INTERIM RECOVERY PLAN NO.184

CUMQUAT EREMOPHILA

(*EREMOPHILA DENTICULATA* SUBSP. *TRISULCATA* MS)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: Ryan Butler

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DEPARTMENT OF Conservation AND LAND MANAGEMENT
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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50.

IRPs 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.

CALM is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Endangered, this IRP will be reviewed after five years and the need for a full recovery plan assessed.

This IRP was given regional approval on 11 November, 2004 and was approved by the Director of Nature Conservation 24 December, 2004. The provision of funds and personnel identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate in June 2004.

ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Barbara Archer	Member of the Esperance District Threatened Flora Recovery Team, amateur botanist and specimen collector, Norseman.
Anne Cochrane	Manager, CALM's Threatened Flora Seed Centre
Bob Chinnock	Botanist, Adelaide Herbarium

Thanks to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and CALM's Wildlife Branch for assistance.

SUMMARY

Scientific Name:	*Eremophila denticulata* subsp. *trisulcata* ms	**Common Name:**	Cumquat Eremophila
Family:	Myoporaceae	**Flowering Period:**	October - March
Dept Regions:	South Coast	**Dept Districts:**	Esperance
Shires:	Esperance	**Recovery Teams:**	Esperance District Threatened Flora Recovery Team (EDTFRT)

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

Current status: *Eremophila denticulata* subsp. *trisulcata* ms was declared as Rare Flora in 1980 and downgraded to Priority 4 in 1999. It was believed at that time that the taxon no longer met IUCN criteria due to further populations being found. However, during recent taxonomic studies it was discovered that most listed populations are a related, undescribed taxon and that just three extant populations are true *Eremophila denticulata* subsp. *trisulcata*. The subspecies currently meets World Conservation Union (IUCN, 2000) Red List Category 'CR' under criteria A3; B1b(v)c(iii,iv)+2b(v)c(iii,iv) due to a decline of 80% over the last three generations, a continuing decline in the number of mature individuals and extreme fluctuations in the number of mature individuals and populations. The subspecies is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The subspecies will be re-nominated for Declared Rare Flora (DRF) under the Western Australian *Wildlife Conservation Act 1950* in 2005. The main threats are lack of disturbance, roadworks, clearing and inappropriate fire regimes.

Description: *Eremophila denticulata* subsp. *trisulcata* ms is an erect shrub to1-2.5 metres with resinous, shiny branches and alternate, dark green, shiny, resinous leaves with entire or, very rarely, obscurely denticulate margins. Buds are generally orange while mature flowers, which grow between 15-30 mm long, are carmine in colour. The fruit is usually ovoid to subglobular in shape, with the apex depressed and with three furrows deeply trisecting it. These lead to the scientific name trisulcata.

Habitat requirements: Three extant populations of Eremophila *denticulata* subsp. *trisulcata* ms are known from five localities over a range of 46 km north and north-west of Mt Ragged where it grows on powdery grey loams over limestone in tall *Eucalyptus ovularis* and *Eucalyptus fraseri* subsp. *fraseri* woodland with *Melaleuca quadrifaria* and *Melaleuca sheathiana*.

Critical habitat: The critical habitat for *Eremophila denticulata* subsp. *trisulcata* ms comprises the area of occupancy of known populations; similar habitat within 200 metres of known populations; and additional nearby occurrences of similar habitat (loamy soils over limestone) that do not currently contain the taxon but may have done so in the past and may be suitable for future translocations.

Habitat critical to the survival of the species, and important populations: Given that this subspecies is listed as Critically Endangered it is considered that all known habitat containing wild and translocated populations is habitat critical.

Benefits to other species/ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Eremophila denticulata* subsp. *trisulcata* ms will also improve the status of remnant vegetation in which it is located.

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. *Eremophila denticulata* subsp. *trisulcata* ms is not specifically listed under any international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register no sites have been discovered near *Eremophila denticulata* subsp. *trisulcata* ms populations. Input and involvement will be sought from Aboriginal groups that have an active interest in areas that contain the habitat of *Eremophila denticulata* subsp. *trisulcata* ms. This is discussed under relevant recovery actions.

