statement No. 9 (CALM, 1999). Note that CALM formally became the Department of Conservation and Environment (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

Interim Recovery Plans (IRP's) outline the 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 (RP) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan (IRP) will operate from August 2008 to August 2012 but will remain in force until withdrawn or replaced. It is intended that this IRP will be reviewed after 4 years and the need for a full Recovery Plan assessed at that time.

An IRP for *Darwinia masonii* is required by the Minister for the Environment (State) and the Minister for the Environment and Heritage (Commonwealth) under environmental approvals granted to Mount Gibson Mining Limited (MGM) and Extension Hill Pty Ltd (EHPL) in 2007 and 2008 for iron ore mining at Extension Hill and Extension Hill North, in the Mt Gibson Ranges, approximately 350km north east of Perth. The plan will be implemented by MGM and EHPL (the "project proponents") in close consultation with DEC and the Botanic Gardens and Parks Authority (BGPA).

This Plan has been prepared in accordance with Condition 6.2 of Ministerial Statement 753 (24<sup>th</sup> October, 2007). The Plan includes a timetable and actions to:

- 1) locate and report any additional populations of the species;
- 2) enhance the survival of existing populations of the species; and
- 3) expand the existing populations or establish new populations.

This Interim RP was approved by the Director of Nature Conservation on 3 September, 2008.

Information in this IRP was accurate at August 2008.

## ACKNOWLEDGMENTS

This IRP was prepared by Ms Martine Scheltema and Ms Cassyanna Gray of Coffey Environments.

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

Dr Mathew Barrett	Botanic Gardens and Parks Authority
Shaun Grein	Coffey Environments

## CITATION

This IRP should be cited as:

Department of Environment and Conservation (2008) Mason's Darwinia (*Darwinia masonii*) Interim Recovery Plan 2008-2012. Interim Recovery Plan No. 282. Department of Environment and Conservation, Western Australia.

**SUMMARY**

<b>Scientific Name:</b>	<i>Darwinia masonii</i>	<b>Common Name:</b>	Mason's Darwinia
<b>Family:</b>	Myrtaceae	<b>Flowering Period:</b>	April to November
<b>DEC Region:</b>	Midwest	<b>DEC District:</b>	Geraldton
<b>Shire:</b>	Yalgoo	<b>Recovery Team:</b>	Geraldton District Threatened Flora Recovery Team

**Illustrations and/or further information:** Brown, A., Thomson-Dans, C. and Marchant, N. (eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.

**Current status:** *Darwinia masonii* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* on 14<sup>th</sup> November 1980 and was ranked as Vulnerable under World Conservation Union (IUCN 2001) Red List criterion VU D2 as it is known from one location (9 populations, one genetic population) The species was listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in July 2000.

**Distribution:** *D. masonii* appears to be generally restricted to the upper slopes and ridges over the 6km length of the Mt Gibson Ranges although recently it has been found on a granitic breakaway to the East of Extension Hill and at the base of a valley on granitic substrate, in the mid-west region of Western Australia. Areas with similar geology (banded ironstone formation or chert) and vegetation to that at the Mt Gibson Ranges was surveyed by Paul Armstrong & Associates (2004), ATA Environmental (2004), and more recently BGPA (2008). An additional population on granite was discovered in June 2008 by project personnel, with the taxonomy confirmed by the Botanic Gardens and Parks Authority (BGPA) on a second field visit, however the population is still to be quantified in respect to the extent of the population.

**History:** A definitive census was undertaken in 2004 (ATA Environmental, 2004) to determine the population size, distribution and age spectrum of *D. masonii* in the Mt Gibson Ranges. Nine discrete populations of *D. masonii* were recorded from the Mt Gibson Ranges (based on the DEC 500m separation distance), with a total population of 14,315 adult plants and 1,711 seedlings (ATA Environmental, 2004), see Figure 2. Genetic investigations by BGPA using standard population genetic statistics suggest that the whole Mt Gibson Ranges area can be treated as a single provenance unit for *D. masonii* (BGPA, 2005a).

A preliminary study was undertaken by BGPA between August 2004 and January 2005 to provide benchmark indicators of the research needed to develop an effective integrated conservation and recovery plan for *D. masonii* (BGPA, 2004). The preliminary study found genetic diversity of the species was generally low, with nearly all (94% of the variation occurring within rather than between populations. No significant population structuring could be detected between populations (BGPA, 2004). Since completion of the preliminary study, DNA sequencing research has shown that *D. masonii* belongs to a complex of four species; the other three being *D. acerosa*, *D. purpurea* and *D. sp. Chiddarcooping*.

A preliminary translocation trial of *D. masonii* plants grown from cuttings and planted out (with watering) in the Mt Gibson Ranges (Iron Hill East, see Figure 1) in June 2005 has 89% survival, with 50% reaching sexual maturity 18 months after planting, provided plants are watered through summer. Growth rates for these plants were much faster than observed in existing stands, and faster than un-watered plants, suggesting that growth rates of *D. masonii* are water rather than nutrient limited. *D. masonii* may be accessing water pooling in the fine cracks between the BIF substrate, although this is yet to be substantiated through research work. Translocated plants that were not watered showed only 20% survival (in a very dry season) and a greatly reduced growth rate more consistent with wild plants.

MGM and EHPL have already commenced a 3 plus year research program using researchers at BGPA to conduct studies on *D. masonii* to facilitate the continued *in-situ* survival and improvement in the conservation status of the species over time. This will ultimately assist in the development of integrated recovery plan. The research and development plan addresses Condition 6.1 of Ministerial Statement 753. The research plan

includes conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions, plant health assessment, restoration, plant translocation and *ex-situ* conservation work (BGPA, 2008). The Research Plan itself commenced in February 2007.

MGM and EHPL have Ministerial approval to take approximately 2100 adult plants or 14% of the population during mining that is inclusive of all plants within the approved footprint (Ministerial Statement 753).



Figure1: *D. masonii* growing at Iron Hill East, south of the main project area at Extension Hill (photograph taken in June 2008).

**Description:** *D. masonii* is an erect shrub 1.5 to 3m tall, with narrow leaves approximately 1cm long, which are almost triangular in cross-section. These leaves are closely crowded towards the ends of the branchlets. The flowering inflorescences are approximately 3cm in diameter and are surrounded by numerous spreading pinkish bracts that are pendulous on the ends of small branchlets. The bracts are broad at the base but narrow to a pointed apex with a distinct midrib. Each bract is approximately 2cm in length and 5mm wide at the base. Each tubular flower is about 5mm long with a style approximately 1.5cm in length with hairs below the stigma (Brown *et al.*, 1998).

