Department of Parks and Wildlife

Botanic Gardens & Parks Authority

The University of Western Australia
Achieving International Excellence

Interim Recovery Plan No. **341**

Pearl-like Androcalva (*Androcalva perlaria*)

Interim Recovery Plan
2014–2019

Department of Parks and Wildlife, Western Australia

May 2014

List of Acronyms

The following acronyms are used in this plan:

ADTFRT	Albany District Threatened Flora Recovery Team
BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DPaW	Department of Parks and Wildlife (also shown as the department)
DRF	Declared Rare Flora
EN	Endangered
EPA	Environmental Protection Agency
EPBC	Environment Protection and Biodiversity Conservation
GRL	Grange Resources Limited
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
MRWA	Main Roads Western Australia
NRM	Natural Resource Management
PEC	Priority Ecological Community
RP	Recovery Plan
SCB	Species and Communities Branch
SWALSC	South West Aboriginal Land and Sea Council
TFSC	Threatened Flora Seed Centre
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
WA	Western Australia

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Policy Statements Nos. 44 and 50 (CALM 1992; CALM 1994). Note: The Department of Conservation and Land Management (CALM) formally became the Department of Environment and Conservation (DEC) in July 2006 and the Department of Parks and Wildlife in July 2013 (the department). Plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

The department is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, within one year of endorsement of that rank by the Minister.

This plan will operate from May 2014 to April 2019 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked as Endangered (EN) in Western Australia, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given Regional approval on 1 April 2014 and was approved by the Director of Science and Conservation on 11 May 2014. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting the department, as well as the need to address other priorities.

Information in this plan was accurate at May 2014.

Plan preparation: This plan was prepared by:

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

Chris Bishop	Environmental Coordinator, DPaW Environmental Management Branch
Andrew Brown	Threatened Flora Coordinator, DPaW Species and Communities Branch (SCB)
Anne Cochrane	Manager, DPaW Threatened Flora Seed Centre (TFSC)
Kingsley Dixon	Director of Science, BGPA
Amanda Shade	Assistant Curator (Nursery), BGPA

Thanks also to the staff of the Western Australian Herbarium for providing access to Herbarium databases and specimen information.

Cover photograph by Shane Turner.

Citation: This plan should be cited as: Department of Parks and Wildlife (2014) Pearl-like androcalva (*Androcalva perlaria*) Interim Recovery Plan 2014–2019. Interim Recovery Plan No. 341. Department of Parks and Wildlife, Western Australia.

Summary

Scientific name:	***Androcalva perlaria***	**Common name:**	Pearl-like androcalva
Family:	Malvaceae	**Flowering period:**	Sept–Dec; spot flowering all year
DPaW region:	South Coast	**DPaW district:**	Albany
Shire:	City of Albany	**NRM region:**	South Coast
IBRA region:	Esperance Plains	**Recovery team:**	ADTFCRT
IBRA subregion:	Fitzgerald ESP01		

Distribution and habitat: *Androcalva perlaria* is known to occur in white-grey sandy loam and dark brown peaty sand in seasonally waterlogged wetlands. The vegetation community of the wetlands where it has been recorded is *Eucalyptus occidentalis* low woodland (with occasional tall shrubs of *Melaleuca cuticularis*, *Acacia cyclops* and *Hakea corymbosa*) over low open shrubs of *Androcalva perlaria*, *Lasiopetalum parvuliflorum* and *Actinodium calocephalum* over a closed sedgeland dominated by *Lepidosperma striatum*, *Cyperochloa hirsuta*, *Schoenus subfascicularis* and *Anarthria laevis*.

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

Conservation status: *Androcalva perlaria* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as EN under International Union for Conservation of Nature (IUCN 2001) criterion D due to the population size estimated to number fewer than 250 mature individuals. The species is known from five fragmented natural populations and one translocated population. A total of some 73 mature (> 3 years old) and 134 juvenile plants (<18 months old) remain in four natural populations with a further 96 semi-mature (~2 years old) individuals remaining in a translocated population established in 2012. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the species are grazing, mining, altered hydrology and water quality, weeds and inappropriate fire regimes.

