INTERIM RECOVERY PLAN NO. 108

Herbaceous plant assemblages on bentonite lake beds (Vegetation Types 1,2,3&7) and margins (Vegetation Types 4,5&6) of the Watheroo-Marchagee region

Interim Recovery Plan

2002-2007

Sheila Hamilton-Brown

Photograph: Sheila Hamilton-Brown

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Department of Conservation and Land Management
Western Australian Threatened Species and Communities Unit
PO Box 51, Wanneroo, WA 6946

Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

Natural Heritage Trust
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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (the Department) 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.

The Department is committed to ensuring that Critically Endangered, and where appropriate and feasible, other threatened ecological communities 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This Interim Recovery Plan will operate from July 2002 to June 2007 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still ranked Critically Endangered, this IRP will be reviewed after five years and the need for a full Recovery Plan assessed.

This IRP was approved by the Director of Nature Conservation on 24 September 2002. The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting the Department, as well as the need to address other priorities.

Information in this IRP was accurate at July 2002.

SUMMARY

Name: Herbaceous plant assemblages on bentonite lake beds (Vegetation Types 1,2,3&7) and margins (Vegetation Types 4,5&6) of the Watheroo-Marchagee region.

Description: The plant community comprises herbaceous plant assemblages dominated by a combination of *Triglochin mucronata, Trichanthodium exile, Asteridea athrixioides* and *Puccinellia stricta* (Vegetation types 1,2,3&7) on the lake beds, and a combination of *Podolepis capillaris, Angianthus tomentosus* and *Pogonolepis stricta* (Vegetation types 4,5&6) on the lake margins, of bentonite lakes in the Watheroo-Marchagee region. These herbaceous plant assemblages are characterised by a dependence on a bentonite (saponite) substrate – naturally restricted to the lake beds and margins of perched, ephemeral freshwater playa lakes and claypans of the Watheroo-Marchagee region. Whilst most lakes comprise only herbaceous species, there are a number with varying densities of *Casuarina obesa* trees, and shrubs of *Melaleuca lateriflora* subspp. *lateriflora* and *Acacia ligustrina*.

IBRA Bioregion: Geraldton Sandplains

Department of Conservation and Land Management Region: Midwest Region

Department of Conservation and Land Management District: Moora

Recovery Team: Moora District Threatened Flora Recovery Team

Current status: This community was assessed by the Western Australian Threatened Ecological Communities' Scientific Committee on the 13 December 2000 as Endangered; this status was endorsed by the Western Australian Minister for the Environment and Heritage on 8 May 2002.

Critical habitat: The critical habitat comprises the area of occupancy of the known occurrences comprising bentonite substratum on perched ephemeral fresh water playa lakes and claypans, and the local catchment for the surface waters that provide the wetland habitat of the community.

IRP Objective(s): The maintenance or improvement of the overall condition of the plant assemblages on the lake-beds and -margins, and the reduction in the levels of threat.

Criteria for success: The continuing existence of the remaining herbaceous community on the bentonite lake beds and margins.

Criteria for failure: Loss of area or further modification of the community due to threatening processes as highlighted in this document.

Summary of recovery actions for the herbaceous plant assemblages on bentonite lake beds (Vegetation Types 1,2,3&7) and margins (Vegetation Types 4,5&6) of the Watheroo-Marchagee region:

1. Continue to determine the plant assemblages of all lakes	7. Monitor the boundaries of the community
2. Determine hydrological conditions and monitor changes in them	8. Design and implement weed control strategy
3. Manager water quality and ensure stability in hydrological regimes	9. Seek to fence occurrences on private land
4. Obtain biological and ecological information on the major components of the community	10. Seek to revegetate buffers
5. Liaise with owners and surrounding landholders to manage their properties in ways sympathetic to the community	11. Seek to acquire unallocated crown land parcel for the conservation estate
6. Design and implement a flora monitoring program	12. Nominate the TEC under the Commonwealth EPBC Act (1996)

1 BACKGROUND

History, defining characteristics of ecological community, and conservation significance

Saponite, a magnesium-rich form of bentonite (known commercially and locally as 'Watheroo bentonite'), is found only on a number of ephemeral playa lakes and claypans in the Watheroo-Marchagee area (Fetherston *et al*. 1999) on the Dandaragan Plateau.