**Habitat Requirements:** *D. masonii* is restricted to Western Australia where it occurs in the Mt Gibson Ranges located approximately 80km northeast of Wubin and 350 km north east of Perth. It is generally restricted to the upper slopes (350m+ ADH), crests and ridges of the eleven major hills that comprise the 6 km range although it has been found on granitic substrate in a valley and breakaway system to the east of Extension Hill. In the majority of locations in which *D. masonii* was recorded, soil was extremely skeletal and limited to shallow pockets between exposed ironstone and Banded Ironstone Formations (BIF) or granite.

**Habitat critical to the survival of the species, and important populations:** It is considered that all known habitat supporting the existing populations and any successfully transplanted populations, is habitat potentially critical to its survival. Further research is required to determine the substrates, hydrology and spatial location within the landscape, including that in relation to other flora species, to better understand those elements that define critical habitat for the survival of *D. masonii*. Hence, all current populations are important populations until the species' distribution factors are better understood. Determination of other areas that may provide supportive habitat that could be critical to the long term health and survival of *D. masonii* will be investigated for possible translocation studies. The translocation trials will assist in determining whether areas of similar habitat elements may allow the natural spread of the species and act as a supportive habitat. DEC's Policy

Statement 29 (CALM, 1995) will be consulted in regards to translocation of threatened flora. There is strong evidence to suggest that *D. masonii* recruits well post disturbance as evidenced by strong recruitment in previously cleared exploration tracks and drill pads (documented in monitoring work).



Figure 2: 2a to 2c *D. masonii* flowering inflorescences depicting shape and size (June 2008).

**Benefits to other Species/Ecological Communities:** Recovery actions implemented to preserve the quality and security of the habitat of *D. masonii* will also preserve vegetation that similarly supports the Declared Rare Flora (DRF) taxon *Lepidosperma gibsonii* and priority flora *Chamelaucium* sp. Yalgoo (Priority 1), *Acacia cerastes* (Priority 1), *Personia pentasticha* (Priority 2) and *Podotheca uniseta* (Priority 3) (see Figure 3).

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

**Indigenous Consultation:** There are two Native Title claims over the Mt Gibson area (the Badimia People WC96/98, registered; and the Widi Mob WC97/72, not registered) that include the habitat, and potential habitat, of *D. masonii*. In agreements with MGM and EHPL, the claimant groups have recorded a general interest in the environment of the area. There are registered ethnographic and / or archaeological sites within the habitat of *D. masonii* which are of cultural significance to both groups.

**Affected Interests:** The known populations of *D. masonii* occur across a variety of land tenures including pastoral leases, Crown reserve (Reserve 17367), unallocated Crown land, mining leases and native title areas. Affected parties include MGM Limited, EHPL, Pindiddy Aboriginal Corporation (Ninghan Station), Australian Wildlife Conservancy (Mt Gibson Station), the Badimia People and the Widi Mob.

**Social and Economic Impacts:** The implementation of this Recovery Plan will result in some economic impact through both EHPL and MGM funding the development and implementation of this plan and because sections of the overall population that are protected in accordance with statutory environmental approvals have resulted in restricted access to underlying iron ore deposits. Mineral leases are held over the area containing the entire population of *D. masonii*.

**Evaluation of Plan's Performance:** The Department of Environment and Conservation (DEC), MGM, EHPL, and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA), in conjunction with BGPA, will evaluate the performance of this Interim Recovery Plan. 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. Management of the non-mining areas that include *D. masonii* populations by MGM and EHPL in consultation with DEC, DEWHA and BGPA are consistent with environmental legislation.
2. A comprehensive, reproducible population census was completed by ATA Environmental in 2004. Additional population surveys were conducted in 2008.
3. A Department of Environment and Conservation (DEC) Conservation Officer from the Midwest Region has monitored population health annually since 2000. Monitoring was also undertaken prior to 2000 by the Geraldton District Threatened Flora Recovery Team.
4. Studies into the genetic structure of *D. masonii*, were completed by BGPA in February 2005 as part of a preliminary study on *D. masonii*.
5. A three year (minimum) research programme by BGPA on *D. masonii* to facilitate the continued in-situ survival and improvement in the conservation status of *D. masonii* over time, which assists in the development of a recovery plan. The research and development plan commenced in February 2007 and addresses Condition 6.1 of Ministerial Statement 753. The research plan includes conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions and plant health, restoration and translocation and ex situ conservation (BGPA, 2008).
6. A preliminary translocation trial of *D. masonii* plants grown from cuttings at Mt Gibson has 89% survival rate, with 50% of plants reaching reproductive maturity, 18 months after planting, providing plants are watered during summer.
7. An Environmental Management Plan has been prepared by MGM and EHPL in accordance with the Conditions of Ministerial Statement 753. The Environmental Management Plan provides measures to limit the risk of secondary mining impacts on the species (i.e. inadvertent disturbance, excessive dust deposition, fire impact and weed invasion), and also provides for monitoring to track plant condition.

**Interim Recovery Plan Objectives:** The objective of this Interim Recovery Plan as outlined in Condition 6.2 of Ministerial Statement 753 is to maintain or improve the conservation status of *D. masonii* during the preparation of the Recovery Plan.

#### **Recovery Criteria:**

**Criteria for success:** The number of *in-situ* individuals in areas of current occupancy outside of direct mining operations to remain stable (i.e. equal to the adult 2004 census result) or increase over the term of the Interim Recovery Plan.

**Criteria for failure:** The number of *in-situ* adult individuals in areas of current occupancy outside of direct mining operations has decreased by more than 10% and/or the number of individuals within a population and/or the number of populations decreasing by 20% or more over the term of the Interim Recovery Plan.

Note that in the event of a significant fire event, it is expected that population numbers will initially decrease. However, it is anticipated that the population will then increase to a number greater than the pre fire population due to abundance of seedlings, but will eventually resume similar status to the pre-fire population. The timeframe will be taken into account when conducting a post fire population census to avoid over- or under-estimating the recovery success or failure.

