

Berri – Barmera Local Revegetation Plan



July 1999

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Prepared for the Berri Barmera Local Action Planning Committee
by Creation Care Pty Ltd

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Executive summary

PURPOSE OF THE REVEGETATION PLAN

This revegetation plan has been developed to define the revegetation program required as part of implementing the Berri Barmera Local Action Plan. In the development of the revegetation plan the authors have considered the landscape features, major soils, land use, priority issues and other issues of the LAP to develop appropriate revegetation options, targets (in hectares), and where possible identify priority locations.

The priority issues of the Berri Barmera area are similar to those of the other Upper Riverland Local Action Plan areas, being predominantly associated with the use and management of the regions water resources.

The Berri Barmera LAP has identified five priority issues, these are:

- **Impact of irrigation and drainage**
- **Floodplain and wetland degradation**
- **Water quality**
- **Biodiversity and conservation**
- **Planning and reporting**

In addition to these, the unique issue of the management of **Lake Bonney** also has bearing on the revegetation planning for this region.

The strategies to deal with the above priority issues that are addressed by this revegetation plan are as follows:

- **Reducing off site impacts of irrigation**
- **Reducing irrigation drainage entering the River Murray**
- **Protecting existing native vegetation**
- **Encouraging community groups to include biodiversity outcomes as part of their revegetation projects**

The priority revegetation options that best address these strategies are summarised in Figure 1 (Page 6). Hectare revegetation targets have been set for the LAP (Table 1) and the cost to implement these targets has been calculated (Table 2). Also, where possible, priority locations have been defined (Page 27), and issues requiring further information have been identified.

This revegetation plan has been used as the basis for seeking investment to support on ground works for the Berri Barmera LAP and lays the basis for developing an incentive scheme that will distribute funds to revegetation projects of a high priority.

While further studies and a benefit:cost analyses are required to quantify the exact benefits from implementing this revegetation plan the targets have been set to make a significant contribution towards the protection of natural resources and viability of industries in the Berri Barmera LAP area.

The implementation of this plan over the proposed three-year term reflects the urgency of the situation to address the environmental degradation issues within the LAP. Every effort should be made to achieve the targets of this plan within this timeframe. If delays do occur so to will the delays in redressing the issues faced by the LAP.

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	Blocks of native mix	Wide linear of native mix	Narrow linear of native mix	Blocks of fodder	Blocks of timber	Wide and narrow linear of timber	Blocks of timber - irrigated	Protection remnants	Totals
Perched watertable	10	5	5	0	20	5	0	0	45
Low production land	25	0	0	40	0	0	0	0	65
Reuse drainage water	5	0	0	0	0	0	15	0	20
Riparian - wetland and recreation sites	40	10	0	0	0	0	0	0	50
Reuse stormwater	0	0	0	0	0	0	5	0	5
Remnant protection	0	0	0	0	0	0	0	150	150
Native veg. linking remnants	50	0	0	0	0	0	0	0	50
Total	130	15	5	40	20	5	20	150	385

Table 1. Hectares of each revegetation option

	Funding sought	Community contribution	Total
Revegetation works	\$143,691	\$195,634	\$339,325
Fencing	\$61,500	\$112,500	\$174,000
Total	\$205,191	\$308,134	\$513,325
% split	40%	60%	

Table 2. Total cost to implement the revegetation plan

UPTAKE OF THE REVEGETATION PLAN IN THE COMMUNITY

The level of on-ground revegetation works taken up by the community will ultimately measure the success of this revegetation plan. In order for this to occur the Berri Barmera LAP committee with assistance from relevant Local and State Government agencies will, upon receipt of funding, call for expressions of interest from the community to implement revegetation work on their properties.

In order for the revegetation work detailed in this plan to be implemented information is given in this document to aid in the development of an incentive scheme to landholders. The levels of incentives offered will need to be modified according to such factors as the level of uptake required for a particular revegetation option, distinct local biodiversity issues, distinct revegetation opportunities that may arise subsequent to this plan, community willingness and involvement and so on.

Support for the process of the planned revegetation will be derived from a Revegetation Support Team currently being developed by the LAP Committee in partnership with the PIRSA Revegetation Officer (based at Loxton Research Centre). Support is likely to take the form of:

- Assisting the LAP Committee in sourcing local expertise and skills from the local community
- Helping promote the revegetation plan
- Providing additional technical expertise where required
- Providing support materials and the training of local people who will give on-ground revegetation advice to farmers and community group
- Assisting in the sourcing of seed and tube stock for revegetation work

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KEY ISSUES REQUIRING FURTHER INVESTIGATION

A number of key investigative issues are recognised within this plan that may need to be considered before the complete revegetation plan is implemented. These include:

- **Promotion of the Revegetation Plan**
- **Revegetation support**
- **Local 'Recipes' for revegetation**
- **Development of local species lists**
- **Sourcing of native seed**
- **Review of the criteria for incentives**
- **Work contracts**
- **Administration funds**
- **Remnant vegetation condition**
- **Long term returns from investment**
- **Woodlot feasibility study**
- **Soil salinity investigations**
- **Biodiversity Plan**
- **Carbon and salt credits**
- **Urban planting**

(The above issues are addressed within the text and specifically in **Other Actions** Page 38.)

Berri Barmera Local Revegetation Plan

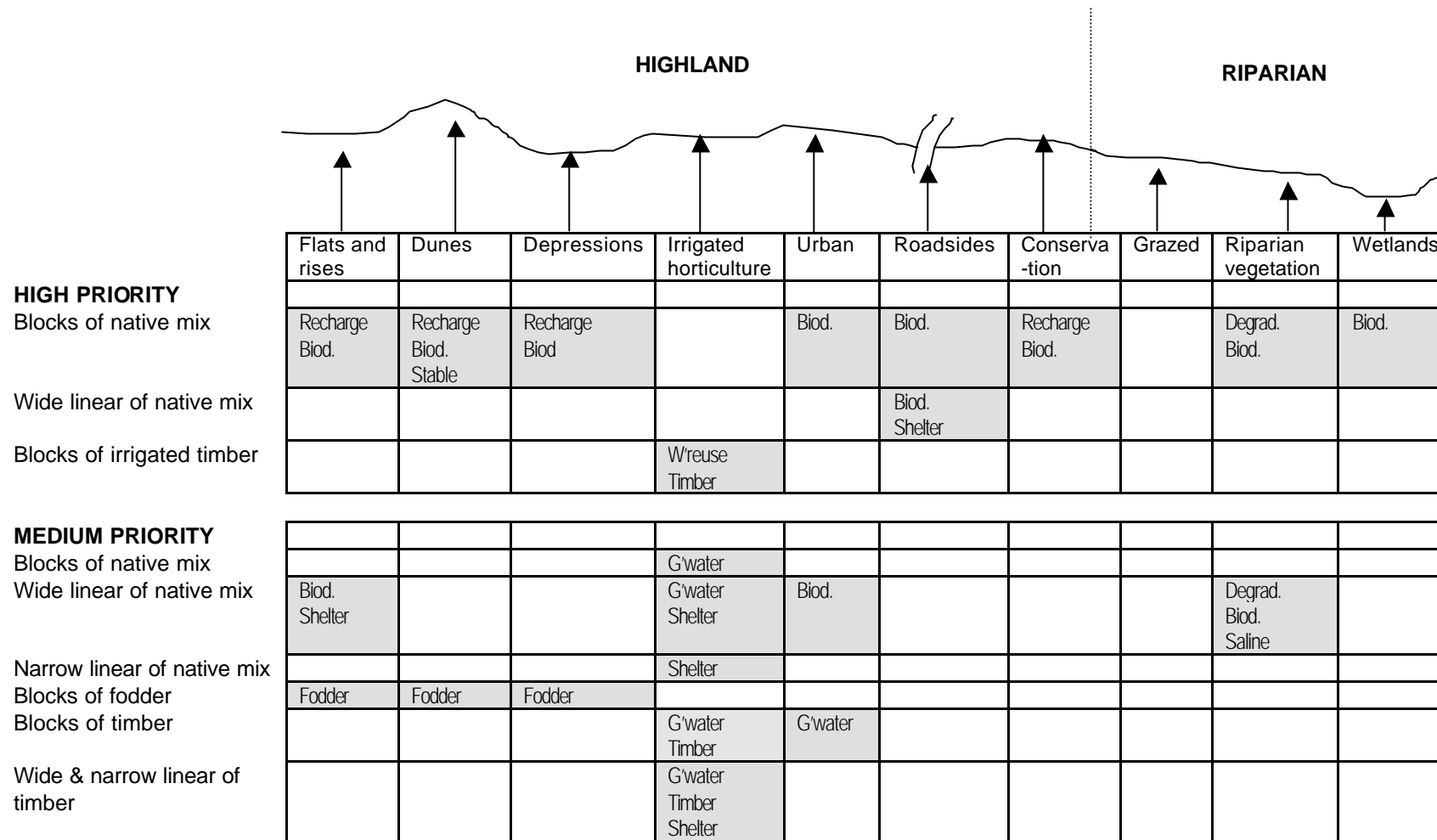


Figure 1. The revegetation options for the Berri Barmera LAP

The issues that each option addresses are given in the shaded box. The key is as follows: Recharge = reduce recharge, Biod. = biodiversity benefit, Stable = stabilise soil, Degrad. = rehabilitate degraded area, Shelter = windbreak benefits, W'reuse = reuse irrigation drainage water, Timber = produce timber products, G'water = intercept groundwater (high or perched water table), Saline = rehabilitating saline area, Fodder = produce fodder for stock. (The 'Products – irrigated' options have not been included as they are being dealt with by the LAP in a separate 'Permaculture' consultancy.)

Revegetation and the Local Action Plan

INTRODUCTION

Revegetation is an important tool in addressing the economic and natural resource issues in the South Australian region of the Murray Darling Basin (Anon 1999). This local revegetation plan outlines the revegetation options required to address the priority issues of the Berri Barmera Local Action Plan (LAP). The underlying approach taken in this local revegetation plan has been to address the following basic questions.

1. What to do?
2. How much to do?
3. How much will it cost?
4. Where to do it?

Without answers to these questions we do not have a plan.

What to do has been addressed by prioritising the revegetation options that suit the landscape divisions of the LAP and that address the driving issues of the LAP. For example, reuse of drainage water on blocks of timber will alleviate drainage water problems and river water quality problems.

How much to do has been derived based upon the strategic targets of the draft LAP.

How much it will cost has been calculated based upon up-to-date revegetation designs and costs. Historical information has been used as a guide to how much it will cost the community and what may be expected from external investors.

Where to do the revegetation has been defined where possible, based upon previous studies and background resource information. In many cases the actual locations are dependent upon more information or willing landowners in the study area.

This information has been used as the basis for seeking investment to support the on-ground works for the Berri Barmera LAP and lays the basis for developing an incentive scheme for the distribution of these funds to implement the plan.