Existing recovery actions: The following recovery actions have been or are currently being implemented and have been considered in the preparation of this plan:

1. Land managers and landowners have been made aware of the location and threatened status of the species.
2. Declared Rare Flora (DRF) markers have been erected for the road reserve populations.
3. Grange Resources Limited (GRL) has produced an A4 brochure describing the species and seeking assistance with locating new populations.
4. Seeds collected in 2006 (4,517 seeds), 2007 (4,507 seeds) and 2009 (52 seeds) are in storage at the department's TFSC, with viability of 76% (2006 accession) and germination of 86% (viability adjusted) within 42 days when seeds were nicked prior to sowing.
5. The Botanic Gardens and Parks Authority (BGPA) Science Directorate holds 44,000 (2010 collection), 11,000 (2011 collection), 36,000 (2012 collection) and 138,000 (2013 collection) viable seeds collected from containerised plants maintained under *ex situ* conditions.

6. Living collections at BGPA (nursery) currently include live specimens in their nursery (five) and gardens (14) from an accession derived from departmental supplied seedlings in May 2008 (TFSC accession number 02195). The BGPA Science Directorate also holds an additional 922 plants for research purposes derived from 93 genotypes sampled from all four remaining natural *in situ* populations.
7. The BGPA Science Directorate has stored 13 different genotypes as vegetative material cryogenically in liquid nitrogen.
8. In 2006/07, extensive surveys of 124 wetlands undertaken by Ecologia identified only four as having at least one plant remaining (a fifth population was identified from Florabase records).
9. The four populations with extant plants have been surveyed extensively with a total of 207 plants identified.
10. All known plants across these four populations have been individually labelled.
11. Seed biology experiments have been undertaken since 2010 and have established a thorough understanding of the seed and germination biology of *Androcalva perlaria*.
12. Vegetative material has been collected from most individuals for genetic and propagation purposes.
13. Asexual propagation protocols for both tissue culture and cutting propagation of *Androcalva perlaria* have been established.
14. Populations 2, 3, 4 and 6 are fenced (2, 3 & 4 are on private property). Plants in Populations 2, 3 and 4 have been guarded with wire fences.
15. Population 2 has had a fence installed around the perimeter of the two remnant vegetation areas to exclude stock. The fenceline has been installed approximately three metres outside the remnant vegetation areas to allow for the installation of a 2.5 metre wide chemical firebreak.
16. A translocation of 235 tubestock was implemented in 2012 at Mettlers Lake Nature Reserve.
17. A prescribed burn by the department's Albany District was undertaken in September 2012 on the southern section of Population 1 where one plant had been recorded in 2007. This was followed by germination and recruitment in 2012 and 2013 with flowering commencing eight months after fire.
18. An article on the seed ecology of *A. perlaria* was published in Australian Plant Conservation in winter 2013.

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

Recovery criteria

Criteria for recovery success:

- The number of extant populations has increased from four to five or more over the term of the plan and/or
- The number of mature individuals has increased by 20% or more over the term of the plan.

Criteria for recovery failure:

- The number of populations has decreased from four to three or less over the term of the plan and/or
- The number of mature individuals has decreased by 20% or more over the term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Maintain an *ex situ* germplasm collection of seed and vegetative material
4. Obtain additional biological and ecological information
5. Establish new populations through translocations
6. Develop and implement a fire management strategy
7. Undertake surveys
8. Liaise with land managers and aboriginal communities
9. Promote awareness
10. Map habitat critical to the survival of *Androcalva perlaria*
11. Review this plan and assess the need for further recovery actions

1. Background

History

Botanists Ray Cranfield and Dave Kabay collected *Androcalva perlaria* from north of Mount Groper in 1993 and lodged the specimens at the Western Australian Herbarium. Cate Tauss made a second collection in September 2005 during the Ecologia Environment Southdown mine site survey. Subsequent surveys in 2006 and 2007 of 124 wetlands in the greater Wellstead region identified *Androcalva perlaria* from an additional three sites (Table 1).

Currently, five populations are known. Four together contain 207 extant plants while live plants are absent from a fourth site where the species is thought to persist as a soil stored seed bank. The exact whereabouts of the type location is currently unknown and no plants have been relocated in the approximate area where the type location was thought to have been made.