### Recovery actions

1. Coordinate recovery actions and liaise with stakeholders.
2. Continue the implementation of the *D. masonii* Research Programme (including conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions and plant health, restoration and translocation and *ex situ* conservation).
3. Establish and implement the *D. masonii* condition monitoring programme.
4. Implement fire management strategy.
5. Manage secondary impacts of mining on *D. masonii*.
6. Manage inappropriate grazing pressure on *D. masonii*.
7. Undertake translocation trials as part of the *D. masonii* Research Programme.
8. Maintain adequate seed/germplasm and cutting collections to ensure material with a broad genetic base is available for on-going *ex situ* conservation.
9. Conduct further surveys and report any additional populations of *D. masonii*.
10. Promote awareness of *D. masonii* and Recovery Plan initiatives.
11. Review ranking of the species and prepare a full Recovery Plan if the review of the Interim Recovery Plan indicates this is necessary.

## 1. BACKGROUND

### History

Charles Gardner described Mason's Darwinia in 1964 from specimens collected by D Mason of Whitewells Station in about 1960. The species was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* on 14<sup>th</sup> November 1980 and was ranked as Vulnerable under World Conservation Union (IUCN 2001) Red List criterion VU D2 as it is known from one location (9 populations, one genetic population). The species was listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in July 2000.

Previous surveys of the populations of *D. masonii* within the Mt Gibson Range were undertaken by Muir Environmental (1995), Bennett Consulting (2000) and Paul Armstrong & Associates (2004). Bennett Environmental Consulting (2000) reported on nine populations. Muir Environmental (2005) recorded ten populations, while Paul Armstrong and Associates (2004) recorded seven populations.

The most recent and comprehensive survey of the populations was undertaken by ATA Environmental (2004). Discrete populations were defined using the DEC definition to delineate populations (i.e. 500m separation between populations). Using this criteria a total of nine discrete populations were recorded from the Mt Gibson study area during the ATA Environmental June and July 2004 field survey (Figure 1).

An old record indicated that *D. masonii* occurred on Mt Singleton, however this area has been extensively searched with no occurrences of this particular *Darwinia* recorded.

A preliminary study of *D. masonii* was undertaken by BGPA between August 2004 and January 2005 to provide benchmark indicators of the research needed to develop an effective integrated conservation and recovery plan for *D. masonii* (BGPA, 2004). The preliminary study found genetic diversity of the species was generally low, with nearly all (94% of the variation occurring within rather than between populations. No significant population structuring could be detected between populations (BGPA, 2004). Since completion of the preliminary study, DNA sequencing research has shown that *D. masonii* belongs to a complex of four species; the other three being *D. acerosa*, *D. purpurea* and *D. sp.* Chiddarcooping.

MGM and EHPL have already commenced a 3 plus year research plan being undertaken by BGPA on *D. masonii* to facilitate the continued in-situ survival and improvement in the conservation status of *D. masonii* over time, which assists in the development of a recovery plan. The research and development plan addresses Condition 6.1 of Ministerial Statement 753. The research plan includes conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions and plant health, restoration and translocation and ex situ conservation (BGPA, 2008). The research plan commenced in 2007.

MGM and EHPL have Ministerial approval to take approximately 2100 adult plants or 14% of the total number of plants recorded during the ATA Environmental (2004) survey of the Mt Gibson Ranges which is inclusive of all plants within the approved footprint (Ministerial Statement 753).

### Description

*D. masonii* is an erect shrub 1.5 to 3m tall, with narrow leaves approximately 1cm long, which are almost triangular in cross-section. These leaves are closely crowded towards the ends of the branchlets. The flowering inflorescences are approximately 3cm in diameter and are surrounded by numerous spreading pinkish bracts that are pendulous on the ends of small branchlets. The bracts are broad at the base but narrow to a pointed apex with a distinct midrib. Each bract is approximately 2cm in length and 5mm wide at the base. Each tubular flower is about 5mm long with a style approximately 1.5cm in length with hairs below the stigma (Brown *et al.*, 1998).

*D. masonii* has a known flowering period from April to November (Brown *et al.*, 1998). As the rainfall in the region is unreliable, *D. masonii* is likely to respond opportunistically to rainfall events (i.e. tropical cyclonic summer rainfall events and southern winter cold fronts). Strong vegetative growth (but not reproductive stages) has been observed following summer rainfall events.



## Distribution and habitat

*D. masonii* is generally found within the Banded Ironstone Formations of the Mt Gibson Ranges, 350km north-east of Perth, however, it has also been found granitic substrates within the general catchment area of the ranges. *D. masonii* is predominantly restricted in its distribution to the upper slopes, crests and ridges of the eleven major hills that comprised the 6km range but has been found on lower slopes and a granite breakaway area recently as June 2008 (east of Extension Hill). Details of this latter population are still being investigated. Research (Muir, 1995, Bennett, 2000, Armstrong and Associates, 2004 and ATA Environmental, 2005) suggests that the species is restricted in distribution to the Mt Gibson Ranges. There is anecdotal evidence (Muir, 1995) that *D. masonii* may have been previously recorded from Mt Singleton, although no voucher specimens have been found to date at the Western Australian Herbarium and brief examinations of the site by Muir (1995), Paul Armstrong and Associates (2004) and ATA Environmental (2004) did not identify the species from this location.

A definitive census was undertaken in 2004 (ATA Environmental, 2004) to determine the population size, distribution and age spectrum of *D. masonii* in the Mt Gibson Ranges. Nine discrete populations (based on DEC separation distance of 500m) of *D. masonii* were recorded from the Mt Gibson Ranges, with a total population of 14,315 adult plants and 1,711 seedlings (Figure 1) (ATA Environmental, 2004). Genetic investigations by the BGPA using standard population genetic statistics have indicated that the whole Mt Gibson area can be treated as a single provenance unit for *D. masonii* (Botanic Gardens & Parks Authority, 2005a).