DESCRIPTION OF THE LAP AREA

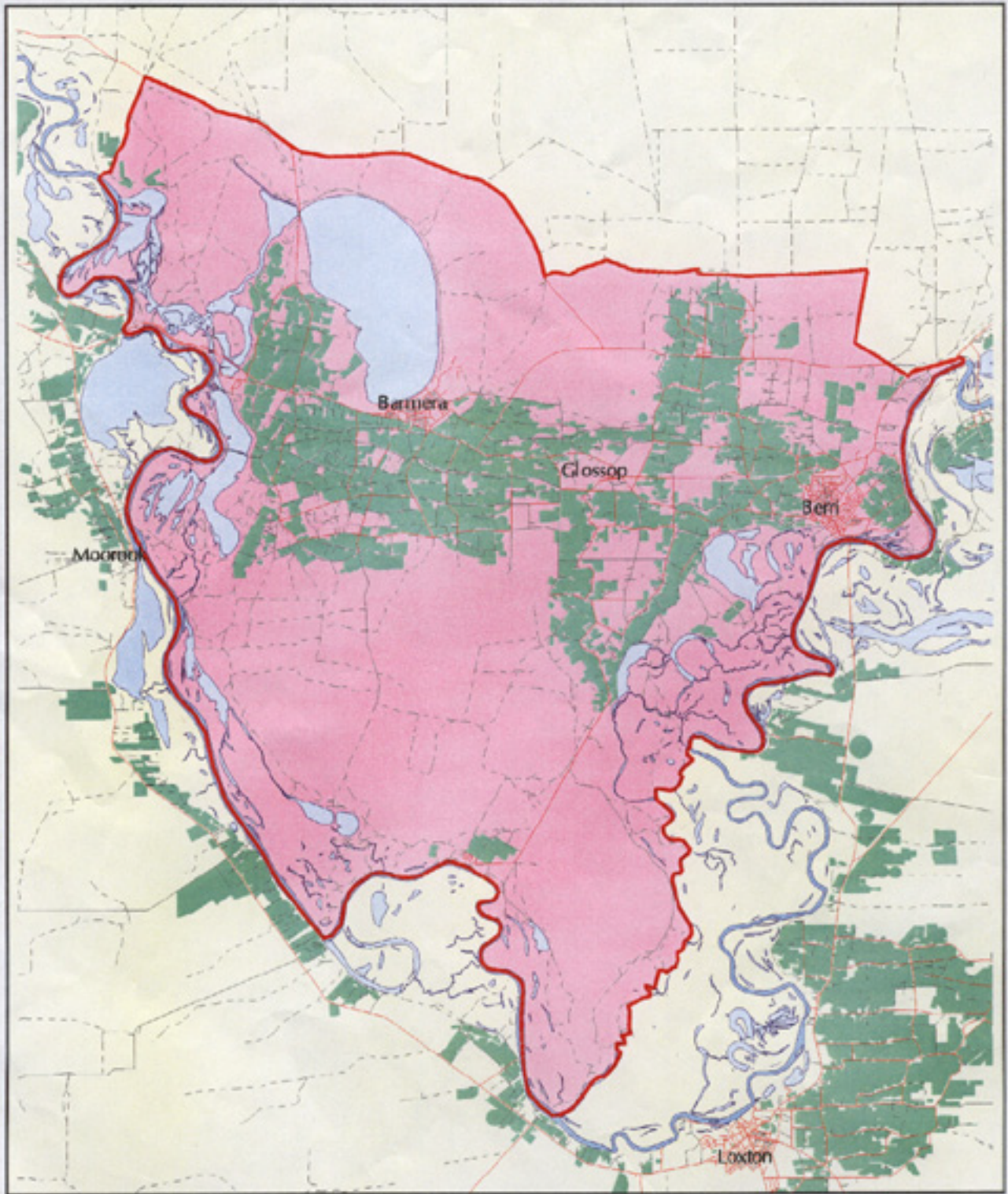
A map of the Berri Barmera LAP area is given in Figure 2 (Page 6).

The geological layering below the Berri area is typical of that found in the eastern Riverland and comprises the following units:

(Source Woodward Clyde 1998)

- ◆ Monoman Formation - high permeability alluvial sand deposits within the river valley. These sands transmit saline groundwater to the river and floodplain.
- ◆ Woorinen Sands - surficial red-brown sand deposits of wind blown origin which are found above the river valley.
- ◆ Carbonate Soils - underlie the surface sands at shallow depths and retard the downward percolation of irrigation drainage water.
- ◆ Blanchetown Clay –Present between the carbonate soil horizon and the Pliocene Sands aquifer. This clay prevents a significant amount of drainage water from recharging to the underlying water table.
- ◆ Pliocene Sands - the regional unconfined water aquifer, which comprises a fine to coarse-grained upper sand unit and a lower fine grained silty sand unit. Groundwater salinity in this aquifer ranges between 22,000 and 34,000 mg/L.
- ◆ Bookpurnong beds - a regional aquitard of thinly bedded clays, silts and fine sands which forms a low permeability barrier between the unconfined aquifer and the deeper Murray Group Limestone.
- ◆ Murray Group Limestone – the regional confined limestone aquifer. Regional studies indicate groundwater salinity in this aquifer is around 35,000 mg/L.

BERRI TO BARMERA LOCAL ACTION PLANNING AREA



- Berri to Barmera Local Action Planning Area
- Crops Irrigated 1997
- River Murray
- Wetlands
- Local Action Planning Boundary
- Land and Water Management Boundary
- Sealed Road
- Unsealed Road
- Vehicular Track



Figure 2. Map of the Berri Barmera LAP area showing the areas of irrigated land.



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Land System	General Soil Descriptions	Native Vegetation	Land use
Barmera	Deep sands to sandy loams on the rises. Sandy loams on the flats with increasing clay content at depth. Soils on the flats may also overlay rubbly carbonates or in some areas gypsum. Depressions in some areas are highly saline.	Mallee associations (predominantly cleared).	Mostly used for irrigated horticulture. Some dryland farming to the east of Lake Bonney.
Loxton	Reddish sand grading to sandy clay loam over lime, rubble and calcrete in the flats and rises; a deeper layer of coarse reddish sand with moderate lime at depth on the hills; the depressions are more clayey, often rubble free and non-limy at the surface.	Mallee associations, <i>Eucalyptus cyanophylla</i> , <i>E. socialis</i> , limited areas of <i>E. oleosa</i> and <i>E. gracilis</i> . Native pines, black oak, bullock bush. Some low shrubland, <i>Dodonea viscosa</i> .	Dryland cereal (limited), almost the entire area over this land unit is remnant vegetation.
Overland Corner	Stony flats and depressions too stony for cropping. Other flats overlie rubbly calcrete as do the sand dunes which are predominantly infertile sands of poor water holding capacity.	Mallee associations.	Some limited cropping and irrigation.
River Terraces (Upper Murray Valley)	River flats – Deep grey clay; Deep coarse sand on Sandhills and sandbars.	River red gum, river box, lignum, old man saltbush, and river couch.	Some grazing on flats; (Spectacle Lakes area) recreational use.

Table 3. General soil descriptions, native vegetation and land use for land systems of the study area.

The four land systems that occur within the Berri Barmera LAP, their general soil descriptions, native vegetation associations and land use are given in Table 3. This information has been derived from Potter et al (1973) and Primary Industries and Resources South Australia. Although the Berri Barmera area was not actually included in the Potter study, subsequent mapping by Primary Industries and Resources South Australia has delineated the different land units in the region and these units are described by Potter et al. The Geographic Information Services Unit of Primary Industries and Resources has supplied the hectares for each land system (Table 4).

Land System	Berri-Barmera LWMP	Total ha.	% Land units
Barmera	9,523.72	9,523.72	22%
Loxton	14,719.99	14,719.99	33%
Overland Corner	1,629.63	1,629.63	4%
Upper Murray Valley	17,914.27	17,914.27	41%
Total hectares	43,787.61	43,787.61	100%

Table 4. Hectares of each land unit of the LAP

The landscape features, general soil features and land use of an area largely determine which revegetation options are suitable to meet the desired purposes. The Berri Barmera LAP can be broadly divided into two main landscape divisions, viz. highland and riparian. These can be further divided according to landscape features. These landscape feature divisions and their major land use and general soil characteristics are given in Table 5.

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Landscape features	Major land use	General soil characteristics
Highland		
Flats, rises and sandhills	Dryland farming	Shallow soils over lime rubble calccrete or clay, some limited calcareous loams and saline land with gypsum deposits (eastern side of Lake Bonney)
Flats, rises and sandhills	Irrigated horticulture	Calcareous loams, alluvial soils in western region, some limited areas of unbleached siliceous sand over calcareous subsoils (in dune swale systems)
Flats, rises and sandhills	Urban reserves	Several soil types
Flats, rises and sandhills	Roadsides	Several soil types
Flats, rises and sandhills	Conservation areas (remnant vegetation)	Several soil types
Riparian		
River flats	Conservation (Riparian vegetation)	Grey clays (some salinity)
River flats	Grazing areas	Grey clays (some salinity)
Wetland	Conservation	Alluvial soils

Table 5. Main landscape features, and their major land use and soil characteristics.

ISSUES INFLUENCING REVEGETATION OPTIONS.

Issues influencing the choice of revegetation options within the landscape divisions of Table 5 are given below.

Highland: Dryland farming

- Reduction of recharge from dryland farming is an important regional issue however it is of minimal importance in the Berri Barmera LAP as only a very small proportion of the LAP area is utilised for dryland farming.
- Farm benefits can be from blocks of fodder, dune stabilisation with native vegetation, and windbreaks. Wind erosion of soils is a priority issue for the Murray Mallee region (Gale 1992).

Highland: Irrigated

- The irrigated horticultural area within the Berri Barmera LAP is 6,160 ha. A progressive build up of groundwater beneath the Berri irrigation area has been occurring since soon after the area was developed. Groundwater mounds under many of the existing irrigation areas are still developing and further irrigation extensions following transfers of allocation will result in the development of new mounds. These mounds will continue to contribute to raising watertables on the floodplains, salinising the soils and degrading vegetation (Woodward Clyde 1998). Improved highland irrigation practices will reduce drainage water problems.
- The River Murray is incised into the Monoman Sands aquifer and consequently receives saline water from this aquifer. Increased recharge to the water table under the adjacent irrigated areas results in greatly increased rates of discharge of groundwater to the floodplain and River, and a subsequent increase in River salinity and degradation of the floodplain (Woodward Clyde 1998).
- Berri East contributes 13 tonnes/salt/day, Berri-Cobdogla 146 tonnes/salt/day, and Gerard 18 tonnes/salt/day.
- 2,946 ha. is currently being drained, that is 45% of the Berri irrigation district and 33% of the Cobdogla irrigation district. This drainage feeds into 5 disposal basins; Berri, Cobdogla, Loveday, K Country and Loveday South. The K Country basin is having the greatest impact on the local environment (Cambell 1999, Smith 1999).

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- The longer term recommended strategy to deal with the high salt loads to the river is to decommission Cobdogla, Loveday and K Country disposal basins and divert water to the Berri basin where saline water is pumped to Noora.
- Using drainage water has a public benefit from water not impacting on the floodplain.
- Revegetation that is irrigated with drainage water must take into account the high levels of boron in the water that may be toxic to some species.
- It is best to replant local native species in their natural habitat rather than irrigate them. Irrigation with drainage water is more suitable for producing a product such as firewood.
- Opportunity exists for windbreaks for horticultural crops.
- Opportunities may exist for introducing native vegetation or timber (for harvesting) to areas that have been taken out of production due to perched water tables (Figure 3).

Highland: Urban reserves

- Primarily require revegetation for biodiversity and amenity, but may have some scope for use of groundwater.

Highland: Roadsides

- Opportunity to extend biodiversity and provide windbreaks.
- Needs pest plant and animal control.
- May be a case for incentives to shift boundary fences when re-fencing to give wider strips of vegetation.

