Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Interim Recovery Plan No. **384**

Hypocalymma sylvestre

Interim Recovery Plan

Department of Biodiversity, Conservation and Attractions, Western Australia

December 2018

List of Acronyms

The following acronyms are used in this plan:

AOO	Area of occupancy
BGPA	Botanic Gardens and Parks Authority
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DPLH	Department of Planning, Lands and Heritage
DBCA	Department of Biodiversity, Conservation and Attractions
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EN	Endangered
EOO	Extent of occurrence
EPBC	Environment Protection and Biodiversity Conservation
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
SCP	Species and Communities Program
SRTFCRT	Swan Region Threatened Flora and Communities Recovery Team
SWAEDA	South West Australia Ecoregion Demonstration Area
SWALSC	South West Aboriginal Land and Sea Council
TFSC	Threatened Flora Seed Centre
TPFL	Threatened and Priority Flora Database
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
WA	Western Australia
WWF	World Wide Fund for Nature

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Biodiversity, Conservation and Attractions (DBCA) Corporate Policy Statement No. 35 (DPaW 2015*a*) and DBCA Corporate Guideline No. 35 (DPaW 2015*b*). 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.

DBCA are committed to ensuring that threatened flora (also known as Declared Rare Flora (DRF)) 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) flora, always within one year of endorsement of that rank by the Minister.

This plan will operate from December 2018 to December 2023 but will remain in force until withdrawn or replaced. It is intended that, if *Hypocalymma sylvestre* is still listed as Threatened Flora in Western Australia following five years of implementation, this plan will be reviewed and the need for further recovery actions assessed.

This plan was given regional approval on 22 November 2018 and was approved by the Executive Director of Biodiversity and Conservation Science on 10 December 2018. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting DBCA, as well as the need to address other priorities.

Information in this plan was accurate at April 2018.

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:

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Amanda Shade	Curator (Nursery), DBCA Botanic Gardens and Parks Authority

Thanks also to the staff of the Western Australian Herbarium for providing access to Herbarium databases and specimen information, and other DBCA staff for assistance in developing this plan.

Cover photograph by Marnie Mallié.

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Summary

Scientific name:	*Hypocalymma sylvestre*	**Shire:**	Chittering
Family:	Myrtaceae	**NRM region:**	Avon Catchment Council
Common name:	none	**IBRA region:**	Jarrah Forest
Flowering period:	August – November	**IBRA subregion:**	Northern Jarrah Forest JAF01
DBCA region:	Swan	**Recovery team:**	Swan Region Threatened Flora and Communities Recovery Team
DBCA district:	Perth Hills		

Distribution and habitat: *Hypocalymma sylvestre* is only found on private property in the Chittering area, approximately 10 km south of Bindoon. It grows in steep ironstone-quartz and lateritic slopes and ridges in brown to yellow loamy sand, on all aspects of slopes, in areas deeply to moderately dissected by gullies. The habitat consists of open powderbark wandoo (*Eucalyptus accedens*) woodland with occasional *Corymbia calophylla*, over open shrubland understorey typically comprised of *Xanthorrhoea acanthostachya*, *Kunzea* sp., *Hibbertia lasiopus*, *H. hypericoides*, *Hakea lissocarpha* and *Gastrolobium spinosum* (Swinburn 2012).

Habitat important for the survival of the species, and important subpopulations: It is considered that all known habitat for the wild subpopulations is critical to the survival of *Hypocalymma sylvestre*, and that wild subpopulations are important subpopulations. Habitat critical to the survival of the species includes the area of occupancy of subpopulations and areas of similar habitat surrounding and linking subpopulations (these provide potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered subpopulations 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: *Hypocalymma sylvestre* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 6 November 2012, and ranked as Critically Endangered (CR). It was subsequently reassessed as Endangered (EN) under Red List criteria B1ab(iii)+B2ab(iii) on 6 January 2017 due to less than five locations known, which are not considered severely fragmented; and a continuing decline in habitat condition and extent from clearing, fence and firebreak construction and maintenance, fire, secondary impacts from stock, weeds, poor recruitment, lack of available habitat and a drying climate. The species was listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 11 May 2018.

Threats: The main threats to *Hypocalymma sylvestre* are subdivision development, fence and firebreak construction and maintenance, secondary impacts from stock, altered fire regimes, habitat grazing, weed invasion, lack of available habitat and drought.