Griffin and Associates (1991) surveyed the vegetation and flora (made up of mainly herbaceous species) of twelve bentonite lakes and identified four distinct vegetation types on the lake beds and three on the lake margins (Table 1). Most of the smaller lake beds carried one (mostly Type 3), or to a lesser extent, two vegetation types, with the larger ones carrying up to three. The study concluded that the plant assemblages on the bentonite lakes – although the individual herbaceous species are known to occur elsewhere in Western Australia - were different from other lakes in the region and probably restricted to them due to the bentonite substrata.

Table 1: Herbaceous species defining the vegetation types associated with the bentonite lakes of the Watheroo-Marchagee region

	Vegetation types						
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Angianthus tomentosus					√		
Asteridea athrixioides							√
Podolepis capillaris				√			
Pogonolepis stricta						√	
Puccinellia stricta	√		√				
Trichanthodium exile	√	√					
Triglochin mucronata		√	√				

A study carried out by the author clearly demonstrated that there were no lakes elsewhere on the Dandaragan Plateau, or in the Swan Coastal Plain or central western Wheatbelt, with a similar assemblage of herbaceous plants (Hamilton-Brown 2000). Similar findings were supported by the State Salinity Strategy Biological Survey: 230 lakes throughout the south-west agricultural zone were sampled, and not one of the clay-based lakes carried any assemblages similar to those on the bentonite lakes (M. Lyons, personal communication[1]).

Description of Occurrences

All the occurrences are located in the Watheroo-Marchagee area immediately south and east of Lake Pinjarrega, within an area roughly 17 km x 11 km. Approximately 62% of the occurrences are found scattered on the eastern side of Watheroo National Park and Pinjarrega Nature Reserve with the remainder clustered on adjacent unallocated crown land and private property (Table 2):

Reserve System occurrences

The occurrences within the National Park and Nature Reserves are surrounded by remnant vegetation. The main threatening processes include salinisation, water-logging, weed invasion and feral animals.

[1] Mike Lyons – Research Scientist, Department of Conservation and Land Management.

Table 2: Summary of occurrence information and threats

Occ. #	Land Status	Area of occurrence (ha)	Condition	Threatening Process
1	Nature Reserve	0.5	Insignificantly modified	Weed invasion, recreational activities and salinisation
2	Nature Reserve	2.7	Slightly modified	Weed invasion, recreational activities and salinisation
3	Nature Reserve	1.3	Insignificantly modified	Weed invasion, recreational activities and salinisation
4	Nature Reserve	0.8	Moderately modified	Mining activities, weed invasion, recreational activities and salinisation
5	Nature Reserve	3.5	Slightly modified	Mining activities, weed invasion, recreational activities and salinisation
6	Nature Reserve	1.4	Insignificantly modified	Weed invasion, recreational activities and salinisation
7	Nature Reserve	0.5	Insignificantly modified	Weed invasion, recreational activities and salinisation
8	Nature Reserve	0.3	Very slightly modified	Weed invasion, recreational activities and salinisation
9	Nature Reserve	3.2	Moderately modified	Mining activities, weed invasion, recreational activities and salinisation
10	Nature Reserve	2.5	Insignificantly modified	Weed invasion, recreational activities and salinisation
11	Nature Reserve	0.8	Insignificantly modified	Weed invasion, recreational activities and salinisation
12	Nature Reserve	0.6	Insignificantly modified	Weed invasion, recreational activities and salinisation
13	UCL	1.4	Moderately modified	Mining activities, weed invasion, trampling and salinisation
14	UCL/PP	0.4	Moderately modified	Mining activities, weed invasion, feral animal trampling and salinisation
15	UCL	1.1	Highly modified	Mining activities, weed invasion, feral animal trampling and salinisation
16	UCL	0.3	Highly modified	Mining activities, weed invasion, feral animal trampling and salinisation
17	UCL	3.2	Moderately modified	Mining activities, weed invasion, feral animal trampling and salinisation
18	National Park	0.6	Highly modified	Salinisation, weed invasion and nutrient enrichment
19	National Park	1.7	Very slightly modified	Salinisation, weed invasion, feral animal trampling and nutrient enrichment
20	National Park	1.5	Moderately modified	Salinisation, weed invasion, feral animal trampling and nutrient enrichment
21	National Park	0.5	Slightly modified	Salinisation and weed invasion
22	Multiple Use Reserve	10.0	Completely modified	Mining activities, weed invasion and salinisation
23	National Park	3.7	Insignificantly modified	Salinisation and weed invasion
24	National Park	0.3	Insignificantly modified	Salinisation and weed invasion
25	Nature Reserve	24.0	Completely modified	Weed invasion and salinisation
26	PP	15.0	Highly modified	Mining activities
27	PP	3.2	Completely modified	Salinisation, water-logging , weed invasion, stock trampling and nutrient enrichment
28	PP	2.7	Moderately modified	Salinisation, water-logging , weed invasion, stock trampling and nutrient enrichment
29	PP	0.6	Moderately modified	Salinisation, water-logging and weed invasion
30	PP	2.9	Moderately modified	Salinisation, water-logging and weed invasion
31	PP	0.6	Highly modified	Salinisation, water-logging and weed invasion
32	PP	0.5	Highly modified	Salinisation, water-logging and weed invasion
33	PP	0.8	Highly modified	Salinisation, water-logging and weed invasion

