INTERIM RECOVERY PLAN NO. 65

Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale Floristic Region

Interim Recovery Plan 2000-2003

by
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Photograph: Val English

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Natural Heritage Trust
Helping Communities Helping Australia

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, and where appropriate and feasible, other threatened ecological communities are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans. CALM will also ensure that conservation action commences as soon as possible and always within three years of endorsement of Endangered rank by CALM's Director of Nature Conservation.

This Interim Recovery Plan will operate from 11 September 2000 but will remain in force until withdrawn or replaced.

The provision of funds 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 at 18 August 2000.

SUMMARY

Name: Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale Floristic Region.

Description: This community consists of tall, dense heath dominated by either *Regelia megacephala* or *Allocasuarina campestris* on exposed chert ridges; tall, dense heath or open low woodland over dense to mid-dense heath dominated by *Kunzea praestans* or *Allocasuarina campestris* on shallow loamy rocky soil over chert on the slopes and ridges of chert hills. The suite of plant species associated with the dominant species named above includes one or more of *Dryandra fraseri var. fraseri, Dryandra sessilis, Hibbertia subvaginata, Xanthorrhoea drummondii, Melaleuca* sp.*, Calothamnus quadrifidus* and *Calytrix leschenaultii*.

IBRA Bioregion: Avon Wheatbelt

CALM Region: Midwest Region

CALM District: Moora

Recovery Team: Moora Threatened Flora Recovery Team.

Current status: This community was assessed by the Threatened Ecological Communities Scientific Advisory Committee on the 29 October 1999 as Endangered; this status was endorsed by CALM's Director of Nature Conservation on 24 November 1999.

Critical habitat: The area of occupancy of the known occurrences corresponding to the outcrop of Noondine chert from Jingemia to Moora (Carter and Lipple 1982).

IRP Objective(s): To improve the overall health of the community and reduce the level of threat so that the community does not move into the higher category of Critically Endangered.

Criteria for success:

1. Maintenance of the diversity and composition of the native species in the community.
2. An increase in the area of this community under conservation management.
3. Improvement in terms of reduction of threatening processes as defined in this document.

Criteria for failure:

Significant loss of area or further modification of occurrences of the threatened ecological community.

Summary of recovery actions for the heath community on the chert hills of the Coomberdale Floristic Region.

1. Form and maintain a Recovery Team
2. Clarify the extent of the community and locate more occurrences
3. Monitor the extent and boundaries of the community
4. Design and implement a program for monitoring the flora of the heath community
5. Continue to liaise with current owners, land managers and other interested groups
6. Encourage and assist landowners to access available incentives and mechanisms for conserving the community
7. Seek rate rebates for landowners protecting occurrences
8. Fence all known occurrences

9. Design and implement weed control strategy
10. Implement replanting and rehabilitation where necessary
11. Determine the fire ecology of the community
12. Design and apply appropriate fire management plans
13. Liaise with surrounding landholders to ensure strategies for fuel reduction on their lands do not impact on the community
14. Seek to acquire occurrences on private land for addition to the conservation reserve system

1 BACKGROUND

History, defining characteristics of ecological community, and conservation significance

Noondine (= Coomberdale) chert is a discontinuous, narrow (up to 14 km wide) band of the Moora group of Proterozoic rocks stretching from Carnamah to Moora (Baxter and Lipple 1985, Carter and Lipple 1982). The Coomberdale Floristic Region corresponds to the discontinuous, narrow (~2-10 km wide) outcrop of Noondine chert from Jingemia to Moora with the largest most extensive outcrop between Coomberdale and Dalaroo (Carter and Lipple 1982, Griffin 1992).