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. DBCA with the assistance of the SRTFCRT, is overseeing the implementation of recovery actions for *Hypocalymma sylvestre*.
2. Notifications to land owners/managers detail the current Threatened status of *Hypocalymma sylvestre* and the associated legal obligations in regards to its protection.
3. Surveys for *Hypocalymma sylvestre* have been conducted in areas of suitable habitat.
4. Subpopulation 1c on private property was fenced from stock in 2010 by the property owner using fencing material provided by DBCA Perth Hills District.
5. Fencing was installed around a single plant at Subpopulation 1e by the property owner to protect it from sheep.
6. Monitoring of the species has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System locations of plants within the subpopulations have been recorded in

Geographic Information System databases at Perth Hills District, and at Species and Communities Program.

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

Recovery criteria

Criteria for recovery success: The plan will be deemed a success if one or more of the following take place over the term of the plan.

- There is no reduction in the extent of occurrence, and the number of mature individuals within known subpopulations has increased by >5% from 17,225 to 18,086 or more; or
- New subpopulations have been found, increasing the number of known subpopulations from four to five or more with no net loss of mature plants; or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Criteria for recovery failure: The plan will be deemed a failure if one or more of the following take place over the term of the plan.

- Subpopulations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature individuals has decreased by >5% to 16,364 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor subpopulations
3. Liaise with land managers and Aboriginal communities
4. Seek protection for subpopulations
5. Fence Subpopulations 3a and b
6. Collect and store seed
7. Undertake weed control
8. Develop and implement a fire management strategy
9. Rehabilitate habitat in cleared areas
10. Obtain biological and ecological information
11. Undertake surveys for new subpopulations
12. Develop and implement a translocation proposal
13. Map habitat critical to the survival of *Hypocalymma sylvestre*
14. Promote awareness
15. Review this plan and assess the need for further recovery actions

1. Background

History

Hypocalymma sylvestre was first collected in 1998 from Chittering by Mike Hislop. The species was then subsequently described by Strid and Keighery in 2002 as part of a taxonomic revision of the *Hypocalymma* genus.

Hypocalymma sylvestre is currently known from four subpopulations consisting of 17,225 mature plants (Tables 1, 2). All plants are located on private property and threatened by subdivision development and stock. One private property location containing Subpopulation 1b is being managed sympathetically to conservation and is registered as Land for Wildlife.

Description

Hypocalymma sylvestre is a spreading, much-branched shrub up to 80 cm tall, with rather stout, rod-like branches, and glabrous throughout. The leaves are ovate-elliptic, overlap, approximately 5 by 4 mm, flat to slightly V-shaped, glandular-punctate, with margins with a line of hairs, and the apex acute-pungent. The flowers are white to pale cream, solitary or paired in leaf axils, and attached by the base (Strid and Keighery 2002).

Hypocalymma sylvestre is closely related to *H. tetrapterum* but differs by having elliptic, V-shaped imbricate leaves with a pungent apex (Strid and Keighery 2002).

Hypocalymma sylvestre is named from the Latin *sylvestris* pertaining to the woods, or growing wild (Strid and Keighery 2002).

Illustrations and/or further information

Strid, A. and Keighery, G.J. (2002) A taxonomic review of the genus *Hypocalymma* (Myrtaceae). *Nordic Journal of Botany* 22(5): 535–572.

Western Australian Herbarium (1998–) *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. http://florabase.dpaw.wa.gov.au/

Distribution and habitat

Hypocalymma sylvestre is only found on private property in the Chittering area, approximately 10 km south of Bindoon (Table 1). It grows in steep ironstone-quartz and lateritic slopes and ridges in brown to yellow loamy sand, on all aspects of slopes, in areas deeply to moderately dissected by gullies. The habitat consists of open powderbark wandoo (*Eucalyptus accedens*) woodland with occasional marri (*Corymbia calophylla*), over open shrubland understorey typically comprised of *Xanthorrhoea acanthostachya*, *Kunzea* sp., *Hibbertia lasiopus*, *H. hypericoides*, *Hakea lissocarpha* and *Gastrolobium spinosum* (Swinburn 2012).

The actual extent of occurrence (EOO) is 3.6 km^2 and the area of occupancy (AOO) using the standard IUCN 2km x 2km grid method is 16km^2, with the area of mapped habitat being 0.267 km^2 (Swinburn 2012).