Population 2 occurs within a Grange Resources Limited (GRL) proposed mining project area (ML70/718). Approval has been granted to proceed with mining on the proviso that Population 2 and a second area of potential habitat will not be disturbed until a viable off-site population is established in a secured reserve or a protected area such that the threat status of the species would not change from "Endangered" to "Critically Endangered" (GRL 2009).

Description

The genus *Androcalva* belongs to the Malvaceae (Subfamily Byttnerioideae - Tribe Byttnerieae) which is a predominantly Australian group with 11 species found in south-west of Western Australia. Five of these are currently listed as threatened or priority taxa (Western Australian Herbarium 1998 -).

Androcalva perlaria (formerly *Commersonia* sp. Mt Groper) is a spreading shrub to 50cm high by 1m wide. The leaves are grey-green in colour and shallowly to deeply lobed. The flowers are cream and white with flowering observed between September and December with spot flowering at other times of the year. The fruit is green-grey in colour with a velvety hairy covering.

Illustrations and/or further information

Western Australian Herbarium (1998–) *FloraBase- the Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au/.

Wilkins CF and Whitlock BA (2011) A new Australian genus, *Androcalva*, separated from *Commersonia* (Malvaceae s.l. or Byttneriaceae). Australian Systematic Botany 24, 284–349.

Distribution and habitat

Androcalva perlaria is known to occur over a range of approximately 33km around Wellstead, approximately 100km east of Albany. The species has only been recorded on sandy-clay in seasonally-waterlogged sites adjacent to *Eucalyptus occidentalis* wetlands, growing with *Anarthria laevis*. Other species commonly found in association include: *Acacia cyclops*, *Actinodium* sp. Fitzgerald River, *Adenanthos cuneatus*, *Cyperochloa hirsuta*, *Lasiopetalum parvuliflorum* (Priority 3), *Lepidosperma striatum*, *Melaleuca cuticularis* and *Schoenus subfascicularis*.

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

Population number & location	DPaW District	Shire	Vesting	Purpose	Manager
1. South Coast Highway east of Wellstead - North & South of hwy	Albany	Albany	MRWA	Road reserve	MRWA
2. South Coast Highway west of Wellstead	Albany	Albany	Private property		GRL
3. South Coast Highway north east of Wellstead	Albany	Albany	Private property		Landowners
4. Boat Harbour Road	Albany	Albany	Private property		Landowners
North of Mt Groper (type location) - precise location unknown	Albany	Albany	LGA	Road reserve	City of Albany
T. Mettlers Road Mettlers Lake Nature Reserve South of Wellstead	Albany	Albany	DPaW	Class C Reserve	DPaW

Biology and ecology

Androcalva perlaria is believed to be a re-seeder as significant quantities of seeds are produced under field and nursery conditions (Anne Cochrane pers. comm). However, it remains unknown whether it is an obligate or facultative re-seeder as plants under field conditions have also been observed to reshoot vigorously from the basal stem after stress. Additionally, it is also unknown whether adult plants are killed by fire as no research is known to have been conducted on the taxon's response to fire. However, seedlings germinated after a prescribed burn in September 2012 at a site where one adult had last been observed in 2007 and regeneration is therefore likely to be largely from seed. Newly emerged seedlings commenced flowering within eight months after the burn.