Three closely related vegetation sub-types occur on the exposed chert ridges and gravelly slopes of the chert hills in the Coomberdale Floristic Region that are recognisably different from other vegetation types within this floristic region and other floristic regions (Griffin 1992, 1994). These consist of dense heath dominated by *Regelia megacephala* or *Allocasuarina campestris* on the exposed chert ridges (sub-type 1); or dense heath or open low woodland over dense to mid-dense heath dominated by *Kunzea praestans* (sub-type 2) or *Allocasuarina campestris* (sub-type 3) on shallow loamy rocky soil over chert on the slopes and ridges (Table 1). One or more of *Dryandra fraseri var. fraseri, Dryandra sessilis, Hibbertia subvaginata, Xanthorrhoea drummondii, Melaleuca* sp.*, Calothamnus quadrifidus* and *Calytrix leschenaultii* are common to all sub-types.

Table 1: Summary of the heath community sub-types on the chert hills of the Coomberdale Floristic Region.

Sub-type	Habitat	Dominant species	Occurrences*
1	Exposed chert ridges	*Regelia megacephala*	1-5
2	Gravelly slopes	*Kunzea praestans*	1-5
3	Chert ridges and gravelly slopes	*Allocasuarina campestris*	1-8

*Refer Table 3

The heath community also supports six 'Declared Rare' or 'Priority' taxa (including *Regelia megacephala)* that are either totally or largely confined to these chert hills (Table 2).

Table 2: List of Declared Rare (threatened) and Priority Taxa (Dept. CALM 1999)

Species	Conservation category
Acacia aristulata	R
Baeckea sp. Moora	P1
Daviesia dielsii	R
Goodenia arthrotricha	P1
Regelia megacephala	P4
Synaphea quartzitica	R

The chert substrate is highly restricted and there are currently only 8 known occurrences of the heath community. The major threats to the community are weed invasion, grazing, inappropriate fire regimes, clearing and mining.

Description of Occurrences

All the known occurrences are located in the Shire of Moora on the range of Noondine chert hills that extend discontinuously from Jingemia south to Moora, ie. the Coomberdale Floristic Region. Table 3 summarises the occurrence information.

Table 3: Summary of occurrence information and threats

Occ.	Land Status	Estimated area (ha)	Condition	Threats
1	Private land including "Cairn Hill"	152	Slightly to moderately modified	Mining, grazing and weed invasion
2	Private land	17	Highly modified	Fragmentation, grazing, fire and weed invasion
3	Private land	25	Insignificantly to slightly modified	Fire and weed invasion
4	Private land	60	Highly to Completely modified	Mining, fire and weed invasion
5	Private land	272	Moderately modified	Grazing, fire and weed invasion
6	Water Reserve (40089)	10	Highly modified	Recreational trampling, grazing and weed invasion
7	National Park (Watheroo NP) and Private land	100	Insignificantly modified	Grazing, fire and weed invasion
8	Private land	15	Slightly to moderately modified	Grazing, fire and weed invasion

Occurrence 1 is spread across 3 freehold properties 12 km north of Moora. The Threatened Ecological Community (TEC) comprises 152 ha of the 251 ha of remnant vegetation. The remaining vegetation comprises mixed low heath and vestiges of the once widespread *Eucalyptus loxophleba* woodland on the plains and valley floors (Griffin 1992). The northern portion of Occurrence 1 (61 ha) is on private land and is only known to have been inspected once to locate *Regelia megacephala* (Burgman 1983). The central portion of Occurrence 1 (79 ha, known as 'Cairn Hill') is owned freehold by Westrail and is apparently the most intact portion. The Moora Shire has, until recently, been extracting gravel from the base of this portion of the hills which has extended up into the edges of the heath community. Two radio and television towers are located on the highest portion of the hills in the centre of the Westrail land, and low land on the eastern portion of this land is currently under a grazing lease. There is a prospecting lease over much of the central and northern portions of Occurrence 1 for the purposes of extracting chert with exploration tracks over a segment of the northern portion.

The southern and smallest portion (12 ha) of Occurrence 1 is located on private land that is heavily grazed with vegetation only on the summits. Occurrence 2 (17 ha) occurs on the same property and comprises more of the TEC fragmented into six portions, with the largest site 7 ha and the smallest 0.5 ha.

