Government of **Western Australia**
Department of **Environment and Conservation**

INTERIM RECOVERY PLAN NO. 327

WESTERN TRITHURIA

(*Trithuria occidentalis*)

INTERIM RECOVERY PLAN

2012–2017

July 2012
Department of Environment and Conservation
Kensington

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

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.

DEC is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs 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This plan will operate from August 2012 to July 2017 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Critically Endangered (CR) in WA, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 12th August 2012 and was approved by the Director of Nature Conservation 16th August 2012. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this plan was accurate at August 2012.

PLAN PREPARATION

This plan was prepared by Robyn Luu[1], Terry Macfarlane[2] and Andrew Brown[3].

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ACKNOWLEDGMENTS

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Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and DEC's Species and Communities Branch for assistance.

Cover photograph by Melissa Okely

CITATION

This plan should be cited as:

Department of Environment and Conservation (2012) Western Trithuria (*Trithuria occidentalis*) Interim Recovery Plan 2012–2017. Interim Recovery Plan No. 327. Department of Environment and Conservation, Western Australia.

SUMMARY

Scientific name:	***Trithuria occidentalis***	**Common name:**	Western Trithuria
Family:	Hydatellaceae	**Flowering period:**	October to November
DEC region:	Swan	**DEC district:**	Swan Coastal
Shire:	City of Swan	**NRM region:**	Perth
IBRA region/:	Avon Wheatbelt	**Recovery team:**	Swan Region Threatened Flora and Communities Recovery Team
IBRA subregion	Perth		

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora.* Department of Conservation and Land Management, Perth, Western Australia; Sokoloff, D.D., Remizowa, M.V., Macfarlane, T.D. and Rudall, P.J. (2008) Classification of the early-divergent angiosperm family Hydatellaceae: one genus instead of two, four new species and sexual dimorphism in dioecious taxa. *Taxon*: 57(1), 179-200; Western Australian Herbarium (1998−) *FloraBase − The Western Australian Flora*. Department of Environment and Conservation. http://florabase.dec.wa.gov.au/.

Current status: *Trithuria occidentalis* is declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered (CR) in WA under International Union for Conservation of Nature (IUCN 2001) criteria B1ab(iii)+2ab(iii) due to its extent of occurrence being less than 100km^2; area of occupancy less than 10km^2; it being known to exist at no more than one location; and there being a continuing decline in area, extent and/or quality of habitat. The species is currently listed (as *Hydatella dioica*) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) as Endangered. The main threats to the species are weeds, hydrological changes and soil disturbance.

Description: Sokoloff *et al*. (2008) describes *Trithuria occidentalis* as having fruits with a maximum width in their distal part; dry mature fruits that dehisce by separating three longitudinal ribs; dry mature seeds clearly sculptured (cells of exotesta well recognizable from surface with dissecting microscope). Male reproductive units with two bracts 5.5–10.1mm long; female reproductive units usually with eight bracts.

Habitat requirements: *Trithuria occidentalis* is currently known from one confirmed location near Ellenbrook. There is also a possible second location in Upper Swan in which the species has not been relocated since 1978. The species grows partly submerged on the edge of shallow, winter-wet claypans in very open shrubland of *Melaleuca lateritia*.

Habitat critical to the survival of the species, and important populations: *Trithuria occidentalis* is ranked in WA as CR and it is considered that the known habitat for the wild population is critical to the survival of the species, and that the wild population is an important population. Habitat critical to the survival of *T. occidentalis* includes the area of occupancy of the population, areas of similar habitat surrounding the population (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.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Trithuria occidentalis* will also improve the status of associated native vegetation including one DRF taxon, five Priority flora taxa, one threatened fauna species, and two Threatened Ecological 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. *Trithuria occidentalis* is not listed under any specific international treaty however, and this plan does not affect Australia's obligations under any other international agreements.