Social and economic impact: Two populations of *Eremophila denticulata* subsp. *trisulcata* ms occur on a private (mining) road verge and negotiations will continue with regard to their future management. A further population occurs on a strategic firebreak that protects farmland and National Park from potentially large wildfires that may arise within an adjacent area of Unvested Crown Land (UCL). Consequently, the implementation of this recovery plan has the

potential to have some social and economic impact. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Evaluation of the Plans Performance: The Department of Conservation and Land Management (CALM), in conjunction with the Esperance District Threatened Flora Recovery Team, will regularly evaluate the performance of this Interim Recovery Plan (IRP). The plan is to be fully reviewed within five years of its implementation

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:

1. All land managers have been formally notified of the presence of *Eremophila denticulata* subsp. *trisulcata* ms
2. A review of Western Australian Herbarium specimens has been undertaken by A Brown to clarify the identity and extent of populations. Additionally, liaison has been undertaken with Dr Bob Chinnock over the taxonomy of the subspecies. A copy of his type collection (Population 4) has been lodged in the Western Australian Herbarium
3. CALM's Ryan Butler and Mike Fitzgerald undertook a two day field trip in February 2004 to check populations of *Eremophila denticulata* subsp. *trisulcata* ms. Plants were located at populations 1 and 2, population 3 could not be reached and populations 7 and 8 appeared to be of a related but different species.
4. CALM's Ryan Butler and Owen Massenbauer conducted a further field trip in March 2004 and an old Herbarium population was relocated. This population is yet to receive an official CALM Endangered Flora database (DEFL) population number.
5. Staff from CALM's Esperance District regularly monitor populations of the taxon.
6. The Esperance District Threatened Flora Recovery Team is overseeing the implementation of this IRP.

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

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions
2. Recommend listing as DRF
3. Map critical habitat
4. Develop a fire management strategy
5. Deviate firebreak and mine road around populations
6. Conduct recovery burning and soil disturbance trials
7. Continue monitoring populations
8. Collect seed and cutting material
9. Seek long-term protection of habitat
10. Conduct further surveys
11. Obtain biological and ecological information
12. Promote awareness
13. Quantify impacts and if necessary implement feral animal control
14. Quantify impacts and if necessary implement weed control
15. Review this IRP

1. BACKGROUND

History

Eremophila denticulata subsp. *trisulcata* ms was first collected from north of Cape Arid National Park and west of Duralinya Homestead by Bob Chinnock in 1986. In 1990 William Archer found a new population along a small track near Mt Buraminya. In 1997 the track was upgraded to allow for gypsum mining, however, plants were marked and damage was kept to a minimum. The north side of the track was scrub-rolled for a firebreak in 2001 and more plants appeared.

In 1999 *Eremophila denticulata* subsp. *trisulcata* ms was removed from the schedule of Declared Rare Flora and reduced to Priority 4 status after it was thought that many new populations had been found. However, taxonomic studies conducted in 2003 found that most of these were of a related undescribed species. As *Eremophila denticulata* subsp. *trisulcata* ms is now known from just three sites and the total number of mature plants is less than 1000 individuals, the subspecies will be re-nominated for Declared Rare Flora (DRF) in 2005.

Description

Eremophila denticulata subsp. *trisulcata* ms is an erect shrub 1 to 2.5 metres high with resinous, shiny branches and alternate, dark green, shiny leaves with entire or, very rarely, obscurely denticulate margins. Buds are generally orange while mature flowers, which grow between 15-30 mm long, are carmine in colour. The fruit is usually ovoid to subglobular in shape, with the apex depressed and with three furrows deeply trisecting it. These lead to the scientific name *trisulcata*.

Distribution and habitat

Eremophila denticulata subsp. *trisulcata* ms is known from five localities over a range of 46 km north and north-west of Mt Ragged where it grows on powdery grey loams over limestone in tall *Eucalyptus ovularis* and *Eucalyptus fraseri* subsp. *fraseri* woodland with *Melaleuca quadrifaria* and *Melaleuca sheathiana*.

Biology and ecology

Much remains unknown about the biology and ecology of *Eremophila denticulata* subsp. *trisulcata* ms. Because the taxon has only been found at disturbed sites such as on road verges and firebreaks it is currently considered to be a disturbance opportunist. The complete disappearance of several relatively undisturbed populations only a few years after their discovery suggests plants may be short lived (<10 years?).