UCL = Unallocated Crown Land PP = Private Property

Occurrences on unallocated crown land /road reserve

This land parcel - comprising a narrow (~ 1 km) strip of land - contains five lakes surrounded by remnant vegetation adjacent to the Marchagee Track. It is not being managed for conservation; and cattle have occasionally been seen on the lakes. All of the lakes have had some degree of mining activity: Occurrence 17 has been the most affected with the bentonite mined and stockpiled on the lake since the 1960's. There is a mining lease– which has remained idle since the stockpile was created- over this lake although there may be plans to use the stockpile and mine further if there is market demand for the product (B. Scott, personal communication[2]).

Occurrences on private property

All the occurrences have been modified: they are immediately surrounded by cropping or grazing land cleared right up to the boundary, have no protection from grazing and no buffers to protect them from weed invasion. Practically all have had bentonite - at varying depths – mined from them. None are being managed for conservation and some are being mined currently (e.g. occurrences 26 and 27).

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 (a) occupied (continuously, periodically or occasionally) by an organism or group of organisms; or (b) once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind that the potential to be reintroduced (sections 207A and 528 of Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The critical habitat of the herbaceous plant assemblages on bentonite lake beds (Vegetation Types 1,2,3&7) and margins (Vegetation Types 4,5&6) of the Watheroo-Marchagee region comprise the area of occupancy of the known occurrences and encompasses:

- perched ephemeral freshwater playa lakes and claypans
- bentonite substratum
- the local catchment for the surface waters that create the wetland habitat of the community.

Biological and ecological characteristics

All the playa lakes and claypans are perched (L. Stelfox, personal communication[3]) with beds varying from at least 20 cm to 3-4 metres of 100% bentonite clay (B. Scott, personal communication[4]). Bentonite in the northern hemisphere originates from acid volcanics, but 'Watheroo bentonite' may originate from weathering of the Moora Group of Proterozoic rocks (M. Freeman, personal communication[5]).

The herb-dominated community is dependent upon intermittent freshwater inundation and drying out within a few weeks of filling. Most of the plants are annuals (Table 3) and along with the other biota, particularly the non-insect invertebrate fauna (A. Pinder, personal communication[6]), probably depend on relatively freshwater and regular drying out of the lake bed for survival.

Information on the biological and ecological characteristics of the lake bed community is limited. All the flora are found in other places in Western Australia: *Trichanthodium exile, Asteridea athrixioides, Puccinellia stricta* and *Pogonolepis stricta* have been recorded widely around the fringes of saline lakes, whilst *Triglochin mucronata* is virtually ubiquitous around most brackish and saline lakes (M.

[2] Bill Scott – Watheroo Minerals Pty Ltd.
[3] Louise Stelfox -Hydrogeologist, Department of Environment, Water and Catchment Protection.
[4] Bob Scott - Watheroo Minerals Pty Ltd.
[5] Mike Freeman – Geologist, Department of Minerals and Petroleum Resources.
[6] Adrian Pinder - Research Scientist, Department of Conservation and Land Management.

Lyons, personal communication[1]). Nothing is know about the germination requirements nor the response of each species to water-logging, salinity and other disturbances; gaining such information is a priority in this IRP. Most of the lakes have had a history of bentonite removal yet the herbs still persist. The author hypothesises that rather than a particular vegetation type being specific to a lake (i.e. static), all plant germplasm are present on all lakes, and the appearance of particular species is dependent on various abiotic factors, including seasonal and climatic variation and management practices, that vary widely.