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

TPFL subpopulation number & location	DBCA District	Shire	Vesting	Purpose	Manager
1a. Chittering	Swan	Chittering	Private property		Land owners
1b. Chittering	Swan	Chittering	Private property		Land owners
1c. Chittering	Swan	Chittering	Private property		Land owners
1d. Chittering	Swan	Chittering	Private property		Land owners
1e. Chittering	Swan	Chittering	Private property		Land owners
3a. Chittering	Swan	Chittering	Private property		Land owners
3b. Chittering	Swan	Chittering	Private property		Land owners
4a. Chittering	Swan	Chittering	Private property		Land owners
4b. Chittering	Swan	Chittering	Private property		Land owners
4c. Chittering	Swan	Chittering	Private property		Land owners
4d. Chittering	Swan	Chittering	Private property		Land owners
4e. Chittering	Swan	Chittering	Private property		Land owners
4f. Chittering	Swan	Chittering	Private property		Land owners
4g. Chittering	Swan	Chittering	Private property		Land owners
4h. Chittering	Swan	Chittering	Private property		Land owners
5a. Chittering	Swan	Chittering	Private property		Land owners
5b. Chittering	Swan	Chittering	Private property		Land owners
5c. Chittering	Swan	Chittering	Private property		Land owners

Biology and ecology

Hypocalymma sylvestre flowers August to November, peaking from August to September and setting fruit October to November. It is not known what pollinates the species, however, European honey bees have been observed visiting flowers. Its basic flower configuration suggests that it is likely to be a pollination generalist (Mike Hislop pers. comm., cited in Swinburn 2012).

Hypocalymma sylvestre appears to regenerate from basal and epicormic growth, which is likely to be an adaptive response to fire. The health and subsequent regeneration of plants also appears to be influenced by slope aspect (Swinburn 2012).

Conservation status

Hypocalymma sylvestre was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 6 November 2012, and ranked as Critically Endangered (CR) under International Union for Conservation of Nature (IUCN) 2001 Red List criteria B2ab(iii) due to an area of occupancy being less than 10 km^2; severely fragmented subpopulations; and a continuing decline in the area, extent and quality of habitat. However, a reinterpretation of the 'Guidelines for Using the IUCN Red List Categories and Criteria' meant that the assessment under criterion B2 changed, with the area of occupancy re-estimated as 16 km^2, and thus above the CR threshold. Additionally, the number of known locations had increased to 5, four of which were in larger areas of remnant vegetation. The species therefore no longer met criteria for CR. The species was reassessed as Endangered (EN) under

criteria B1ab(iii)+B2ab(iii) on 6 January 2017 due to five or less locations known, which are not considered severely fragmented; and a continuing decline in habitat condition and extent from clearing, fence and firebreak construction and maintenance, fire, secondary impacts from stock, weeds, poor recruitment, lack of available habitat and a drying climate. The species was listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 11 May 2018.