Conservation Status

Androcalva perlaria is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Endangered (EN) in Western Australia under International Union for Conservation of Nature (IUCN 2001) criterion D due to the population size estimated to number fewer than 250 mature individuals remaining in natural populations. The species is known from four extant natural populations comprising a total of 230 plants. An additional translocated population of 235 plants was established in 2012. One population natural occurs within a proposed mining project area (GRL 2009). Androcalva *perlaria* is not currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Grazing** has been observed to be a significant issue in one site (Population 3) with plants in this population found to be severely stunted and approximately 10% of the size of plants found at the other sites. Most of the plants in this site are relatively exposed and located within 5–10 m of grazed farmland. Fencing is present though clearly is inadequate. However, since the installation of wire fences around each remaining plant there has been a marked improvement in plant health and size. Less extensive grazing has been noted in Population 4 with no grazing noted in Population 1 or 2. Population 1 is located within a relatively large and intact roadside reserve while population 2 is located in a large intact bush block. Plants within this population are relatively sheltered within abundant understorey species. Plants in Population 4 occur within a relatively large bush block, though are surrounded by farmland. Plants in Populations 2 and 4 have also been fenced.
- **Mining** is a significant threat for Population 2 which occurs within the GRL proposed Southdown Magnetite mine site. The population occurs within the project footprint and would be directly impacted by mining. However, the Environmental Protection Agency (EPA) has advised that the population is to be excluded from mining activities and impacts such as dewatering until a viable off-site population is established on a secured reserve (GRL 2009).
- **Inappropriate fire regimes** may affect the viability of populations. The species appears to be an obligate seeder with a soil-stored seed bank based on observations made following a planned burn in spring 2012. However, an overly frequent fire regime may be detrimental to populations leading to the exhaustion of the soil seed bank though on other hand in the absence of fire adults may senesce and not be replaced. The longevity of the soil seed bank is unknown though appears to have the capacity to last for at least 5 years (Turner unpublished results). Preliminary data suggest that a significant proportion of seeds are physically dormant (Turner unpublished results). It is known that for other species (such as some *Acacia* spp. and *Dodonaea* spp.) with physically dormant seeds, heat from fire can overcome seed dormancy and promote germination in the post-fire environment and data from the DPaW burn in spring 2012 shows that this appears to be the case for *A. perlaria* seeds as well.
- **Weed invasion** appears to be a minor threat to all populations. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads that are produced annually by many grass weed species. Recovery actions to address weeds will be introduced if the threat becomes more severe.
- **Altered hydrology and water quality** may potentially be a significant issue. *Androcalva perlaria* is a fringing wetland species and is likely to be sensitive to changes in hydrology through draining or runoff, salinity and nutrient enrichment. The largest population (Population 1) is located adjacent to several large drains running under the South Coast Highway. Under extreme conditions these are likely to lead to localized flooding. Given that the area is also the lowest point in the local landscape, runoff from surrounding farmland may carry salt and fertilizer into the habitat. Similar issues are applicable to Populations 2, 3 and 4. Altered hydrology during and following proposed mining is also a threat to Populations 2.

The intent of this plan is to provide actions that will mitigate immediate threats to *Androcalva perlaria*. Although climate change and drought may have a long-term effect on the species, especially through the altered hydrology of the wetland habitat, actions taken directly to prevent their impact are beyond the scope of this plan.

Table 2. Summary of population information and threats

Population number & location	Land status	Year/No. plants	Current condition	Threats
1.South Coast Highway east of Wellstead (north & south of highway)	Road reserve	2006 50 2009 54 2010 64 2014 207	Majority reasonably healthy though plants on the north side continue to die regularly and several more appear to be in poor health. New plants on the south side are healthy and growing rapidly.	Altered hydrology, salt, fertilizer runoff, fire
2. South Coast Highway	Private property	2005 1 2006 0 2013 8		Mining, altered hydrology, weeds, grazing, fire
3. South Coast Highway NE of Wellstead	Private property	2007 18 2010 10 2013 7	Heavily grazed before fencing	Grazing, weed invasion, fire, altered hydrology
4. Boat Harbour Road	Private property	2007 30 2010 12 2013 8	Healthy, though relatively small	Grazing, weed invasion (minor), fire, altered hydrology
North of Mt Groper (type location) - precise location unknown	Road reserve	1993 1 2006 0	No plants recorded since 1993, may exist as a soil seed bank	Fire, grazing, weed invasion
T. Mettlers Road Mettlers Lake Nature Reserve South of Wellstead	Class C reserve	2012 235 2014 96	Set up in July 2012 the translocated population is not thriving and all remaining plants show significant signs of stress.	Fire, grazing, weed invasion

Note: Populations in **bold text** are considered important populations. T = translocated population.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Proposals for development and/or land clearing in the immediate vicinity of *Androcalva perlaria* may require assessment. On-ground works should not be approved unless the proponents can demonstrate that their actions will not have any significant negative impact on the species, its habitat or potential habitat or on the local hydrology, such as drainage in the habitat of the species would be altered.

Actions that could result in any of the following may potentially result in a significant impact on the species:

- Damage or destruction of occupied or potential habitat
- Alteration of the local surface hydrology or drainage of occupied or potential habitat
- Reduction in population size
- Major increase in disturbance in the vicinity of populations.

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

Given that *Androcalva perlaria* is ranked as EN, it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations.