Table 3: Some characteristics of the herb species associated with the bentonite lakes of the Watheroo-Marchagee region (WA Herbarium 2000)

Species	Family	Life span	Flowering period	Habitat
Angianthus tomentosus	Asteraceae	Annual	Aug-Dec	wetlands, granite outcrops
Asteridea athrixioides	Asteraceae	Annual	Jul-Nov	wetlands, rocky hills
Podolepis capillaris	Asteraceae	Annual/Perennial (?)	Jan-Dec	various
Pogonolepis stricta	Asteraceae	Annual	Aug-Nov	various
Puccinellia stricta	Poaceae	Perennial	Aug-Nov	wetlands
Trichanthodium exile	Asteraceae	Annual	Sep-Oct	wetlands
Triglochin mucronata	Juncaginaceae	Annual	Jul-Nov	wetlands

Hydrology and Water Quality

The lakes are part of the Moore River Catchment. There has been research on the hydrology and hydrogeology in this catchment, but most work/study has concentrated on the areas north of Lake Pinjarrega. It is thought the lakes in the Upper Coonderoo Zone (covering lakes north and south of Lake Pinjarrega and including the bentonite lakes) primarily act as groundwater recharge basins for flows from the Darling Scarp to the east (Sinclair Knight Merz 2001).

Many of the lakes in the southern part of the range (ie. Watheroo National Park) have been suffering salinisation – with effects ranging from the death of the fringing vegetation to massive weed invasion. Surface water drainage from adjacent agricultural-cleared lands is thought to be the cause (P. Commander, personal communication[7]). Investigations to determine the hydrological processes are given high priority in this IRP.

Threatening processes

There has been an observed decline in the margin vegetation and an increase in weed species on the lake bed of many of the lakes. The processes causing this decline are still occurring. The main threats to the TEC are salinisation, water-logging/inundation, weed invasion, mining, trampling by feral animals and nutrient enrichment.

- **Salinisation** – particularly saline surface water from adjacent cleared farm-land - is thought to be affecting many of the lakes. Although many of the component species are known from around salt lakes, they are unlikely to be able to cope with hyper-saline conditions, towards which some lakes appear to be moving.

- **Excessive inundation and water-logging** can be a major threat to the lake-bed community as its components are thought to rely on the lakes drying-out to complete their life-cycles. The eventual death of tree and shrub species and the consequent lack of deeper roots to lower the water table add to rising saline water tables.

[7] Dr Philip Commander – Supervising Hydrogeologist, Department of Environment, Water and Catchment Protection.

- **Weeds** can have significant impacts on a community through competition with the native species. Disturbances such as salinity and water-logging can predispose areas to weed invasion if weed propagules are present. Some lake beds (eg. Lake 25) are already dominated by highly salt tolerant weeds that are more aggressive than the native species that can tolerate saline conditions.

- **Mining** of bentonite lakes involves removing most - if not all - the bentonite substratum which is though to be vital for the survival of the plant community. Even if the topsoil was stockpiled and returned, rehabilitation to its former state would be unlikely as the subsequent lake would be a permanently inundated depression. For economic reasons, mining activities have concentrated on the larger, and consequently more diverse lakes. To date, three applications to mine bentonite in the nature reserve and national park have seen one lake (occurrence 22) excised from the park; the other two applications were rejected.

  There have also been applications to mine limestone from adjacent lakes. So far these have been rejected, but if they were to go ahead, there is the potential to increase surface water drainage, rates of weed invasion, and possibly changes in groundwater processes.

- **Trampling** of the lake beds - by trail bikes, feral goats and cattle - can remove component species, prevent recruitment and act as a source of weed invasion.

- **Nutrient enrichment** resulting from the faeces of feral goats and cattle or surface water carrying fertilizers draining from agricultural land may affect plants through suppressing germination, nutrient toxicity (therefore killing or handicapping the plants directly), or by increasing weed levels and thus competition.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of the occurrences require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the ecological community.

Current status

The 'Herbaceous plant assemblages on bentonite lake beds (Vegetation Types 1,2,3&7) and margins (Vegetation Types 4,5&6) of the Watheroo-Marchagee region' community meets the following criterion for Endangered (EN) ecological communities:

> *B) Current distribution is limited, and*
> *(iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.*

Recovery strategy

To work with landholders, the Moore River Catchment group and/or other interested organisations to identify and ameliorate the negative processes that directly affect the lakes.

To conduct appropriate research into the ecology of the community to develop further understanding about the management actions required to maintain or improve the condition of the community.

2 RECOVERY OBJECTIVES AND CRITERIA

Objective

To maintain or improve the overall condition of the slightly to moderately modified occurrences and reduce the level of threat to their survival with the aim of reclassifying the community from Endangered to Vulnerable.