## Summary of population information

Pop. No. & Name /Location	Year	No. Mature plants	No. Seedlings	Tenure
1. Extension Hill North	2004	545	12	Pastoral and mining leases
2. Extension Hill	2004	1,924	12	Pastoral and mining leases, unallocated Crown land
3. Extension Hill South	2004	1,874	26	Unallocated Crown land, mining lease
4. Iron Hill North	2004	586	33	Crown reserve, mining lease
5. Iron Hill	2004	370	597	Unallocated Crown land, Crown reserve, mining lease
6. Iron Hill South	2004	1,601	970	Crown reserve, mining lease
7. Iron Hill East	2004	70	11	Crown reserve, mining lease
8. Mt Gibson	2004	7,021	61	Unallocated Crown land, Crown reserve, mining lease
9. Mt Gibson South	2004	324	1	Crown reserve, mining lease
<b>Total Mt Gibson Ranges</b>	<b>2004</b>	<b>14,315</b>	<b>1,723</b>	

The habitat where *D. masonii* grows was described by Brown *et al.* (1998) as tall shrublands on yellow-brown clay loams on the Banded Ironstone Formations or granite breakaway. The definitive ATA Environmental (2004) targeted survey recorded *D. masonii* from eight vegetation communities. These were previously identified and mapped by Bennett Environmental Consulting (2000) and included one mallee, six thicket and one heath community:

- T1 Dense Thicket of mixed species dominated by *Acacia* species, *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Calycopeplus paucifolius* and *Melaleuca nematophylla* over Low Shrubland in jaspilite rocks and pockets of loam.
- T2 Dense Thicket dominated by *Acacia assimilis*, *A. stereophylla* var. *stereophylla*, *A. ramulosa* and *Allocasuarina acutivalvis* subsp. *prinsepiana* over Low Shrubland of *Acacia acuaria*, *Hemigenia* sp. Paynes Find and *Baeckea* aff. *cryptandroides* in loam with scattered rocks on the surface.

- T3 Dense Thicket dominated by *Acacia assimilis*, *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Melaleuca nematophylla* over Low Shrubland of *Hemigenia* sp. Paynes Find and *Hibbertia crassifolia* in loam pockets in jaspilite rocks.
- T4 Dense Thicket of *Allocasuarina acutivalvis* subsp. *prinsepiana* with occasional *Eucalyptus oldfieldii* over an Open Scrub of *Acacia* species over Open Shrubland of *Hemigenia* sp. Paynes Find or Open Herbs of *Xanthosia bungei*.
- T5 Thicket of *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Grevillea obliquistigma* with emergent *Callitris glaucophylla* over Low Shrubland dominated by *D. masonii*, *Hibbertia crassifolia*, *Melaleuca radula*, and *Philotheca brucei* over Herbs of *Xanthosia brucei* in loam pockets in dense jaspilite rocks.
- T6 Thicket of *Acacia acuaria* and *Acacia stowardii* over Low Shrubland of mixed species with large numbers of *D. masonii* in loam with abundant rocks on the surface.
- M4 Very Low Open Shrub Mallee of *Eucalyptus leptopoda* with emergent *Eucalyptus loxophleba* subsp. *supralaevis* over Thicket of *Acacia ramulosa* over herbland of Asteraceae in loam.
- HS1 Low Heath of *Ptilotus obovatus* with emergent shrubs of *Acacia stowardii* and *Calycopeplus paucifolius* over Herbs in loamy clay large amongst large boulders.

### Biology and Ecology

*D. masonii* is one of 57 Western Australian species of *Darwinia*. The genus is highly unusual in having a high proportion of species that are considered rare and endangered as a result of intrinsic rarity – i.e. a species naturally limited as a result of limiting natural factors such as edaphic preference or breeding biology constraints. *D. masonii* represents a highly specialized case of a nationally significant, intrinsically rare species.

Investigations into pollination biology have been carried out by BGPA using cultivated plants to ensure accurate assessment of pollination success. Preliminary results suggest that there is little barrier to self pollination at least as far as fertilisation, and that self pollen grains typically germinate readily on the stigma and penetrate the full length of the style (BGPA, 2005b). Based on field observations and the fact that many bird species are attracted to colourful inflorescences with potential sources of nectar, *D. masonii* is also most likely to be pollinated by birds.

A comprehensive phylogeny of the related genera *Chamelaucium*, *Darwinia*, *Verticordia*, *Actinodium*, *Homoranthus* and *Pileanthus* has been completed to more accurately assess the taxonomic status and phylogenetic position of *Darwinia* (in particular *D. masonii*). This complex of genera has been difficult taxonomically, and relationships between species, groups and genera were particularly poorly understood.

Key results of these investigations are:

- Generic status of *Chamelaucium*, and *Pileanthus* is confirmed (ie. they are monophyletic).
- Eastern and Western Australia *Darwinia* species belong in separate groups, the latter including *Actinodium*
- The genera *Chamelaucium*, *Pileanthus*, *Darwinia*, *Homoranthus* and *Actinodium* are nested within *Verticordia* as currently circumscribed.
- *D. masonii* has been shown to be very closely related to three other species, *D. acerosa*, *D. purpurea* and *D. species* Chiddarcooping, rather than close to either *D. leiostyla* or *D. helichrysoides* as has been previously speculated. All four species have similar geographic distribution north and east of Perth, mostly in the drier Wheatbelt. Exact relationships between these four species is as yet unresolved.

These findings provide insight into the origins of *D. masonii* and allow selection of appropriate comparison species during further research, in particular comparing levels of genetic variation, root growth patterns and seed biology. As a side benefit, relationships between genera and some within-generic groups can now be accurately assessed (BGPA, 2005b).

Contrary to comments by Brown *et al.* (1998) that *D. masonii* will re-sprout from rootstock following fire, there is no current evidence of this from the Mt Gibson Ranges (Armstrong and Associates, 2004). In fact the species appears to be fire sensitive. A wildfire burnt out a significant area in southern and eastern portions of the Ranges in January 2003. None of the *D. masonii* plants burnt during this fire were observed to have survived during the spring of 2003 by Armstrong and Associates (2004). Regeneration is restricted exclusively to seed.

A preliminary planting trial of *D. masonii* in the Mt Gibson Ranges was undertaken by BGPA using a disused drill pad on Iron Hill East that had not been rehabilitated and was outside the proposed mining footprint. Two hundred and twenty nine young plants from a cross-section of genotypes were propagated at Kings Park by BGPA personnel from cuttings and planted at the trial site in June 2005. A fence was erected around the plants (except for 20 controls to examine the effect of excluding herbivores and regular watering). A tank was installed at the site to allow drip irrigation of the plants during dry periods (see Figure 1). Until December 2005 only four plants died, despite the highly rocky and inhospitable nature of the transplant site and very dry mid-winter period following planting (BGPA, 2005b). The survival rate as at February 2007 was 89% within the enclosure. Growth rates for these plants were much faster than observed in existing stands, and faster than non watered plants, suggesting that growth of *D. masonii* is substantially water dependant, and that *D. masonii* may be accessing pooled water in the fine cracks between the BIF substrate. Translocated plants that were not watered showed only 20% survival (in a very dry season) and a greatly reduced growth rate consistent with wild plants. The preliminary trial was undertaken for research purposes to gain information on plant survival, breeding biology and phenology. The survival and future management of any plants remaining at the conclusion of the preliminary trial will be determined by BGPA in association with DEC.