Occurrence 3 is located on private land 7 km north-east of Moora. The TEC comprises 25 ha of the 54 ha of remnant vegetation surrounded by cropping land; the remainder of the remnant vegetation comprising *Eucalyptus loxophleba* and *E. salmonophloia* woodland in the lower areas. The occurrence has not been grazed for at least seven years and has recently been fenced under the Remnant Vegetation Protection Scheme.

Occurrence 4 is located on private land 0.25 km north of Occurrence 1. The TEC originally comprised 60 ha of the 95 ha of remnant vegetation - surrounded by cropping land – but 45 ha was mined for chert. Exploration tracks traverse the rest of the occurrence and the remnant vegetation.

Occurrence 5 is the largest occurrence and is located on private land 0.5 km north of occurrence 4. As with four previously mentioned occurrences, the three sub types are represented on this occurrence as well as an *Acacia acuminata* thicket on top of one ridge and a *Eucalyptus loxophleba* and *E. wandoo* woodland on the lower west side. The occurrence – spread across 3 freehold properties – is fragmented; with cropping and grazing lands between hills and on the lower slopes. Only 21 ha of the occurrence has been fenced for conservation and covenanted under the Remnant Vegetation Protection Scheme. In 1981 a fire swept through the south eastern side of the occurrence affecting the fenced portion and the hill dominated by *Acacia acuminata.*

Of the total 668 ha of the community across all occurrences, 60 ha occur in two reserves. Occurrence 6 (10 ha) is in a water reserve 1 km east of Moora - surrounded by agricultural land - managed by the Water Corporation. Only sub type 3 is represented in this reserve, although *Regelia megacephala* was thought to occur on the reserve (T. Griffin, personal communication[1]). Much of the reserve has been cleared for gravel extraction and access tracks, and has been trampled through recreational use.

Occurrence 7 includes the only portion of the TEC (sub type 3 only) in conservation reserve - 50 ha in Watheroo National Park vested in the National Parks and Nature Conservation Authority and managed by the Department of Conservation and Land Management (CALM). The remainder of the occurrence is on private land. The National Park portion part of it is on the edge of the park and borders a gravel road. The rest is surrounded by extensive, intact *Eucalyptus loxophleba* and mallee woodlands. The privately owned portions are surrounded by agricultural land and are currently grazed.

Occurrence 8 is located on private land 2 km west of occurrence 4. The TEC comprises 15 ha of the 35 ha of remnant vegetation and the remainder is *Eucalyptus loxophleba, E. salmonophloia* and *E. wandoo* woodland.

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 for the heath community on the chert hills of the Coomberdale floristic region comprises the area of occupancy of the known occurrences corresponding to the outcrop of Noondine chert from Jingemia to Moora (Carter and Lipple 1982).

Biological and ecological characteristics

The floristic composition of the heath community is assumed to correspond to the soil/substrate types and depths: *Regelia megacephala*, for example, is only found where chert is exposed at the summit of the hills. Otherwise, little is known of the biology and ecology of the community and gaining more information is a priority in this Interim Recovery Plan.

[1] Ted Griffin – Research Officer, Agriculture WA, Perth

Threatening processes

Only eight occurrences are currently known. With the exception of the occurrence within the National Park (Occurrence 7), all the other occurrences are surrounded by agricultural land – many with very little or no native vegetation buffer (eg. Occurrence 2 is fragmented into six small areas with no vegetation on the lower slopes and the valleys). Of the three vegetation sub-types that make up the community, only sub-type 3 is in a conservation reserve (in the National Park). Potential and current threatening processes to individual occurrences were summarised in Table 3 and are elaborated as follows:

Clearing

Clearing for agriculture in the Shire of Moora has been extensive with some 85% of vegetation in the area cleared (B. Lullfitz, personal communication[2]). New proposals to clear one ha or more of any occurrences, and/or of the surrounding vegetation, of this community on private land would be subject to assessment in accordance with the Memorandum of Understanding for the protection of remnant vegetation on private land in the agricultural region of Western Australia (Government of Western Australia 1997)..

