Department of Parks and Wildlife

Interim Recovery Plan No. **381**

Austrostipa bronwenae

Interim Recovery Plan

2017–2022

Department of Parks and Wildlife, Western Australia

May 2017

List of Acronyms

The following acronyms are used in this plan:

BGPA	Botanic Gardens and Parks Authority
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EN	Endangered
EPA	Environmental Protection Authority
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
LGA	Local Government Authority
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
SCB	Species and Communities Branch
SRTFCRT	Swan Region Threatened Flora and Communities Recovery Team
SWALSC	South West Aboriginal Land and Sea Council
SWRTFRT	South West Region Threatened Flora Recovery Team
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Centre
TPFL	Threatened Priority Flora Database
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia
WAPC	Western Australian Planning Commission

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015*a*) and Department of Parks and Wildlife 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.

Parks and Wildlife is committed to ensuring that threatened taxa (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) taxa, always within one year of endorsement of that rank by the Minister.

This plan will operate from May 2017 to April 2022 but will remain in force until withdrawn or replaced. It is intended that, if the species is still listed as threatened in Western Australia following five years of implementation, this plan will be reviewed, the need for further recovery actions assessed and a revised plan prepared if necessary.

This plan was given regional approval on 15 May 2017 and was approved by the Director of Science and Conservation on 22 May 2017. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at May 2017.

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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Anne Harris	Flora Conservation Officer, Parks and Wildlife Swan Coastal District.
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Andrew Webb	Flora Conservation Officer, Parks and Wildlife South West Region.

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

Cover photograph by Andrew Webb.

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Summary

Scientific name:	*Austrostipa bronwenae*	**Shires:**	Gosnells, Bunbury, Harvey, Kalamunda
Family:	Poaceae		
Common name:	None	**IBRA region:**	Swan Coastal Plain
Flowering period:	October–November	**IBRA subregion:**	Perth SWA02
DPaW regions:	Swan, South West	**NRM regions:**	Swan, South West
DPaW districts:	Swan Coastal, Wellington	**Recovery teams:**	SRTFCRT, SWRTFRT

Distribution and habitat: *Austrostipa bronwenae* is currently known from four populations over a linear distance of 175km on the Swan Coastal Plain, growing in grey-brown sandy loam or dark brown loam over clay in low-lying winter wet areas.

Habitat critical to the survival of the species, and important populations: *Austrostipa bronwenae* is ranked as Critically Endangered (CR) in Western Australia and 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. bronwenae* includes the area of occupancy of populations and areas of similar habitat surrounding populations (providing potential habitat for population expansion). It may also include 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: *Austrostipa bronwenae* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 2 December 2014. It is ranked as EN in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(ii,iii,v)+B2ab(ii,iii,v); C2(a)(i) due to its area of occupancy estimated to be less than 500km^2, populations being severely fragmented, a continuing decline in its area of occupancy, quality of habitat, and the number of mature individuals, there being less than 2500 mature individuals and no subpopulations having more than 250 mature individuals. 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 recreational use, weeds, grazing, fire, firebreak maintenance, poor recruitment, clearing, mineral sands mining, drought and feral pigs.

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. Parks and Wildlife, with the assistance of the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) and South West Region Threatened Flora Recovery Team (SWRTFRT), is overseeing the implementation of recovery actions for *Austrostipa bronwenae*.
2. Land managers have been notified of the location and threatened status of *Austrostipa bronwenae*.
3. *Austrostipa bronwenae* has been opportunistically surveyed for in areas of potential habitat with no new populations located.
4. A ring lock fence has been placed around the single known plant at Population 3 in order to reduce grazing by kangaroos.
5. Monitoring has been carried out opportunistically with plant numbers and current threats recorded.

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

Recovery criteria

Recovery will be considered successful 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 plants within known populations has remained within a 10% range or has increased by >10% from 335 to 368 or more; or
- New populations have been found, increasing the number of known populations from three to four 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.

Recovery will be considered unsuccessful if one or more of the following take place over the term of the plan.

