

Prepared by the Angas Bremer  
Water Resources Committee



ANGAS BREMER

WATER RESOURCE MANAGEMENT PLAN

1996-2001

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PREPARED BY THE ANGAS BREMER WATER RESOURCES COMMITTEE

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## EXPLANATORY STATEMENT

This management plan covers the area proclaimed under the Water Resources Act as the Angas Bremer Proclaimed Wells Area. The name of the management plan has been broadened because the plan also provides for the management of River Murray water used within or drawn from within the area.

Where the plan refers to the "area" or the "Angas Bremer Area", this is the same as the Angas Bremer Proclaimed Wells Area (see area shown in Figure 5).

## EXECUTIVE SUMMARY

Management of the groundwater resource in the Angas Bremer Area was introduced in 1981 with the formation of a committee to investigate groundwater use and to recommend policies for management of the resource. Management plans to date have been very successful in reducing groundwater use to a sustainable volume. This has been achieved largely through the conversion of groundwater allocations to River Murray allocations sourced from Lake Alexandrina.

It appears that pressures in the confined aquifer have returned to a similar condition to that of pre-irrigation times. However, any improvement in groundwater salinities is likely to be very slow.

The change to River Murray water as the main resource for irrigation has brought about the need to review management of all water resources in the area. This plan provides a policy framework for the management of both groundwater and River Murray resources in the area.

The objective for the plan is to achieve a sustainable level of water resource use whilst optimising economic productivity. This presents quite a challenge because there will need to be a balance between the use of groundwater and River Murray water to ensure that rising watertables and the associated salinisation effects are minimised.

A range of strategies are included which will assist in achieving the plan's objective. These are;

- Maintaining a flow of groundwater through the basin
- Implementing a water allocation transfer policy
- Minimising the potential for rise in watertables through improving the efficiency of irrigation practices
- Implementation of annual reports on irrigation practice as a means of fostering a better understanding of irrigation efficiency
- Close monitoring of the watertable, particularly in areas where the watertable is less than 3 m below the surface.
- Full metering of water use.

Key changes to groundwater policy include the introduction of a transfer policy for water allocations and increases in the credits (to 100%) that can be claimed for unused allocations, artificial recharge of surface water from the Angas and Bremer Rivers and temporary storage of River Murray water in the groundwater system.

A full range of policies for managing River Murray water used in the area are included. These are based on current River Murray policies and where necessary include policies specific to the Angas Bremer Area, for example different transfer provisions dependant on the arrangement under which River Murray allocations were made available.

The maintenance of sustainable productivity in the area will depend largely on the ability to understand how the groundwater system is responding to the change in the water balance of the area. The key to this is maintaining up to date information on the level of the watertable of the unconfined aquifer and pressures in the confined aquifer so that appropriate future management decisions can be made. Irrigators are being encouraged to participate in the necessary data collection through the requirement for construction of monitoring wells and the preparation of annual reports on irrigation practice.

## DISCUSSION PAPER

### 1. INTRODUCTION

The Angas Bremer Water Resources Committee (ABWRC) was formed in the late 1970s and the Angas Bremer Proclaimed Wells Area (ABPWA) was proclaimed under the Water Resources Act in 1981 to introduce coordinated management of a groundwater resource that had been excessively developed beyond its sustainable limit.

The first formal management plan was introduced in 1987 and revised in 1992. These plans sought to reduce the amount of groundwater that was allocated under licence, to increase the use of River Murray water in the area and to promote policies that conserved the resource.

This paper:

- outlines the success of these policies,
- describes the current status of the groundwater resource,
- introduces the new management plan,
- discusses the development of new policies to maintain a sustainable groundwater system, with minimal impact on land
- outlines the likely new institutional arrangements for the area.

### 2. MANAGEMENT ACTIONS TO DATE AND SUCCESS

The first management plan introduced cuts to groundwater allocations. Reductions in allocation were continued under the second plan resulting in a reduction of approximately 30% of the total volume allocated.

Artificial recharge of Angas and Bremer River water to the confined aquifer was promoted with 50% of the volume recharged being credited on the groundwater licence.

The committee sought access to River Murray water for use in the area on the basis that on average, well in excess of 15 000 ML flowed into Lake Alexandrina each year from the Angas and Bremer Rivers. As a result the River Murray Water Resources Committee made 15 000 ML of River Murray water available for conversion of groundwater allocations to River Murray allocations. When allocations were converted they reverted to the original pre-review (1986/87) allocations and were only available within the ABPWA. However there was little interest, due mainly to the cost of constructing pipelines, and by 1990/91 less than 2 000 ML had been converted.

The review of the Management Plan in 1992 led to the introduction of transferability for River Murray allocations gained by conversion of groundwater allocations. This allowed a licensee to convert groundwater and then sell a portion of the River Murray allocation outside of the ABPWA to

assist in funding construction of a pipeline. This policy resulted in some increased conversion but by April 1994 only 7 000 ML had been converted.

At this time the Australian wine industry was gearing up for a major expansion of the export wine market which would require extensive planting of new vineyards. This resulted in an overwhelming request for conversions to such an extent that an additional 10 000 ML of River Murray water would have been required to satisfy the demand. After careful consideration of the ability of the area to cope with additional River Murray water, the committee sought and was granted an additional 6 000 ML by the government. At the end of the conversions the remaining groundwater allocations totalled 6 400 ML, close to what is thought to be a sustainable extraction from the groundwater system.

Table I indicates the changes in allocation and use that have occurred over the last 15 years. The table clearly shows that the majority of water used for irrigation is now sourced from the River Murray. This presented a dilemma to the committee who were charged with managing only the groundwater resource.

How could the committee manage the groundwater resource - if 80% of the water used for irrigation in the area was River Murray water ?

The current management plan does not expire until 30.6.97. A review of progress was however planned to be undertaken after 3 years. Following the large conversion to River Murray it became evident to the committee that the current plan was out of date and that a complete new plan should be a high priority. In early 1995 the committee commenced the development of a new plan.