Grazing

All occurrences have been or are actively grazed. Grazing has caused alterations to the species composition of a number of the occurrences by the selective grazing of edible species, the introduction of weeds and nutrients, trampling and general disturbance.

Weed invasion

Weeds can have significant impacts on a community through competition with the native species, prevention of regeneration and alteration of fire regimes (Hobbs and Mooney 1993). Disturbances such as fires and grazing can predispose areas to weed invasion if weed propagules are present. All of the occurrences of this community are close to agricultural areas that act as weed sources, and would be vulnerable to weed invasion following any disturbance. At present, weed levels in occurrences 2, 4, 5 and 6 are high, but still quite low in the other occurrences.

Altered fire regimes

Fire can cause alterations to the species composition by increasing the number of weeds. As well, an increase in the frequency of fire can prevent species from completing growth and reproductive cycles. The risk of frequent fire to all occurrences is increased by the presence of grassy weeds in the understorey, as they are likely to be more flammable than many of the original native species in the understorey. A fire swept through Occurrence 5 in 1981 seemingly damaging the community such that some of the species have still not recovered, including the *Regelia megacephala* (G. Ridgeway, personal communication[3]). No post fire assessment, however, has been carried out to confirm and determine the factors responsible for the apparent loss of species.

Mining

Plants that are reliant on the chert substrate are unlikely to regenerate once the chert is removed from the soil profile. Regeneration techniques such as returning the topsoil and controlling weeds may be useful in reducing native species loss, however unless all species reliant on chert are identified regeneration may not be enough to return the community to anything approaching its original state. Occurrence 4 has been extensively mined for chert, and there are applications for mining on Occurrence

[2] Bill Lullfitz – Community Landcare Coordinator, Moora
[3] George Ridgeway – Landholder, Coomberdale

1. The company responsible for mining Occurrence 4 has reportedly successfully cultivated and re-introduced *Regelia megacephala* for use in rehabilitation (L. Doust, personal communication[4]) but there is no information on the successful regeneration of the other components of the community.

Mining proposals would be subject to assessment by the Environmental Protection Authority in accordance with the *Environmental Protection Act 1986.*

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 'Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on the ridges and slopes of the chert (quartzite) hills of the Coomberdale floristic region' community meets the following criteria for Endangered (EN) ecological communities:

> *B) Current distribution is limited, and*
> *ii) There are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes*

Recovery strategy

To devise, in close liaison with landholders and land managers, recovery actions for all known occurrences, and promote their conservation.

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

2 RECOVERY AIM AND CRITERIA

Aim

- To improve the status of the heath community by protecting and maintaining the known occurrences, and reducing the level of threat so that the community will not become Critically Endangered.
- To locate more occurrences and promote their protection, maintenance and recovery.

Criteria for success

- Maintenance of the diversity and composition of the native species in the community.
- An increase in the area of this community under conservation management.
- Improvement in terms of reduction of threatening processes as defined in this document.

[4] Lance Doust – Landholder, Moora

Criterion for failure

- Significant loss of area or further modification of occurrences of the threatened ecological community.

3 RECOVERY ACTIONS

All but one of the occurrences are on land not managed by CALM. All land managers/owners 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 managers/owners prior to any recovery actions being taken.

3.1 Establish a Recovery Team

The Moora District Threatened Flora Recovery Team will be the recovery team for this community. The team will give consideration to including members to represent landholders. The Recovery Team will continue to report annually to CALM's Corporate Executive.

Action:	Establish a Recovery Team
Responsibility:	Moora District Threatened Flora Recovery Team (MTFRT)
Estimated cost:	$Nil
Completion date:	Completed

3.2 Clarify the extent of the community and locate more occurrences

The best quality colour aerial photographs (stereoscopic pairs) may assist in selecting likely sites, as would geological maps. An appropriate starting point would be areas of Noondine chert between Coomberdale and Watheroo. Field surveys (ground-truthing) will confirm their status. New occurrences should be added to the threatened ecological community (TECs) database as recommended in English and Blyth (1999).