Habitat critical to the survival of *Androcalva perlaria* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (i.e. *Eucalyptus occidentalis* wetlands on sandy-clay seasonally-waterlogged sites), as these areas provide potential habitat for pollinators or biota essential to the continued existence of the species to move between populations; additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable sites for future translocations; and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Androcalva perlaria* will also improve the status of associated native vegetation. The species occurs in association with the Priority flora species *Lasiopetalum parvuliflorum* (Priority 3) and a Priority Ecological Community (PEC) Swamp Yate (*Eucalyptus occidentalis*) woodlands in seasonally inundated clay basins (Priority 3).

(For a description of conservation codes for Western Australian flora and fauna see http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_18092013.pdf).

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 species is not listed under Appendix II in the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES), and this plan does not affect Australia's obligations under any other international agreements.

Aboriginal consultation

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register did not reveal any sites of Aboriginal significance within or immediately adjacent to *Androcalva perlaria* populations. Input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and DAA to determine if there are any issues or interests with respect to management for this species in the vicinity of these sites. Indigenous opportunity for future involvement in the implementation of the plan is included as an action in the plan. Aboriginal involvement in management of land covered by an agreement under the *Conservation and Land*

Management Act 1984 is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this species occurs.

Social and economic impacts

The implementation of this recovery plan may cause some social and economic impacts as populations occur on two farming properties and in an area proposed for mining. Efforts will be made to mitigate these impacts as much as reasonably possible.

Affected interests

Populations of *Androcalva perlaria* occur on lands (roadside reserve) managed by the City of Albany and Main Roads Western Australia (MRWA), on private property, in a Class C Reserve managed by DPaW and on a mining tenement.

Evaluation of the plan's performance

The department, with assistance from the Albany District Threatened Flora Recovery Team (ADTFRT), will evaluate the performance of this plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

2. Recovery objective and criteria

Plan objective

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

Recovery criteria

Criteria for recovery success:
- The number of extant populations has increased from four to five or more over the term of the plan and/or
- The number of mature individuals has increased by 20% or more over the term of the plan

Criteria for recovery failure:
- The number of populations has decreased from four to three or less over the term of the plan and/or
- The number of mature individuals has decreased by 20% or more over the term of the plan

3. Recovery actions

Existing recovery actions

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

Declared Rare Flora markers have been erected for the road reserve population (Population 1) located adjacent to the South Coast Highway.

Grange Resources Limited has produced an A4 brochure describing the species and seeking assistance with locating new populations.

The department's Threatened Flora Seed Centre (TFSC) has 9,076 *Androcalva perlaria* seeds, collected in 2006, 2007 and 2009. Over 200,000 viable seeds are also held by the Science Directorate, Botanic Gardens and Parks Authority (BGPA). Preliminary investigations have found that seeds are physically dormant and respond to either nicking or hot water treatment and germinate readily (>80%) and rapidly (7−42 days) (Anne Cochrane pers. comm., Shane Turner pers. comm.).

The BGPA nursery currently has 19 live plants in their nursery and gardens, ranging in age from less than six months (five nursery held plants) to approximately 48 months old (14 plants growing in the threatened flora beds). These plants were derived from TFSC supplied seedlings in May 2008 (TFSC accession number 02195). In addition the BGPA Science Directorate currently holds approximately 922 plants derived from 93 different genotypes originally derived from plants occurring in all four remaining *in situ* populations. A further eight clones are held in tissue culture. Asexual propagation protocols for both tissue culture and cutting propagation have been established as has cryogenic storage techniques.

There have been extensive surveys in the vicinity of current populations and in the surrounding region. In 2006 and 2007, surveys of 124 wetlands were undertaken by Ecologia Environment which identified only four as having at least one plant remaining.

Starting in December 2009 and continuing up until February 2014 regular surveys have been undertaken by S. Turner (BGPA/UWA) and K. Baker (the department's Albany District) in the vicinity of known populations. As part of these surveys all *Androcalva perlaria* plants found were individually labelled to cross reference with the establishment of *ex situ* collections.

To protect from grazing pressures all plants in Population 3 were fenced in April and July 2010, plants in Population 2 and 4 have also been fenced.

A translocation was implemented at Mettlers Lake Nature Reserve in 2012.