Recent discussions with the River Murray Water Resources Committee have indicated approval in principle for the ABWRC to become responsible for River Murray water used in the area.

This paper also addresses the policies that have been developed for management of River Murray water used in the area.

Table I Changes in Allocation and Source of Irrigation Water

YEAR	GROUNDWATER		RIVER MURRAY
	ALLOCATION ML	USE ML	ALLOCATION +
1980/81		26 600	
1984/85		19 800	
1985/86	29 600	21 050	3 000
1986/87	29 600	20 080	
1987/88	24 650	12 130	
1988/89	22 275	15 175	
1989/90	21 460	11 490	
1990/91	19 525	10 900	4 900
1991/92	17 700	9 315	
1992/93	16 600	3 690	
1993/94	13 900	5 570	
1994/95	11 290	7 290	10 000 *
1995/96	6 400	2 406	23 750 #

+ typical River Murray allocations within the area for particular years only are shown

\* estimate only

# includes all River Murray diversions in the area

### 3. THE IMPACT OF IRRIGATION ON THE GROUNDWATER BASIN

Prior to the commencement of irrigation in the basin, natural recharge to the limestone aquifer occurred along the escarpment to the north west and through the river beds at a rate sufficient to flush the aquifer and maintain relatively low salinities across an area some 15 km long and 10 km wide. Water from the aquifer discharged through the low lying land in the south of the basin adjacent to Lake Alexandrina because the pressure head in the aquifer was higher than the ground surface in this area.

Early horticultural development in the area used natural flooding from the Bremer River as a means to irrigate crops, particularly the early vineyards. The use of natural flood waters was increased by installing levies and diversion gates, practices still used today. During the 1950s significant use of groundwater for irrigation commenced. The high level of irrigation development, particularly the expansion during the 1970s resulted in a marked decrease in the pressure head in the main aquifer and a substantial increase in groundwater salinity in many areas. The changes in the aquifer system are illustrated in Figures 1-4.

The changes occurred because the volume of water withdrawn for irrigation from the 1950s far exceeded the natural recharge to the basin. As a result of this overuse, the natural through flow of the basin ceased and more saline water to the north, west and east was drawn towards the main irrigation areas

where a cone of depression had developed. The cone of depression also induced downward leakage from the more saline upper aquifer further increasing salinities in the water used for irrigation.

Reduced extraction of groundwater for irrigation from the late 1980s (due to reductions in allocation and change to lower water use crops) reduced the impact of the cone of depression.

The extremely wet period in late 1992 resulted in exceptionally high natural recharge and minimal extraction for irrigation in the 1992/93 season. This resulted in a recovery of pressures in the confined aquifer, the source of irrigation supplies, in the following winter (1993) to near pre-irrigation times. Low groundwater use during the 93/94 and 94/95 seasons has maintained pressures in the confined aquifer with only minor drawdown since 1992. Review of confined aquifer data from early 1996 indicates that flow through the basin has been restored. The confined aquifer piezometric surface for August 1995 is shown in Fig 5 (this is the approximate elevation above sea level). Any improvement in groundwater salinities are expected to be very slow however.

#### 4. PREDICTED FUTURE STATUS OF THE BASIN

A recent report by Mines and Energy South Australia (Howles 1995) discusses the current status of the basin and the likely scenario with future water use in the area. The report assumes that 4 500 ML of groundwater and 13 500 ML of River Murray water will be used annually. However the report does not take account of "traditional" River Murray allocations in the area which total approximately 5 000 ML, taking the amount of River Murray water likely to be used to 17 000 - 18 000 ML.

Assessment of recent groundwater data indicates that there is now a potential for upward leakage from the confined aquifer in the south of the area. This together with leakage of some of the River Murray water past the root zone is likely to lead to rising watertables. If the watertable rises too far surface salinisation can occur. Problems are only expected to occur in some low lying areas in the south that were badly salinised prior to irrigation development.

Howles defines those areas at risk being areas where the depth to the watertable is less than 3 m. Figure 6 presents data showing the depth to the watertable in September 1995 overlain by data showing the approximate location of both groundwater and River Murray water allocations. Areas where the water table is less than 3 m and with large allocations of either groundwater or River Murray water are the areas at most risk.

If the watertable rises excessively waterlogging could occur and close to the lake surface discharge of groundwater may occur. This area has historically been subject to problems related to high watertables and the re-emergence of such problems would signify that the basin has returned to pre-irrigation conditions.

To ensure that the committee has the best available information on which to base its decisions it is necessary to increase the number of monitoring wells to provide more information on the depth to the watertable. For this reason a policy requiring all licensees to install at least one monitoring well is being introduced.

This future scenario has been considered during the drafting of policies for water resource management in the area. However, if problems become excessive options such as a drainage system may need to be implemented. Other options are identified in Section 7.9.

Figure 7 presents the allocation data on a landuse plan for the area.

## 5. OBJECTIVE OF NEW PLAN

The objective of the previous plan was to achieve a balance between groundwater extracted for irrigation and the natural and artificial recharge to the basin. This has been achieved through conversion of groundwater allocations to River Murray allocations and change to lower water use crops, principally vines.

The objective of this plan is:

**TO ACHIEVE A SUSTAINABLE LEVEL OF WATER RESOURCE USE  
WHILST OPTIMISING ECONOMIC PRODUCTIVITY**

In effect this means that groundwater flow through the basin must be maintained. As discussed above it appears that a sustained return to near pre-irrigation pressures has occurred and hence flow through the basin has been restored. To protect groundwater users from further deterioration in groundwater salinity this flow through must be maintained.

This presents quite a challenge because there will need to be a balance between the use of groundwater and River Murray water to ensure that rising watertables and the associated salinisation effects are minimised.

## 6. STRATEGIES FOR ACHIEVING THE OBJECTIVE

The following strategies will assist in achieving the objective

- Maintaining a flow of groundwater through the basin
- Implementing a transfer policy
- Minimising the potential for rise in watertables through improving the efficiency of irrigation practices
- Implementation of annual reports on irrigation practice as a means of fostering a better understanding of irrigation efficiency
- Close monitoring of the watertable, particularly in areas where the watertable is less than 3 m below the surface.
- Full metering of water use

The policies drafted in the attached policy document will assist the implementation of these strategies.