Highland: Conservation areas

- Large areas of remnant vegetation in the Berri Barmera region have a high biodiversity value given their exclusion from grazing over a number of years. It is a high priority to conserve and enhance these areas of remnant vegetation as much as possible (Figure 4).
- Lake Bonney and its surrounds needs special consideration due to the high impact of recreational users and the increase in salt entering the Lake.
- The Department of Environment Heritage and Aboriginal Affairs (DEHAA) is currently preparing a 'Biodiversity Plan for the MDB in South Australia'.¹ This plan will assist the determination of biodiversity objectives, in particular the objectives that link the LAP with the surrounding regions.

Riparian: Natural vegetation

- Willow removal² is required in backwaters where they block watercourses (with their roots and by falling over). The riparian areas are popular for recreational water sports and houseboats that subject the native vegetation and soils to degradation pressure (eg. Martins Bend).
- Some areas are very saline and would require mounding or mulching to ameliorate salinity levels for revegetation (eg. the western banks of Lake Bonney). On 18 March 1999 observation was made on the west of Lake Bonney of healthy black box (*E. largiflorens*) trees growing adjacent to an area with samphire and bare ground. Soil samples were taken from each area, within 10 metres of each other, after removing the top 10-30 mm of soil and litter. The ECe readings of the soil salinity gave the following readings.

	ECe (mS/cm)
Samphire area	8.5
Black box area	1.7

Figure 5 shows the leaf litter and mulch that was on the soil surface of the black box area. Mulch prevents evaporation of moisture from the soil and thereby reduces the concentration of salts in topsoil (Handreck & Black 1984). The mulch under the black box may be having this effect and if so this demonstrates the benefit of mulching techniques when establishing trees on saline areas.

¹ This study is being done by Monique Kahrmanis, Department of Environment, Heritage and Aboriginal Affairs.

² Introduced willow species do not require clearance consent to remove (DEHAA, Native Vegetation Branch).

However removal must be done in a way that minimises riverbank erosion and this may include grading the soil, establishing native grasses such as river couch, placement of logs or rocks, or doing the removal when the river level is low (personal communication from Ross Stockdale, Water Resources, DEHAA). Also, killing and leaving willows in situ is another option where they are accessible (Murphy, date unknown).

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Additionally this data emphasises the need to analyse the soil salinity of saline sites before planting trees and shrubs. Data is available to give guidance on the survival and growth of trees under saline conditions (Bulman 1995, Dalton and Dowie 1986, Dooley 1995).

- Planting the 'green box' variant of *Eucalyptus largiflorens* for higher salinity tolerance is of benefit where salinities are too high for the non-variant *E. largiflorens*. However it has been reported that the 'green box' variant does not breed true from seed (Frahn pers. comm.) so there may be some difficulty obtaining significant numbers of seedlings for planting.
- Some natural regeneration will occur in areas where flooding is induced (associated with wetland management). This is recognised as the most effective means of revegetation in these areas (Harper et al 1998).

Riparian: Grazed areas

- Grazing occurs on some river flats. Grazing activity should be reduced in some cases to allow regeneration of native vegetation and reduce soil erosion and nutrients loads into the river from defecation (Harper et al 1998). Fencing the areas that are to be grazed to minimise on-site and off-site impacts should be considered.

Wetlands

- Management of wetting and drying cycles is the prime issue for the health of wetlands (eg. 50,000 ML/day flood) and usually results in an abundance of natural regeneration of wetland vegetation. Revegetation of the wetland itself is best left to these processes.

The main issues centre on the use and management of water – viz. drainage water, groundwater mounds, regional groundwater, water quality, and stormwater

Other factors that might affect the selection of a revegetation option are:

1. Social acceptance of that option. Some resistance to the use of direct seeding as an establishment technique is apparent in the Northern Mallee, (Bennett pers comm) as is the concept of windbreaks in some horticultural areas where increased frost risks are cited.
2. Negative impacts – eg the potential for revegetation to become a harbour for weeds or rabbits.
3. Other benefits – Carbon or salt credits may become a reality in the next few years (Plastow 1998³, Schonfeldt 1998⁴).

PRIORITY LAP ISSUES

This revegetation plan is aimed at identifying how revegetation can be effectively carried out in the Berri Barmera LAP area to help address the priority issues identified. Five key issues have been identified:

1. Impact of Irrigation and Drainage.
2. Floodplain and Wetlands Degradation.
3. Water Quality.
4. Nature Conservation and Biodiversity.
5. Planning and Reporting.

³ Carbon credits is when trees have a financial and tradable benefit according to the amount of carbon sequestration of a plantation. Keith Plastow is the Principal Greenhouse Advisor of the Environment Protection Authority (EPA). The EPA should be monitored for further developments on carbon credit. Although there is nothing definite, some people are documenting what they have done in their revegetation programs in hope that they will be eligible for carbon credits in the future.

⁴ Salt credits are when trees have a financial and tradeable benefit according to the amount of salinity mitigation they achieve. Claus Schonfeldt is Deputy Director Environment Policy, Department for Environment, Heritage and Aboriginal Affairs.

Berri Barmera Local Revegetation Plan

The Berri Barmera Local Action Plan Committee has developed strategies for each of the priority issues. The revegetation options proposed in this revegetation plan, will directly assist in the implementation of a number of these strategies, in particular:

- ✓ Reducing off site impacts of irrigation.
- ✓ Reducing irrigation drainage entering the River Murray.
- ✓ Protecting existing native vegetation.
- ✓ Encouraging community groups to include biodiversity outcomes as part of their revegetation projects.

The role of revegetation in addressing these issues is given in Table 6.

Berri Barmera Local Revegetation Plan

Priority Issue	Role of revegetation
Impact of Irrigation and Drainage	
Use of irrigation drainage water	<p>Revegetation is an option for using irrigation drainage water, especially to grow an irrigated woodlot. Irrigated woodlots have the potential to use more drainage water than local groundwater, in the woodlot designs discussed by SKM (1997).</p> <p>Note: Reuse of drainage water with revegetation/woodlots will, in the long-term, not totally reduce the salt loading into the river as the drainage from a woodlot will eventually enter the river. This drainage water will tend to be a more concentrated point source rather than a diffuse source. A woodlot will however reduce nutrient loading into the river and this is seen as a very real benefit. Woodlots also have the potential to produce a source of income, possibly firewood for the Houseboat industry, (for riverside fires).</p>
Reduce groundwater mounds and waterlogged ground due to irrigation	Strategically located revegetation could be used to intercept and reduce regional groundwater flow or groundwater mounds resulting from irrigation. This will reduce the nutrient loading into the river and by lowering water tables may reduce the salt loads into the river.
Degradation of Floodplains and Wetlands	
Floodplain	<p>Reintroduction of more natural wetting and drying cycles will most likely provide the best opportunity for revegetation through natural regeneration in the floodplain/wetland areas (Carter J pers. comm.).</p> <p>Opportunities exist for strategic revegetation of riverine areas to redress degradation from recreational activities and improve amenity/tourism value as well as enhance biodiversity. Fencing to control stock and human access will assist in the natural regeneration of such areas and protect any other revegetation carried out.</p> <p>Uncontrolled access to firewood has seen the depletion of an enormous amount of dead standing and dead fallen timber as well as some green timber. Revegetation in the form of timber lots for specific firewood production would potentially be of great benefit.</p>
Wetland	<p>Revegetation can be considered around the periphery of wetlands depending on the wetting and drying cycles that exist and the level of soil and groundwater salinity.</p> <p>The study by ID&A (1998) on wetland management for Martins Bend wetland recommends promoting regeneration of indigenous flora through increasing flooding across the floodplain. Some active revegetation is also recommended for areas deemed suitable.</p> <p>Revegetation recommendations of the Wetlands Management Study (Harper et al 1998), provide a sound basis for revegetation in the 7 wetland complexes of the Berri Barmera LAP region. A recommendation for the Spectacle Lakes Complex includes the selective removal of grazing to allow regeneration.</p> <p>Revegetation of areas around the fringes of Lake Bonney has been carried out in the past in an effort to reduce the degradation of this natural resource. The relative success or otherwise of these plantings are documented in the findings of the <u>Berri Barmera Area Revegetation Report</u>, by Kevin Smith (1998). The south western area of the Lake may be suited to the hand planting of red gums, river box and river cooba, (Fiona Bennett pers com.) More thorough soil salinity tests would need to first be carried out.</p> <p>The PPK (1999) report on the water quality of Lake Bonney notes that Riparian vegetation is continuing to decline around the Lake as salinity increases.</p>
Water Quality	
Reducing irrigation drainage entering the River Murray	Irrigation drainage water not only increases salt loads to the river, but also carries other pollutants such as nutrients and sediments (SKM 1997). Revegetation may assist in the interception of excess nutrients before they enter the River, as mentioned in 'Impact of Irrigation and Drainage, above.
Diversion of storm water from the River Murray	<p>Planned LAP work includes the investigation of stormwater reuse options. Storm water could be used to irrigate woodlots. More investigation into this option is required.</p> <p>The PPK report on the water quality of Lake Bonney (1999) recommends the diversion of stormwater away from the Lake to a holding basin with reed vegetation for filtering.</p>

Berri Barmera Local Revegetation Plan

Biodiversity and Conservation	
Protection of remnant vegetation	As well as fencing remnant vegetation, revegetation of adjacent areas as links or buffers will assist in the long-term viability of the remnants. Pest plant and animal control will be a necessary part of any revegetation management plan.
Mallee Degradation	Revegetation of the nominated sites in this revegetation plan will proceed according to the targets set. Species selection and seed sources will be determined on a site by site basis.
Planning	
Revegetation	In line with the Berri Barmera LAP, revegetation work will be carried out to address the priority issues of the region. Further site information is expected to be available on completion of the Land and Water Management Plans (LWMPs). These plans are being developed to determine the level of water use in the horticultural areas and the movement of water and salts in the landscape. Management recommendations will then be developed to determine appropriate water use, possible engineering solutions and other works to reduce salt loads to the River.

Table 6. The role of revegetation in addressing the priority issues of the Berri Barmera LAP

The Revegetation Options

REVEGETATION DESIGNS

Revegetation designs are described in this plan in terms of their layout and major theme. These are defined and explained below.

Layout

Three major revegetation layouts have been used. These are:

1. Block (BL)- (or a 'blob' - not necessarily a formal rectangle). Characterised by more than 5 rows of revegetation which are less than or equal to 10 m apart and no farming operations (eg cropping or pasture production) in the inter-row/alleys.⁵ Long blocks connecting vegetation will constitute a corridor. Usually but not necessarily fenced (eg on riparian areas). A small block is called a clump.
2. Wide linear (WL)- 3 - 5 rows ('belt') of trees and/or shrubs (closely spaced). Farming operations are done in the areas outside the revegetation but no farming operations are done within the belts. The wide linear belts may be repeated across a paddock and create alleys where farming operation may occur. These belts are usually too narrow for an effective wildlife corridor. Usually but not necessarily fenced.
3. Narrow linear (NL)- 1 - 2 rows (closely spaced) of trees or shrubs with are repeated across a paddock at more than 10m apart. Usually the tree rows are not fenced. Farming operations are done in the alleys. Wide spaced agroforestry is covered in this design, even though the trees may not strictly be in rows.

It is envisaged that where the belts (for wide linear) and rows (for narrow linear) are repeated across paddocks they are done so at a distance 15 - 20 times the height of the trees. This is not necessarily the case for some fodder systems, especially on the dunes where erosion risk would make this impractical.