## Threats

*D. masonii* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* on 14<sup>th</sup> November 1980 and was ranked as Vulnerable (V) under World Conservation Union (IUCN 2001) Red List criterion VU D2 as it is known from just one location (nine populations, one genetic population). The species was listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in July 2000.

The main threat to *D. masonii* is direct removal, loss of habitat by mining and fire with possible secondary threats associated with nearby mining operations, grazing by herbivores and other natural environmental factors.

Threats include:

- **Mining (direct removal):** *D. masonii* occupies outcropping ironstone formations that are highly prospective for iron ore. Environmental approval has been provided for the removal of all plants of the pre-disturbance population within the Ministerial approved mine footprint (approximately 2100 adult plants, roughly 14% of the total population) (Ministerial Statement 753).
- **Mining (secondary threats):** Nearby mining also presents possible secondary threats through dust, inadvertent disturbance such as cracking of rock faces, negative effects on pollinator activity arising from habitat disturbance and removal of food plants within the mine footprint, and other effects on reproductive biology that may lead to a decline in recruitment rate. It is possible that populations at Extension Hill South, and Iron Hill North may be at some risk from secondary effects of mining.
- **Limited Habitat:** *D. masonii* is generally restricted to the upper slopes crests and ridges of the eleven major hills that comprise the 6km long Mt Gibson Ranges.
- **Weed Invasion:** No significant weed invasion has been observed to date. Weed invasion is a potential threat to *D. masonii*.
- **Grazing:** Only very minor grazing pressure from feral goats and rabbits of *D. masonii* has been observed to date. Domestic stock generally do not occur in the area being kept well within adjacent pastoral properties.

- **Fire:** Frequent fires represent the greatest threat to the long term survival of the species as it has the potential to result in the local extinction of the species which in turn may lead to a reduction in species viability and loss of genetic diversity.

A summary of the threats faced by each population is provided below.

#### Summary of population information and threats

Pop. No.	& Name /Location	Year	No. Mature plants	No. Seedlings	Condition	Threats
1.	Extension Hill North	2004	545	12	Moderate	Ministerial approval to take this population
2.	Extension Hill	2004	1,924	12	Healthy	Ministerial approval to take part of this population. Remaining population threatened by proximity to mining, fire and other environmental factors.
3.	Extension Hill South	2004	1,874	26	Moderate	Population threatened by proximity to mining, secondary effects of mining, fire and other environmental factors.
4.	Iron Hill North	2004	586	33	Moderate	Population threatened by proximity to mining, secondary effects mining, fire and other environmental factors.
5.	Iron Hill	2004	370	597	Healthy	Population threatened by proximity to mining, fire and other environmental factors.
6.	Iron Hill South	2004	1,601	970	Healthy	Population threatened by secondary effects of mining, fire and other environmental factors.
7.	Iron Hill East	2004	70	11	Moderate	Population threatened by secondary effects of mining, fire and other environmental factors.
8.	Mt Gibson	2004	7,021	61	Healthy	Population threatened by secondary effects of mining, fire and other environmental factors.
9.	Mt Gibson South	2004	324	1	Healthy	Population threatened by secondary effects of mining, fire and other environmental factors.
	<b>Total Mt Gibson Ranges</b>	<b>2004</b>	<b>14,315</b>	<b>1,723</b>		

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

Given that this taxon is listed as Vulnerable under the World Conservation Union (IUCN 2001) Red List it is considered that all known habitat supporting the existing population, and any successfully rehabilitated populations, is habitat critical to its survival and that all populations are important populations. Further research is required to determine the substrates, hydrology and spatial location within the landscape, including that in relation to other flora species, to better understand those elements that define critical habitat for the survival of *D. masonii*. Determination of other areas that may provide supportive habitat that could be critical to the long term health and survival of *D. masonii* will be investigated for possible translocation studies. Translocation trials will assist in determining whether areas of similar habitat elements may allow the natural spread of the species and act as a supportive habitat. DEC's Policy Statement 29 (CALM, 1995) will be consulted in regards to translocation of threatened flora.

### **Benefits to other species/ecological communities**

Recovery actions implemented to preserve the quality and security of the habitat of *D. masonii* will also preserve remnant vegetation in which it is located and supports the Declared Rare Flora (DRF) taxon *Lepidosperma gibsonii* and priority flora *Chamelaucium* sp. Yalgoo (P1), *Acacia cerastes* (P1), *Persoonia pentasticha* (P2) and *Podotheca uniseta* (P3) (Figure 3).

### **International obligations**

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

### **Indigenous consultation**

There are two Native Title claims over the Mt Gibson area (the Badimia People WC96/98, registered; and the Widi Mob WC97/72, not registered) that include the habitat, and potential habitat, of *D. masonii*. In agreements with MGM and EHPL, the claimant groups have recorded a general interest in the environment of the area. There are registered ethnographic and / or archaeological sites within the habitat of *D. masonii* which are of cultural significance to both groups.

### **Affected Interests**

The known populations of *D. masonii* occur across a variety of land tenures including pastoral leases, Crown Reserve (Reserve 17367), unallocated Crown land, mining leases and native title areas. Affected parties include MGM, EHPL, Pindiddy Aboriginal Corporation (Ninghan Station), Australian Wildlife Conservancy (Mt Gibson Station), the Badimia People and the Widi Mob.

### **Social and economic impacts**

The implementation of this IRP will have some economic impact through MGM and EHPL funding the development and implementation of this plan and because sections of the population that are protected in accordance with statutory environmental approvals have resulted in restricted access to underlying iron ore deposits. Mineral leases are held over the area containing the entire population of *D. masonii*.

### **Guide for decision-makers**

Section 1 provides details of current and possible future threats. Any further development in the vicinity of existing or potential habitat requires further assessment. No development should be approved unless the proponents can demonstrate that it will not have a long-term deleterious impact on the species, its habitat or potential natural habitat.

### **Evaluation of the Plan's performance**

The DEC, the Geraldton District Threatened Flora Recovery Team, MGM, EHPL and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA), in conjunction with BGPA, 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.

## 2. RECOVERY OBJECTIVE AND CRITERIA

### Recovery Plan Objective:

The objectives of this IRP as outlined in Condition 6.2 of Ministerial Statement 753 (24<sup>th</sup> October 2007) is to maintain or improve the conservation status of *D. masonii* during the preparation of the Recovery Plan.