Indigenous consultation: A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has shown that the Ellenbrook area (site #3525), which includes the population of *Trithuria occidentalis*, is of Aboriginal significance. Input and involvement has therefore been sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests with respect to management for this species at this site. Indigenous opportunity for future involvement in the implementation of the recovery plan is included as an action in the plan. Indigenous involvement in management of the land is also provided for under the joint management arrangements in the *Conservation and Land Management Act 1984*.

Social and economic impacts: As the site containing the extant population of *Trithuria occidentalis* is of Aboriginal significance, recovery actions may potentially impact on Indigenous interests. Actions therefore refer to continued liaison between the relevant stakeholders. The implementation of this recovery plan is unlikely to cause any other social and economic impacts as the population is on a nature reserve.

Affected interests: The protection of the species impacts on DEC as the known population occurs in a nature reserve. Its habitat is also subject to Aboriginal interests.

Evaluation of the plan's performance: DEC 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.

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. Staff from DEC's Swan Coastal District regularly monitor the extant population.
2. DEC with assistance from the SRTFCRT is overseeing the implementation of threatened flora recovery/management in Swan Region, which will also incorporate implementation of this plan.

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

Recovery criteria

Criteria for success: At least one additional population discovered or established and/or the number of mature individuals has increased by 10 per cent or more over the term of the plan.

Criteria for failure: The number of mature individuals has decreased by 10 per cent or more over the term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Monitor population
3. Undertake surveys
4. Conduct weed control
5. Collect seed
6. Obtain biological and ecological information
7. Develop and implement a translocation proposal
8. Develop and implement a fire management strategy
9. Promote awareness
10. Liaise with indigenous communities
11. Map habitat critical to the survival of *Trithuria occidentalis*
12. Review this plan and assess the need for further recovery actions

1. BACKGROUND

History

Trithuria occidentalis was described in 1878 from a pre-1851 James Drummond collection but was later regarded as a synonym of *T. submersa*. Between 1898 and 1903 collections of *Trithuria* from the Midland Junction area were sent to Kew Gardens. These included *Trithuria submersa* and *Hydatella dioica* for which only male plants were known. Further plants were collected by Greg Keighery while undertaking a floristic survey of the southern Swan Coastal Plain (Gibson *et al*. 1994). During a taxonomic revision by Sokoloff *et al*. (2008) it was realised that some plants were all female and matched *T. occidentalis*. Evidence was found that these and the male plants called *H. dioica* were the two sexes of the same species. The research resulted in taxonomic changes to the Hydatellaceae.

Trithuria was traditionally characterised by its dehiscent fruits, which contained three longitudinal ribs, and bisexual reproductive units. *Hydatella* was characterised by its indehiscent, non-ribbed fruits and unisexual reproductive units. Sokoloff *et al*. (2008) found an absence of a correlation between these two characters and therefore combined all species of Hydatellaceae into a single genus of *Trithuria*, which had naming priority over *Hydatella*. Two of the original populations of *H. dioica* were reclassified as belonging to the widespread species *T. bibracteata* and *T. austinensis*, and a third to the highly restricted species *T. occidentalis*.

Trithuria occidentalis is currently known from one population on a nature reserve near Ellenbrook. A survey of the species in 1982 recorded an estimated 1000 plants present. However, in 2007 a partial survey recorded less than 200 plants. A possible second location is represented by a 1978 Greg Keighery collection from Warbrook Siding in Upper Swan but the locality has not been confirmed.