Criteria for success

- Maintenance or improvement of the extent of the community, and of the number of occurrences, described as insignificantly or slightly modified.
- Reduction of threatening processes as defined in this document.

Criteria for failure

- Continuing increases in salinity of all occurrences.
- Significant loss of one or more of the component species or further modification (ie. increase in weed composition) of the community due to increased salinity or other means.
- Reduction in the extent of the community, and of the number of occurrences, described as insignificantly or slightly modified.

3 RECOVERY ACTIONS

3.1 Existing Recovery Actions

The Moora District Threatened Flora Recovery Team (MTFRT) is the recovery team for this TEC and will continue to report annually to the Department's Corporate Executive.

All land owners/managers have been notified of the importance of the community and their cooperation will be sought to ensure that management activities do not affect the occurrences. Permission and cooperation will be sought from the appropriate land owners/managers prior to any recovery actions being taken.

Feral goat control is being carried out in the National Park and Nature Reserve.

3.2 Recommended Recovery Actions

The following recovery actions are roughly in order of descending priority; however this should not constrain addressing any of the priorities if funding is available for 'lower' priorities and other opportunities arise.

3.2.1 Continue to determine the plant assemblages of all lakes

An annual survey to determine the plant species and categorise the lakes according to vegetation types will be conducted when the plants are flowering (September to October) and the lakes are dry. Resulting information will be correlated with abiotic factors such as rainfall, drying and filling cycles. This information will be added to the Department's Threatened Ecological Community (TEC) database as recommended in English and Blyth (1999).

Responsibility: WA Threatened Species and Communities Unit (WATSCU) and Moora District through the MTFRT
Estimated cost: $2,000 p/a

Completion date: Year 5.

3.2.2 Determine hydrological conditions and monitor changes in them

Surface- and ground- water processes affecting all the lakes need to be clarified. This may require the strategic installation of groundwater piezometers and depth gauges to provide ongoing monitoring to determine the influx of salts to the lakes and measure water level, conductivity, and temperature.

Responsibility: WATSCU and Moora District in liaison with the Moore River Catchment Group and the Department of Environment, Water and Catchment Protection (DEWCP)
Estimated cost: $15,000 p/a for first 3 years, $3,000 for subsequent years
Completion date: Ongoing.

3.2.3 Manage water quality and ensure stability in hydrological regimes

Design and implement strategies to manage water quality and ensure stability in hydrological regimes. This may include surface water diversion schemes and one or more groundwater pumping schemes, along with the disposal of both the pumped groundwater and surface water, not only from the lakes but also from adjacent lands that may drain into the lakes.

Responsibility: WATSCU and Moora District through the MTFRT in liaison with the Moore River Catchment Group and DEWCP
Estimated cost: WATSCU and Moora District to determine costs and seek funds
Completion date: On-going.

3.2.4 Obtain biological and ecological information on the major components of the community

Research designed to increase understanding of the biology of the defining species of the community will provide a scientific base for management in the wild. Research will include:

1. Study of the soil seed bank dynamics and the role of various factors (disturbance, competition, rainfall and grazing) in recruitment and seedling survival.
2. Seed germination requirements.
3. Quantification of level of seed predation or removal of seed.
4. Determination of reproductive strategies, phenology and seasonal growth.
5. Factors determining level of flower and fruit abortion.
6. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
7. Effects of weeds on recruitment and establishment.
8. Response to trampling.
9. Response to changes in salinity and periods of inundation, particularly at different stages of their life-cycles.

Responsibility: WATSCU and Moora District through MTFRT in liaison with the Science Division
Estimated cost: $30,000 p/a initially, $25,000 p/a subsequent years
Completion date: On-going.

3.2.5 Liaise with owners and surrounding landholders to manage their properties in ways sympathetic to the community

Liaise with the owners and surrounding landholders to manage their properties without compromising the conservation values of the TEC and the conservation reserves, particularly in regard to drainage and stock movement.

Responsibility: WATSCU and Moora District through the MTFRT
Cost: $2,000 p/a
Completion date: On-going.

3.2.6 Design and implement a flora monitoring program

Data collected should include plant species diversity and weed levels. The occurrences will be monitored regularly to provide information on condition. The program will include re-scoring the quadrats already erected on some of the lakes and erecting permanent quadrats on the others. It will also entail establishing photopoints and photoplots annually (Elzinga *et al*. 2001). This information will be added to the TEC database.