- Populations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature plants has decreased by >10% from 335 to 302 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 populations
3. Install/maintain fencing
4. Collect and store seed
5. Undertake weed control
6. Undertake surveys
7. Undertake regeneration trials
8. Achieve long-term protection of habitat
9. Develop and implement translocations
10. Develop and implement a fire management strategy
11. Obtain additional biological and ecological information
12. Liaise with land managers and Aboriginal communities
13. Map habitat critical to the survival of *Austrostipa bronwenae*
14. Promote awareness
15. Review this plan and assess the need for further recovery actions

1. Background

History

Austrostipa bronwenae, previously known as *Austrostipa* sp. Harvey (BJ Keighery GWAL/1), was formally described in 2011 by Alexander Williams in a revision of *Austrostipa* subgenus *Lobatae* (Williams 2011).

The species was first collected by Bronwen Keighery in 2003 in an area that was subsequently ceded to the Department of Parks and Wildlife by Kemerton Silica Sands as a condition of mining (EPA Bulletin 1183, 2005). The area was to be included in the proposed Kemerton Nature Reserve but this placement is being opposed by the Department of Mines and Petroleum (DMP) due to its potential for minerals. When first discovered, three subpopulations and over 100 plants were known over an area of 10 hectares. However, plant numbers at this site have declined significantly and by 2008 had declined to 20 individuals over an area of 200m^2. As at June 2016 just one plant is known from this site.

In 2009, Cate Tauss found a new population at Kenwick some 175km to the north of the original collection area. The new population comprised two subpopulations on adjoining lots, one privately owned (Subpopulation 1a) and the other State Government managed (Subpopulation 1b). Both are within Bush Forever Site 387. In 2014, a detailed survey of Subpopulation 1a located 232 plants over 0.5 hectares. Access to Subpopulation 1b requires authorisation by the landowner for an accurate plant count to be undertaken.

In 2012, Andrew Webb discovered a new population comprising over 100 plants on a recreation reserve within the City of Bunbury.

Austrostipa bronwenae is currently known from three widely separated populations, together comprising 335 plants.

Description

Austrostipa bronwenae is a perennial, rhizomatous grass to 1.5m tall (including flower spikes). Leaves are to 45cm long, terete, rolled or involute, and the abaxial surface is not ribbed. The inflorescence is 10 to 20cm long. Flowering occurs in October through November. Fruit matures in November to December (Williams 2011).

Austrostipa bronwenae is similar to *A. juncifolia* and *A. geoffreyi* in habit, but differs in having shorter lemma lobes and ligules, and occupying different habitat and geographical region.

Austrostipa bronwenae is also similar to *A. jacobsiana* (which is also listed as threatened flora) in habit, but differs in its long sheath lobes, an involucel of hairs subtending the panicle, 3-nerved upper glume, dark golden-brown lemma hairs at maturity, broader awn column, and longer, pencillate anthers (Williams 2011).

Austrostipa bronwenae is named after Bronwen Keighery who has assisted with habitat information and collected fruiting material and type specimens (Williams 2011).

Illustrations and/or further information

Western Australian Herbarium (1998–) FloraBase- the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/; Williams, A.R. (2011) *Austrostipa* (Poaceae) subgenus *Lobatae* in Western Australia. *Telopea* 13(1–2): 177–192.

Distribution and habitat

Austrostipa bronwenae is currently known from three populations over a linear distance of 175km, one (comprising two subpopulations) at Kenwick approximately 16km southeast of Perth, one at Kemerton 131km south of Perth and one at Bunbury 191km south of Perth.

Austrostipa bronwenae grows in calcareous, winter-wet grey-brown sandy-loam or dark brown loam over clay. The Kenwick and Kemerton sites are examples of the Muchea Limestone Threatened Ecological Community (TEC) (Keighery and Keighery 1995). At Kenwick, the species grows under tall open shrubland of *Callitris pyramidalis* and *Viminaria juncea* over open shrubland of *Melaleuca brevifolia* over open low heath of *Hypocalymma angustifolium*, *Grevillea thelemanniana* subsp. *thelemanniana* (P4), *Acacia lasiocarpa*, *Banksia telmatiaea*, *Boronia crenulata* with *Gahnia trifida*. Plants were also recorded on the boundary of a sedgeland/herbland of *Chaetanthus aristatus* and *Centrolepis aristata*.