The layout definitions are sketched in Figure 3 and summarised in Table 7.

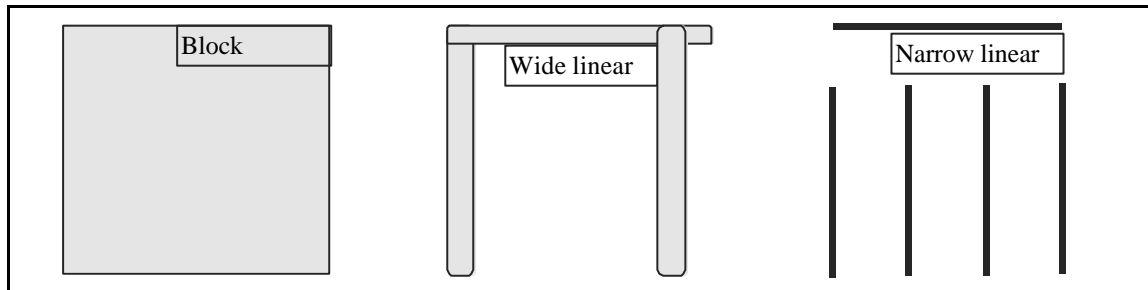


Figure 6. Sketches of the revegetation layouts used.

	Block (BL)	Wide linear (WL)	Narrow linear (NL)
Number of rows	>5	3-5	1-2
Row spacing	<=10 m	Close (2-5m)	Close (2-5m)
Farming in alleys	No	Yes	Yes
Fencing	Usually, but not necessarily	Usually, but not necessarily	Not usually
Typical designs	Blocks of native vegetation or fodder	Windbreaks	Alley farming

Table 7. Summary of the revegetation layout definitions.

⁵ An 'alley' is defined as the land between belts or rows of trees.

Berri Barmera Local Revegetation Plan

Major theme

A theme refers to the major characteristic of a planting. For example, a timber planting is one that is characterised by the production of timber.

The themes that have been used are:

1. Native mix – A mix of native species as local as possible. Includes native grasses where appropriate. The main theme is centred on establishing native species for biodiversity, habitat and amenity (with associated other benefits). Local is defined as from a matching site type that is geographically as close as possible to the one being revegetated (Dalton 1988). Non-local native species may be more suitable in some cases.

Note: The philosophy followed in this plan is to make local natives species the first choice for a planting. However the next choice is non-local native species, and then exotic species, when they fulfil the function of the planting better than local native species. For example, when a land change has occurred such as land turning saline, salt tolerant species, which are not necessarily local, may be required. Similarly, a product such as timber may best be produced by a species other than local native species.

2. Fodder – Planting with a view to providing fodder for stock feed.
3. Timber – Planting with a view to harvesting a timber or wood product (eg firewood, posts, and construction timber).
4. Products⁶ – Planting with a view to producing products other than timber, such as broombush, carobs, bush tucker, etc.

Irrigation (dripper, flood or sprinkler) may be applicable to the timber and products themes. It is highly unlikely that fodder species such as saltbushes and acacias would be irrigated. Irrigation of a native mix is also highly unlikely, as native mixes are healthiest when left to their natural environmental conditions.

A revegetation design is constituted of a layout and a theme. All the possible combinations of layouts and themes for new areas of revegetation, and common purposes they are used for, are given in Table 8. Additional to these is the protection of remnant vegetation.

Layout	Theme	Common purposes
Blocks	Native mix	Biodiversity (blocks or clumps)
	Fodder	Fodder
	Timber	Dryland woodlot
	Products	Income diversification
	Timber – irrigated	Irrigated woodlot
	Products – irrigated	Irrigated income diversification
Wide linear	Native mix	Windbreak; roadside planting
	Fodder	Windbreak with drought fodder spp.
	Timber	Windbreak with timber by-product
	Products	Windbreak with income diversification product
	Timber – irrigated	Windbreak with irrigation
	Products – irrigated	Permaculture
Narrow linear	Native mix	Narrow windbreak; Alley farm
	Fodder	Alley farm
	Timber	Alley farm with timber product; Narrow windbreak; Wide spaced agroforestry
	Products	Unlikely to be used (Maybe in permaculture)
	Timber – irrigated	Unlikely to be used (not worth irrigating 1-2 rows for timber production, although the irrigation will reduce competition with the horticultural crops)
	Products – irrigated	Unlikely to be used (Maybe in permaculture)

Table 8. Revegetation designs and common purposes they are used for.

⁶ A separate permaculture consultancy is being done by the LAP looking at other products suitable for integrating into the horticulture blocks.

PRIORITY OPTIONS

How the options were determined

In Table 5 (Page 10), there are 8 landscape features and in Table 8 (Page 18) there are 18 possible revegetation designs. This gives 144 possible combinations/options of design and landscape feature. The 144 options were rated as to how they matched the landscape features and land use with consideration as to how the revegetation options met the priority issues of the LAP (Appendix 1). A rating of 3 = high/suitable match of the option with the landscape feature and land use, 2 = medium match, 1 = low/not very suitable match, 0 = not at all a suitable match. Revegetation knowledge, the references used in preparing this report, field trips and discussion with local experts were used to determine the ratings and provide the comments. This rating system is for new revegetation and was not used for protection of existing native vegetation. Protection of remnant vegetation is much better value for biodiversity per dollar invested than establishing new areas of native species (See page 30). For this reason protection of remnant vegetation was always rated as a high priority.

Protection of remnant vegetation is much better value for biodiversity per dollar invested than establishing new areas of native species.

The most unlikely options (rating = 0) were then filtered out of the list to leave every option that at least has some possibility of being implemented. The remaining options were then sorted into priority groups (Appendix 2).

In reality options in the low priority group (rating = 1) are unlikely to be implemented. However they should be read to make sure that an option that may suit some particular person or situation is not overlooked

High and Medium options

The high and medium priority options are presented in Table 9 and Table 10, and discussed below.

Berri Barmera Local Revegetation Plan

Landscape features	Major soil types	Major land use	Reveg Theme	Reveg Layout	Comments
Highland	Shallow soils over lime rubble calccrete or clay, some limited calcareous loams and saline land with gypsum deposits (eastern side of Lake Bonney).	Dryland farming	Native mix	BL	The main benefits will be through biodiversity benefits and the stabilisation of sandy ground. This option will also reduce recharge, however in the Berri Barmera area recharge reduction is not a priority issue.
Highland	Calcareous loams, alluvial soils in western region, some limited areas of unbleached siliceous sand over calcareous subsoils (in dune swale systems) Sand to sandy loams on rises, clays on flats.	Irrigated horticulture	Timber – irrigated	BL	Could be opportunity to use drainage water. Not necessarily planted on prime horticultural land.
Highland	(as above)	Irrigated horticulture	Products – irrigated	BL	Could be some good opportunities, further research is required to determine appropriate tree crops (this will be determined in the permaculture study currently being finalised).
Highland	Several soil types	Urban reserves	Native mix	BL	Investigations in to the possibilities of tree plantings around the townships of Berri Barmera and Glossop need to be carried out. Ground water use is likely, however the main benefits will be those of biodiversity and amenity.
Highland	Several soil types	Roadsides	Native mix	BL	No fencing required. Gives shelter. Opportunity to demonstrate revegetation with indigenous species and change community attitudes, including attitudes about revegetation methods (eg direct seeding).
Highland	Several soil types	Roadsides	Native mix	WL	Wide linear would suit many roads (not necessarily in rows).
Highland	Several soil types	Conservation areas	Native mix	BL	Protect remnant vegetation. New vegetation to link to remnants.
Riparian vegetation	Grey clay	Conservation	Native mix	BL	Revegetate areas not too saline. Requires salinity survey. Includes planting around wetlands.

Table 9. High priority revegetation options

Berri Barmera Local Revegetation Plan

Landscape features	Major soil types	Major land use	Reveg Theme	Reveg Layout	Comments
Highland	Shallow soils over lime rubble calccrete or clay, some limited calcareous loams and saline land with gypsum deposits (eastern side of Lake Bonney).	Dryland farming	Fodder	BL	Provides benefits in supplementing native pastures and providing some shelter for stock. Useful in rehabilitation of degraded land and provides good cover to reduce soil erosion.
Highland	(as above)	Dryland farming	Native mix	WL	Has a possibility as windbreaks do provide real benefits, however the concept of windbreaks may need to be promoted for this option to be taken up.
Highland	Calcareous loams, alluvial soils in western region, some limited areas of unbleached siliceous sand over calcareous subsoils (in dune swale systems) Sand to sandy loams on rises, clays on flats.	Irrigated horticulture	Native mix	BL	Resistance to blocks using horticultural land, but may be opportunity to use groundwater. Some plantings have already taken place. Monitoring of these, and any benefits they are bringing, is considered to be very worthwhile.
Highland	(as above)	Irrigated horticulture	Native mix	WL	May be used to intercept groundwater and for windbreak. Benefits of windbreaks need to be communicated to the irrigators, with options that are available.
Highland	(as above)	Irrigated horticulture	Native mix	NL	Horticulture windbreak benefit.
Highland	Several soil types	Urban reserves	Timber	BL	May be able to integrate with groundwater use. Natives may be preferable to timber due to harvesting disturbances.
Highland	(as above)	Irrigated horticulture	Timber	WL	May be used to intercept groundwater and for windbreak.
Highland	(as above)	Irrigated horticulture	Timber	NL	Horticulture windbreak benefit.
Highland	(as above)	Irrigated horticulture	Timber	BL	Possibilities for interception of groundwater.
Highland	Several soil types	Urban reserves	Native mix	WL	May be some opportunities.
Riparian vegetation	Grey clay	Conservation	Native mix	WL	May be some areas where there is only room for wide linear layouts. Useful to surround salty areas and wetlands.

Table 10. Medium priority revegetation options

Berri Barmera Local Revegetation Plan

Discussion of options

The priority revegetation options have been summarised in Figure 1, (Page 6) and are discussed below. The 'Products-irrigated' options have not been included in Figure 1 as they are being dealt with by the LAP in a separate permaculture consultancy.

Highland: Dryland farming

High priority

1. Blocks of native mix. – Important across all soil types to improve biodiversity and create higher water use landscapes.

Medium priority

1. Wide linear layouts of native mix for windbreaks. – There is a need to address the resistance to windbreaks. This could be done by identifying windbreaks that are providing good shelter and not causing problems and reviewing associated management.
2. Fodder species on sand dunes or saline depressions. – With the current trends in wool prices farmers are reducing stock numbers. However, with reduced stock numbers blocks of fodder may become more important for autumn feed when farmers want to keep stock off cropping land. If/when stock numbers increase again blocks of fodder will be more important. Blocks of fodder have the very real benefit of reducing soil erosion.

Highland: Irrigated horticulture

High priority

1. Blocks of irrigated timber. – Provide one of the best opportunities to use drainage water.
2. Blocks of irrigated products. – Pending the outcome of the LAP permaculture study, there may be suitable products that can be grown.

Medium priority

1. Native mix in blocks, wide linear or narrow linear layouts. – Because of the high priority to use groundwater the block and wide linear options were rated as the medium priorities, even though there is resistance to using horticultural land for native species (native species are non-productive and attract birds, which eat fruit). This would only occur on specific land where groundwater use is a priority or can be readily accessed by the revegetation. The wide linear layout may also function as a windbreak but narrow linear layouts are likely to be more popular as a windbreak as they utilise less ground than wide linear.
2. Blocks, wide linear, or narrow linear layouts of timber. – These could intercept groundwater and function as windbreaks as well as produce timber. It is likely that they would only suit a low number of particular sites (ie. groundwater access, harvesting access limitations).