Description

Trithuria occidentalis is an aquatic herb, 2 to 3cm high, with tufted, linear, usually reddish leaves, 1mm wide by 2 to 3cm long, which are usually submerged until the pool dries up. Male plants have slender emergent inflorescences up to 3cm long composed of 8 to 10 male flowers enclosed in 2 red bracts 5.5 to 10mm long, each flower consisting of a single stamen bearing a red anther 1.7 to 4.3mm long. Female plants have much smaller inflorescences with 8 to 10 flowers enclosed in 8 bracts 1.5 to 2.2mm long, each flower consisting of a single ovary bearing a tuft of protruding stigmas (Brown *et al*. 1998, Sokoloff *et al*. 2008). Further to this, Sokoloff *et al*. (2008) describes *Trithuria occidentalis* as having fruits with a maximum width in their distal (uppermost) part; dry mature fruits that dehisce by separating three longitudinal ribs; dry mature seeds clearly sculptured, the cells of the exotesta rectangular in outline and transversely elongated as distinct from a honeycomb pattern (the sculpturing well recognizable from surface with dissecting microscope).

The common name of One-sexed Hydatella originally used to describe the species no longer applies as it is now known from both sexes (originally only the males were known). In addition, the species has been moved to the genus *Trithuria* and it will now be referred to as Western Trithuria (*occidentalis* = western).

Distribution and habitat

Trithuria occidentalis is known from a single confirmed location near Ellenbrook. There is also a possible second location near Upper Swan in which the species has not been relocated since collected in 1978. The species grows partly submerged on the edge of shallow, winter-wet claypans in very open shrubland of *Melaleuca lateritia* and ground layer of *Lepidophyllum capitatum, Utricularia inaequalis, Aphelia drummondii, Lachnagrostis* sp., *Amphibromus nervosus* and *Polypogon tenellus*.

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

Pop. no. & location	DEC district	Shire	Vesting	Purpose	Manager
1. Ellen Brook	Swan Coastal	City of Swan	Conservation Commission	Conservation of flora and fauna	DEC

Note: Population in **bold text** is considered to be important population.

Biology and ecology

In winter, *Trithuria occidentalis* is submerged in wet shallow claypans, flowering as the water recedes, while in summer it occurs as seed in the dried up mud of the claypans.

Note: the morphology and ecology of this species raises some issues concerning monitoring and surveys, including:

- Timing of the survey is critical. The plants need to be in flower, not pre-flowering nor post-flowering, for proper identification, and for making population size estimates when the plants are most visible.
- The habitat is very wet in good seasons but the time of drying out (when flowering occurs) can be unpredictable. Reconnaissance visits are needed to get survey timing right, and some flexibility in dates are needed from the survey team.
- The plants, especially the females, are very tiny and identification can be difficult but is crucial for accuracy of information. The males are readily recognisable. Before anthesis, *Trithuria* can be confused with *Centrolepis* and *Aphelia* spp., especially *Centrolepis glabra*. In addition there are three *Trithuria* species growing in the wetlands at Ellenbrook. *T. occidentalis* and *T. bibracteata* are known to grow together but are readily distinguished at flowering time. *T. submersa* also grows in the area but has not so far been seen intermingled with *T. occidentalis*. This species is very like *T. occidentalis* females but can be distinguished by usually having 4 bracts per inflorescence (rarely 2 or up to 8) and by having 1 or 2 stamens per inflorescence. These are only visible at flowering time and are soon shed.
- Observers need to be equipped with a hand lens and should photograph plants for subsequent checking.
- Trampling is a possible issue for survey teams.

Threats

Trithuria occidentalis is declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered (CR) in WA under International Union for Conservation of Nature (IUCN 2001) criteria B1ab(iii)+2ab(iii) due to its extent of occurrence being less than 100km^2; its area of occupancy being less than 10km^2; it being known to exist at no more than one location; and there being a continuing decline in area, extent and/or quality of its habitat. The species is currently listed (as *Hydatella dioica*) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) as Endangered. The main threats to the species are:

- **Weed invasion.** Dominant weed species include *Crassula natans*, *Hesperantha falcata*, *Sparaxis bulbifera* and *Watsonia* species. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many grass weed species.
- **Hydrological change**. *Trithuria occidentalis* grows partly submerged on the edge of shallow claypans and needs wet winters and standing water for optimal growth. Changes to hydrology may affect the plants ability to grow and reproduce.
- **Soil disturbance.** Bandicoots have been observed in the area of the population. However, it is not certain that plants are being impacted by this species, and monitoring is required.