Action:	Clarify the extent of the community and locate more occurrences
Responsibility:	CALM (WATSCU)
Estimated cost:	$3,000
Completion date:	Year 1

3.3 Monitor the extent and boundaries of the community

Monitor the extent, and determine and compare the condition of the known occurrences and any other identified occurrences (refer recovery action 3.2). The boundary of the occurrences should be monitored regularly and can be determined from current aerial photographs and annual ground-truthing. This information should be added to the threatened ecological community (TECs) database as recommended in English and Blyth (1999).

Action:	Monitor the extent and boundaries of the community
Responsibility:	CALM (WATSCU) for initial monitoring and MTFRT for continuity
Estimated cost:	$2,000 for the initial monitoring ($500 per year for subsequent monitoring)
Completion date:	Ongoing

3.4 Design and implement a program for monitoring the flora of the heath community

Data collected should include plant species diversity, species richness and weed levels. Occurrences should be monitored regularly to provide information on condition. The program could include installing permanent quadrats and taking photographs of the same area. This information should be added to the threatened ecological community database (TECs) as recommended in English and Blyth (1999).

Action:	Design and implement a program for monitoring the flora of the heath community
Responsibility:	MTFRT
Estimated cost:	MTFRT to determine costs
Completion date:	Ongoing

3.5 Continue to liaise with current owners, land managers and other interested groups

Most of the occurrences are privately owned: The involvement of land managers, landholders, local community groups and industry in the recovery of the community wherever possible and practical is therefore essential to the recovery process.

Action:	Continue to liaise with current owners, land managers, and other interested groups
Responsibility:	CALM (WATSCU) via MTFRT
Estimated cost:	$500 per year
Completion date:	Ongoing

3.6 Encourage and assist landowners to gain access to available incentives and mechanisms for conserving the community

Incentives for protection include the Remnant Vegetation Protection Scheme, CALM and National Trust covenanting systems, Land for Wildlife and other funding programs that are available to promote long term protection of the community.

Action:	Encourage and assist landowners to gain access to available incentives and mechanisms for conserving the community
Responsibility:	MTFRT
Estimated cost:	$Nil
Completion date:	Ongoing

3.7 Seek rate rebates for ‘protected’ occurrences

CALM will negotiate with the Shire of Moora and the WA Municipal Association to provide partial or total rate rebates for occurrences covered by conservation agreements (ie. covenants). A provisional period of supplementation to the Shire could be used as an inducement (Binning and Young 1997).

Action:	Seek rate rebates for ‘protected’ occurrences
Responsibility:	CALM (WATSCU and Moora District)
Estimated cost:	Based on outcome of negotiations
Completion date:	Ongoing

3.8 Fence all known occurrences

Fence occurrences to ensure stock (and subsequent weed invasion) are excluded and vehicle access can be limited to management access only. For those occurrences that are already fenced, seek funds to assist in maintenance.

Action:	Fence all known occurrences
Responsibility:	MTFRT
Estimated cost:	MTFRT to determine costs
Completion date:	Ongoing

3.9 Design and implement weed control strategy

As all occurrences are adjacent to cleared farmland and most are weed infested, a weed control strategy is required that takes into account the nature of the community and the need for continuing maintenance. The weed control program should involve:

1. Identifying and mapping the weed species
2. The selection of the appropriate herbicide
3. The control of invasive weeds by hand or spot spraying as soon as the weeds emerge.

Action:	Design and implement weed control strategy
Responsibility:	MTFRT
Estimated cost:	MTFRT to determine costs
Completion date:	Ongoing

3.10 Implement replanting and rehabilitation where necessary

Seek to replant and rehabilitate occurrences that have suffered disturbance – due to the weed control strategy (recovery action 3.9), fire or other such disturbance. The appropriate species can be identified from plot data for each occurrence held in Griffin (1994) or from flora monitoring (recovery action 3.4). These should then be propagated from stock from surrounding areas to preserve local provenance.