Highland: Urban reserves

High priority

1. Blocks of native mix. – Opportunities often arise to revegetate with native species in urban areas for amenity, with possibly some biodiversity benefit from plantings linked by corridors to other blocks of native vegetation.

Medium priority

1. Wide linear layouts of native mix. – There may be situations in urban areas where only sufficient land is available for wide linear plantings, in lieu of blocks (See High priority).
2. Blocks of timber. – It may be possible to locate timber blocks in areas surrounding towns to utilise groundwater, stormwater or industrial effluent. These options need to be more fully investigated.

Highland: Roadsides

High priority

1. Blocks or wide linear layouts of native mix. – Native species are the only theme suitable for roadsides. Roadside offer a good opportunity to do no-fencing revegetation (more revegetation for the \$) which will demonstrate (or evaluate) windbreak benefits and demonstrate revegetation techniques. This will help promotion of revegetation to farmers.
There are no medium priority options for roadsides.

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Highland: Conservation areas

High priority

1. Blocks of native mix. –Protect remnant vegetation and establish new blocks of native vegetation to enhance biodiversity and reduce groundwater recharge.

Riparian: Natural vegetation

High priority

1. Blocks of native mix. – This is a significant opportunity to enhance biodiversity, amenity and even control recreation traffic (with appropriate site design). Many of the sites are so saline that earthworks/mounding would be required to establish vegetation. It would be best to concentrate revegetation on ground of lower salinity in riparian zones (soil salinity reading required). This is less expensive (more revegetation for the \$/effort) and gives more encouraging results than revegetating the high salinity areas.

It would be best to concentrate revegetation on ground of lower salinity in riparian zones.

Medium priority

1. Wide linear layouts of native mix. – These would be applicable when there is not sufficient land to plant a block (See high priority).

Riparian: Wetland

As stated previously managing the wetting and drying cycles best revegetates wetlands. Establishing native vegetation on areas surrounding wetlands is covered under 'Riparian vegetation' above.

Implementation of the Revegetation Plan

REVEGETATION COSTS

On the basis of the summarised revegetation options (Figure 1, Page 6) the cost of the 6 main options was determined using contract costs to implement the options (Table 11). The full details of these costs is given in Appendix 3

No.	Layout	Theme	Location
1	Block	Natives	<ul style="list-style-type: none"> Highland flats, rises, dunes, depressions, urban, conservation, terraces, roadsides (if room for blocks) horticulture, riparian.
2	Wide linear	Natives	<ul style="list-style-type: none"> Roadsides, horticulture, urban, terrace, riparian. Same cost for revegetation works for highland farming plus the cost of fencing.
3	Narrow linear	Natives	<ul style="list-style-type: none"> Horticulture.
4	Block	Fodder	<ul style="list-style-type: none"> Dunes (predominantly on clay). (May be some fodder direct seeded onto mounds on clay saline soils, on highland depressions or riparian zones)
5	Block	Timber	<ul style="list-style-type: none"> Primarily irrigated horticulture, but also for all suitable sites. For wide and narrow linear timberbelts use block of timber costing but scaled down to size of wide linear planting. Same cost for revegetation works used for blocks of timber established for irrigation with drainage water, but the irrigation costs are to be added.
6	Protect remnants	Remnants	<ul style="list-style-type: none"> All sites.

Table 11. The revegetation options for which a cost has been calculated.

TARGETS

Revegetation targets should be set to achieve specific goals and objectives of the driving issues of the LAP (Murphy and Dalton 1998). The priority issues of the LAP which revegetation has a role in addressing are given in Table 6 (Page 16). For detailed biodiversity goals the LAP is waiting for the completion of the 'Biodiversity Plan for the MDB in South Australia', and for revegetation to utilise groundwater and drainage water the LWMP is to be completed and the role of revegetation determined. There are many other options that will have a greater impact on minimising groundwater and drainage water problems than revegetation and revegetation is likely to only play a relatively small part in addressing these problems. While waiting for the completion of these studies it is necessary to set some interim targets in order to secure funding and to initiate programs. Targets can be modified after the completion of these studies. The interim targets in hectares related to these priority issues are given in Table 12 below.

Description of main purpose of option	Priority Issue addressed	Hectares
Perched water table	Impact of irrigation and drainage	45
Reuse drainage water		20
Riparian Wetland and Recreation sites	Floodplain & Wetlands degradation	50
Low productive land		65
Reuse stormwater	Water Quality	5
Remnant protection	Nature Conservation & Biodiversity	150
Native vegetation. Linking remnants		50
Total hectares		385

Table 12. Three-year revegetation targets (hectares) and the priority issues they address

Berri Barmera Local Revegetation Plan

The targets are in general terms and the priority revegetation options were allocated to these targets according to the suitability of the options to address the strategic issue of the target. The details of this allocation are given in Appendix 4, along with the costing associated with this allocation using the costs in Appendix 3. Figure 7 shows the hectares of revegetation that is to be done for each revegetation option. Figure 8 gives the funding required and community cost for the revegetation works for these targets, based upon the cost-share arrangements discussed on page 37. The total cost to implement the revegetation targets, including the funding required, fencing costs and community contribution is given in Table 13. All costs are calculated on the basis of engaging contractors. This recognises the time and ‘in kind’ contribution made by landowners to a project. Conversely this means that the community contributions do not require the level of cash outlay indicated in the costing tables but the costs reflect the significant proportion of time and equipment supplied by landowners. Also landowners should consider whether any cash outlay is eligible for tax deductions⁷.

The proportion of the revegetation targets to be achieved in the three-year program is 25%, 35%, 40% for years 1, 2 and 3 respectively. The detail costs for this split is given in Appendix 4.

The hectare targets are linked to cost sharing in Table 16 (Page 37) to give the total funds to be spent for each revegetation option.

	Funding sought	Community contribution	Total
Revegetation works	\$143,691	\$195,634	\$339,325
Fencing	\$61,500	\$112,500	\$174,000
Total	\$205,191	\$308,134	\$513,325
% split	40%	60%	

Table 13. Total costs to implement the revegetation plan.

⁷ The Australian Taxation Office has published a booklet titled “Income tax deductions for landcare related activities – A guide to sections 51(1), 53, 54, 75B and 75D. This booklet does not have a date of publication in it but gives general guidance on the June 1991 amendments of the Tax Assessment Act.

Berri Barmera Local Revegetation Plan

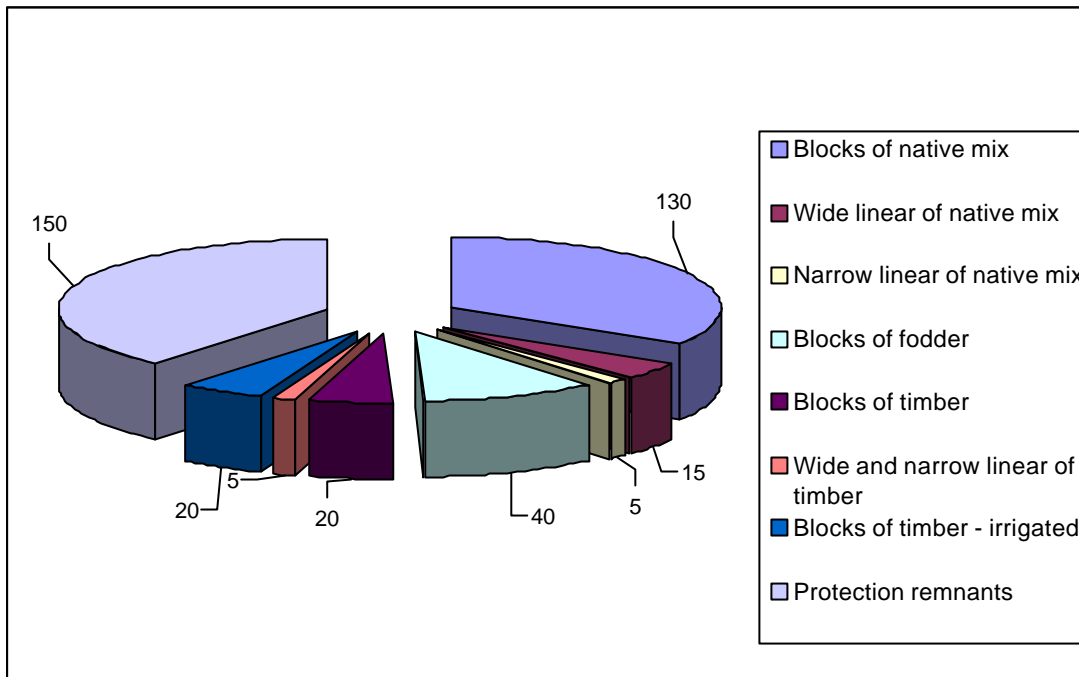


Figure 7. The three year hectare targets for each revegetation option.

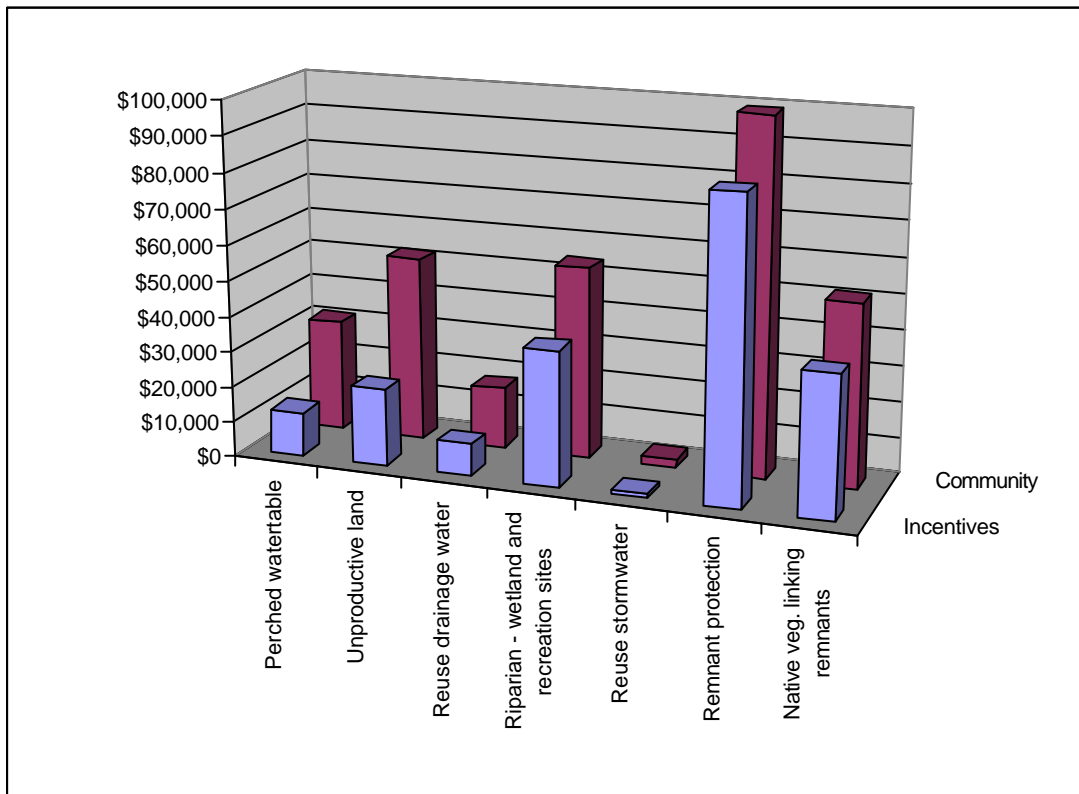


Figure 8. Cost of implementing the revegetation targets.