Threats

- **Subdivision development**. Future subdivision of private property locations is a potential threat to Subpopulations 1d, 4a–h and 5a–b. A development proposal, which has yet to be finalised or implemented, includes a 50m radius buffer with restrictive covenant and fencing applied for the building envelope. Shire management plans are suspected to override these covenants. Of concern is a 100m hazard separation zone around residential buildings, outlined in the development proposal. This is a fuel reduced area and requires the removal of fuel loads including shrubs, which has the potential to severely and continually affect approximately 2,500 plants in Subpopulations 5a and b, and 300 plants in Subpopulation 1d. If fencing and/or firebreaks are installed, it is likely Subpopulations 1d, 4a–h and 5a–b will be divided between at least 11 new properties with a significant number of plants being affected.
- **Fence and firebreak construction and maintenance** have impacted upon and will continue to impact Subpopulations 3a and b. Approximately 15% of plants along the fenceline have been graded and consist of only stunted stems of basal shoots. It is also suspected that construction of an emergency access way and drainage has further isolated these small subpopulations from the extensive adjacent woodland reserve and potential habitat. In the past, Subpopulations 1a and 1b and Subpopulation 2 have been impacted by fencing and firebreak construction and maintenance but these activities are not currently threats as they are not ongoing. However should these properties undergo future subdivision then impacts are likely.
- **Secondary impacts from stock.** Subpopulations 1d, 1e, 4a–h, and 5a and b occur on cleared agricultural areas on private property that were once grazed by stock (sheep and cattle), which is thought to have supressed the growth of *Hypocalymma sylvestre* as well as caused erosion and compaction to the soil. The land has since been sold and largely destocked but its use has the potential to change again in the future.
- **Altered fire regimes.** It is not known whether fire is needed to stimulate recruitment; however the species appears to regenerate from basal and epicormic growth, suggesting a resprouting fire response. The species occurs in fire prone areas where land owners may implement inappropriate fire management regimes to decrease fuel loads, to the detriment of the species. Destocking has resulted in an increase in biomass of annual weedy species, particularly grasses which has contributed to a high fuel load and fire risk. Fire is likely to facilitate further weed invasion and should be followed up with appropriate weed control. A high intensity bushfire burnt Subpopulations 1a, b and c in February 2004.
- **Habitat grazing.** Despite *Hypocalymma sylvestre* appearing to be unaffected by grazing, the surrounding vegetation is heavily grazed by kangaroos, which may impact on *H. sylvestre* in the long-term through loss of associated habitat values.
- Habitat degradation by **weed invasion** is a threat to subpopulations of *Hypocalymma sylvestre*. Subpopulations 1d, 1e, 4a–h, and 5a and b occur in cleared agricultural areas where weeds such as *Arctotheca calendula*, *Ursinia anthemoides* and *Romulea rosea* form a dense ground cover. Weeds suppress early plant growth by competing with the species and its associated vegetation for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase fire hazard due to

the easy ignition of high fuel loads that are produced annually by many grass weed species. Grassy weeds such as *Avena fatua* occur in close proximity to all subpopulations and have potential for invasion as reduced grazing increases seed load and thus penetration into uninfested areas.

- **Lack of available habitat** is a threat to Subpopulations 1d, 1e, 4a–h, and 5a and b of *Hypocalymma sylvestre* which occur in extensively cleared agricultural areas with little natural vegetation to provide a buffer for the species from the impact of stock or other threats.
- **Drought** is a threat to the species. Low rainfall, exacerbated by a changing climate and exposure on N-E aspects, may affect the species' survival in the long term.

The intent of this plan is to identify actions that will mitigate immediate threats to *Hypocalymma sylvestre*. Although climate change may have a long-term effect on the species, actions taken directly to prevent its impact are beyond the scope of this plan.

Table 2. Summary of subpopulation information and threats

TPFL subpopulation number & location	Land status	Year/no. mature plants		Condition		Threats
				Plants	Habitat	
1a. Chittering	Private property	1998 2011	locally common 3,827 (52) [2 dead]	Moderate	Excellent	Subdivision development, fire, stock
1b. Chittering	Private property	2006 2011	40 448	Healthy	Very good	Subdivision development, fire (burnt 2004), weeds
1c. Chittering	Private property	2006 2010 2011	150 1,200 755	Moderate	Excellent	Subdivision development, stock, fire (burnt 2004), weeds
1d. Chittering	Private property	2011	333 (3)	Healthy	Degraded	Subdivision development, fence construction and maintenance (proposed subdivision), firebreak maintenance, stock, fire, weeds, habitat grazing (kangaroos)
1e. Chittering	Private property	2011	1	Healthy	Completely degraded	Stock, fire, weeds, lack of habitat
3a. Chittering	Private property	2005 2011	20 115	Moderate	Very good	Stock, fire, fence and firebreak maintenance
3b. Chittering	Private property	2011	83	Moderate	Excellent	Fire, stock, fence and firebreak maintenance
4a–b. Chittering	Private property	2011	1,217 (12)	Healthy	Degraded	Subdivision development, fence construction and maintenance (proposed subdivision), firebreak maintenance, stock, fire, weeds, habitat grazing (kangaroos)
4c–d. Chittering	Private property	2011	3,500	Healthy	Degraded	Subdivision development, fence construction and maintenance (proposed subdivision), firebreak maintenance, stock, fire, weeds, habitat grazing (kangaroos)
4e–h. Chittering	Private property	2011	1,627 (30) [3 dead]	Healthy	Degraded	Subdivision development, fence construction and maintenance (proposed subdivision), firebreak maintenance, stock, fire, weeds, habitat grazing (kangaroos)
5a–b. Chittering	Private property	2011	2,320 (69) [1 dead]	Healthy	Degraded	Subdivision development, fence construction and maintenance (proposed subdivision), firebreak maintenance, stock, fire, weeds, habitat grazing (kangaroos)
5c. Chittering	Private property	2011 2013	10 2,999	Poor	Excellent	Subdivision development, fire, fence and firebreak maintenance, stock, drought