A prescribed burn was undertaken in September 2012 by DPaW's Albany District on the southern section of Population 1 where one plant had been last recorded in 2007. This was followed by

germination and recruitment in 2012 and 2013 with flowering commencing within eight months after the fire. One hundred and thirty four plants have been so far recorded following the 2012 burn.

An article on the seed ecology of *A. perlaria* was published in Australian Plant Conservation in winter 2013.

Future recovery actions

The department, with the assistance of the ADTFRT, is overseeing the implementation of this plan and will include information on progress in annual reports to the department's Corporate Executive and funding bodies. Where recovery actions are implemented on lands other than those managed by the department, permission has been or will be sought from the appropriate land managers prior to actions being undertaken. The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the plan. However this should not constrain addressing any recovery action if funding is available and other opportunities arise.

1. Coordinate recovery actions

The department, with the assistance of the ADTFRT, will coordinate recovery actions for *Androcalva perlaria* and will include information on progress in annual reports to the department's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	The department (Albany District), with assistance from the ADTFRT
Cost:	$8,000 per year

2. Monitor populations

Monitoring of grazing, habitat degradation, salinity, wind damage, population stability (expansion or decline), weed invasion, pollinator activity, seed production, recruitment, and longevity will be undertaken annually.

Action:	Monitor populations
Responsibility:	The department (Albany District), BGPA (until 2014), with assistance from the ADTFRT
Cost:	$8,000 per year (funded by GRL from 2010 to 2014)

3. Maintain an *ex situ* germplasm collection of seeds and vegetative material

Although seed has been previously collected, further collections are highly desirable particularly from Population 2. Collecting seed from all populations and from a range of plants will ensure an adequate representation of genetic diversity. With 93 genotypes currently maintained as a containerised collection by the BGPA, priority genotypes will also be cryopreserved and stored in liquid nitrogen as part of the long-term germplasm collection maintained by BGPA. Some of the material from these collections will be used to create a backup collection at another institution. Duplicate samples from

collections of *Androcalva perlaria* held at the TFSC and BGPA have already been sent for safe keeping at the Millennium Seed Bank at the Royal Botanic Gardens, Kew, United Kingdom.

Action:	Maintain *ex situ* germplasm collection of seeds and vegetative material
Responsibility:	The department (Albany District, TFSC), BGPA (until 2014)
Cost:	$5,000 per year (funded by GRL from 2010 to 2014)

4. Obtain additional biological and ecological information

Increased knowledge of the biology and ecology of the species will provide a scientific basis for management of *Androcalva perlaria* in the wild. Overall investigations will ideally include:

1. Soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival.
2. Reproductive strategies, phenology and seasonal growth.
3. Reproductive success and pollination biology.
4. Minimum viable population size.
5. Investigating seed ecology under laboratory and field conditions
6. The impact of changes in hydrology in the habitat.

Action:	Obtain additional biological and ecological information
Responsibility:	The department (DPaW Science, Albany District), BGPA (until 2014)
Cost:	$14,000 per year (funded by GRL from 2010 to 2014)

5. Establish new populations through translocations

In situ translocation will be conducted with the aim of establishing at least one new *Androcalva perlaria* population of 200 plants in a secured reserve or a protected area. Translocation of a species which has a highly restricted distribution presents significant challenges. To aid success, key site factors influencing the range of the species will need to be determined to aid identification of potential new sites for translocation. The type of germplasm (seed, seedlings or cuttings) to be used for translocation trials will also be assessed. Issues to be considered include the identification of optimal microhabitat requirements for planting greenstock and seed sowing, the immediate requirements for establishment, optimal timing for establishment, and the requirement for fencing to exclude grazing. To determine translocation success, monitoring of translocated populations and natural populations will be undertaken for comparisons of health, size, and reproductive status. Information on the translocation of threatened plants and animals in the wild is provided in the department's policy statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995), and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al.* 2004). All translocation proposals require endorsement by the department's Director of Science and Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Establish new populations through translocations
Responsibility:	The department (DPaW Science, Albany District), BGPA (until 2014)
Cost:	$42,000 in years 1 and 2; and $26,500 in subsequent years as required

6. Develop and implement a fire management strategy

It is thought that fire kills adult plants and regeneration is largely from seed. Frequent fire may prevent the accumulation of sufficient soil-stored seed for recruitment to occur while too few fires may limit natural regeneration from the soil seed bank leading to population reductions as adults die and are not replaced. Fire should therefore be prevented from occurring in the area of populations, except where it is being used as a recovery tool. A fire management strategy will be developed to determine fire control measures and fire frequency.