At Kemerton, *Austrostipa bronwenae* grows under *Eucalyptus decipiens* over *Gahnia trifida* and at Bunbury, plants grow under *Melaleuca rhaphiophylla*, *Eucalyptus rudis* low open forest over *Hakea varia* tall open shrubland over *Gahnia trifida* and *Baumea juncea* sedges. The wetland at Bunbury is an example of the 'Dense shrublands on clay flats' (Swan Coastal Plain type 09) TEC.

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

TPFL population number & location	Parks and Wildlife district	Shire	Vesting	Purpose	Manager
1a. Kenwick	Swan Coastal	City of Gosnells	Private property	Freehold	WAPC
1b. Kenwick	Swan Coastal	Shire of Kalamunda	Private property	Freehold	Landowners
2. Bunbury	Wellington	City of Bunbury	LGA	Recreation	City of Bunbury
3. Kemerton	Wellington	Shire of Harvey	Private property	Unofficial nature reserve	Parks and Wildlife

Biology and ecology

Austrostipa bronwenae flowers between October and November with mature seed present between November and December. Pollen transfer is by wind. Mature and juvenile plants were recorded in the Kenwick population. Plants are caespitose and usually form large clumps, however, some very small non-flowering plants have been seen in the Kenwick population.

Conservation status

Austrostipa bronwenae was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 2 December 2014. It is ranked as EN in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(ii,iii,v)+B2ab(ii,iii,v); C2(a)(i) due to its area of occupancy estimated to be less than 500km^2, populations being severely fragmented, a continuing decline in its area of occupancy, quality of habitat, and the number of mature individuals, there being less than 2500 mature individuals and no subpopulations having more than 250 mature individuals. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Recreational use.** Although Population 1 is located on private property, the fence is in disrepair and unauthorised trailbike riders easily gain access. Population 2 is located on a recreation reserve where tracks and cubby houses have been created.
- **Weed invasion.** Perennial Veldt Grass (*Ehrharta calycina*) and African Lovegrass (*Eragrostis curvula*) occur in the area of Subpopulation 1a and Narrowleaf Cottonbush (*Gomphocarpus fruticosus*) is present at Population 3. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also increase the fire hazard due to their easy ignition. Control of grassy weeds using herbicides will require care as spraying may also impact the *Austrostipa*.
- **Grazing by kangaroos.** Population 3 is threatened by grazing which reduces seed production, limiting natural recruitment.
- **Altered fire regimes.** Frequent fire may deplete the soil seed store and also facilitate weed invasion. If habitat is burnt it should be followed up with appropriate weed control.
- **Firebreak maintenance.** The single plant of *Austrostipa bronwenae* at Population 3 occurs on the edge of a firebreak.
- **Poor recruitment.** Population 3 contained over 100 plants when discovered in 2003, but has declined to a single plant as at 2016.
- **Clearing.** Possible future subdivision of a private property is a threat to Subpopulation 1b.
- **Mineral sands mining, petroleum exploration and associated infrastructure development.** Population 3 is covered by Petroleum Exploration Title EP 416 R1 held by Allied Oil and Gas Ltd, Empire Oil Company and ERM Gas Pty Ltd. It is also bisected by the Dampier to Bunbury Natural Gas Pipeline. Kemerton Silica Sands have conditional approval to use a dredge to mine areas to the west of *Austrostipa bronwenae*.
- **Drought.** Population 2 occurs in a claypan that is at risk from decreasing rainfall.
- **Feral pigs.** Population 3 suffered severe damage from feral pigs in 2008. Pigs can damage plants and habitat when digging in search of food. Pigs also have the potential to introduce nutrients, and soil disturbance may encourage the establishment of weeds. Grazing may also reduce the reproductive output of the species.