Note: Subpopulation 2 was renumbered as Subpopulation 1c; ( ) = number of seedlings/juveniles; Subpopulation 5c was only partially surveyed in 2011.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land clearing in the immediate vicinity of *Hypocalymma sylvestre* may require assessment. Actions that could result in any of the following may potentially significantly impact the species:

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

Habitat important for the survival of the species, and important subpopulations

Hypocalymma sylvestre is listed as Threatened (Endangered) in Western Australia and it is considered that all known habitat for the wild subpopulations is important for the survival of the species, and that all wild subpopulations are important subpopulations. Habitat important for the survival of the species includes the area of occupancy of subpopulations and areas of similar habitat surrounding and linking subpopulations (these provide potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered subpopulations 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.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Hypocalymma sylvestre* will also benefit the Threatened and Priority flora listed in the table below:

Table 3. Conservation-listed flora species occurring within 500m of *Hypocalymma sylvestre*

Species name	Conservation status (WA)	Conservation status (EPBC Act 1999)
Grevillea corrugata	DRF (Vulnerable)	Endangered
Gastrolobium crispatum	Priority 1	-

For a description of conservation codes for Western Australian flora see https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities

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. *Hypocalymma sylvestre* 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 Planning, Lands and Heritage (DPLH) Aboriginal Heritage Sites Register revealed no sites of Aboriginal significance adjacent to subpopulations of *Hypocalymma sylvestre*. Input and involvement has been sought through the South West Aboriginal Land and Sea Council

(SWALSC) and DPLH to determine if there are any issues or interests with respect to management for this species. Opportunity for future Aboriginal 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

Management of private land containing the subpopulations of *Hypocalymma sylvestre* may need to be modified to restrict stock access. The implementation of this plan may also result in some social and economic impacts for private land holders through the implementation of recovery actions (controlling weeds, fencing) and restrictions imposed on the management of the land. Subpopulations 1d, 4a–h and 5a–b are also proposed for future subdivision. Depending on the outcome of this, there may be social and economic impacts if the occurrences of *Hypocalymma sylvestre* cause the planned subdivisions to be modified, as well as the requirement for fencing.

Affected interests

The implementation of this plan has some implications for private landholders, the Shire of Chittering and land developers, particularly as the subpopulations occur on lands which are not specifically managed for conservation.

Evaluation of the plan's performance

DBCA, with assistance from the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT), 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* subpopulations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success: The plan will be deemed a success if one or more of the following take place over the term of the plan.

- There is no reduction in the extent of occurrence, and the number of mature individuals within known subpopulations has increased by >5% from 17,225 to 18,086 or more; or

- New subpopulations have been found, increasing the number of known subpopulations from four to five or more with no net loss of mature plants; or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Criteria for recovery failure: The plan will be deemed a failure if one or more of the following take place over the term of the plan.

- Subpopulations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature individuals has decreased by >5% to 16,364 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

3. Recovery actions

Existing recovery actions

DBCA, with the assistance of the SRTFCRT, is overseeing the implementation of recovery actions for *Hypocalymma sylvestre*.

Notifications to land owners/managers detail the current Threatened status of *Hypocalymma sylvestre* and the associated legal obligations in regards to its protection.

Surveys for *Hypocalymma sylvestre* have been conducted in areas of suitable habitat and include:

- Surveys by WA Herbarium Research Associates and DBCA volunteers Jean and Fred Hort.
- Survey of 22 private properties in Bindoon and Toodyay areas by Jenny Borger, Project Officer from WWF's South West Australia Ecoregion Demonstration Area (SWAEDA).
- Extensive survey of DBCA estate and private property in the Bindoon area for Bauxite Resources Ltd by Andrew Waters, Principal Ecologist from Woodgis.
- Targeted surveys on conservation estate, private property and shire land by DBCA staff.
- Survey of private property by environmental consultants following subdivision development proposals resulted in the discovery of new Subpopulations 1d, 3a, 3b and 4a–h.