## 7. DISCUSSION ON POLICIES

Previous plans for the area have considered a wide range of policy options by necessity because of the critical situation that the basin was in with excessive drawdown and increasing salinity.

The shift in source of most irrigation water from groundwater to the River Murray means that most of the policies implemented to reduce groundwater use in previous plans are no longer necessary.

The plan includes separate policies for the use of groundwater and River Murray water. This allows some variation in the individual policies where considered appropriate although in most cases they are the same. The following sections discuss the background to the policies outlined in Part 2 of the plan.

### 7.1 Sale of Properties with Groundwater and/or River Murray Allocations

Previous Management Plans have reduced groundwater allocations on sale of properties. There is no longer a need to reduce groundwater allocations and therefore no further reduction in allocations as a result of the sale of properties is proposed. When a property is sold any water allocation licences remain in the possession of the original owner. The licences may be transferred to the new owner upon a request from the original owner. However conditions on the new licences may be different depending on the status of the basin at the time of transfer.

Upon subdivision of properties with licensed allocations, licences can be divided to provide water to new allotments created. The division requires the approval of the Minister and is subject to the request meeting the specified hydrogeological criteria (see Appendix 1).

### 7.2 Amalgamation of Licensed Water Allocations

Provision has been made for amalgamation of licensed water allocations to provide flexibility in water use. An amalgamation is the combining of two or more licensed water allocations, whereby the individual licensees share the responsibility for managing the licence and any associated breach of licence conditions. There are two types of amalgamation, temporary and long term. Temporary amalgamations can be applied for by any licensees. Long term amalgamations are only proposed for licensed water allocations held by one licensee. Where there are existing long term River Murray amalgamations between different licensees, these will continue.

For example, licensee A may not need to use all of their licensed allocation in a particular year. Whereas licensee B may wish to use more than their licensed allocation.

A temporary amalgamation allows the two allocations to be joined so that licensee B can use the balance of licensee A's allocation.

Due to the uncertainty about problems such as rising watertables, temporary amalgamations have a maximum period of twelve months, but may be renewed subject to there being no evidence of rising watertables or other hydrogeological problems.

A licensed River Murray allocation cannot be amalgamated with a licensed groundwater allocation.

### 7.3 Transfer of Licensed Water Allocation

#### 7.3.1 Groundwater Allocations

In the past there has been no provision for the transfer of licensed groundwater allocations due to the potential for licensees wanting to transfer allocations into areas of lower salinity groundwater which could have compounded the stress on the groundwater basin.

Given that the situation has changed, provision for transfer of groundwater allocations within the area has been made. Approval is subject to applications meeting the hydrogeological criteria and being accompanied by satisfactory Irrigation and Drainage Management Plans.

Recharge and temporary storage credits can only be transferred to a new owner of the land where the recharge or temporary storage took place.

Transfer policies could also be a useful tool in managing rising watertables and consideration on how they could be utilised to assist with basin management will be given as trends in the level of the watertable become evident in the next few years.

#### 7.3.2 River Murray Allocations

##### 7.3.2.1 Transfer within the Area

Provision for transfer of River Murray allocations within the area has been made. Approval is subject to the applications meeting the hydrogeological criteria and being accompanied by satisfactory Irrigation and Drainage Management Plans.

Standard conditions applicable to transfers along the River Murray Proclaimed Watercourse have been included.

Similar to transfer of groundwater allocations, transfer of River Murray allocations could be a useful tool in managing problems such as rising watertables. However the permanent nature of vineyards, where much of the water is to be used, will restrict this option, nevertheless consideration as to

how transfer of allocations could assist with basin management will be given by the committee.

#### 7.3.2.2 Transfer outside the Area

Provision is made for transfer of River Murray allocations out of the proclaimed area except for allocations granted from within the additional 6 000 ML granted by the Minister in 1994, where it was specified that the additional allocation could not be transferred outside of the proclaimed area.

Transfer to other areas along the River Murray would be subject to current River Murray policies for those areas at the time.

#### 7.4 Policies Promoting Conservation of Water

A large emphasis has been placed on conservation in water use in the past and this has been very successful. Even though the stress on the basin appears to have been alleviated there is still a strong need for conservation in water use practices. Maximising efficiency of water use, particularly River Murray allocations and reducing the potential for losses past the root zone, will be critical if the basin is to be managed responsibly given the possibility of rising watertables.

The roll over credit policy for groundwater allocations, introduced in the original plan has been changed to allow a credit of 100% of the unused allocation which reflects the changed status of the basin. The impact of this policy will be reviewed during the first 2-3 years of the plan. The ability to use more than the current maximum of 130% (ie 30% credit) of the base licence entitlement, in any one year, will also be reviewed in this period.

Although there could be a case for additional, strategically positioned groundwater extraction in the future as a management tool, inefficient use of groundwater for irrigation will lead to increased salinisation problems. Therefore continued promotion of efficient water use practices is essential.

Most of the new irrigation development in the area uses drip irrigation practices which means that irrigation at these sites should be relatively efficient.

As one means of fostering efficient irrigation practices the committee is introducing through this plan the compulsory preparation of Annual Reports on irrigation practices by each licensee. In addition, all transfers and new irrigation development will be required to prepare an irrigation and Drainage Management Plan (see Part 2 Policies, Section 6 Land Management Policies and Appendix 2).

#### 7.5 Recharge Policies

In the previous management plan the case for increasing the amount of artificial recharge was discussed at some length. At that time the use of

artificial recharge was one of the few options available to improve the management of the basin. There were two distinct ways in which artificial recharge was seen as a management tool.

Firstly it would assist individuals with improving salinity of the confined aquifer on a local scale and provide the benefit of increased water allocation through the 50% credit gained on water recharged. Secondly artificial recharge on a large scale using either the Angas and Bremer Rivers and/or River Murray water from Lake Alexandrina was viewed as a possible option for halting the encroachment of saline groundwater in areas such as the north east of Langhorne Creek and the eastern end of Ballandown Road.