Threats

Eremophila denticulata subsp. *trisulcata* ms was declared as Rare Flora in 1980 and downgraded to Priority 4 in 1999. It was believed at that time that the taxon no longer met IUCN criteria due to further populations being found. However, during recent taxonomic studies it was discovered that most listed populations are a related, undescribed taxon and that just three extant populations are true *Eremophila denticulata* subsp. *trisulcata*. The subspecies currently meets World Conservation Union (IUCN, 2000) Red List Category 'CR' under criteria A3; B1b(v)c(iii,iv)+2b(v)c(iii,iv) due to a decline of 80% over the last three generations, a continuing decline in the number of mature individuals and extreme fluctuations in the number of mature individuals and populations. The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The main threats are:

- **Inappropriate fire and soil disturbance regimes** are a potential threat to all populations. Although occasional fire or soil disturbance is needed for reproduction of this species the soil seed bank would rapidly be depleted if fire or soil disturbance recurred before regenerating or juvenile plants reached maturity. Wildfire suppression and prescribed burning represent a particular threat to populations 1 (a,

b) and 2(a, b). These two large populations lie astride a mine road and an adjoining scrub-rolled firebreak. In the event of a wildfire arising in the vicinity of the populations, the likely response will be to burn the scrub-rolled vegetation within the firebreak and to back burn, depending on the position of the wildfire, either from the southern road verge or the northern edge of the fire break. Both fire control strategies will have serious consequences for the taxon if they occur in the next few years. Plants appear to have arisen from disturbance caused by road construction in 1997 and from the chaining of the firebreak in 2001 and are unlikely to have yet produced sufficient seed to ensure adequate future recruitment.

- **Poor recruitment and declining populations** are a major threat to *Eremophila denticulata* subsp. *trisulcata* ms. Several populations that contained large plant numbers in the 1990s either could not be relocated during recent surveys or were represented by very few extant plants.

- **Vehicle traffic** along the mine road represents a minor threat to populations 1(a, b) and 2(a, b), either through direct injury to plants growing on the road verge or by dust build up on plants downwind of the traffic. This may result in either the death of plants or a reduction in their health.

- **Grazing and trampling** by feral rabbits, camels, horses and cattle is a moderate threat to all populations. Grazing and trampling will have an impact on the establishment of *Eremophila denticulata* subsp. *trisulcata* ms seedlings thus limiting the natural recruitment of the species. Grazing and trampling of mature plants will reduce the reproductive potential of populations and consequently the availability of seeds for later recruitment. In addition, disturbance of soil by rabbit warren construction and increased nutrient levels from droppings will impact the habitat of the species. Recent monitoring indicates that introduced animals have not yet had a direct and significant impact on populations but are impacting on the adjoining habitat.

- **Weed invasion** is currently a minor threat to all populations. The effect of weeds is uncertain but they are likely to compete for soil moisture and nutrients. Weeds may also increase the fire hazard due to the easy ignition of high fuel loads produced annually by many grass weed species.

- **Insecure tenure** is a minor threat to all populations. It could result in an adverse change in land management practices and may place populations at risk from future inappropriate management practices.

Summary of population information and threats

Pop. No & Location	Land Status	Year/No. plants	Condition	Threats
1a. NE of Esperance	Private Rd reserve	1990 100 1996 24 2004 2	Moderate	Roadworks, clearing, insecure tenure, inappropriate fire, poor recruitment, weeds
1b. NE of Esperance	Firebreak	2004 40	Good (disturbed)	Firebreak maintenance, inappropriate fire, poor recruitment, grazing, weeds
2a. NE of Esperance	Private Rd reserve	1990 20 1996 124 2004 250	Healthy	Roadworks, clearing, insecure tenure, inappropriate fire, poor recruitment, weeds
2b. NE of Esperance	Firebreak	2004 500+	Good (disturbed)	Firebreak maintenance, inappropriate fire, poor recruitment, grazing, weeds
3. NE of Esperance	UCL	1990 1500 2004 0	No extant plants	Inappropriate fire, poor recruitment
4. NE of Esperance	Shire Rd reserve	1986 40 2004 0	No extant plants	Inappropriate fire, poor recruitment
5. NE of Esperance	NPK	1980 ? 2004 15	Good	Inappropriate fire, poor recruitment, weeds

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms or once occupied

(continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced. (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The critical habitat for *Eremophila denticulata* subsp. *trisulcata* ms comprises:

- The area of occupancy of known populations;
- areas of similar habitat within 200 metres of known populations, i.e. powdery grey loams over limestone in tall *Eucalyptus ovularis* and *Eucalyptus fraseri* subsp. *fraseri* woodland over *Melaleuca quadrifaria* and *Melaleuca sheathiana* shrubland; and
- additional occurrences of similar habitat that do not currently contain the taxon but may have done so in the past (these represent possible translocation sites).