Subpopulation 1c on private property was fenced from stock in 2010 by the property owner using fencing material provided by DBCA Perth Hills District. A fence was also installed around the single plant at Subpopulation 1e by the property owner to protect it from sheep.

Monitoring has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System (GPS) locations of plants within the subpopulations have been recorded in Geographic Information System databases at Perth Hills District and at Species and Communities Program (SCP).

Future recovery actions

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. Where these recovery actions are implemented on

lands other than those managed by DBCA, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

1. Coordinate recovery actions

DBCA with assistance from the SRTFCRT will oversee the implementation of recovery actions for *Hypocalymma sylvestre* and will include information on progress in annual reports.

Action:	Coordinate recovery actions
Responsibility:	DBCA (Perth Hills District), with assistance from the SRTFCRT
Cost:	$8,000 per year

2. Monitor subpopulations

Monitoring of subpopulations and their habitat should be undertaken to identify trends or potential management requirements. Subpopulation monitoring should record the health and expansion or decline in subpopulations, and other observations such as pollinator activity or seed production. Site monitoring should include observations of grazing, habitat degradation including weed invasion, and hydrological status (drought). Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Hypocalymma sylvestre* are included in other recovery actions detailed below.

Action:	Monitor subpopulations
Responsibility:	DBCA (Perth Hills District), with assistance from the SRTFCRT
Cost:	$8,000 per year

3. Liaise with land managers and Aboriginal communities

As all known subpopulations are located on private property, it is essential that staff from DBCA Perth Hills District liaise with land owners/managers to ensure subpopulations of *Hypocalymma sylvestre* are not accidentally damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the species. Ongoing liaison with the Shire of Chittering is also required to ensure protection of subpopulations and supporting habitat from future subdivisions.

Consultation with Aboriginal communities will take place to determine if there are any issues or interests in areas that are habitat for the species and opportunities will be provided for Aboriginal people to be involved in implementing this plan.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	DBCA (Perth Hills District)
Cost:	$4,000 per year

4. Seek protection for subpopulations

Improved security of private property locations containing all subpopulations and their associated habitat will be investigated and may include land acquisition for conservation reservation, conservation covenants and/or registering as Land for Wildlife properties.

Action:	Seek protection for subpopulations
Responsibility:	DBCA (Perth Hills District, SCP Nature Conservation Covenant Program and Land Unit)
Cost:	$4,000 per year

5. Fence Subpopulations 3a and b

Private property locations containing subpopulations of *Hypocalymma sylvestre* that are restocked with livestock may require fencing to prevent grazing and trampling.

Action:	Fence Subpopulations 3a and b
Responsibility:	DBCA (Perth Hills District), land owners/managers
Cost:	$5,000 in year 1

6. Collect and store seed

To guard against the extinction of known natural subpopulations of *Hypocalymma sylvestre*, it is recommended that seed be collected and stored at the TFSC. Collections should aim to sample the maximum range of genetic diversity possible by collecting from the widest range of reproductive plants. If it is not feasible to collect seed, living collections from cuttings or storage of tissue culture material should be undertaken.

Action:	Collect and store seed
Responsibility:	DBCA (Perth Hills District, TFSC)
Cost:	$10,000 per year

7. Undertake weed control

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

1. Determine which weeds are present and map them.
2. Control invasive weeds by hand removal and/or spot spraying as they first emerge.
3. Monitor the success of the treatment on weed death, and the tolerance of *Hypocalymma sylvestre* and associated native plant species to the treatment methods.
4. Report on the method and success of the treatment.
5. Revegetate with site-specific native species (in autumn) to suppress weeds.

Action:	Undertake weed control
Responsibility:	DBCA (Perth Hills District), land owners/managers
Cost:	$10,000 per year, as required

8. Develop and implement a fire management strategy

A fire management strategy will be developed in consultation with land owners/managers and the Shire of Chittering, that recommends fire frequency, intensity and seasonality, precautions to prevent bushfire and strategies for reacting to bushfire, and the need, method of construction and

maintenance of firebreaks. The risk of fire occurring in the habitat of subpopulations should be minimised, except where it is being used to assist recovery. All data relating to fire response of the species will be entered into the Threatened Priority Flora (TPFL) fire response data base.