The intent of this plan is to provide actions that will deal with immediate threats to *Trithuria occidentalis*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. no. & location	Land status	Year / no. of plants	Current condition	Threats
1. Ellenbrook	Nature Reserve	1982 1000 2007 <200	Healthy	Weeds, hydrological changes, soil disturbance

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 *Trithuria occidentalis* may require assessment.

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.
- Reduction in population size.
- A major increase in disturbance in the vicinity of a population.
- Pollution from adjacent highway, e.g. spillage from vehicle accidents.

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

Trithuria occidentalis is ranked in WA as CR and it is considered that all known habitat of the wild population is habitat critical to its survival, and that the wild population is an important population. Habitat critical to the survival of *T. occidentalis* includes the area of occupancy of the population, areas of similar habitat surrounding the population (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.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Trithuria occidentalis* will also improve the status of associated native vegetation. DRF and Priority flora species that occur within 500m of *T. occidentalis* are listed in the table below:

Table 3. Conservation–listed flora species occurring within 500m of *Trithuria occidentalis*

Species name	Conservation Status (WA)	Conservation Status (EPBC Act 1999)
Eleocharis keigheryi	DRF (Vulnerable)	Vulnerable
Rhodanthe pyrethrum	Priority 3	-
Schoenus capillifolius	Priority 3	-
Stylidium longitubum	Priority 3	-
Anthotium junciforme	Priority 4	-
Schoenus natans	Priority 4	-

For a description of the Priority categories see Smith (2012).

Recovery actions implemented to improve the quality or security of the habitat of *Trithuria occidentalis* may also improve the status of habitat for *Pseudemydura umbrina* (Western Swamp Tortoise), a threatened fauna species.

Trithuria occidentalis occurs within the Herb rich shrublands in claypans (SCP 08) Threatened Ecological Community (TEC) and within 1km of the *Eucalyptus calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain TEC.

Table 4: Threatened Ecological Communities in which *Trithuria occidentalis* occurs or is near

Community name	Conservation status (WA)	Conservation status (EPBC Act 1999)
Eucalyptus calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain (SCP 3a)	Critically Endangered	Endangered
Herb rich shrublands in claypans (SCP 08)	Vulnerable	-

For a description of TEC categories see DEC (2007).

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. *Trithuria occidentalis* is not listed under any specific international treaty, however, and this plan does not affect Australia's obligations under any other international agreements.

Indigenous consultation

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has shown that the Ellenbrook area (site #3525), which includes the extant population of *Trithuria occidentalis* is of Aboriginal significance. Input and involvement has therefore been sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests with respect to management for this species at this site. Indigenous opportunity for future involvement in the implementation of the recovery plan is included as an action in the plan. Indigenous involvement in management of the land is also provided for under the joint management arrangements in the *Conservation and Land Management Act 1984*.

Social and economic impacts

As the site containing the population of *Trithuria occidentalis* is of Aboriginal significance, recovery actions may potentially impact on Indigenous interests. Recovery actions therefore refer to continued liaison between relevant stakeholders. The implementation of this recovery plan may also cause some economic impact through the cost of implementing recovery actions.

Affected interests

The protection of the species impacts on DEC as the known population occurs in a nature reserve for which DEC has primary management responsibility. Its habitat is also subject to Aboriginal interests.

Evaluation of the plan's performance

DEC, with assistance from the Swan Region Threatened Flora and Communities Recovery Teams (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

Objective

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

Criteria for success: At least one additional population discovered or established and/or the number of mature individuals has increased by 10 per cent or more over the term of the plan.

Criteria for failure: The number of mature individuals has decreased by 10 per cent or more over the term of the plan.