**Criteria for success:** The number of *in-situ* individuals in areas of current occupancy outside of direct mining operations to remain stable (equal to the adult 2004 census result) or increase over the term of the IRP.

**Criteria for failure:** The number of *in-situ* adult individuals in areas of current occupancy outside of direct mining operations has decreased by more than 10%, and/or the number of individuals within a population and/or the number of populations decreasing by 20% or more over the term of the IRP.

Note that in the event of a significant fire event, it is expected that population numbers will initially decrease. However, it is anticipated that the population will then increase to a number greater than the pre fire population due to abundance of seedlings, but will eventually resume similar to status to the pre-fire population. The timeframe will be taken into account when conducting a post fire population census to avoid over- or under-estimating the recovery success or failure.

## 3. RECOVERY ACTIONS

### Roles and Responsibilities

#### Department of Environment and Conservation (DEC)

The DEC is responsible for administration and enforcement of the *Wildlife Conservation Act 1950*, the *Conservation and Land Management Act 1984* and the *Environmental Protection Act 1986* and undertakes a range of activities in relation to identifying, conserving and protecting threatened flora and fauna. The DEC is a signatory to this plan and will be partly responsible for implementation of a number of recovery actions as specified in this section, including monitoring of the implementation and performance of the Plan itself.

#### Geraldton District Threatened Flora Recovery Team (GDTFRT)

The role of the GDTFRT, which is a non-statutory association of stakeholders committed to the recovery of threatened species, is to assist in coordinating the recovery of threatened flora in the DEC Geraldton District. The GDTFRT also plays an active role in implementing recovery actions where possible.

#### Department of Environment, Water, Heritage and the Arts (DEWHA)

The DEWHA is responsible for administration and enforcement of the *Environment Protection and Biodiversity Conservation Act 1999*. The DEWHA will liaise with the local DEC in Geraldton and the WA Environmental Protection Authority to assess the suitability of the IRP.

#### MGM and EHPL

The proponents of the Mount Gibson Iron Ore Mine and Infrastructure Project and commitments undertaken by both parties include the responsibility to undertake (or to engage suitably qualified consultants to undertake) the specified recovery actions relevant to the populations on the mining tenements, or those populations impacted by activities associated with the project.

#### Botanic Gardens and Parks Authority (BGPA)

BGPA is contracted to MGM and EHPL to undertake research into the species as per the *Conservation and Restoration Research Proposal for Darwinia masonii and Lepidosperma gibsonii*.

## Existing recovery actions

A comprehensive, reproducible population census of *D. masonii* was undertaken by ATA Environmental in June and July 2004. Mapping of the critical habitat has been completed as required by the *EPBC Act*, 1999.

Management of the non-mining areas that include *D. masonii* populations by MGM and EHPL in consultation with DEC, DEWHA and BGPA are consistent with environmental legislation.

An Environmental Management Plan (EMP) has been developed in accordance with requirements of Ministerial Statement 753 (24<sup>th</sup> October 2007). This plan provides measures to limit the risk of secondary mining impacts on the species (i.e. inadvertent disturbance, excessive dust deposition, fire impact, altered hydrology and weed invasion), and also provides for monitoring to track plant condition.

A DEC Conservation Officer from the Midwest Region has monitored population health annually since 2000. Monitoring was also undertaken prior to 2000 by the Geraldton District Threatened Flora Recovery Team.

A preliminary study of *D. masonii* was undertaken by BGPA between August 2004 and January 2005 to provide benchmark indicators of the research needed to develop an effective integrated conservation and recovery plan for *D. masonii* (BGPA, 2004). The preliminary study found genetic diversity of the species was generally low, with nearly all (94%) of the variation occurring within rather than between populations. No significant population structuring could be detected between populations (BGPA, 2004). Since completion of the preliminary study, DNA sequencing research has shown that *D. masonii* belongs to a complex of four species; the other three being *D. acerosa*, *D. purpurea* and *D. sp.* Chiddarcooping.

EHPL and MGM have commenced the funding a 3 year plus research plan being undertaken by BGPA on *D. masonii* to facilitate the continued *in-situ* survival and improvement in the conservation status of *D. masonii* over time, which has assisted in the development of this recovery plan. The research and development plan addresses Condition 6.1 of Ministerial Statement 753. The research plan includes conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions and plant health, restoration and translocation work together with *ex-situ* conservation (BGPA, 2008).

A preliminary planting trial of *D. masonii* plants grown from cuttings and planted at Iron Hill East currently has 89% survival (50% reaching reproductive maturity) 18 months after planting that included a summer watering regime. Seed collections were carried out in late October 2004 (also in November 2007). Counts of viable seed by cut test revealed 19% viable seed from the 2004 collections. In addition, further analysis of the 2004 seed collection was undertaken to evaluate requirements for breaking dormancy and optimal germination conditions (BGPA, 2005a). It was concluded that *D. masonii* is readily propagated by standard germination techniques.

## Future recovery actions

Many of the actions described below were initiated in 2005, and are ongoing. This section details the planned implementation of these recovery actions, and others, from the commencement of the Recovery Plan in 2008.

### 1. Coordinate recovery actions and liaise with stakeholders

GDTFRT will continue to coordinate the implementation of recovery actions for *D. masonii* and other Declared Rare Flora in their district.

MGM and EHPL will ensure the implementation of research, management and recovery actions for *D. masonii* in consultation with DEC, DEWHA, BPGA, Geraldton District Threatened Flora Recovery Team, relevant land managers and indigenous groups. An annual progress report will be produced by 31 March each year. Liaison with stakeholders is addressed in the EMP and associated procedures within the site based Environmental Management System for the Mt Gibson Iron Ore Mine and Infrastructure Project.

**Action:** Coordinate recovery actions, liaise with stakeholders and provide an annual report  
**Responsibility:** EHPL, MGM, DEC and GDTFRT

**Timing:** ongoing until 2012

## 2. Continue implementation of the *D. masonii* research programme

A comprehensive programme of research into the conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions and plant health, restoration and translocation work and *ex-situ* conservation of *D. masonii* is currently being implemented and is ongoing. The key research fields are described below. The initial research programme will extend to December 2010, at which time the direction of future research will be reviewed. The nature of some of the research is longer term (5 years minimum).