Action:	Develop and implement a fire management strategy
Responsibility:	DBCA (Perth Hills District), land owners/managers, Shire of Chittering
Cost:	$10,000 in year 1, and $6,000 in years 2–5

9. Rehabilitate habitat in cleared areas

Rehabilitation of Subpopulations 1d, 1e, 4a–h, and 5a and b with local native plant species in cleared areas should be considered if the land owners/managers are amenable.

Action:	Rehabilitate habitat in cleared areas
Responsibility:	DBCA (Perth Hills District), land owners/managers
Cost:	$20,000 in years 1, 3 and 5

10. Obtain biological and ecological information

It is recommended that research on the biology and ecology of *Hypocalymma sylvestre* include:

1. Identification of pollinators and their habitat requirements.
2. Soil seed bank dynamics.
3. Seed viability.
4. Conditions necessary for natural germination.
5. Response to disturbance, competition, drought, inundation and grazing.
6. Longevity of plants, time taken to reach maturity, and minimum viable population size.
7. The impact of changes in hydrology.

Action:	Obtain biological and ecological information
Responsibility:	DBCA (Biodiversity and Conservation Science, Perth Hills District)
Cost:	$50,000 in years 1–3

11. Undertake surveys for new subpopulations

Surveys should be undertaken from August through November with all surveyed areas recorded and the presence or absence of *Hypocalymma sylvestre* documented to improve survey efficiency and prevent duplication of effort. Where feasible, volunteers will be encouraged to participate. A potential new subpopulation discovered by Chittering Landcare Centre on private property also requires confirmation through collection and identification of a herbarium specimen.

Action:	Undertake surveys for new subpopulations
Responsibility:	DBCA (Perth Hills District), with assistance from the SRTFCRT and volunteers
Cost:	$10,000 per year

12. Develop and implement a translocation proposal

Translocations may be required for the long-term conservation of *Hypocalymma sylvestre*, with the first priority being augmentation of any secure subpopulations.

Information on the translocation of threatened plants and animals in the wild is provided in DBCA Corporate Policy Statement No. 35 (DPaW 2015*a*), DBCA Corporate Guideline No. 36 (DPaW 2015*c*) and the Australian Network for Plant Conservation (ANPC) translocation guidelines (Vallee *et al*. 2004). The ANPC translocation guidelines state that a translocation may be needed when a species is represented by few subpopulations and the creation of additional self-sustaining, secure subpopulations may decrease its susceptibility to catastrophic events and environmental stochasticity. For small subpopulations which may be declining in size or subject to high levels of inbreeding, successful subpopulation augmentation may increase subpopulation stability and hence long-term viability. Translocation is not an alternative to *in situ* conservation and is not a suitable ameliorative, compensatory, or mitigating measure for development and should be considered as a last resort when all other options are deemed inappropriate or have failed (Vallee *et al*. 2004).

Depending on the characteristics of the species, Vallee *et al*. (2004) suggest a minimum viable population size estimated between 50 and 2,500 individuals will be required. Suitable translocation sites may include where the taxon occurs, where it was known to have occurred historically and other areas that have similar habitat (soil, associated vegetation type and structure, aspect etc.), within the known range of the taxon (Vallee *et al*. 2004).

All translocation proposals require endorsement by the department's Executive Director of Biodiversity and Conservation Science. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Develop and implement a translocation proposal
Responsibility:	DBCA (Biodiversity and Conservation Science, Perth Hills District), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in subsequent years as required

13. Map habitat important for the survival of *Hypocalymma sylvestre*

Although spatial data relating to habitat important for the survival of *Hypocalymma sylvestre* is alluded to in Section 1, it is not yet mapped. If additional subpopulations are located, habitat important for their survival will also be determined and mapped.

Action:	Map habitat important for the survival of *Hypocalymma sylvestre*
Responsibility:	DBCA (SCP, Perth Hills District)
Cost:	$6,000 in year 2

14. Promote awareness

The importance of biodiversity conservation and the protection of *Hypocalymma sylvestre* will be promoted through direct contact with affected land owners/managers, and more broadly through the print and electronic media and by setting up poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action:	Promote awareness
Responsibility:	DBCA (Perth Hills District, SCP, Public Information and Corporate Affairs (PICA)), with assistance from the SRTFCRT
Cost:	$7,000 in years 1 and 2; $5,000 in years 3–5

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

If *Hypocalymma sylvestre* is still listed as Threatened 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:	DBCA (SCP, Perth Hills District)
Cost:	$6,000 at the end of year 5