Action:	Develop and implement a fire management strategy
Responsibility:	The department (Albany District)
Cost:	$10,000 in year 1, and $6,000 in years 2–5

7. Undertake surveys

All *Androcalva perlaria* populations were last surveyed between 2006 and 2013. Additional surveys should be conducted by staff from the department, and community volunteers during the main flowering period of the species (September – December). All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys.

Action:	Undertake surveys
Responsibility:	The department (Albany District), with assistance from the ADTFRT and volunteers
Cost:	$10,000 per year

8. Liaise with land managers and aboriginal communities

Staff from the department's Albany District will liaise with appropriate land managers to ensure that populations of *Androcalva perlaria* are not accidentaly damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the species. Aboriginal consultation will take place to determine if there are any issues or interests in areas that are habitat for the species.

Action:	Liaise with land managers and aboriginal communities
Responsibility:	The department (Albany District)
Cost:	$4,000 per year

9. Promote awareness

The importance of biodiversity conservation and the protection of *Androcalva perlaria* will be promoted to the public through poster displays and the development of an information sheet which includes a description of the plant, its habitat type, threats, management actions and photos. This has already been produced but may need to be updated, reprinted and redistributed. A postal drop to local residents would also further raise awareness. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action:	Promote awareness

Responsibility:	The department (Albany District, Species and Communities Branch (SCB), Corporate Relations), with assistance from the ADTFRT
Cost:	$7,000 in years 1 and 2; $5,000 in years 3–5 (funded by GRL from 2010 to 2014)

10. Map habitat critical to the survival of *Androcalva perlaria*

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

Action:	Map habitat critical to the survival of *Androcalva perlaria*
Responsibility:	The department (SCB, Albany District)
Cost:	$6,000 in year 2

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

If *Androcalva perlaria* is still ranked as EN at the end of the five-year term of this plan, the need for further recovery actions or a review of this plan will be assessed and a revised plan prepared if necessary.

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	The department (SCB, Albany District)
Cost:	$6,000 at the end of year 5

Table 3. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	The department (Albany District), with assistance from the ADTFRT	Ongoing
Monitor populations	High	The department (Albany District), BGPA, with assistance from the ADTFRT	Ongoing
Maintain *ex situ* germplasm collection of seeds and vegetative material	High	The department (Albany District, TFSC), BGPA	2019
Obtain additional biological and ecological information	High	The department (DPaW Science, Albany District), BGPA	2017
Establish new populations through translocations	High	The department (DPaW Science, Albany District), BGPA	2019
Develop and implement a fire management strategy	High	The department (Albany District)	Developed by 2015, implementation ongoing
Undertake surveys	High	The department (Albany District), with assistance from the ADTFRT and volunteers	Ongoing
Liaise with land managers and aboriginal communities	High	The department (Albany District)	Ongoing
Promote awareness	Medium	The department (Albany District, SCB, Corporate Relations), with assistance from the ADTFRT	2019
Map habitat critical to the survival of *Androcalva perlaria*	Medium	The department (SCB, Albany District)	2016
Review this plan and assess the need for further recovery actions	Medium	The department (SCB, Albany District)	2019

4. Term of plan

This plan will operate from May 2014 to April 2019 but will remain in force until withdrawn or replaced. If the species is still ranked EN after five years, the need for further recovery actions will be determined, and a review of this plan will be assessed and a revised plan prepared if necessary.

5. References

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

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

Department of Conservation and Land Management (1995) Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.

Government of Australia (1999) Environment Protection and Biodiversity Conservation Act.

Grange Resources Limited (2009) Declared Rare Flora Management Plan. Southdown Magnetite Project Environmental Protection Authority Bulletin No. 1291.

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Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M. and Rossetto, M. (2004) Guidelines for the Translocation of Threatened Australian Plants. Second Edition. *The Australian Network for Plant Conservation*. Canberra, Australia.