The intent of this plan is to identify actions that will mitigate immediate threats to *Austrostipa bronwenae*. 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 population information and threats

TPFL population number & location	Land status	Year/no. mature plants		Condition		Threats
				Plants	Habitat	
1a. Kenwick	Private property	2009 2013 2014	Few plants 188 (45) 232	Healthy	Very good	Recreational use, weeds, fire, poor recruitment, drought
1b. Kenwick	Private property	2009	Two clusters	Healthy	Very good	Weeds, clearing, fire, clearing, poor recruitment, drought
2. Bunbury	Recreation reserve	2012 2015	100 100+	Healthy	Excellent	Weeds, recreational activities, drought
3. Kemerton	Proposed nature reserve	2003 2008 2015	100 20 1	Grazed	Poor	Grazing (kangaroos), weeds, firebreak maintenance, sand mining, fire, poor recruitment, drought, feral pigs (past threat)

Note: all populations are considered to be important populations.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions that result in any of the following may potentially have a significant impact on 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 critical to the survival of the species, and important populations

Austrostipa bronwenae is listed as Threatened in Western Australia and 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. bronwenae* includes the area of occupancy of populations and areas of similar habitat surrounding populations (providing potential habitat for population expansion). It may also include 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.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Austrostipa bronwenae* will also benefit the Declared Rare Flora (DRF) and Priority species listed in table 3.

Table 3. Conservation-listed flora species occurring adjacent to *Austrostipa bronwenae*

Species name	*Austrostipa bronwenae* population	Conservation status (WA)	Conservation status (EPBC Act 1999)
Diuris drummondii	2	DRF (VU)	Vulnerable
Grevillea thelemanniana subsp. *thelemanniana*	1	DRF (CR)	-
Byblis gigantea	1	Priority 3	-
Platysace ramosissima	2	Priority 3	-
Acacia flagelliformis	2	Priority 4	-
Caladenia speciosa	3	Priority 4	-

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

Populations 1 and 3 occur within the "Shrublands and woodlands on Muchea Limestone" TEC listed as Endangered (EN) by Western Australia and the Commonwealth.

The habitat of Population 2 is thought to be the "Dense shrublands on clay flats (SCP09)" TEC which is listed by Western Australia as Vulnerable (VU) and by the Commonwealth as CR.

Table 4. TECs in which *Austrostipa bronwenae* occurs

TEC title	Conservation status (WA)	Conservation status (EPBC Act)
Shrublands and woodlands on Muchea Limestone	EN	EN
Dense shrublands on clay flats (SCP09)	VU	CR

For a description of TEC and PEC categories see Department of Environment and Conservation (2010).

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 revealed no sites of Aboriginal significance adjacent to populations of *Austrostipa bronwenae*. However, 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. 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

The implementation of this recovery plan may result in some social and economic impact through restrictions imposed on the management of land on which the species occurs, including maintenance of fences and firebreaks, road infrastructure and future development and asset protection.

Affected interests

The implementation of this plan has some implications for private landholders, the City of Bunbury, Kemerton Silica Sands, Allied Oil and Gas Ltd, Empire Oil Company and ERM Gas Pty Ltd, and the operators of the Dampier to Bunbury Natural Gas Pipeline.

Evaluation of the plan's performance

Parks and Wildlife, with assistance from the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) and South West Region Threatened Flora Recovery Team (SWRTFRT), 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 extant populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Recovery will be considered successful 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 plants within known populations has remained within a 10% range or has increased by >10% from 335 to 368 or more; or
- New populations have been found, increasing the number of known populations from three to four 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.

Recovery will be considered unsuccessful if one or more of the following take place over the term of the plan.

- Populations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature plants has decreased by >10% from 335 to 302 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

3. Recovery actions

Existing recovery actions

Parks and Wildlife, with the assistance of the SRTFCRT and SWRTFRT, is overseeing the implementation of recovery actions for *Austrostipa bronwenae*.

Land managers have been notified of the location and threatened status of *Austrostipa bronwenae*. Notifications detail the current DRF status of the species, the associated legal obligations in regards to its protection and contact details for management assistance.