Action:	Implement replanting and rehabilitation where necessary
Responsibility:	MTFRT
Estimated cost:	MTFRT to determine costs
Completion date:	Ongoing

3.11 Determine the fire ecology of the community

Seek funds for research into recovery of the community (and target species) from fire, and to determine the implications of findings for management (eg. preservation of seed for future re-introduction in case of fire, prescribed burning). This would also include developing a fire history map of the occurrences, to be updated regularly.

Action:	Determine the fire ecology of the community
Responsibility:	MTFRT
Estimated cost:	MTFRT to determine costs
Completion date:	Ongoing

3.12 Design and apply appropriate fire management plans

A fire management plan should be developed with landowners and the relevant authorities. The plan should deal with minimising wildfires; the need for, design, position and upgrade of firebreaks/fire-fighting access tracks; fire management (including the need for and design of prescribed fire) and fire suppression. The plan should include an annual fire monitoring and reporting schedule.

Action:	Design and apply appropriate fire management plans
Responsibility:	MTFRT
Estimated cost:	MTFRT to determine costs
Completion date:	Ongoing

3.13 Liaise with surrounding landholders to ensure strategies for fuel reduction on their lands do not impact on the community

Liaise with owners and surrounding landholders to prevent burning at inappropriate times when fires are likely to spread to the community.

Action:	Liaise with surrounding landholders to ensure strategies for fuel reduction on their lands do not impact on the community
Responsibility:	MTFRT in liaison with owners of land containing, or adjacent to, the community
Cost:	$Nil
Completion date:	Ongoing

3.14 Seek to acquire occurrences on private land for the conservation estate

To secure the long-term recovery of this community, CALM will liaise with landholders, including Westrail, and seek to acquire appropriate occurrences if they are offered for sale. Such areas should then be declared Class A reserves for the purpose of 'Conservation of Flora and Fauna' vested in the National Parks and Nature Conservation Authority (NPNCA).

Action:	Seek to acquire occurrences on private land for the conservation estate
Responsibility:	CALM (Land Acquisitions Section)
Estimated cost:	CALM to negotiate costs on a market/valuation basis
Completion date:	When available

4 ACKNOWLEDGMENTS

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John Tonkin	Nyerri Stud, Moora

5 REFERENCES

Baxter, J. L. and Lipple, S. L. (1985). *Perenjori, Western Australia.* 1:250,000 Geological Series – Explanatory Notes. Geological Survey of Western Australia, Perth.

Binning, C. and Young, M. (1997). *Motivating people: Using management agreements to conserve native vegetation.* National R&D Program on Rehabilitation, Management and Conservation of Remnant Vegetation. Environment Australia: Canberra.

Burgman, M. A. (1983). *Rare and Geographically restricted plants of Western Australia, vol 20: Gastrolobium appressum, Hemiandra gardneri, Regelia megacephala, Jacksonia eremodendron and Adenanthos stictus.* Confidential unpublished report to the Department of Fisheries and Wildlife.

Carter, J. D. and Lipple, S. L. (1982). *Moora, Western Australia.* 1:250,000 Geological Series – Explanatory Notes. Geological Survey of Western Australia, Perth.

Department of Conservation and Land Management (1999). *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management, Perth.

English, V. and Blyth, J. (1999). Development and application of procedures to identify and conserve threatened ecological communities in the South-west Botanical Province of Western Australia. *Pacific Conservation Biology 5: 124-138.*

Government of Western Australia (1997). *Memorandum of Understanding between the Commissioner of Soil and Land Conservation, Environmental Protection Authority, Department of Environmental Protection, Agriculture Western Australia, Department of Conservation and Land Management, Water and Rivers Commission for the protection of remnant vegetation on private land in the agricultural region of Western Australia*. Western Australian Department of Agriculture, Perth.

Griffin, E. A. (1992). Floristic survey of remnant vegetation in the Bindoon to Moora area, Western Australia. *Agriculture Western Australia Resource Management Technical Report 142*.

Griffin, E. A. (1994). Floristic Survey of Northern Sandplains between Perth and Geraldton, Western Australia. *Agriculture Western Australia Resource Management Technical Report 144*.