PRIORITY LOCATIONS

General

Priority locations can not be determined for options that apply across a landscape, and which are dependant upon landholders applying for that option. For example, priority locations can not be determined for narrow linear layouts of local species for windbreaks in irrigated horticulture, or for blocks of fodder in dryland farming. The protection of remnant vegetation and establishing new revegetation to link with remnants for biodiversity benefits are options that apply across all landscape features, however specific sites for these should be identified as part of the 'Biodiversity Plan for the MDB in South Australia'.

The Land and Water management plan currently being developed for the Berri Barmera LAP area will provide valuable information regarding the extent and location of perched water tables, ground water and River salinity levels, expected salinity trends, opportunities for the use or disposal of drainage water and so on. All this information will provide the necessary technical background knowledge to make sound decisions in the location of revegetation works.

The comments on priority locations (Table 14) are based on current knowledge to this point, and it is therefore that this will be considerably added to and made more specific as further on-ground planning of revegetation takes place.







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Landscape feature	Location issues and priority locations (where identified)
Highland: Dryland Farming	<ul style="list-style-type: none"> • Dryland farming in the Berri Barmera area is very limited however good opportunities still exist for the protection of remnant vegetation and revegetation of some areas with native mix. • Fodder plantings may be possible in the north western and eastern region of Lake Bonney.
Highland: Irrigated	<ul style="list-style-type: none"> • No specific locations for windbreaks, blocks of natives, or products however a number of successful woodlots have already been planted in the irrigated areas. Further research as to the benefits of these woodlots is recommended (ie potential water use & economic value) • Specific locations for intercept wateruse plantings are dependant upon information which will be contained in the LWMP (currently being completed). In the interim planting may be done where groundwater is known to be close to the soil surface.
Highland: Roadsides	<ul style="list-style-type: none"> • There may be opportunity to shift boundary fences adjacent to roadside vegetation to give wider belts of native vegetation. • Incentives should be considered for weed removal programs (maybe linked with Animal and Plant Control Commission programs). The very significant saving in revegetation costs within roadsides (no requirement for fencing) makes this option very attractive. Windbreak and biodiversity benefits could be shown in demonstration sites.
Highland: Conservation areas	<ul style="list-style-type: none"> • The Berri Barmera LAP region has a number of excellent conservation areas with significant blocks of remnant vegetation predominantly located to the south of the Cobdogla irrigation area. Good areas of remnant vegetation also occur in the Monash area. The protection of these areas and the linking of remnants is seen as a high priority (see Biodiversity section, page 30). • Areas to the south of K Country disposal basin, which are currently degraded, may be amenable to planting with salt tolerant species (Fiona Bennett pers comm).
Riparian – Natural vegetation	<ul style="list-style-type: none"> • Opportunities exist for revegetation in these areas to enhance biodiversity, reduce drainage flow to the river and control recreational traffic. • The Wetland management Plan – Martin Bend (ID&A 1998) recognises the need to both promote natural regeneration and actively revegetate in this high use area. Planting with salt tolerant Green Box variant of the River Box is recommended given the high salinity in this area. • <u>Lake Bonney</u> is a unique natural resource in the Berri Barmera region. A major study has been carried out by PPK (1999) to assess the water quality of the Lake. The report notes that much of the riparian/floodplain vegetation is in significant decline due to increasing soil and ground/surface water salinity. Kevin Smith, (Berri Barmera Revegetation Survey Report 1998), has assessed past revegetation projects that have been carried out around the Lake, and these planting's have in many cases experienced the same decline in health. From this study it is clear that a number of real difficulties are presenting in this area and any works undertaken would need to develop sound revegetation guidelines and techniques to ensure success. • Areas to the south west of Lake Bonney are possibly suited to hand planting (red gums. river cooba, river box), whilst areas to the northwest near Nappers Bridge to direct seeding (Fiona Bennett pers com). Soil salinity readings should be taken in such areas prior to any revegetation. Mounding and mulching may well assist (Handreck & Black 1984).
Riparian – Grazed.	<ul style="list-style-type: none"> • No specific sites as it is dependent on the willingness of individual landholders. Opportunities may exist in the Spectacle Lakes area and particularly on Beldora Station.
Wetlands	<ul style="list-style-type: none"> • The Wetland Management Study (Harper et al 1998) is an in depth study of the management of wetlands in the SA riverine region. The main locations for revegetation in the Berri Barmera are given below in the wetlands section (page) • Two Wetland Management plans have been completed for the area. Martins Bend (ID& A 1999) and Cobdogla/Loveday Swamps (Jensen et al 1999) • Other wetland management plans will be developed for Katarapko Creek, Spectacle Lakes, Loch Luna Berri Basin and Gerard (Campbell 1999)

Table 14. Location priorities and issues.

Berri Barmera Local Revegetation Plan



- | | | | |
|---|--|---|--|
|  | Unclassified Vegetation |  | <i>Dodonaea viscosa</i> ssp. <i>angustissima</i> low shrubland |
|  | <i>Eucalyptus cyanophylla</i>
<i>E. socialis</i> open scrub |  | Study Areas |
|  | <i>Eucalyptus oleosa</i>
<i>E. gracilis</i> open scrub | | |
|  | <i>Myoporum platycarpum</i> low woodland | | |

(Source: Kirk et al 1995)



Figure 9. Remnant vegetation in the Berri Barmera LAP area.



(Source: Kirk et al 1995)

Berri Barmera Local Revegetation Plan

Biodiversity

The Berri Barmera LAP region contains significant areas of remnant vegetation, (12,700ha Campbell 1999). This is shown in Figure 9 (Page 29). The bulk of this remnant vegetation still occurs in a contiguous block to the south of the Cobdogla irrigation area. This whole area is considered to be a high priority for the protection of remnants. At this point no heritage agreements are in existence and large areas remain unsurveyed. A recent survey (1996) in the Loveday South area showed a number of rare plants and animals resulting in the restriction of further irrigation development, (Campbell 1999).

Intact areas of native vegetation have greater conservation significance than replanted areas as they contain a greater diversity of native species and are more self-sustaining.

Priority areas for revegetation will be based upon the biodiversity benefits such plantings will likely bring. The Regional Biodiversity Plan currently being developed will be providing information, which will assist in this regard. Until this document is completed the biodiversity planning principles which have been developed in the Upper South East Regional Biodiversity Strategy (Croft et al, in press) serve as good guidelines for high biodiversity outcomes. These are listed below:

Retention

- Intact areas of native vegetation have greater conservation significance than replanted areas as they contain a greater diversity of native species and are more self-sustaining.
- Intact areas of native vegetation are cheaper to maintain than replanted areas.
- Conservation of existing intact remnants of native vegetation is considered more important and takes precedence over revegetation works on a cleared landscape.

Restoration

- Many of the remaining native vegetation remnants are in poor or declining condition with older thinning tree canopies and reductions in the number and diversity of understorey plants.
- These areas provide opportunity for fencing and de-stocking to allow natural regeneration.
- Supplementary planting of native vegetation in degraded areas can assist the area to become self sustaining once again.
- Pest plant and animal control is a necessary part of restoration management.
- Priority areas are; threatened plant communities and areas containing rare and endangered species.
- High priority should also be given to regenerate areas which:
 - retain a large proportion of the original plant species;
 - contain vegetation still in relatively good health;
 - can be restored to a self sustaining or regenerating condition;
 - link existing good quality intact native vegetation; and /or,
 - increase the area of intact native vegetation.

Re-establishment

- The completion of the State Revegetation Strategy for SA (1996) has given an overall aim for revegetation projects.
- Priority for revegetation projects should be given to:
 - establishment of effective wildlife corridors and stepping stones linking remnant blocks of native vegetation;
 - buffers to existing stands of remnant trees or blocks of native vegetation;
 - re-establishment of threatened plant communities and habitats;
 - those which provide feeding habitat for threatened fauna species;
 - local species suitable to the soil type and land form, grown locally from locally collected seed, (within 5 km of the site wherever possible).

Wildlife Corridors

- A means of overcoming local and regional species decline and extinction in remnant vegetation can be through developing wildlife corridors or links.
- This assists in wildlife exchange between existing blocks and can provide access to refuges in the case of fire.

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- Links must consider where existing vegetation occurs and the intervening land use. (eg will farm management practices be unduly affected by corridor revegetation?)
- Road and railway links may already exist but these are commonly very narrow and accordingly often degraded. Incentives could be provided to revegetate along side (parallel to) these areas on private property. This will also likely provide increased windbreak benefits.

Wetlands

The Wetland Management Study (Harper et al 1998) gives well-constructed proposals for each of the 7 wetlands in the Berri Barmera area. Active revegetation is recommended for three of these, LakeBonney/Loch Luna, Berri Basin, and Spectacle Lakes. The Wetland Management Plan for Martins Bend also recommends active revegetation in selected areas of this wetland, (ID&A 1998).

Wetland degradation is a key issue in the Berri Barmera region, revegetation is one management tool that can help in the restoration of these areas. The adoption and management of wetlands in the Murray Valley region by community groups, (such as Katarapko Island near Loxton) will provide good opportunities for the implementation of the recommendations of the Wetland Management Study (1998), and other wetland management plans in the area. It is an express aim of the Berri Barmera LAP to encourage community groups to become involved in the management of wetlands in the area (Campbell 1999).

BENEFIT:COST

A benefit:cost analysis of the total LAP program is being done as a separate consultancy. The revegetation costing and benefits will be incorporated into this total LAP benefit:cost analysis.

COST SHARING

Incentives

Funding is being sought for the implementation of this revegetation plan. While it may be possible to obtain significant levels of funds from programs like the Natural Heritage Trust (NHT) the funding bodies require a contribution from the local community. The split of costs between a funding body (which represents the broader community or the public) and the local community members is called 'cost sharing.' The cost sharing is split according to the split of private and public benefits, which is determined by a benefit:cost analysis of the program, usually as part of a benefit:cost analysis of the all the programs of the LAP. Successful funding is to be distributed under a set of prioritised criteria as an incentive scheme for landowners to implement the revegetation. The level of funding will be decided upon the submission of a proposed works program and site inspection. Some comments about the incentive scheme in relation to different aspects of the program are given below.

Biodiversity

- The incentive scheme will involve a contractual agreement between the LAP and landowners and under this agreement it will be expected that stock will be excluded from areas receiving funds for the protection of native vegetation. However there is currently no long-term management agreement to protect the investment by NHT. The exception to this occurs when an area of native vegetation is ungrazed for 10 years. It then automatically comes under the protection of the Native Vegetation Act (See reference below), and approval must be obtained before grazing or clearance can take place.
- There is opportunity for funding to assist with fencing for the protection of native vegetation.
- There is opportunity for funding for weed control (eg. olives, bridal creeper) and rabbit and fox control among native vegetation over and above legal obligations.
- There is opportunity for funding for re-establishment of native vegetation in bare or degraded areas within the remnant vegetation.