Austrostipa bronwenae has been surveyed for in the Swan Coastal and Wellington Districts by Parks and Wildlife staff and include:

- Surveys undertaken at Population 1 (Kenwick) by Parks and Wildlife staff in 2009 and 2014.
- Surveys of the reserve containing Population 2 (Bunbury) in 2012, 2013 and 2015.
- Surveys undertaken at Population 3 (Kemerton) in 2003 and 2008.
- In addition to the above, numerous surveys of the eastern side of the Swan Coastal Plain were undertaken during the Swan Coastal Plain Floristic Survey, System 6 update, Bush Forever and Swan Bioplan.

Parks and Wildlife staff have erected a ring lock fence around the single plant at Population 3 to protect it from kangaroo grazing.

Monitoring has been carried out opportunistically with plant numbers and current threats recorded. GPS locations of all populations have been recorded in Geographic Information System databases at Swan Coastal District, Wellington District, and Species and Communities Branch (SCB).

Future recovery actions

The following recovery actions are listed in approximate order of decreasing 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 recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

1. Coordinate recovery actions

Parks and Wildlife, with the assistance of the SRTFCRT and SWRTFRT, will oversee the implementation of recovery actions for *Austrostipa bronwenae* and will include information on progress in annual reports.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts), with assistance from the SRTFCRT and SWRTFRT
Cost:	$8,000 per year

2. Monitor populations

Monitoring of populations and their habitat should be undertaken to identify trends or potential management requirements. Population monitoring should record the health and expansion or decline in populations, 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 *Austrostipa bronwenae* are included in other recovery actions detailed below.

Action:	Monitor populations
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts), with assistance from the SRTFCRT and SWRTFRT
Cost:	$8,000 per year

3. Install/maintain fencing

Temporary ring lock fencing has been installed around an *Austrostipa bronwenae* plant at Population 3 to protect from grazing (kangaroos). However, a larger fenced area is required to provide room for recruitment. Fencing may also be required at Population 2 to protect plants from recreational users. The fence at Subpopulation 1a is in need of repair.

Action:	Install/maintain fencing
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts), WAPC
Cost:	$20,000 in year 1

4. Collect and store seed

To guard against the extinction of natural populations of *Austrostipa bronwenae* it is recommended that seed be collected and stored at the Parks and Wildlife TFSC. Collections should aim to sample and preserve the maximum range of genetic diversity possible by collecting from the widest range of reproductive plants.

Action:	Collect and store seed
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts, TFSC)
Cost:	$10,000 per year

5. Undertake weed control

Weeds are a threat to populations and the following actions should be implemented:

1. Determine which weeds are present, map them, and prioritise control sites.
2. Select an appropriate control technique; herbicide, mowing or hand weeding.
3. Control invasive weeds by hand removal and/or spot spraying.
4. Monitor the success of the treatment on weed death, and the tolerance of *Austrostipa bronwenae* and associated native plant species to weed control methods.
5. Report on the method and success or otherwise of the treatment.
6. Revegetate with site-specific native species to maintain low weed levels.

Action:	Undertake weed control
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts)
Cost:	$10,000 per year, as required

6. Undertake surveys

Surveys should be undertaken in areas of potential habitat. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, landcare groups, wildflower societies and naturalists' clubs will be encouraged to become involved.

Action:	Undertake surveys
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts), with assistance from the SRTFCRT, SWRTFRT and volunteers
Cost:	$10,000 per year

7. Undertake regeneration trials

As habitat disturbance (physical or fire) is thought to promote germination of soil stored *Austrostipa bronwenae* seed, it is recommended that disturbance trials be undertaken to encourage regeneration of the species at known sites.

Action:	Undertake regeneration trials
Responsibility:	Parks and Wildlife (Science and Conservation Division, Swan Coastal and Wellington Districts)
Cost:	$10,000 in years 1 and 3, $4,000 in years 2, 4 and 5

8. Achieve long-term protection of habitat

Ways and means of achieving further protection of the species on private land containing Subpopulation 1b will be investigated. Possible methods include developing a Management Plan in consultation with the land owner, covenanting and purchasing the land. Population 2 is in an area that is part of the proposed Preston River to Ocean Regional Park. The placement of Population 3 in a proposed nature reserve will continue to be negotiated with DMP.