3. RECOVERY ACTIONS

Existing recovery actions

Staff from DEC's Swan Coastal District regularly monitor the extant population.

DEC with assistance from the SRTFCRT is overseeing threatened flora recovery/management in Swan Region, which will also incorporate implementation of this plan.

Future recovery actions

Where recovery actions occur on lands other than those managed by DEC, permission has been or will be sought from appropriate owners/land managers prior to actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

DEC with assistance from the SRTFCRT will oversee the implementation of recovery actions for *Trithuria occidentalis* and will include information on progress in the recovery team's annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Swan Coastal District) with assistance from the SRTFCRT
Cost: $6,000 per year

2. Monitor population

Monitoring of factors such as weed invasion, habitat degradation, hydrology, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The population will be inspected and an accurate location recorded (note monitoring/survey requirements for this species). Soil disturbance possibly from bandicoots has been observed at the population and will need to be monitored in case further action is required.

Action: Monitor population(s)
Responsibility: DEC (Swan Coastal District)
Cost: $10,000 per year

3. Undertake surveys

It is recommended that areas of potential suitable habitat be surveyed for the presence of *Trithuria occidentalis* during its flowering period in October to November (note monitoring/survey requirements for this species). Potential areas for survey include the Warbrook Siding area (Keighery collection 1978), Bullsbrook Nature Reserve, Brixton Street Reserve and near Gingin.

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, and technically feasible, volunteers from the local community, landcare groups, wildflower societies and naturalists clubs will be encouraged to be involved.

Action: Undertake surveys
Responsibility: DEC (Swan Coastal District)
Cost: $5,000 per year

4. Conduct weed control

Weeds are a threat to the population and the following actions are recommended:

1. Determine which weeds are present and map them.
2. Select appropriate technique; herbicide, mowing or hand weeding.

3. Control invasive weeds by hand removal and/or spot spraying around the *Trithuria occidentalis* plants when weeds first emerge.
4. Revegetation with site specific species is required (in Autumn) to maintain low weed levels.
5. Monitor the success of the treatment on weed death, and the tolerance of *Trithuria occidentalis* and associated native plant species to the treatment.
6. Report on the method and success of the treatment, and effect on *Trithuria occidentalis* plants and associated species.

Action: Conduct weed control
Responsibility: DEC (Swan Coastal District)
Cost: $6,000 per year, as required

5. Collect seed

Seed collection is required to ensure the genetic diversity of the species is captured.

Action: Collect seed
Responsibility: DEC (Swan Coastal District, TFSC), BGPA
Cost: $5,000 per year

6. Obtain biological and ecological information

Improved knowledge of the biology and ecology of the species will provide a scientific basis for management of *Trithuria occidentalis* in the wild. To obtain this information research should be undertaken on:

1. the soil seed bank dynamics including the depth of burial and the role of various other 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. population genetic structure, levels of genetic diversity and minimum viable population size; and
5. the impact of changes in hydrology in the habitat.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Swan Coastal District)
Cost: $10,000 per year

7. Develop and implement a translocation proposal

Translocation may be deemed desirable for the conservation of this species if surveys fail to locate new populations. A translocation proposal will be developed and suitable translocation sites selected. Information on the translocation of threatened plants and animals in the wild is provided in DEC'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 DEC's Director of Nature Conservation. 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: DEC (Swan Coastal District)
Cost: $5,000 in year 4

8. Develop and implement a fire management strategy

Fire will be prevented from occurring in the habitat of the population except where it is being used experimentally as a recovery tool. A fire management strategy will be developed that recommends fire frequency, intensity, season and control measures.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Swan Coastal District)
Cost: $10,000 in first year and $2,000 in subsequent years

9. Promote awareness

The importance of biodiversity conservation and the protection of *Trithuria occidentalis* will be promoted to the public. This will be achieved using local print and electronic media and by setting up poster displays that would be focussed mainly on the conservation of the Western Swamp Tortoise at this site, and the nature reserve itself. An information sheet that includes a description of the plant, its habitat type, threats and management actions, and photos will be produced to support this promotion. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness
Responsibility: DEC (Swan Coastal District, SCB, Strategic Development and Corporate Affairs Division) with assistance from the SRTFCRT
Cost: $4,000 in year 1 and $2,000 in years 2-5

10. Liaise with Indigenous communities

Indigenous consultation will take place to determine if there are any issues or interests in areas that are habitat for *Trithuria occidentalis*.