However landowners must also be informed of the incentives and conditions under Heritage Agreements as some may be interested in Heritage Agreements, or the protection of remnant vegetation under the LAP program may lead to interest in Heritage Agreements in subsequent years.

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The booklet “Guide to the Native Vegetation Act – how it affects rural landholders”⁸ briefly explains what Heritage Agreements are. Some points in this booklet are:

- Heritage Agreements are a legal contract between a landowner and the South Australian Government that pertains to a defined area of native vegetation. The Agreement indicates that “the main land use for the area will be for wildlife conservation” and “once an area is placed under Heritage Agreement the intention is that it is protected in perpetuity.” Also that the “landowner retains the ownership of the property and there is no right of public access without landowner approval”.
- “The full cost of internal fencing of a Heritage Agreement” may be paid for, although there is a backlog in fencing payments.
- Heritage Agreement landowners are eligible to apply for management assistance for the area, for example for “weed control and vermin control over and above your legal obligations.”
- Heritage Agreements offer release from rates and taxes (see page 21 of the booklet).

Farming systems

The incentives for revegetation for sustainable farming systems should be linked with incentives or other programs that promote sustainable farming systems. Revegetation is only one part of a sustainable farming system and the advantages that revegetation can offer such as stabilising soils and protecting crops and stock from wind need to be presented as part of the total sustainable farming package.

Revegetation is only one part of a sustainable farming system.

Criteria for incentives

Following is information and comments on criteria that will affect the incentive levels.

Incentives for biodiversity benefits

Rating of the revegetation options according to the biodiversity benefits that they are expected to bring can be done on the basis of the work carried out by the Coorong and Districts (C&D) Local Action Plan Committee (1997). This work uses a number of different criteria to rate the biodiversity value of proposed revegetation and conservation works. This has been done in order to provide appropriate incentives that have been offered to landholders to encourage the implementation of on-ground works.

The only options that are deemed as providing any significant biodiversity benefits are those which conserve existing remnant vegetation, and large areas of revegetation works where local indigenous species are used. This recognises the ecological principle of the dependent relationships between local fauna and flora. While it can be argued that the planting of trees and shrubs regardless of their endemic status is inherently valuable (ie. to provide amenity benefits, erosion control, windbreaks etc), it is clear that in order to promote greater biodiversity outcomes indigenous species are required. (Breckwoldt 1983, Buchanan 1989, Dalton 1998, Hussey & Wallace 1993 etc.). Other options in this plan such as windbreaks in horticultural areas may still provide some biodiversity benefit however it will be minimal compared to that which is provided by indigenous vegetation.

The C&D Plan recognises a number of principles regarding the conservation and revegetation of bushland and have related these to incentive payment, these are as follows:

⁸ Reprinted in 1997 by the Department of Environment and Natural Resources (now the Department of Environment Heritage and Aboriginal Affairs), ISBN 0 7308 0522 0.

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Protecting Existing Native Vegetation

- High incentives for fencing areas of native vegetation will be paid given the ecological/biological importance of these areas and the \$ advantages of protecting what remains rather than establishing new vegetation. The larger the area the more habitat will be protected. Highest payments will be made to areas over 50ha.
- Shape is important. The lower the boundary to area ratio, the higher the incentive paid. Projects should be planned to have a boundary of less than 700m per ha (to minimise 'Edge' Effect).
- The site should have an effective rabbit control program both around the site and within the vegetation if necessary, using minimum disturbance methods.
- Woody weed and bridal creeper control within and surrounding the vegetation is important.
- Certain vegetation communities and species in the LAP area are considered rare or threatened. Bonuses will be given to areas that protect rare or threatened plant and animal communities.
- Areas undisturbed by grazing and other human interference will provide better value and thus a higher payment.

Planting Native Vegetation for Biodiversity

- It is better to use seeds or seedlings from local provenance plants as these should have the genetic variability to grow in the local conditions. Use a 10km radius from the site as a guide.
- The ratio of tree to shrub species is important. There will need to be more understorey species planted than tree species. As a guide use at least 5 understorey species to each tree species.
- The number of plants in an area is also important to match as closely as possible with nature. It is difficult to give a guide, as each community is different. For typical Mallee at least 200 trees/ha and 1,000 understorey species/ha is recommended. (For determining appropriate seed amounts to achieve this see Dalton 1993)
- Try to include a minimum of 10 species in the seed mix or tube-stock selection.
- Plant a minimum of 5ha (over 10ha is preferable), taking into account the shape of the area to minimise the boundary. Keep blocks short and wide rather than long and narrow.
- Corridors planted for biodiversity should be at least 50m wide.
- A corridor should link at both ends to blocks of existing natural vegetation that are at least 10ha and are less than 1km apart.

Table 15 shows the C&D criteria for rating the biodiversity benefits of revegetation and protecting remnant vegetation (Coorong and Districts Local Action Plan Committee 1997). The actual dollar values given in the table serve only to indicate the different levels of incentives offered and do not imply that the Berri Barmera LAP should use these values. These values will need to be reviewed by the LAP and modified as appropriate.

Although the C&D LAP region contains different vegetation communities to those of the Riverland region the principles of the assessment procedure are transferable. Scoring for proximity to other vegetation and disturbance will remain the same. Scoring for the protection of rare or threatened communities/species will only differ in the communities/species lists, scoring will remain the same based upon whether the species are listed as rare, vulnerable, endangered or threatened. (Lists and where possible locations of rare, vulnerable, endangered or threatened species will need to be sourced from DEHAA for the LAP region so that incentive values (that apply in this regard) can be accurately determined). (For C&D incentive assessment sheets see Appendix 5.)

It would be required that the LAP determines the most appropriate way for training of personnel to use the field assessment sheets. Once this is done field assessment and subsequent rating of biodiversity values to determine incentive payments can proceed. Direct assistance could be obtained from the Revegetation Officer in the region. Localised vegetation assessment sheets could be produced with basic plant ID information attached to assist in identification of vegetation types.

The LAP committee will need also to determine if there are any other factors that may influence the rate of incentive payments. For example whilst not directly a biodiversity issue, high recharge areas may attract greater incentives given the increased benefit of locating revegetation in such areas.

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Regarding the priority conservation of rare or threatened species, significant information of the location of such will be forthcoming from the Murray Darling Basin Biodiversity Strategy. Until this is released decisions will need to be made on existing information.

It is clear, as previously stated, that biodiversity benefits (and related incentives) will only be considered on those options that include the protection of remnant native vegetation or the planting of large areas of indigenous vegetation.

Where indigenous vegetation is planted the options include wide linear and block layouts. Blocks will receive higher incentive payments than wide linear. Payments for wide linear however could be increased if the planting directly increased adjoining remnant vegetation, such as alongside roadside vegetation.

Incentive criteria for revegetation and protection of floodplain vegetation need to be developed for riparian areas, as this has not been considered in the C&D biodiversity criteria and incentives. It is suggested that incentives developed for revegetation/conservation works in these areas still be based upon the C&D criteria. Minimum sizes of 5 or 10ha as base payments may however need to be modified, given that revegetation work in the riparian zone is more likely to consist of smaller areas (due to high salinity limitations), but recognising that these areas would still provide good biodiversity outcomes. For example in the removal of grazing pressure from floodplains the benefits are likely to be considerable even in relatively small areas, similarly revegetation of small areas may provide good links between existing floodplain vegetation.

In summary, the biodiversity benefits and incentives paid for revegetation and conservation work in the LAP area can be based upon the criteria developed by the C&D LAP. Modifications to this are likely to be minimal and will be based upon local factors such as the presence of rare or threatened species, local distinct vegetation communities such as floodplain communities, the local priority locations for biodiversity and the presence of other key factors such as high recharge zones.

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C&D incentive payment criteria for establishing native vegetation (Establishment costs only, - fencing costs are rated at \$650/km (<10ha), \$900/km (10-50ha), and \$1,000/km (>50ha))	C&D incentive payments. (figures are shown only to give an indication of the level of incentives offered)
Level 1 Incentive Payment <ul style="list-style-type: none"> ✓ Only local indigenous species used ✓ All seed is collected locally (within 10km) ✓ Species are of the same habitat type as the original vegetation of that soil and location ✓ Only tree species are used in the revegetation ✓ A minimum of 400 trees/ha with a minimum of 3 rows 	<p>\$150/linear km for Wide Linear</p> <p>\$300/ha for Blocks</p>
Level 2 Incentive Payment (higher incentive than level one) <ul style="list-style-type: none"> ✓ Minimum area of 5ha ✓ Only local indigenous species used (within 10km) ✓ Species are of the same habitat type as the original vegetation of that soil and location ✓ The ratio of trees to shrubs is at least 5 shrubs (or native grasses/other native understorey as applicable) for each tree ✓ There is at least 10 species in the seeding mix or tube-stock mix ✓ The planting of tubestock is random or the seeding is done as a mix through out the area 	<p>\$175/linear km for Wide Linear</p> <p>\$350/ha for Blocks</p>
Incentive paid for corridors if Level 2 criteria met <ul style="list-style-type: none"> ✓ The new vegetation corridor is at least 50m wide ✓ The new vegetation corridor links at both ends to blocks of existing natural vegetation of at least 10ha in size which are less than 1km apart 	<p>\$200/linear km</p>
Incentives paid for buffers to existing vegetation if Level 2 criteria met <ul style="list-style-type: none"> ✓ The new vegetation is contiguous with and expands an existing natural block of vegetation of at least 10ha, OR, ✓ The new vegetation will widen a natural corridor such as a roadway or creekline where there is native vegetation in good condition, to a minimum total width of 100m ✓ The new vegetation is in blocks of at least 10ha 	<p>\$400/ha</p>
Priority Vegetation Types <ul style="list-style-type: none"> ✓ If the planting extends a priority vegetation type (ie rare or endangered) a bonus payment may be paid. 	<p>\$100/ha</p>
C&D incentive payment criteria for the protection of remnant vegetation (fencing costs only)	C&D incentive payments. (figures are shown only to give an indication of the level of incentives offered)
Level 1 Payment for Remnant Vegetation <ul style="list-style-type: none"> ✓ Fencing remnant trees with depleted understorey (through grazing or other damage), or revegetation sites ✓ Areas must be over 10ha ✓ Stock proof fence only 	<p>\$700/km or \$400/ha which ever is lowest</p>
Level 2 Payment for Remnant Vegetation <ul style="list-style-type: none"> ✓ Rabbit and woody weed program in place ✓ Area between 10-50ha ✓ Boundary to area ratio less than 700m/ha protected ✓ If boundary to area ratio is more than 700m/ha got to Level1 	<p>\$900/km or \$400/ha which ever is lowest</p>
Level 3 Payment for Remnant Vegetation <ul style="list-style-type: none"> ✓ Rabbit and woody weed program in place ✓ Over 50ha in area ✓ Boundary to area ratio less than 700m/ha protected 	<p>\$1,000/km or \$400/ha which ever is lowest</p>
Bonus – Species Diversity <ul style="list-style-type: none"> ✓ 80% of the original species recorded for that habitat type are protected and/or ✓ Score of at least 3 achieved for disturbance criteria (see Appendix 5 for field assessment sheets), with no or very limited grazing in the future and/or ✓ Score of at least 2 or 3 for proximity to other vegetation (see Appendix 5) 	<p>\$150/ha</p>
Bonus – Protection of Priority Vegetation <ul style="list-style-type: none"> ✓ Score of at least 2 for protection of rare or threatened communities/species (see Appendix 5) ✓ Score of 4 or 5 for proximity to other vegetation (see Appendix 5) 	<p>\$150/ha</p>

Table 15 Coorong and Districts incentive payment criteria for the establishment of indigenous vegetation and the protection of remnant vegetation.