Given the change in the water balance for the area and the possibility of rising watertables, artificial recharge may now be undesirable. However, it has been a policy promoted by the committee in the past and without evidence to demonstrate that it is having an undesirable impact will continue to be allowed. The committee will investigate the impact of artificial recharge if trends in rising watertables become evident in these areas.

The option of providing for transfer of recharge or temporary storage credits was discussed but it was considered inappropriate due to the potential contribution to rising watertables by these activities. However transfer of recharge credits will be allowed to the new owner of land where the recharge or temporary storage took place.

#### 7.5.1 Recharge From the Angas and Bremer Rivers

Whilst private schemes for artificial recharge from the Bremer River in particular will continue to some degree, it is thought that the use of artificial recharge will decrease considerably.

The policy provided in the previous management plan has been modified to provide for a 100% credit on artificial recharge to minimise the effect recharge may have on rising watertables. Roll over provisions are provided to enable flexibility in the use of the recharged water.

Angas and Bremer River water that is to be used for recharge must have a salinity of less than 1500 mg/L and be better than the groundwater salinity at the recharge site.

Applications are required to satisfy the hydrogeological criteria.

The period over which a recharge credit can be claimed is 1 November to 31 October in the following year. This period has been selected because the end of October is about the time when recharge opportunities from the two rivers will cease for that season. The credit, when applied for, will be endorsed on the licence and is available for use in that irrigation season.

The various conditions to be met for a licensed recharge scheme from which a credit can be gained are continued, including metering of both recharge and extraction.

### 7.5.2 Temporary Storage of River Murray Water

In order to assist with schemes for converting groundwater allocations to River Murray allocations the use of temporary storage in the groundwater system was promoted as an option. This allowed a lower capacity pipeline to be constructed which would be used to pipe water for storage in the groundwater system. Under this scheme a credit of 90% on either an existing groundwater licence or a new licence (with a base allocation of 0) was obtained for the water stored.

Under the current scenario temporary storage may be undesirable as it could exacerbate rising watertables.

However, some of the pipeline schemes have been developed to use this option therefore it would be unreasonable to discontinue this. The credit to be endorsed on the groundwater licence has been increased to 100% as there is no longer a need to provide a permanent gain for the groundwater system. There are no roll over provisions as it is undesirable to allow the temporary storage of water for more than a few months. Roll over provisions could lead to a considerable gain by the groundwater system which is clearly undesirable.

In order to utilise this option the application has to satisfy the hydrogeological criteria.

The period over which a temporary storage credit can be claimed is 1 April to 31 March in the following year. This period has been selected because it allows the licensee the greatest flexibility in being able to calculate how much River Murray water may need to be stored for use at the appropriate time in that season. The credit, when applied for, will be endorsed on a groundwater licence and is available for use in that irrigation season.

River Murray water that is to be used for temporary storage must have a salinity of less than 1500 mg/L and be better than the groundwater salinity at the site of temporary storage.

Similar conditions to those required for artificial recharge in respect to headworks and metering etc have to be met.

### 7.6 Specific River Murray Policies

A number of existing River Murray policies have been included in this management plan. These include;

- below entitlement flows
- stock and domestic diversions

Current River Murray policies include the provision for use of declared surplus flows. However the cap on diversions from the River Murray means that surplus flows are unlikely to be declared in the future. Hence the policy has not been included.

### 7.7 Excess Charges

in the previous plan excess charges for use of groundwater above licensed allocation (and any credits) were set at prevailing SA Water (formerly EWS) rates. River Murray excess charges were however considerably lower. It was considered that where a licensee with both a groundwater allocation and a River Murray allocation needed to use excess he would clearly use River Murray water. Use of excess River Murray water could be detrimental to basin management and it would be preferable to have the excess used from groundwater. Consequently the excess charges for groundwater have been lowered to match those for River Murray.

In the future it could be desirable to ensure that any excess water required is taken from the groundwater system. Policies to facilitate this option will be investigated.

### 7.8 Meters

Under the previous plan provision was made for the transfer of ownership of meters to groundwater licensees. Approximately 50% have been transferred to date. It is proposed that all meters be transferred by 30 June 1997.

Once meters have been transferred the licensee takes full responsibility for meter operation and is required to have the meter calibrated once every five years by a qualified person.

It is proposed that River Murray licensees be required to also take ownership of their meters.

### 7.9 Land Management Policies (including Annual Reports, IDMPs and Monitoring Wells)

As discussed earlier (Section 7.4), all licensees will be required to prepare an Annual Report on irrigation practices, to be submitted by 31 July each year. All transfers of water allocations and new development will be subject to satisfactory Irrigation and Drainage Management Plans. These are considered to be necessary to assist with responsible water and land management.

The aim of the annual reporting process is to increase the awareness of licensees on irrigation efficiency and practices. Information provided in the Annual Reports will be collated by the committee and used to prepare a summary report on irrigation practices in the area which will be circulated to licensees.

Details on the information required in Annual Reports and Irrigation and Drainage Management plans is provided in Appendix 2. This should only be taken as a guide, particularly in respect to Annual Reports, as the information required will continue to be reviewed to ensure that the most useful information is gathered.

With the possibility of rising watertables it is critical to monitor the level of the watertable. The current unconfined aquifer monitoring well network includes a number of wells which are poorly constructed and during flood periods, flood waters can gain direct access to the groundwater. Due to the low permeability of the aquifer this can result in localised mounding of the watertable. Consequently there is some doubt about the validity of data from these wells following flood periods. Therefore, to improve the network all licensees will be required to install and monitor at least one monitoring well, to a depth of at least 6m, on each licensed property. This has the additional benefit that licensees will gain a better understanding of the impact of irrigation activities on the level of the watertable through self monitoring, particularly if some rise occurs at the end of the irrigation season. Well construction requirements are specified in Appendix 3.