Western Australian Herbarium (1998–) *FloraBase– the Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au/.

Wilkins CF, Whitlock BA (2011) A new Australian genus, *Androcalva*, separated from *Commersonia* (Malvaceae s.l. or Byttneriaceae). Australian Systematic Botany 24, 284–349.

6. Taxonomic description

Wilkins & Whitlock (2011)

Shrub erect, rounded with recurved branches, 0.4–1 x 0.8–1 m; suckering not recorded. *Young stems* with dense to tomentose, sessile and occasionally stalked, white, stellate hairs with 6–12 erect arms up to 0.7mm long, over smaller, stellate hairs, glandular trichomes absent. *Stipules* narrowly ovate to linear-lanceolate, 2.8–6.8 x 0.2–1.4 mm, apex acuminate, entire, bifid, trifid. *Mature leaves* petioles 0.4–3.3mm long; blade undulate, margin strongly recurved, base unequal, attenuate, margin irregularly serrulate, apex obtuse; blade mainly obovate, rarely elliptic, 1–13 x 0.8–9 mm, (*juvenile leaves* not seen); discolorous mid-greyish-green over pale greyish-green; abaxial surface blade and rib tomentose with sessile, white, stellate hairs with 12–24 erect arms up to 0.4mm long, glandular trichomes absent; adaxial surface velvety tomentose with sessile, white, stellate hairs with 6–12 erect arms up to 0.1mm long. *Inflorescence* 4–10 mm long; 3–9 flowered. *Bud* base pale pink and apex white calyx lobes valvate; apex rounded. *Peduncle* 0.3–3.5mm long. *Pedicel* non-articulated, 1–4.2 mm long. Peduncle and pedicel tomentose with sessile, white, stellate hairs with 6–12 erect arms 0.3–0.7mm long, glandular trichomes absent. *Bract* narrowly ovate, 0.7–4 x 0.1–0.5 mm. *Calyx* white with a pinkish-green base; total length 2.6–3.5 mm; tube 0.8–1mm long; lobes ovate, 1.8–2.5 x 1.2–1.8 mm, 67–71% of total calyx length, apex acute; abaxial surface tomentose with sessile, brown, stellate hairs with 6–12 erect arms up to 0.5mm long over smaller, sessile, white, stellate hairs and intermixed medium-density, pink-tipped, clavate, glandular trichomes up to 0.2mm long; adaxial surface centre of lobe with either scattered to medium-density 1–3-armed, appressed hairs up to 0.15mm long, or scattered, clavate, glandular trichomes up to 0.1 mm long, and towards margin of lobes with dense, white, 1–3-armed, erect, stellate hairs up to 0.1 mm long. *Petals* white with base tinged pale pink and with a central perpendicular red stripe; 1.9–3.1 x 1.3–2.4 mm; glabrous; base obcordate when horizontal lateral lobes flattened, margin cucullate; apical ligule sessile, broadly obovate to suborbicular, 1.1–1.7 x 0.8–1.4 mm. *Staminal tube* 0.25–0.4mm long. *Staminodes* 1–3 between each stamen, white; central staminode narrowly ovate, ~1.5 x 0.5 mm; lateral staminodes, if present, linear, white, papillose, attached to central staminode, 0.9–1.0 x 0.15 mm. *Filaments* 0.5–0.9 x 0.15–0.3 mm. *Anthers* dark red with paler red connective, 0.3–0.4 x 0.6–0.7 mm. *Ovary* 4- or 5-loculate; ovoid 0.6–0.8 x 0.6–0.8 mm; outer surface with pre-setae outgrowths. *Ovules* 3–5 per locule. *Styles* 0.7–0.8 mm long. *Fruit* ovoid; 4–5 x 5.5–6 mm; wings absent; outer wall 0.25 mm thick; outer surface with dense, white, stellate hairs beneath medium-density setae up to 0.9mm long, towards apex and dehiscence lines, and shorter between dehiscence lines; shaft straight, with dense, sessile and short-stalked, ~6-armed, white hairs up to 0.2mm long; apical hair with ~24 erect arms; centralaxis hairs ~0.3mm long. *Seed* black, exotesta prominently aculeate or verrucate, ~1.6 x 1.3 mm. *Aril* a white, translucent cap ~1.3 x 1.1mm.