Action:	Ensure long-term protection of habitat
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts, SCB), City of Bunbury, DMP
Cost:	$4,000 per year

9. Develop and implement translocations

Translocations may be required for the long term conservation of *Austrostipa bronwenae* with the first priority being augmentation of populations.

Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015*a*), Parks and Wildlife Corporate Guideline No. 36 (DPaW 2015*c*) and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al*. 2004). The 2004 guidelines state that a translocation may be needed when a species is represented by few populations and the creation of additional self-sustaining, secure populations may decrease its susceptibility to catastrophic events and environmental stochasticity. For small populations which may be declining in size or subject to high levels of inbreeding, successful population enhancement may increase population stability and hence long-term viability.

Depending on the characteristics of the subspecies, 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 Director of Science and Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Develop and implement translocations
Responsibility:	Parks and Wildlife (Science and Conservation Division, Swan Coastal and Wellington Districts), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in subsequent years as required

10. Develop and implement a fire management strategy

A fire management strategy will be developed in consultation with land owners/managers, 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 populations 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:	Parks and Wildlife (Swan Coastal and Wellington Districts)
Cost:	$10,000 in year 1, and $6,000 in years 2–5

11. Obtain biological and ecological information

It is recommended that research on the biology and ecology of *Austrostipa bronwenae* 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:	Parks and Wildlife (Science and Conservation Division, Swan Coastal and Wellington Districts)
Cost:	$50,000 in years 1–3

12. Liaise with land managers and Aboriginal communities

Staff from Parks and Wildlife will liaise with appropriate land managers to ensure that populations of *Austrostipa bronwenae* are not accidentaly damaged or destroyed and the habitat is maintained in a suitable condition for the conservation of the species. Consultation with the Aboriginal community 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 implimenting this plan.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	Parks and Wildlife (Swan Coastal and Wellington Districts)
Cost:	$4,000 per year

13. Map habitat critical to the survival of *Austrostipa bronwenae*

Although spatial data relating to habitat critical to the survival of the species has been identified in Section 1, it has not been mapped. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action:	Map habitat critical to the survival of *Austrostipa bronwenae*
Responsibility:	Parks and Wildlife (SCB, Swan Coastal and Wellington Districts)
Cost:	$6,000 in year 2

14. Promote awareness

The importance of biodiversity conservation and the protection of *Austrostipa bronwenae* 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:	Parks and Wildlife (Swan Coastal and Wellington Districts, SCB, Public Information and Corporate Affairs PICA), with assistance from the SRTFCRT and SWRTFRT
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 *Austrostipa bronwenae* is still listed as threatened in Western Australia following five years of implementation, this plan will be reviewed, the need for further recovery actions assessed and a revised plan prepared if necessary.

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	Parks and Wildlife (SCB, Swan Coastal and Wellington Districts)
Cost:	$6,000 at the end of year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Swan Coastal and Wellington Districts), with assistance from the SRTFCRT and SWRTFRT	Ongoing
Monitor populations	High	Parks and Wildlife (Swan Coastal and Wellington Districts), with assistance from the SRTFCRT and SWRTFRT	Ongoing
Install/maintain fencing	High	Parks and Wildlife (Swan Coastal and Wellington Districts), WAPC	2016
Collect and store seed	High	Parks and Wildlife (Swan Coastal and Wellington Districts, TFSC), BGPA	2020
Undertake weed control	High	Parks and Wildlife (Swan Coastal and Wellington Districts)	Ongoing
Undertake surveys	High	Parks and Wildlife (Swan Coastal and Wellington Districts), with assistance from the SRTFCRT, SWRTFRT and volunteers	Ongoing
Undertake regeneration trials	High	Parks and Wildlife (Science and Conservation Division, Swan Coastal and Wellington Districts)	2020
Achieve long-term protection of habitat	High	Parks and Wildlife (Swan Coastal and Wellington Districts, SCB), City of Bunbury, DMP	2020
Develop and implement translocations	High	Parks and Wildlife (Science and Conservation Division, Swan Coastal and Wellington Districts), BGPA	2020
Develop and implement a fire management strategy	High	Parks and Wildlife (Swan Coastal and Wellington Districts)	Developed by 2016, implementation ongoing
Obtain biological and ecological information	High	Parks and Wildlife (Science and Conservation Division, Swan Coastal and Wellington Districts)	2018
Liaise with land managers and Aboriginal communities	High	Parks and Wildlife (Swan Coastal and Wellington Districts)	Ongoing
Map habitat critical to the survival of *Austrostipa bronwenae*	Medium	Parks and Wildlife (SCB, Swan Coastal and Wellington Districts)	2017
Promote awareness	Medium	Parks and Wildlife (Swan Coastal and Wellington Districts, SCB, PICA), with assistance from the SRTFCRT and SWRTFRT	2020
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Swan Coastal and Wellington Districts)	2020