If rising watertables become a serious problem a range of options to manage the problem would need to be investigated. The options would include:

- Strategic use of groundwater
- Woodlotting to increase water use
- Limiting recharge from the Angas and Bremer Rivers
- Implementing a drainage strategy under the guidelines used elsewhere along the River Murray

The proclaimed area is fed by the adjoining catchments of the Angas and Bremer Rivers. Each of these is covered by a catchment group; the Bremer Barker Catchment Group and the Angas River Catchment Group respectively.

Each of these groups has identified as a major aim, the improvement of the quality of flows in the respective river systems. The aim is to be achieved through the adoption of improved land management practices and the adoption of salinity control measures by local land care groups.

The Angas Bremer Water Resources Committee was instrumental in the establishment of both of these groups and is fully supportive of their activities.

#### 7.10 Self Management

For some time the committee has had the subject of Self Management on its agenda. The 1992-97 Management Plan indicated that the committee would,

explore opportunities for the progressive introduction of self management of the basin with the aim of moving to full self management at the start of the next management plan.

A draft discussion paper on self management was released prior to the public meeting held in November 1995. At the meeting there was general support for the idea of self management even though the actual mechanism and form of self management was not clear due to the current review of the Water Resources Act.

A discussion paper followed by a draft Water Resources Bill and explanatory report have been released to the community for comment. From these documents it is quite clear that in the future the community will play a much larger role in water resource management. A likely scenario for self management in the Angas Bremer area is through the formation of a new committee under the yet to be formed River Murray Catchment Water Management Board.

Funding for local management by the committee could be raised as a special purpose levy by the Board and would be additional to the general levy to be raised from River Murray irrigators. Funds raised specifically for use in the Angas Bremer area would be clearly identified in the Board's management plan. Alternatively the Board may decide to fund the committee and its operations out of its general revenue.

Figure 5.  
 Confined aquifer - Piezometric surface - August 1995  
 including licenced water allocations

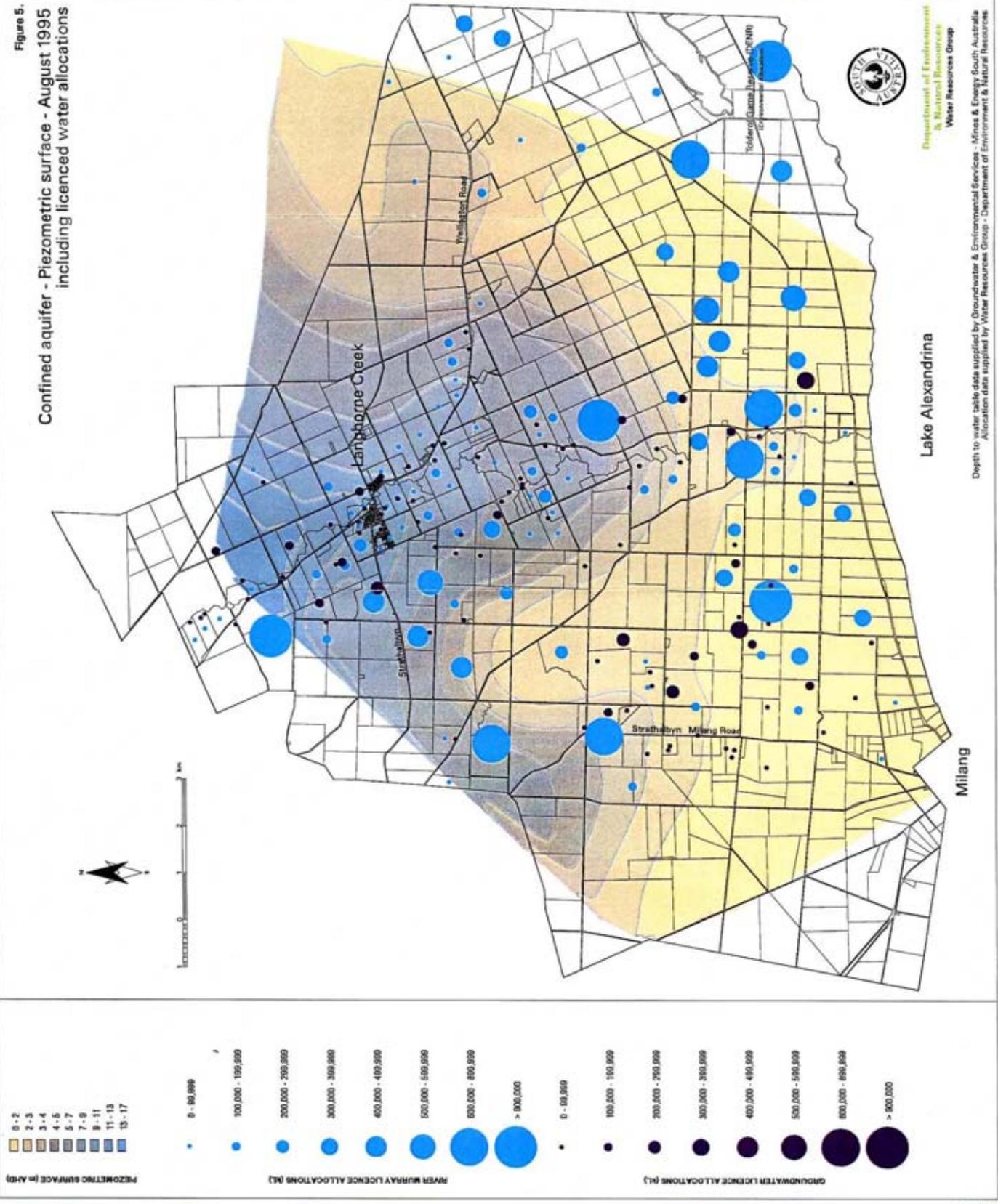
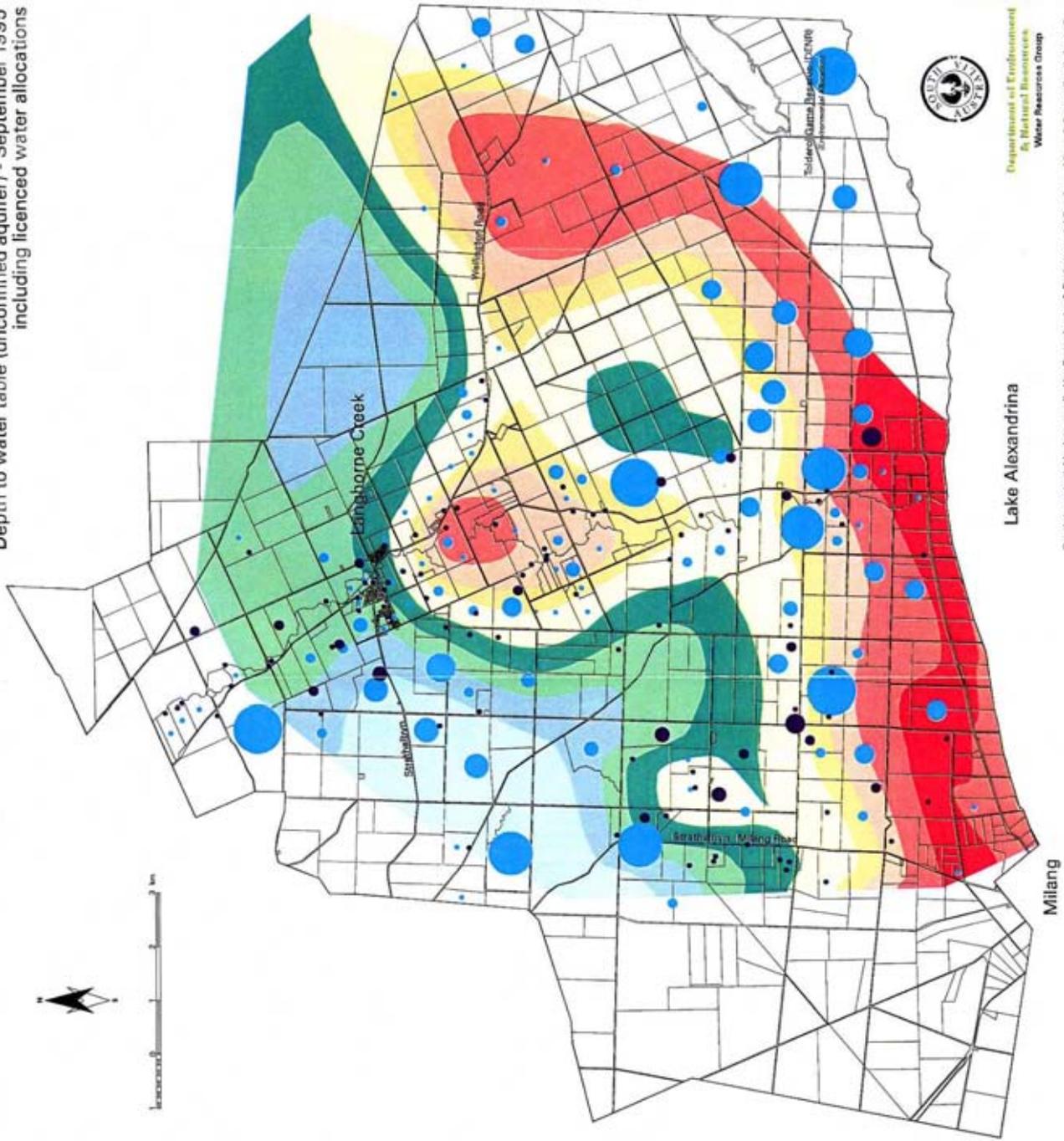