Responsibility: WATSCU and Moora District through the MTFRT
Estimated cost: $ 2,500 p/a
Completion date: On-going.

3.2.7 Monitor the boundaries of the community

The boundary of the occurrences should be monitored regularly and can be determined from aerial photographs and annual ground-truthing. This information will be added to the TEC database.

Responsibility: WATSCU and Moora District through the MTFRT
Estimated cost: $2,500 p/a
Completion date: On-going.

3.2.8 Design and implement weed control strategy

A weed control program for lakes will involve the following steps (Panetta and Hopkins 1991):
1. Accurately mapping the boundaries of the weed populations.
2. Selecting an appropriate herbicide and the application rate after determining which weeds are present.
3. Controlling invasive weeds by hand removal and spot spraying when weeds first emerge.

The tolerance of the native plant species to herbicides is unknown and it is recommended that weed control programs are undertaken in conjunction with research (see recovery action 3.2.4).

Responsibility: WATSCU and Moora District through the MTFRT
Cost: WATSCU and Moora District to calculate and seek funds
Completion date: On-going.

3.2.9 Seek to fence occurrences on private land

Liaise with the landholders of the private property occurrences to utilise the available incentives (Gordon Reid, Threatened Species Network etc.) to fence the occurrences. This should also include, where possible, encouraging landholders to enter into covenants or management agreements.

Responsibility: WATSCU and Moora District through MTFRT in liaison with Covenanting Section

Cost: $5,000 p/a
Completion date: On-going.

3.2.10 Seek to revegetate buffers

Liaise with the landholders of the private property occurrences to revegetate a buffer strip around the lakes, and where possible corridors between the lakes, to provide for the movement of genetic material.

Responsibility: WATSCU and Moora District through the MTFRT in liaison with Moore River Catchment Group
Cost: WATSCU and Moora District to calculate and seek funds
Completion date: On-going.

3.2.11 Seek to acquire unallocated crown land parcel for the conservation estate

Seek to acquire the unallocated crown land and add to Watheroo National Park. This will require negotiation with the leaseholder of the mining lease to relinquish the lease, or negotiate for a dual purpose reserve until the lease has expired.

Responsibility: Land Administration Section
Estimated cost: $250.

3.12 Nominate the TEC under the Commonwealth EPBC Act (1999).

To further secure the TEC, the TEC should be nominated to the Commonwealth for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

Responsibility: WATSCU with support from the Moora District and the Midwest Region.
Estimated cost: $150
Completion date: Year 1.

4 TERM OF PLAN

This Interim Recovery Plan (IRP) will operate from July 2002 for five years but will remain in force until withdrawn or replaced.

5 ACKNOWLEDGMENTS

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

John Blyth	Acting Manager, WATSCU, Department of Conservation and Land Management
Jason Carter	Hydrologist, Moore River Catchment group, Moora
Margaret Collins	Botanist, Perth
Kathleen Glossop	Volunteer, Perth
Robert Gomer	Volunteer, Perth
Keith Hockey	District Manager, Department of Conservation and Land Management, Moora District
Alice Reaveley	District Flora Conservation Officer, Department of Conservation and Land Management, Moora District
Russell Speed	Hydrologist, Department of Agriculture, Geraldton.

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Summary of costs for each Recovery Action

Recovery action	Year 1	Year 2	Year 3	Year 4	Year 5
Continue to determine the plant assemblages of all lakes	$2000	$2000	$2000	$2000	$2000
Determine hydrological conditions and monitor changes in them	$15000	$1500	$15000	$3000	$3000
Manager water quality and ensure stability in hydrological regimes	*	*	*	*	*
Obtain biological and ecological information on the major components of the community	$30000	$25000	$25000	$25000	$25000
Liaise with owners and surrounding landholders to manage their properties in ways sympathetic to the community	$2000	$2000	$2000	$2000	$2000
Design and implement a flora monitoring program	$2500	$2500	$2500	$2500	$2500
Monitor the boundaries of the community	$2500	$2500	$2500	$2500	$2500
Design and implement weed control strategy	*	*	*	*	*
Seek to fence occurrences on private land	$5000	$5000	$5000	$5000	$5000
Seek to revegetate buffers	*	*	*	*	*
Seek to acquire unallocated crown land parcel for the conservation estate	$250	-	-	-	-
Nominate the TEC under the Commonwealth EPBC Act (1999)	$150	-	-	-	-

* Moora District Threatened Flora Recovery Team to determine and seek costs