Research includes conservation genetics, population ecology and viability, propagation studies, *ex-situ* storage of germplasm and restoration. These actions are outlined below:

### 2a. Conservation Genetics

**Actions:** Assessment of genetic variation has been completed. Further work will focus on three areas to benchmark the genetic study relative to other species of *Darwinia*.

- Genetic survey of remaining populations.
- Comparative (preliminary) survey of *Darwinia* species to evaluate Amplified Fragment Length Polymorphism (AFLP) variation in closely related species as a means of benchmarking genetic outcomes with other rare *Darwinia* species.
- DNA sequencing of other *Darwinia* species to determine species relationships and place *D. masonii* in phylogenetic perspective.

**Responsibility:** MGM, EHPL and BGPA

**Timing:** 2007 – 2010 (initially)

### 2b. Population Demography

**Action:** Investigate fire, demography, tools for monitoring plant demographic changes.

**Responsibility:** EHPL, MGM and BGPA

**Timing:** 2007 – 2010 (initially)

### 2c. Breeding Biology

**Action:** Investigate seed research, seed production, soil seed bank, phenology, genetic analysis of breeding systems and dispersal.

**Responsibility:** EHPL, MGM and BGPA

**Timing:** 2007 – 2010 (initially)

### 2d. Population Viability Analysis

**Action:** Undertake modeling of population persistence using parameters obtained from Population Demography and Breeding Biology.

**Responsibility:** MGM, EHPL and BGPA

**Timing:** 2007 – 2010 (initially)

### 2e. Environmental Interactions and Plant Health

**Action:** Investigate biotic and abiotic associations, habitat requirement assessment, ecophysiology, impacts of associations on plant health and tools to monitor plant health.

**Responsibility:** MGM, EHPL and BGPA

**Timing:** 2007 – 2010 (initially)

### 2f. Restoration and Translocation

**Action:** Investigate reconstruction of habitat, propagation, translocations and tools to monitor rehabilitation, dust and water table lowering.

**Responsibility:** MGM, EHPL and BGPA

**Timing:** 2007 – 2010 (initially)

### 2g. Ex situ Conservation



- Action:** Evaluation of the conservation effectiveness of off-site conservation collections (living, cryogenic and seed banking) at state seed banking facilities at the Kings Park Seed Technology Centre, Kings Park Science laboratory and the DEC Threatened Flora Seed Centre.
- Responsibility:** MGM, EHPL, BGPA and DEC
- Timing:** 2007 – 2010 (initially)

### 3. Establish and implement *D. masonii* condition monitoring programme

Monitoring of factors such as weed invasion, grazing, habitat degradation, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The DEC and GDTFRT will inspect populations regularly and will prepare Rare Flora Reports Forms.

The condition of the *D. masonii* population not directly impacted by mining will be monitored for any indirect impacts from mining, of which the greatest risk may be excessive dust deposition, and other potential threats such as grazing by introduced or native animals and weeds that may impact on plant condition. A representative subset of 715 individual plants (5% of total pre—mining adult population) will be monitored in detail annually. In addition, ambient dust monitoring will be undertaken on a monthly basis in permanent quadrats to assess dust deposition on *D. masonii*. Populations closest to the mine (eg Extension Hill South) will be monitored monthly to assess any changes in condition prior to evidence of acute stress or mortality. Visual inspections of the populations closest to the mine (eg Extension Hill South) will be undertaken weekly. Populations located further away from the mine will be inspected quarterly. The results of the monitoring program will be used to guide subsequent management of the species.

The research program will investigate and develop measures to assess plant health and will collect detailed demographic data from approximately 2% of the population in long term monitoring plots as part of the research program.

- Action:** Undertake condition monitoring
- Responsibility:** MGM, EHPL, DEC and GDTFRT
- Timing:** Annually (Oct – Nov), 2008 - 2012

### 4. Implement Fire Management Strategy

Frequent fires represent the greatest threat to the long term survival of the species as it has the potential to result in the local extinction of the species. An Environmental Management Plan and fire management procedures are being developed that details the frequency and intensity of fires and control measures necessary to prevent inappropriate fires which may impact on the species directly, or its habitat. Fire management procedures are to include training of emergency response personnel in fire fighting; site based fire fighting equipment; vehicle maintenance including safety check to reduce fire hazards, fire suppression systems on selected plant and equipment; locating fire breaks; fire break maintenance; fire reporting system in line with legislative requirements; incident control; fire cause investigation and analysis; and liaison with neighbours and FESA with regard to bushfires.

- Action:** Implement Environmental Management Plan and Fire Management procedures
- Responsibility:** MGM and EHPL
- Timing:** ongoing for life of mine

## 5. Manage Secondary Impacts of Mining

The size and condition of the *D. masonii* population may be impacted by secondary impacts of mining, including excessive dust deposition, introduction or spread of weeds, unauthorized access and altered hydrology. A statutory EMP and associated procedures (non statutory) have been prepared that details management actions and procedures to minimize the impact of mining on significant flora, including *D. masonii*.

These management actions and procedures include site access protocols; weed identification and recording systems; weed control procedures (taking into consideration the proximity to significant flora), restricted area access protocols (e.g. restricted access to areas with weed infestations of high biodiversity impact rating); description and pictures of weed species likely to be problematic; and monitoring to assess the effectiveness of weed control measures. The site access protocol itself will include site induction information on environmental constraints to work activities, permit systems to access restricted areas including those around *D. masonii* and *Lepidosperma gibsonii* and Malleefowl mounds, defined weed infested areas, fire risk management and prevention and control procedure, vehicle wash down requirements and washdown facility on site.

Further, the dust management procedures will include the identification of airborne dust, active response to non-fixed dust sources, depositional dust monitoring, dust control systems on fixed plant and dust management systems incorporated into the site clearance procedure.

Secondary impacts of mining are not expected to effect populations outside of the mining tenements due to the ample buffer distance between these populations relative to active mining activities within the tenements.

The EMP and associated procedures will operate in areas under the control of MGM or EHPL, generally defined by the active mining area and the broader mining tenement areas.

**Action:** Implement Environmental Management Plan and associated procedures  
**Responsibility:** MGM and EHPL  
**Timing:** ongoing for life of mine

## 6. Manage inappropriate grazing pressure on *D. masonii*

The impact of grazing by introduced animals (goats and rabbits) will be assessed as part of monitoring the condition of *D. masonii* (Recovery Action 3). Minimal grazing pressure has been observed to date. In the event that grazing pressure is impacting on the health of plants/populations of *D. masonii*, the impacting animal population will be controlled on the mining tenements as detailed in the EMP and associated procedures and/or access to the plants restricted.