Figure 6.  
 Depth to water table (unconfined aquifer) - September 1995  
 including licenced water allocations



Department of Environment  
 & Natural Resources  
 Water Resources Group

Depth to water table data supplied by Groundwater & Environmental Services - Mines & Energy South Australia  
 Allocation data supplied by Water Resources Group - Department of Environment & Natural Resources

DEPTH TO WATER TABLE (M)

0 - 2
2 - 3
3 - 4
4 - 5
5 - 7
7 - 9
9 - 11
11 - 13
13 - 17

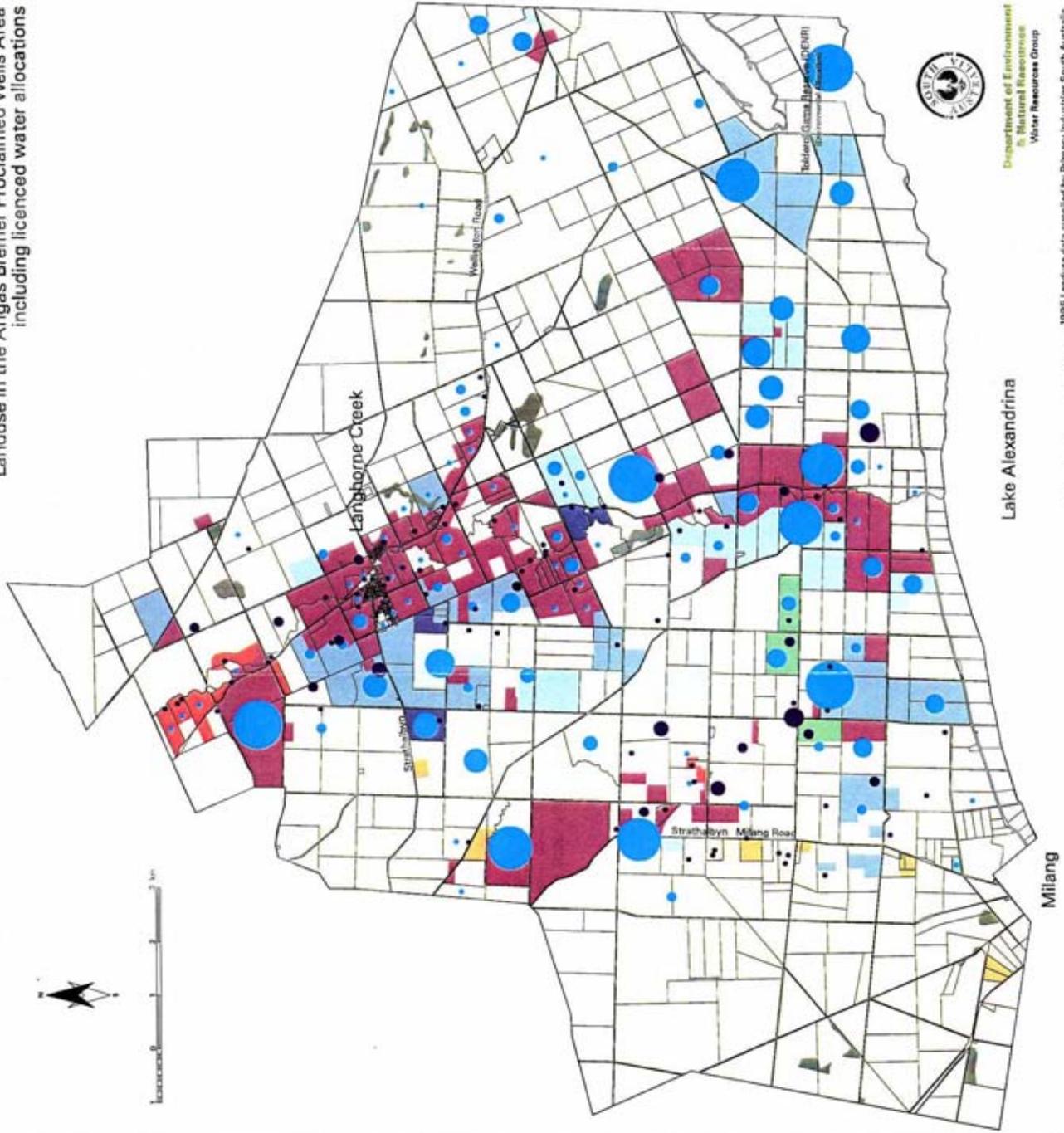
INVER MURRAY LICENCE ALLOCATIONS (ML)

0 - 99,999
100,000 - 199,999
200,000 - 299,999
300,000 - 399,999
400,000 - 499,999
500,000 - 599,999
600,000 - 699,999
800,000 - 899,999
> 900,000

GROUNDWATER LICENCE ALLOCATIONS (ML)

0 - 99,999
100,000 - 199,999
200,000 - 299,999
300,000 - 399,999
400,000 - 499,999
500,000 - 599,999
600,000 - 699,999
> 900,000

Figure 7.  
Landuse in the Angas Bremer Proclaimed Wells Area  
including licenced water allocations



- KEY TO LANDUSE (1989)**
- Crops
  - Hay
  - Dairy
  - Intensive Lucerne/Pasture (Dairy)
  - Intensive Lucerne/Pasture
  - Vegetable/Gracing Rotation
  - Intensive Vegetables
  - Floriculture, Berries, Horticulture
  - Orchards
  - Vines
  - Native Vegetation
  - Urban

- RIVER MURRAY LICENCE ALLOCATIONS (ML)**
- 0 - 99,999
  - 100,000 - 199,999
  - 200,000 - 299,999
  - 300,000 - 399,999
  - 400,000 - 499,999
  - 500,000 - 599,999
  - 600,000 - 699,999
  - > 800,000

- GROUNDWATER LICENCE ALLOCATIONS (ML)**
- 0 - 99,999
  - 100,000 - 199,999
  - 200,000 - 299,999
  - 300,000 - 399,999
  - 400,000 - 499,999
  - 500,000 - 599,999
  - 600,000 - 699,999
  - > 900,000

## PART 2 POLICY DOCUMENT

### 1. OBJECTIVE

The objective for the management plan for the next 5 years is:

**TO ACHIEVE A SUSTAINABLE LEVEL OF WATER RESOURCE USE  
WHILST OPTIMISING ECONOMIC PRODUCTIVITY**

In effect this means that groundwater flow through the basin must be maintained. This would return pressures in the confined aquifer to a condition similar to that prior to the development of extensive irrigation.

### 2. POLICY STATEMENTS

The following policy statements are explained in the Discussion Paper. These policies should be viewed as the means of implementing a comprehensive plan of action which will allow a balance between recharge (including irrigation returns), groundwater extraction and throughflow to be achieved. This balance is possible with the existing level of irrigation development due to the importation of River Murray water into the area as a means of reducing the over exploitation of groundwater.

The plan covers all groundwater and River Murray water sourced from within the Angas Bremer Area, regardless of whether the site at which the water is used is within or outside of the area. In addition, the plan also covers all groundwater and River Murray water sourced from outside the area, part of which is used within the proclaimed area.

### 3. GROUNDWATER POLICIES

#### 3.1 SALE/SUBDIVISION OF PROPERTIES WITH GROUNDWATER ALLOCATION

When land the subject of a licensed groundwater allocation changes ownership the licence remains in the possession of the previous land owner. If the licence is to be transferred to the new owner advice must be received from the previous land owner requesting the transfer.

If land with a licensed groundwater allocation is subdivided the licence holder may request the Minister for approval to divide the licensed water allocation to provide water to the land allotments created. New licences will be created in the name of the original licensee with different licenses and allocations pertaining to each parcel of land, provided that the request meets the hydrogeological criteria which include:

- depth to water table (unconfined aquifer)
- salinity of groundwater in the confined aquifer
- depth to the confined aquifer

proximity to other operations/developments  
potential for waterlogging  
potential for salinisation

and therefore will not have a detrimental impact on the groundwater basin and provided that the total allocation does not exceed the previous single licence allocation. Further information on the Hydrogeological Criteria is provided in Appendix 1.

### 3.2 TEMPORARY AMALGAMATION OF GROUNDWATER ALLOCATIONS

Licensed groundwater allocations may be amalgamated for periods up to twelve months. All amalgamations will expire at the end of that licence period, but may be renewed. Applications for temporary amalgamations will be approved if the application satisfies the hydrogeological criteria. Amalgamations will be reviewed at the end of the licence period and may not be extended if, contrary to an earlier assessment, there is evidence that the amalgamation is detrimental to basin management.