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

Given that *Eremophila denticulata* subsp. *trisulcata* ms currently meets the criteria for Critically Endangered it is considered that all known habitat for wild and any future translocated populations is critical habitat.

Benefits to other species/ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Eremophila denticulata* subsp. *trisulcata* ms will also improve the status of remnant vegetation in which it is located.

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. *Eremophila denticulata* subsp. *trisulcata* ms is not specifically listed under any international treaty however and this plan does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register no sites have been discovered near *Eremophila denticulata* subsp. *trisulcata* ms populations. However, input and involvement will be sought from Aboriginal groups that have an active interest in areas that contain the habitat of *Eremophila denticulata* subsp. *trisulcata* ms. This is discussed under relevant recovery actions.

Social and economic impact

Two populations of *Eremophila denticulata* subsp. *trisulcata* ms occur on a private (mining) road verge and negotiations will continue with regard to their future management. A further two populations occur on a strategic firebreak that protects farmland and National Park from potentially large wildfires. Consequently, the implementation of this recovery plan has the potential to have some social and economic impact. Recovery actions refer to continued liaison with stakeholders with regard to these areas.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, firebreaks etc) in the immediate vicinity of *Eremophila denticulata* subsp. *trisulcata* ms will require assessment. On ground works should not be approved unless the proponents can demonstrate that they will not have an impact on the taxon, its habitat or potential habitat.

Evaluation of the Plans Performance

CALM, in conjunction with the Esperance District Threatened Flora Recovery Team (EDTFRT) will evaluate the performance of this Interim Recovery Plan (IRP). In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed within five years. Any changes to management or recovery actions will be documented accordingly.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

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

Criteria for success: The number of individuals within populations and/or the number of populations has increased or remains stable.
Criteria for failure: The number of individuals within populations and/or the number of populations has decreased.

3. RECOVERY ACTIONS

Existing recovery actions

All land managers have been formally notified of the presence of *Eremophila denticulata* subsp. *trisulcata* ms.

A review of *Eremophila denticulata* subsp. *trisulcata* ms specimens at the WA Herbarium has been undertaken by CALM's A. Brown to clarify the identity of plants in listed populations. This found that all but five populations were of a related, currently undescribed *Eremophila*.

A duplicate specimen from Bob Chinnock's type collection (Population 4) has now been lodged in the WA Herbarium

CALM's Ryan Butler and Mike Fitzgerald conducted a two day field trip in February 2004 to check *Eremophila denticulata* subsp. *trisulcata* ms populations 1, 2, 3 and 7. Plants were found at populations 1 and 2, population 3 could not be reached and populations 7 and 8 appeared to be a different species.

CALM's Ryan Butler and Owen Massenbauer conducted a field trip in March 2004, to check WA Herbarium collections of *Eremophila denticulata* subsp. *trisulcata* ms. One new population was found from an old Herbarium collection (Population 5).

Staff from CALM's Esperance District regularly monitor populations of the taxon.

The Esperance District Threatened Flora Recovery Team is overseeing the implementation of this IRP and will include information on progress in an annual report to CALM's Corporate Executive and funding bodies.

Future recovery actions

As some populations occur on a road associated with a mining lease, and on other regional roads permission has been or will be sought from the landowners prior to recovery actions being undertaken. The following recovery actions are roughly in order of descending priority; however this should not constrain addressing any recovery action if funding is available or other opportunities arise.

1. Coordinate recovery actions

The EDTFRT will continue to oversee the implementation of recovery actions for *Eremophila denticulata* subsp. *trisulcata* ms and will include information on progress in its annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $500 per year.

2. Recommend listing as DRF

A recent taxonomic review indicates that many populations that were thought to be *Eremophila denticulata* subsp. *trisulcata* ms are in fact a related, undescribed taxon. Just three extant populations are now known and the subspecies meets World Conservation Union (IUCN, 2000) Red List Category 'CR' due to a continuing decline in the number of populations and mature individuals and extreme fluctuations in the number of mature individuals. A recommendation to gazette *Eremophila denticulata* subsp. *trisulcata* ms as Declared Rare Flora (DRF) will be forwarded to the Threatened Species Scientific Committee in 2005.

Action: Recommend listing as DRF
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $1,000 in the first year.