(Source: C&D LAP Committee1997).

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Estimates for funding

The cost sharing of the revegetation projects funded by the LAP is to be determined according to the split of private and public benefits as determined in the benefit:cost analysis. However, in order to apply for funding an estimate of the cost of the revegetation program was required and estimates of cost sharing were required to calculate this. Cost share ratios based upon the Coorong and Districts LAP cost sharing were used for this Table 16. Details of the cost share of the Coorong and District that was used is given in Appendix 4. The reason the individual cost-share ratios were chosen is given in Table 17. This gives background information that may be useful to compare with the cost share ratios to be derived by the benefit:cost analysis of the Berri Barmera LAP. The cost share for fencing given in Appendix 4 follows the guidelines of the Natural Heritage Trust. The total cost of the revegetation program is given in Table 2 (Page 4).

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HECTARES	Blocks of native mix	Wide linear of native mix	Narrow linear of native mix	Blocks of fodder	Blocks of timber	Wide and narrow linear of timber	Blocks of Timber irrigated	Protection remnants	Totals
Perched watertable	10	5	5	0	20	5	0	0	45
Unproductive land	25	0	0	40	0	0	0	0	65
Reuse drainage water	5	0	0	0	0	0	15	0	20
Riparian - wetland and recreation sites	40	10	0	0	0	0	0	0	50
Reuse stormwater	0	0	0	0	0	0	5	0	5
Remnant protection	0	0	0	0	0	0	0	150	150
Native veg. linking remnants	50	0	0	0	0	0	0	0	50
Total	130	15	5	40	20	5	20	150	385
COST SHARE									
\$/ha to implement	\$1,212	\$1,331	\$1,237	\$335	\$757	\$757	\$757	\$721	
C&D % incentive	38-662%	31-50%	0%	25%	15-25%	0%	0%	0%	
Berri Barmera % incentive	45%	30%	20%	25%	20%	15%	30%	50%	
Berri Barmera \$/ha share	\$545	\$399	\$247	\$84	\$151	\$114	\$227	\$361	
Total funds required	\$70,902	\$5,990	\$1,237	\$3,350	\$3,028	\$568	\$4,542	\$54,075	\$143,691
Rounded \$/ha share	550	400	250	85	150	115	225	360	
Rounded % share	45.4%	30.1%	20.2%	25.4%	19.8%	15.2%	29.7%	49.9%	

Table 16. The hectares and cost share for each revegetation option.

Notes:

- The "\$/ha to implement" excludes fencing.
- The "C&D % incentive" is the cost share for the Coorong and Districts LAP for the respective revegetation option. 0% indicates a figure was not available from the Coorong and Districts cost share data.
- "Berri Barmera. % incentive" is the % cost share that was used to determine the Berri Barmera revegetation program costing.
- The "Berri Barmera \$/ha" share was calculated by multiplying the "\$/ha to implement" by the "Berri Barmera % incentive".
- The "Total funds required" was calculated by multiplying the "Total hectares" for each option by the "Berri Barmera \$/ha share".
- The "Rounded \$/ha share" is the "Berri Barmera. \$/ha" share rounded to a figure that is more likely to be used in practise should these figures be considered for use prior to the completion of the benefit:cost analysis.

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Option	Coorong and Districts Cost-share %	Cost-share % used for Berri Barmera	Comments
Blocks of native mix	38-62%	45%	Slightly less than mid-range of the Coorong (i.e. 50%) was chosen. However the incentive scheme should include a range of incentives according to the biodiversity value of the planting.
Wide linear of native mix	31-50%	30%	Lower end of scale was chosen as wide linear designs have limited recharge and biodiversity benefits, and have the private benefit of shelter.
Narrow linear of native mix	unknown	20%	Less than wide linear of native mix as narrow linear has less recharge and biodiversity benefits and is even more likely than wide linear to be planted for shelter.
Blocks of fodder	25%	25%	Same as Coorong and Districts.
Blocks of timber	15-25%	20%	Mid-range of the scale was chosen. (A higher percentage incentive may be applicable when a woodlot acts as a buffer zone for native vegetation.)
Wide and narrow linear of timber	unknown	15%	Less incentive than blocks of timber as less public benefit is likely with wide and narrow linear designs.
Blocks of irrigated timber	unknown	30%	More incentive than unirrigated blocks of timber as greater public benefit arises with the reuse of drainage water.
Protection of remnants	unknown	50%	Slightly higher than blocks of native mix.

Table 17. Comments on the cost share ratios used to calculate the cost of the revegetation program

OTHER ACTIONS

The following other actions are suggested as necessary for the successful implementation of this revegetation plan. Facilitation and development of these suggestions will be required, using the aid of local resources where possible, and in particular the local PIRSA revegetation officer who is partially funded by the LAP program and therefore committed to support the LAP revegetation programs. It is recommended that LAP committees work through the following actions and assign responsibilities to individuals and decide the timetable, or develop other strategies to address them.

Promotion

There is a need to promote the benefits of the revegetation options to encourage uptake and to address some of the negative attitudes to revegetation. Surveys on the barriers limiting the uptake of revegetation in the South Australian region of the Murray-Darling Basin (Anon 1999) show the three main barriers to revegetation for most farmers are:

1. The need to see increased productivity
2. The need to reduce costs
3. The need to have support available

There is a need to collate and promote the information that is available which shows the benefits of revegetation to farmers and to link this to cost sharing to show that not all the costs are to be born by farmers. There is a need to demonstrate the most advanced and cost efficient establishment techniques.

Heritage agreements should be promoted given the excellent opportunity such agreements afford to the long-term management of remnant vegetation.

Revegetation Support

The point mentioned above that one of the major barriers to uptake of revegetation is the lack of support should also be addressed by the LAP. Some of the other LAP's in the Murray-Darling Basin are currently investigating the possibility of establishing revegetation support teams to help successfully implement their revegetation plans. In conjunction with PIRSA and particularly the Local Revegetation Officer,

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these LAP's are endeavouring to contact those relevant local people with a good technical knowledge and linking them into the promotion of the revegetation plan so that those implementing revegetation works know who to go to for assistance. Government agencies should also be sourced for any assistance they can offer.

The revegetation support teams would also assist in sourcing appropriate contractors to implement on-ground works and assist with the management and monitoring of the plan implementation. It is recommended that this process is given a very high priority as the success or otherwise of any revegetation project ultimately comes down to what happens on the ground. Local knowledge and experience is often times a key to great effectiveness.

Local recipes

Linked strongly with the need for support, as mentioned by Nicholson (1994), farmers like local prescriptions/recipes on how to go about implementing revegetation options. Such prescriptions would include site designs, staging/timing of operations, species lists, establishment techniques and ongoing management. A set of information packages outlining the benefits and giving local prescriptions for each revegetation options would be highly beneficial. The LAP program should consider how these are to be delivered, as not having this information could be a major hindrance to achieving the LAP objectives.

Development of local species lists

Specific species need to be selected for each revegetation site. It would be beneficial to have a table indicating the naturally occurring dominant species per land type and a list of species to plant where these dominant species occur.

Lists of non-local native species and exotic species will need to be developed for specific groundwater control (interception planting), woodlots, windbreaks and products.

Sourcing of native vegetation seed

The availability of native seed for direct seeding and tube stock planting will need to be evaluated to ensure sufficient seed is available. Seed collection will need to be done in accordance with DEHAA regulations and permits will need to be sought. The LAP may wish to advise seed merchants of the revegetation program so the merchants know of the possible seed demand; with no guarantee of seed sales of course.

Review of the criteria for incentives

As covered in the Incentives for Biodiversity Benefits (Page 31) the criteria for incentive payments for revegetation of large areas with indigenous species and the conservation of remnant vegetation may need to be reviewed to ensure its applicability to the local LAP area. Training requirements for local people to confidently carry out biodiversity assessment will also need to be considered. Review of other incentives will also be required in the development of the incentive program.

Works contracts

Works contracts will have to be prepared for incentive agreements between individual landowners and the LAP. While waiting for the funding approval these contracts should be drafted. A good start could be made by reviewing such contracts used by the Coorong and Districts LAP, Bremer – Barker Catchment Plan, and the Upper South East Salt to Success project.

Administration funds

There is a need to identify who is available to prepare the works contracts, and subsequent to that who will perform site inspections and manage the revegetation incentive program. If nobody is readily available then funds must be sought or allocated to engage somebody for these tasks.

Remnant vegetation condition

The condition of the remnant vegetation associated with the suggestion revegetation areas should be assessed and conservation priorities determined based upon conserving the areas requiring minimal effort first. These may not be the areas adjacent to the suggested revegetation areas and if the condition of the

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remnant vegetation is poor adjacent to particular suggested revegetation areas then it may be best to defer revegetating that area until the condition of the remnant vegetation has been improved.

Long-term returns from investment

While it is proposed in this program to invest funds in the protection of remnant vegetation and new revegetation currently there does not exist a mechanism or body of jurisdiction linked into the program to ensure that the benefits of the investment are secured in the long-term. While a contract of agreement will be written for the revegetation works for specific projects it is expected that this contract will cover a period of one or two years; the period during which the works will be occurring. The issue of long-term security of investment applies across all the LAP groups and all may benefit from a collaborative approach in addressing it. Possible bodies with whom a long-term contractual arrangement could be developed include the LAP Associations, District Soil Conservation Boards, Local Government and State Government. There are advantages and disadvantages of making contractual arrangements with each of these and a thorough evaluation is required.

Woodlot feasibility study

On completion of the LWMP's a woodlot feasibility study should be initiated to determine the best woodlot locations, the specific water volumes and quality that can be used, the irrigation design and the benefit:cost of the best scenarios. Key issues include: on which land should woodlots be grown? What suitable land is within reasonable proximity of the drainage water? Who owns that land and how should the owner(s) be involved with the woodlots. What will be the association and involvement of the irrigation trust? The study should be linked with the possibility of diverting stormwater and reuse of industrial effluent.

Firewood from woodlots could be sold to the houseboat industry, obtaining a premium retail price and reducing the demand for firewood gathering along the riverine areas. It may be the wood could be supplied with the houseboat and the cost included as part of the hire charges. This could be linked with a total education package to the houseboat industry, including education about the impacts of houseboat activity on the riverine areas.

Soil salinity

Soil salinity and groundwater surveys should be done on specific saline revegetation sites to determine the site modification and management required for successful and healthy revegetation.

Biodiversity plan

When the 'Biodiversity Plan for the MDB in South Australia' is complete it will give more information on the linkages and fauna issues for biodiversity plantings and biodiversity objectives should be modified accordingly.

Carbon and salt credits

Contact should be maintained with the Environment Protection Authority (EPA) to monitor the developments on carbon credits, and the Department for Environment, Heritage and Aboriginal Affairs for the developments of salt credits. Documentation of revegetation programs is recommended for many reasons but it may be that such documentation will be useful for claiming carbon or salt credits in the future.

Urban plantings

Investigations into revegetation opportunities around the township of Berri, Barmera, Monash and Glossop should be carried out. Revegetation in such areas will mainly give amenity benefits however some biodiversity benefits could also be obtained particularly if linked with existing remnant vegetation.

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