**Action:** Undertake condition monitoring; implement Environmental Management Plan and associated feral or other introduced animal procedures  
**Responsibility:** MGM and EHPL  
**Timing:** ongoing for life of mine

## 7. Translocation Trials

A preliminary planting trial of *D. masonii* was undertaken by BGPA in the Mt Gibson Ranges using a disused drill pad on Iron Hill East which had not been rehabilitated and was outside the mining footprint. Two hundred and twenty nine young plants from a cross-section of genotypes were propagated at King Park from cuttings and planted at the trial site in June 2005. The preliminary trial was undertaken for research purposes to gain information on plant survival, breeding biology and phenology. The survival and management of any plants remaining at the conclusion of the preliminary trial will be determined by BGPA in association with DEC.

The habitat critical to the survival of *D. masonii* may also include additional nearby occurrences of similar habitat that do not currently support the species but may have done so in the past and may be suitable for future

translocation. Translocation trials undertaken as part of the *Darwinia masonii* Research Program (see Recovery Action 2) will assist in determining whether additional areas of similar habitat are considered suitable for growing *D. masonii*. The findings of the Research Program and the translocation trials will be used in the rehabilitation of disturbed by mining as outlined in the Environmental Management Plan.

- Action:** Describe biotic and abiotic environments and habitat requirements. Trial *in-situ* planting methods.  
Identify critical parameters for the long-term viability of re-established populations of *D. masonii* and related species  
Derive quantitative completion criteria which demonstrate maintenance of viable population dynamics and resilience in *D. masonii*
- Responsibility:** MGM, EHPL and BGPA
- Timing:** 2007 – 2010 (initially)

#### 8. Maintain adequate seed/germplasm collections to ensure material with a broad genetic base is available for translocation and on-going *ex situ* conservation

Maintain adequate seed/germplasm collections to ensure material with a broad genetic base is available for on-going *ex situ* conservation. Seed will also be provided to DEC to be stored at the DEC Threatened Flora Seed Centre.

- Action:** Maintain adequate seed/germplasm collections
- Responsibility:** MGM and EHPL through BGPA, and DEC
- Timing:** ongoing until 2012

#### 9. Conduct further surveys and report any new populations of *D. masonii*

Any new populations of *D. masonii* that may be opportunistically located will be reported to DEC to ensure DEC has accurate data on the species.

- Action:** Report any new populations of *D. masonii* to DEC
- Responsibility:** MGM, EHPL, BGPA, DEC, GDTFRT
- Timing:** ongoing until 2012

#### 10. Promote awareness of *D. masonii*

The status of *D. masonii* and the measures to preserve the species will be promoted to mine site staff and contractors. The significance of the species will continue to be communicated to personnel working at and around the Extension Hill minesite, through an environmental induction and an Environmental Handbook.

The importance of biodiversity conservation and the need for the long-term protection of wild populations of *D. masonii* will be promoted to the community by DEC and the GDTFRT through poster displays and the local print and electronic media.

- Actions:** 1. Promote need for protection through poster displays and local print and electronic media; and  
2. Continue environmental inductions and Environmental Handbook dissemination
- Responsibility:** DEC, GDTFRT, MGM and EHPL
- Timing:** ongoing

## 11. Review ranking of the species and the need for a full Recovery Plan

In accordance with Condition 6.3 of Ministerial Statement 753, the relevance and effectiveness of the plan will be reviewed within 4 years of the commencement of ground disturbing activities and the plan updated as necessary. The ranking of the species (currently Vulnerable) will be reviewed as part of the review of the IRP.

**Action:** Review the IRP and prepare a full Recovery Plan as necessary  
**Responsibility:** MGM, EHPL, DEC, the GDTFRT, in association with BGPA  
**Timing:** February 2011

## 4. TERM OF PLAN

This Interim Recovery Plan will operate from 2008 to 2012 but will remain in force until withdrawn or replaced. The plan will be reviewed in 2011 based on the ranking of the taxon at that time.

## 5. REFERENCES

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## 6. TAXONOMIC DESCRIPTION

*D. masonii* is an erect shrub 1.5 to 3m tall, with narrow leaves approximately 1cm long, which are almost triangular in cross-section. These leaves are closely crowded towards the ends of the branchlets. The flowering inflorescences are approximately 3cm in diameter and are surrounded by numerous spreading pinkish bracts that are pendulous on the ends of small branchlets. The bracts are broad at the base but narrow to a pointed apex with a distinct midrib. Each bract is approximately 2cm in length and 5mm wide at the base. Each tubular flower is about 5mm long with a style approximately 1.5cm in length with hairs below the stigma (Brown *et al.*, 1998).

## ESTIMATED COSTS

No	Recovery Actions – <i>Darwinia masonii</i>	Estimated Cost
1	Coordinate recovery actions and liaise with stakeholders.	\$5000 pa
2	Continue the implementation of the <i>D. masonii</i> research programme (including conservation genetics, population demography, breeding biology, population viability analysis, environmental interactions and plant health, restoration and translocation and ex situ conservation).	<u>Stage 1*</u> \$215,900 (complete) <u>Stage 2</u> \$1.11 million over 3 years* * Costs include <i>Lepidosperma gibsonii</i> research program
3	Implement <i>Lepidosperma gibsonii</i> condition monitoring programme.	\$25,000 pa
4	Implement fire management strategy	\$10,000 pa
5	Manage secondary impacts of mining on <i>D. masonii</i>	\$50,000pa
6	Manage inappropriate grazing pressure on <i>D. masonii</i>	\$10,000 pa
7	Undertake translocation trials as part of the <i>D. masonii</i> Research Programme	Cost included in Recovery Action 2
8	Maintain adequate seed/germplasm and cutting collections to ensure material with a broad genetic base is available for on-going <i>ex situ</i> conservation.	\$10,000 pa
9	Conduct further survey and report any additional populations of <i>D. masonii</i>	Reporting of each additional population \$5000* * does not includes of surveying additional populations
10	Promote awareness of <i>D. masonii</i> and Recovery Plan initiatives	\$5,000 pa
11	Review ranking of species and prepare a full Recovery Plan if the review of the Interim Recovery Plan indicates this is necessary.	\$10,000

**FIGURE 3**  
LOCATION OF SIGNIFICANT FLORA SPECIES IN THE MT GIBSON RANGES AREA