3. Map critical habitat

It is a requirement of the EPBC Act that spatial data relating to critical habitat be determined. Although critical habitat is described in Section 1, the areas as described have not yet been mapped and that will be redressed under this action. If additional populations are located, then critical habitat will also be determined and mapped for these locations.

Action: Map critical habitat
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $2,000 in the first year.

4. Develop a fire management strategy

Although occasional fire is needed for the reproduction of this species, adult plants would be killed and the soil seed bank rapidly depleted if fire recurred before juvenile plants reached maturity. A fire management plan will be developed that details the frequency and intensity of fires and control measures necessary to prevent inappropriate fire.

Action: Develop a fire management strategy
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $3,500 in first year and $1,000 for implementation in subsequent years

5. Deviate firebreak and mine road around populations

It is recommended that the mining road and firebreak be deviated around populations to address threats arising from wildfire suppression and vehicle traffic. The location of the deviations should be based on the mapped extent of the critical habitat (Action 3) and should protect both the populations and the critical habitat.

Action: Deviate firebreak and mine road around populations
Responsibility: CALM (Esperance District), Mining Company through the EDTFRT
Cost: $10,000

6. Conduct recovery burning and soil disturbance trials

It is recommended that recovery burning and soil disturbance be trialed over a portion of one or more known population sites to determine the effectiveness of different regimes in encouraging recruitment. The trial of both fire and soil disturbance would ascertain which method is most effective. This research should determine:

- The size and viability of the soil seed bank.
- The role of disturbance in regeneration and recruitment.

Care, however, should be taken as these processes inherently carry a significant risk of depletion of soil seed bank reserves. The construction of firebreaks around burn plots and attendance of sufficient staff to deal with accidental escapes is therefore recommended.

Action: Conduct recovery burning and soil disturbance trials
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $5800 in both the first and third year for trial implementation, and $1,200 in each other year for monitoring.

7. Continue monitoring populations

All populations of *Eremophila denticulata* subsp. *trisulcata* ms should be monitored specifically for signs of grazing, trampling and weed invasion. In addition, annual monitoring of factors such as population stability (expansion or decline), habitat degradation, pollinator activity, seed production, recruitment, longevity and predation is essential.

Action: Continue monitoring populations
Responsibility: CALM (Esperance) through the EDTFRT
Cost: $1,400 per year

8. Collect seed and cutting material

Preservation of genetic material is essential to guard against extinction if wild populations are lost. Such collections are also needed to propagate plants for possible future translocations. Seed and cutting material will be obtained with seed stored at CALM's Threatened Flora seed Centre (TFSC) and cutting material used to establish a living collection at the Botanic Gardens and Parks Authority (BGPA).

Action: Collect seed and cutting material
Responsibility: CALM (TFSC, Esperance District) and BGPA through the EDTFRT
Cost: $1,000 in second and fourth years

9. Seek long-term protection of habitat

Staff from CALM's Esperance District will continue to liaise with landowners and managers to ensure that populations are not accidentally damaged or destroyed. Input and involvement will also be sought from any Aboriginal groups that have an active interest in areas that are habitat for *Eremophila denticulata* subsp. *trisulcata* ms. In addition, ways and means of improving the security of populations and their habitat will be investigated.

Action: Seek long-term protection of habitat
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $1000 per year

10. Conduct further surveys

Further surveying will reduce the chance that other populations of *Eremophila denticulata* subsp. *trisulcata* ms remain unprotected. It is recommended that the sites of previous Herbarium specimen collections be

resurveyed during the subspecies flowering period as well as nearby areas of similar habitat where fire or mechanical disturbance has occurred.

Action: Conduct further surveys
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $2,000 per year for first four years

11. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Eremophila denticulata* subsp. *trisulcata* ms will provide a better scientific basis for its management in the wild. An understanding of the following is particularly necessary for effective management:

1) Pollination biology and seed set.
2) Factors determining level of flower and fruit abortion.
3) Level of invertebrate grazing or removal of seed.
4) Longevity of plants, and time taken to reach maturity.
5) Longevity of soil-stored seed.
6) Effects of weeds on recruitment and establishment.
7) Extent of genetic variation within and between populations - essential if new populations are to be established.

Action: Obtain biological and ecological information
Responsibility: CALM (Science Division, Esperance District) and BGPA through the EDTFRT
Cost: $10000 for first year and 8000 for each subsequent year.

12. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild population of this subspecies will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged.

To promote an awareness of *Eremophila denticulata* subsp. *trisulcata* ms among relevant CALM staff, the Shire of Dundas, Shire of Esperance and local naturalist groups and interested individuals, the production of vehicle stickers, drink holders and colour posters may be necessary. Vehicle stickers and drink holders illustrate a rare flora marker and provide a contact telephone number if populations of threatened species are encountered. Posters illustrate and provide information on the species.

Action: Promote awareness
Responsibility: CALM (Esperance District, Strategic Development and Corporate Affairs Division) through the EDTFRT
Cost: $1,300 in first year and $500 in subsequent years.

13. Quantify impacts and if necessary implement feral animal control

It is recommended that, as part of the population monitoring strategy (Action 6), monitoring plots will be established to quantify the impacts of feral animals on populations of *Eremophila denticulata* subsp. *trisulcata* ms and its associated critical habitat. If data are produced that indicate a significant threat to either the taxon or its critical habitat, staff from CALM's Esperance District Office will prepare and implement an appropriate strategy.

Action: Quantify impacts and if necessary implement feral animal control
Responsibility: CALM (Esperance) through the EDTFRT
Cost: $500 per year

14. Quantify impacts and if necessary implement weed control

It is recommended that, as part of the population monitoring strategy (Action 6), monitoring plots be established to quantify the impacts of weeds on populations of *Eremophila denticulata* subsp. *trisulcata* ms and its associated critical habitat. If data are produced that indicate a significant threat to either the taxon or its critical habitat, staff from CALM's Esperance District Office will prepare and implement an appropriate strategy.

Action: Quantify impacts and if necessary implement weed control
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $500 per year

15. Review this IRP

If the species is still ranked as Critically Endangered at the end of the fourth year of the five-year term of this IRP, the need for further recovery actions and an update to this IRP will be assessed.

Action: Review this IRP
Responsibility: CALM (WATSCU, Esperance District) through the EDTFRT
Cost: $20,000 in the fifth year (if required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from July 2004 to June 2008 but will remain in force until withdrawn or replaced. If the taxon is still ranked as Critically Endangered after five years, the need for further recovery and a review of this IRP will be determined.

5. REFERENCES

Atkins, K. (2003) *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management, Western Australia.

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

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

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

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

CALM (2004) Western Australian Herbarium FloraBase2 – Information on the Western Australian Flora. Department of Conservation and Land Management, Western Australia. http://florabase.calm.wa.gov.au

Craig, G.F. and Coates, D.J. (1994) *Declared rare and other plants in need of Special protection in the Esperance District.* Western Australian Wildlife Management Program Number 21. Australian Nature Conservation Agency, Canberra and Department of Conservation and Land Management, Western Australia.

Hopper, S., Van Leeuwen, S., Brown, A., and Patrick, S. (1990) *Western Australia's Endangered Flora*. Department of Conservation and Land Management, Perth.

World Conservation Union (2000) IUCN *red list categories prepared by the IUCN Species Survival Commission, as approved by the 51st meeting of the IUCN Council*. Gland, Switzerland.

6. TAXONOMIC DESCRIPTION

Chinnock, R. (in prep.)

Erect sparsely to densely branched glabrous shrub to 1–2.5 m tall. *Branches* triquetrous, non-tuberculate, obscurely glandular-papillose, resinous, shiny. *Leaves* alternate, petiolate; petiole 5–10 mm long; lamina elliptic, acute, margin denticulate except towards base or entire, (26-) 34–59 (-65) × (5.3-) 6.8–16 (-22), prominently minutely glandular-papillose, resinous, shiny; deep green. *Flowers* 1 per axil, pedicellate; pedicel terete, straight or sigmoidly curved, (5-) 15–30 mm long, glandular-papillose, resinous. *Sepals* 5, imbricate, lanceolate-triangular, acute, 3.5–13 × 0.9–2.5 mm; outer surface glandular-papillose, slightly resinous, inner surface glandular-puberulous, margins glandular-papillose. *Corolla* 25–30 mm long, bud orange, open flower carmine, unspotted; outer surface glandular-pubescent, inner surface of lobes glandular-pubescent but with longer eglandular hairs extending from base of lobes of upper lip down tube; lobes acute, lobe of lower lip, acute, reflexed. *Stamens* 4, exserted; filaments glandular-pubescent in basal half; anthers glabrous. *Ovary* ovoid but distinctly 3-sided, 3.5–4.5 × 2.5–3.5 mm, 3-locular with 2 ovules per locule, glabrous; style glabrous. *Fruit* dry, ovoid, prominently beaked, splitting near apex into three segments, or depressed ovoid to subglobular, apex depressed, prominently three furrowed, each of segments with a shallow medial furrow, 10–15 × 8–20 mm; exocarp pale brown, papery, glabrous; endocarp blackish-brown, prominently three-furrowed, apex beaked or very depressed. *Seed* unknown. *Chromosome number* unknown.