4. Term of plan

This plan will operate from May 2017 to April 2022 but will remain in force until withdrawn or replaced.

5. References

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Williams, A.R. (2011) *Austrostipa* (Poaceae) subgenus *Lobatae* in Western Australia. *Telopea* 13(1–2): 177–192.

6. Taxonomic description

***Austrostipa bronwenae* A.R.Williams, sp. nov.**

Williams, A.R. (2011) *Austrostipa* (Poaceae) subgenus *Lobatae* in Western Australia. *Telopea* 13(1–2): 177–192.

Perennial *grass*, 90–150 cm tall. *Leaf* sheaths 2–3 mm wide at the base of the culm, 1–1.5 mm wide at the upper nodes, not ribbed, glabrous. Upper leaf sheaths glabrous, but lower sheath margins sometimes with hairs 0.1–0.3 mm long. Ligule 0.0–1.0(-2) mm long, either between asymmetrical sheath lobes (which can be 3–5 mm long), or if absent, then the sheath lobes do not join in the middle of the inside collar region. Auricular region unmarked, or sometimes with a darkened spot, glabrous, or with few hairs 0.1–0.7 mm long. Leaf blade 35–45 cm long, 0.5–0.8 mm wide; terete, rolled or involute, abaxial surface not ribbed, glabrous and smooth, adaxial surface strongly ribbed, pubescent with an even covering of erect hairs 0.03–0.6 mm long. *Panicle* 25–30 cm long, exserted, contracted, 3–4 cm wide, subtended by an almost completely encircling involucel of hairs 0.3–1.3 mm long; lowest panicle internode 45–75 mm, scabrous, the hairs 0.03–0.06 mm long; shortest undivided branch 2–10 mm long, longest undivided branch 20–28 mm long; branches somewhat flattened with acutely angled edges, 80–120 mm long overall including glumes; pedicels likewise somewhat flattened, 3–13 mm long, scabrous on their acutely angled edges, the hairs 0.1–0.15 mm long; spikelets 11–15 per node, 10–12 mm long. Glumes persistent, subequal, acuminate, glabrous, straw-coloured; lower glume 3-nerved, 11–13 mm long; upper glume 3-nerved, 11–12 mm long. *Floret* 7–8 mm long, without a neck, sericeous with dark golden brown hairs at maturity, 0.5–0.6 mm long, increasing in length towards the apex. Lemma lobes 2, 0.3–1.0 mm long; coma 0.7–1.3 mm long; callus 1.5–1.8 mm long, sericeous with golden hairs 0.4–1.0 mm long, tip weakly bent. Awn 42–55 mm long, 0.33–0.4 mm wide near the base, column 19–26 mm long, 11–17 mm to the first bend, scabrous, with hairs 0.2–0.4 mm long; bristle triangular, no broader than column, paler than the column, scabrous with hairs 0.07–0.15 mm long. Palea equal to and almost completely enclosed by lemma, with glabrous margins, pubescent between the dorsal nerves. Lodicules 3, membranous; abaxial lodicules acutely ovate, 1.0–1.2 mm long, 0.3 mm wide; paleal lodicule acuminate, 0.7–0.8 mm long, 0.2 mm wide. Anthers 3, 4.2–5.0 mm long, pencillate. Style glabrous. Caryopsis 4.1–4.6 mm long, 0.9 mm wide; hilum 2.7–3.6 mm long, embryo 0.9–1.0 mm long.