Table 4. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	DBCA (Perth Hills District), with assistance from the SRTFCRT	Ongoing
Monitor subpopulations	High	DBCA (Perth Hills District), with assistance from the SRTFCRT	Ongoing
Liaise with land managers and Aboriginal communities	High	DBCA (Perth Hills District)	Ongoing
Seek protection for subpopulations	High	DBCA (Perth Hills District, SCP Nature Conservation Covenant Program and Land Unit)	2023
Fence Subpopulations 3a and b	High	DBCA (Perth Hills District), land owners/managers	2019
Collect and store seed	High	DBCA (Perth Hills District, TFSC)	2023
Undertake weed control	High	DBCA (Perth Hills District), land owners/managers	Ongoing
Develop and implement a fire management strategy	High	DBCA (Perth Hills District), land owners/managers, Shire of Chittering	Developed by 2019, implementation ongoing
Rehabilitate habitat in cleared areas	High	DBCA (Perth Hills District), land owners/managers	2023
Obtain biological and ecological information	High	DBCA (Biodiversity and Conservation Science, Perth Hills District)	2021
Undertake surveys for new subpopulations	High	DBCA (Perth Hills District), with assistance from the SRTFCRT and volunteers	Ongoing
Develop and implement a translocation proposal	Medium	DBCA (Biodiversity and Conservation Science, Perth Hills District), BGPA	2023
Map habitat important for the survival of *Hypocalymma sylvestre*	Medium	DBCA (SCP, Perth Hills District)	2020
Promote awareness	Medium	DBCA (Perth Hills District, SCP, PICA), with assistance from the SRTFCRT	2023
Review this plan and assess the need for further recovery actions	Medium	DBCA (SCP, Perth Hills District)	2023

4. Term of plan

This plan will operate from December 2018 to December 2023 but will remain in force until withdrawn or replaced. If the species is still listed as Threatened Flora after five years, a review of this plan will be completed, the need for further recovery actions determined, and a revised plan prepared if necessary.

5. References

Department of Parks and Wildlife (2015*a*) Corporate Policy Statement No. 35 *Conserving Threatened Species and Ecological Communities*. Perth, Western Australia.

Department of Parks and Wildlife (2015*b*) Corporate Guideline No. 35 *Listing and Recovery of Threatened Species and Ecological Communities*. Perth, Western Australia.

Department of Parks and Wildlife (2015*c*) Corporate Guideline No. 36 *Recovery of Threatened Species through Translocation and Captive Breeding or Propagation*. Perth, Western Australia.

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

International Union for Conservation of Nature (2001) IUCN Red List Categories: Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Strid, A. and Keighery, G.J. (2002) A taxonomic review of the genus *Hypocalymma* (Myrtaceae). *Nordic Journal of Botany* 22(5): 535−572.

Swinburn, M. (2012) Form to nominate a Western Australian species for listing as threatened, change of category or delisting 2012. Department of Parks and Wildlife, WA.

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 Biodiversity, Conservation and Attractions. http://florabase.dpaw.wa.gov.au/

6. Taxonomic description

The following description is from Strid and Keighery (2002).

Hypocalymma sylvestre

Spreading, much-branched shrub up to 80 cm tall, with rather stout virgate branches, glabrous throughout. Twigs quadrangular, narrowly winged, ash-grey, becoming straight, slender, ± terete, with conspicuous leaf scars below, densely leafy above. Leaves imbricate, ovate-elliptic, c. 5 x 4 mm, flat to slightly V shaped, glandular-punctate, margins with a line of hairs, apex acute-pungent. Flowers subsessile, solitary or paired in leaf axils, the whorls usually distinctly separate. Bracts leaf-like, bracteoles suborbicular, c. 2 mm, scarious. Calyx lobes short, c. 2 x 2 mm, rounded, green, entire. Petals, broadly ovate, c. 4 x 4 mm, denticulate, white or pale cream. Stamens c. 60, equalling petals; filaments connate only at very base, white or pale cream. Ovary depressed-pyramid, without a central

depression around the style, 3-ribbed, 3-celled with 2-3 ovules per cell. Style exceeding petals. Seeds ± reniform, c. 1.6 x 1.0 mm, with large spongy lateral hilum and neat longitudinal rows of minute pits, medium brown.