Notes

This species is known only from the Phillips & Hamersley Rivers and an area north east of Esperance in Western Australia. Mueller (1887) recorded the species for “near Eucla, Bate.” Black (1929, 1957) recorded the species for South Australia “near Eucla” and presumably he followed Mueller and assumed that the species would most likely be in the western part of the state if it occurs at Eucla. This South Australian record, was rejected by Chinnock (1978).

E. denticulata is closely allied to *E. decipiens* Ostenf., but differs from this species in having glabrous angled branches, larger broader glossy leaves and a larger prominently beaked or sulcated fruit with three locules.

188b. Subsp. *trisulcata* Chinnock, subsp. nov.

Leaves with entire or, very rarely, obscurely denticulate margins; sepals 6.5–13 mm long; fruit depressed ovoid to subglobular, apex depressed with three furrows deeply trisecting it, 10–15 × 11–20 mm.

Distribution and Ecology

Eremophila denticulata subsp. *trisulcata* is known only from the Eyre Botanical District in the areas north and north west of Mt Ragged where it grows on powdery grey loams in tall *Eucalyptus* woodland over *Melaleuca* shrubland.

Conservation status: 2E. Hopper et al. (1991) gave this subspecies a Conservation and Land Management priority rating of 2. The species occurs as scattered individuals or in small populations. Mr W. Archer (pers. comm.) located one population of over 100 individuals E of Mt Buraminya and a smaller one nearby.

Derivation of epithet

Latin *trisulcata*, three-furrowed.

SUMMARY OF RECOVERY ACTIONS AND COSTS (not for publication)

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	CALM	Other	Ext	CALM	Other	Ext	CALM	Other	Ext	CALM	Other	Ext	CALM	Other	Ext
1. Coordinate recovery actions	400	100	0	400	100	0	400	100	0	400	100	0	400	100	0
2. Recommend listing as DRF	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Map critical habitat	1000	0	1000	0	0	0	0	0	0	0	0	0	0	0	500
4. Develop a fire management strategy	2500	0	1000	500	0	500	500	0	500	500	0	500	500	0	500
5. Deviate firebreak and mine road around populations	2000	0	8000	0	0	0	0	0	0	0	0	0	0	0	500
6. Conduct recovery burning and soil disturbance trials	1800	0	4000	400	0	800	1800	0	4000	400	0	800	400	0	800
7. Continue monitoring populations	800	0	600	800	0	600	800	0	600	800	0	600	800	0	600
8. Collect seed and cutting material	0	0	0	500	0	500	0	0	0	500	0	500	0	0	0
9. Seek long-term protection of habitat	500	0	500	500	0	500	500	0	500	500	0	500	500	0	500
10. Conduct further surveys	600	400	1000	600	400	1000	600	400	1000	600	400	1000	600	400	1000
11. Obtain biological and ecological information	2000	0	8000	2000	0	6000	2000	0	6000	2000	0	6000	2000	0	6000
12. Promote awareness	500	0	800	250	0	250	250	0	250	250	0	250	250	0	250
13. Quantify impacts and if necessary implement feral animal control	250	0	250	250	0	250	250	0	250	250	0	250	250	0	250
14. Quantify impacts and if necessary implement weed control	250	0	250	250	0	250	250	0	250	250	0	250	250	0	250
15. Review this IRP	0	0	0	0	0	0	0	0	0	0	0	0	10000	0	10000
Total	**13600**	**500**	**25400**	**6450**	**500**	**10650**	**7350**	**500**	**13350**	**6450**	**500**	**10650**	**15950**	**500**	**21150**
Yearly Total		**$39,500**			**$17,600**			**$21,200**			**$17,600**			**$37,600**	

EA Environment Australia (formerly ANCA)

Total CALM: $49,800
Total Other $2,500
Total Ex: $81,200
Total cost: $133,500