Hobbs, R. J. and Mooney, H. A. (1993). Restoration ecology and invasions. In *Nature Conservation 3: Reconstruction of Fragmented Ecosystems*. pp 127-133, Saunders, D. A., Hobbs, R. J. and Ehrlich, P. R. (eds). Surrey Beatty and Sons: NSW.

List of species found in each occurrence of the Heath community on chert hills of Coomberdale Floristic Region (Note: this is not a comprehensive list and excludes DRF and Priority taxa, which are listed in Table 2 on Page 3)

	Occurrence							
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Acacia acuminata subsp. acuminata				+		+		+
Acacia congesta subsp. congesta	+		+	+				
Acacia scirpifolia	+							
Allocasuarina campestris	+	+	+	+	+	+	+	+
Allocasuarina huegeliana	+		+	+	+			
Amphipogon strictus							+	
Avena fatua							+	
Blennospora drummondii							+	
Borya sphaerocephala							+	
Bossiaea eriocarpa	+							
Burchardia umbellata							+	
Calothamnus hirsutus							+	
Calothamnus quadrifidus	+	+	+			+		
Calytrix leschenaultii	+	+					+	
Daviesia hakeoides subsp. subnuda							+	
Dianella revoluta			+					
Diplolaena angustifolia	+	+	+	+	+	+	+	+
Dodonaea pinifolia	+							
Dryandra fraseri var. *fraseri*						+	+	
Dryandra patens						+		
Dryandra sessilis	+	+	+	+	+	+		
Ecdeiocolea monostachya							+	
Elythranthera brunonis							+	
Eucalyptus loxophleba	+					+	+	+
Gilberta tenuifolia							+	
Gonocarpus nodulosus							+	
Hakea subsulcata							+	
Hibbertia subvaginata	+			+				
Hydrocotyle callicarpa							+	
Kennedia prostrata			+	+				
Kunzea praestans	+	+	+	+	+		+	
Leporella fimbriata							+	
Loxocarya flexuosa						+		
Melaleuca cordata							+	
Melaleuca holosericea							+	
Melaleuca sp.	+				+	+		
Millotia tenuifolia							+	
Neurachne alopecuroidea	+		+	+		+	+	
Patersonia graminea							+	
Regelia megacephala	+	+	+	+	+			
Rhodanthe laevis							+	
Scaevola phlebopetala				+				
Stylidium leptophyllum							+	
Stypandra glauca	+						+	
Thysanotus patersonii							+	
Trachymene cyanopetala							+	
Trachymene ornata							+	
Trachymene pilosa							+	
Verticordia nitens							+	
Xanthorrhoea drummondii	+	+	+		+	+		

Summary of costs for each Recovery Action

	Year 1		Year 2		Year 3	
Recovery action	**NHT***	**Other**	**NHT***	**Other**	**NHT***	**Other**
1. Form and maintain a Recovery Team		$Nil		$Nil		$Nil
2. Clarify the extent of the community and locate more occurrences	$3000					
3. Monitor the extent and boundaries of the community	$2000			$250		$250
4. Design and implement a program for monitoring the flora of the heath community		**		**		**
5. Continue to liaise with current owners, land managers and other interested groups		$500		$500		$500
6. Encourage and assist landowners to gain access to available incentives and mechanisms for conserving the community		$Nil		$Nil		$Nil
7. Seek rate rebates for 'protected' occurrences			Based on outcome of negotiation			
8. Fence all known occurrences		**		**		**
9. Design and implement weed control strategy		**		**		**
10. Implement replanting and rehabilitation where necessary		**		**		**
11. Determine the fire ecology of the community		**		**		**
12. Design and apply appropriate fire management plans		**		**		**
13. Liaise with surrounding landholders to ensure strategies for fuel reduction on their lands do not impact on the community		$Nil		$Nil		$Nil
14. Seek to acquire occurrences on private land for the conservation estate				Market value		

*Funds already contributed

** Moora District Threatened Flora Recovery Team to determine costs