Action: Liaise with Indigenous communities
Responsibility: DEC (Swan Coastal District)
Cost: $2,000 per year

11. Map habitat critical to the survival of *Trithuria occidentalis*

It is a requirement of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that spatial data relating to habitat critical to the survival of the species be determined. Although this habitat is alluded to in Section 1, it has not yet been mapped and this will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to the survival of *Trithuria occidentalis*
Responsibility: DEC (SCB, Swan Coastal District)
Cost: $6,000 in year 2

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

If *Trithuria occidentalis* is still ranked as CR 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: DEC (SCB, Swan Coastal District) with assistance from the SRTFCRT
Cost: $3,000 in year 5

Table 5: Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	DEC (Swan Coastal District) with assistance from the SRTFCRT	Ongoing
Monitor population	High	DEC (Swan Coastal District)	Ongoing
Undertake surveys	High	DEC (Swan Coastal District)	Ongoing
Conduct weed control	High	DEC (Swan Coastal District)	Ongoing
Collect seed	High	DEC (Swan Coastal District, TFSC), BGPA	2017
Obtain biological and ecological information	High	DEC (Science Division, Swan Coastal District)	2017
Develop and implement a translocation proposal	Medium	DEC (Swan Coastal District)	2016
Develop and implement a fire management strategy	High	DEC (Swan Coastal District)	Developed by 2012 with implementation ongoing
Promote awareness	Medium	DEC (Swan Coastal District, SCB, Strategic Development and Corporate Affairs Division) with assistance from the SRTFCRT	Ongoing
Liaise with Indigenous communities	Medium	DEC (Swan Coastal District)	Ongoing
Map habitat critical to the survival of *Trithuria occidentalis*	Medium	DEC (SCB, Swan Coastal District)	2014
Review this plan and assess the need for further recovery actions	Medium	DEC (SCB, Swan Coastal District) with assistance from the SRTFCRT	2017

4. TERM OF PLAN

This plan will operate from August 2012 to July 2017 but will remain in force until withdrawn or replaced. If the species is still ranked CR after five years, the need for further recovery actions will be determined.

5. REFERENCES

Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora.* Department of Conservation and Land Management, Perth, Western Australia.

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6. TAXONOMIC DESCRIPTION

Brown *et al*. 1998; Sokoloff *et al*. 2008

Trithuria occidentalis is an aquatic herb, 2 to 3cm high, has tufted, linear, usually reddish leaves, 1mm wide by 2 to 3cm long, which are usually submerged until the pool dries up. Male plants have slender emergent inflorescences up to 3cm long composed of 8 to 10 male flowers enclosed in 2 red bracts 5.5 to 10mm long, each flower consisting of a single stamen bearing a red anther 1.7 to 4.3mm long. Female plants have much smaller inflorescences with 8 to 10 flowers enclosed in 8 bracts 1.5 to 2.2mm long, each flower consisting of a single ovary bearing a tuft of protruding stigmas (Brown *et al*. 1998, Sokoloff *et al*. 2008). Further to this, Sokoloff *et al*. (2008) describes *Trithuria occidentalis* as having fruits with a maximum width in their distal (uppermost) part; dry mature fruits that dehisce by separating three longitudinal ribs; dry mature seeds clearly sculptured, the cells of the exotesta rectangular in outline and transversely elongated as distinct from a honeycomb pattern (the sculpturing well recognizable from surface with dissecting microscope).