### 3.3 LONG TERM AMALGAMATION OF GROUNDWATER ALLOCATIONS

The only provision for long term amalgamation of groundwater allocations within the basin will be for allocations held by one licensee. Applications for long term amalgamation will only be approved if the application meets the hydrogeological criteria.

### 3.4 TRANSFER OF GROUNDWATER ALLOCATION (By Sale or Lease)

Applications for transfer of licensed groundwater allocation or part thereof within the Angas Bremer Proclaimed Wells Area may be considered favourably provided the applicant can demonstrate that the application meets the hydrogeological criteria.

Applications for transfer of a licensed water allocation must be accompanied by a satisfactory Irrigation Drainage Management Plan (see Appendix 2) for the portion of land to which the licence is to be transferred.

### 3.5 POLICIES PROMOTING CONSERVATION OF WATER

A licensee will be credited with 100% of the basic groundwater licence entitlement not used in the previous year. This "roll-over" credit will be cumulative on a 3 year rolling basis. Use of this credit will be limited to a maximum of 30% of the current base licence entitlement in any one year.

When a licensed allocation or a portion of a licensed allocation is transferred or amalgamated, any accrued roll-over credits will be transferred or amalgamated on a pro rata basis, provided the application meets the hydrogeological criteria. Roll-over credits cannot be separated from the base licence entitlement or portion thereof.

For the purposes of calculating credits, water consumption will be assessed first against the base entitlement followed by any roll-over credit and any recharge credit in that order.

### 3.6 EXCESS USE OF LICENSED ALLOCATION

Where an irrigator uses in excess of the total groundwater licence entitlement (base entitlement + roll over credit + recharge credit), excess water will be charged at the following rates:

- 5c per kL for excess use up to 10% of the licensed groundwater allocation
- 10c per kL for excess use between 10 - 20% of the licensed groundwater allocation
- 25c per kL for all excess use above 20% of the licensed groundwater allocation

The penalties for excess use of groundwater may be reviewed during the period of the plan dependant upon review of groundwater levels in the basin.

The Angas Bremer Water Resources Committee will actively support and promote extension and demonstration programs to assist the implementation of improved irrigation and crop management practices.

### 3.7 RECHARGE POLICIES FOR WATER TAKEN FROM THE ANGAS AND BREMER RIVERS

Artificial recharge of the confined aquifer using water from the Angas and Bremer Rivers will be allowed provided that the salinity of the recharge water is less than the salinity of the groundwater at the recharge site and in all circumstances is less than 1 500 mg/L (approximately 2 500 EC).

A recharge credit of 100% of the volume recharged in the 12 months prior to 31 October of any year can be claimed subject to the above conditions. The credit will only be endorsed on a groundwater licence for that licence year and will be available on a 3 year rolling basis. A credit can not be endorsed on a River Murray licence.

Artificial recharge can only be undertaken on land owned by the licensee and can be separate and remote from the land where the water will be extracted (this may require amalgamation of licences).

Any existing remote recharge operations on land not owned by the licensee will be allowed to continue.

All artificial recharge undertaken within the Angas Bremer Area must be registered with the Water Resources Group of the Department of Environment and Natural Resources.

To gain registration, artificial recharge operations will be required to meet minimum requirements for factors such as recharge well and headworks construction, monitoring, and the hydrogeological criteria (see Appendix 1).

Registration will require the submission of a completed "Recharge Registration Application" Registration of a recharge operation will remain in force until:

- there is a change in ownership of the property,
- the Licensee fails to submit an annual recharge return,
- in the opinion of the Minister continued recharge at the site will result in environmental problems such as rising water tables, salinisation or water logging.

Recharge operations may utilise a production well only if the headworks are such that both recharge and production well operations can be metered without interference.

A land owner may obtain a groundwater licence by recharging from either the Angas or Bremer Rivers and applying for a recharge credit. The licence gained in this manner will have a base entitlement of zero.

Licensees seeking a recharge credit will be required to ensure that all recharge is measured in accordance with the minimum requirements for metering and that their recharge return includes all meter readings and other information specified.

Endorsement of a recharge credit on a groundwater licence may attract a fee to cover the cost of administration.

Licensees wishing to recharge but not claim a recharge credit will be required to ensure that the volume of recharge is estimated and that their recharge return includes this estimate and other information specified.

Recharge credits cannot be sold or transferred from one licensee to another or from one licence to another. However when a property is sold, any recharge credits endorsed on the licence can be transferred with the licence to the new owner.

The availability of water from the Angas and Bremer Rivers and the impact of recharge operations on downstream users will be monitored. If necessary controls will be put in place to ensure that the resource is shared equitably.

Recharge policies may be reviewed during the period of the plan if review of groundwater levels in the basin indicates that recharge is having a detrimental impact on the basin.

### 3.8 TEMPORARY STORAGE POLICIES FOR WATER TAKEN FROM THE RIVER MURRAY

Licensees with a River Murray Licence may utilise the confined aquifer for temporary storage of irrigation water extracted from the River Murray (Lake Alexandrina).

A Temporary Storage credit of 100% of the water put underground for storage in this manner in the 12 months prior to 31 March can be claimed subject to conditions (see below). The credit will only be endorsed on a groundwater licence for that licence year and there will be no provisions for roll-over to following irrigation seasons of any unused portion of this credit. A credit can not be endorsed on a River Murray licence.

A land owner may obtain a groundwater licence by storing River Murray water in this manner and applying for a temporary storage credit. The licence gained in this manner will have a base entitlement of zero.

To gain a temporary storage credit a licensee will have to demonstrate that the total amount taken from Lake Alexandrina is within the irrigator's entitlement under their River Murray licence.

All temporary storage operations must be registered with the Water Resources Group of the Department of Environment and Natural Resources.

To gain registration, temporary storage operations will be required to meet minimum basic requirements for factors such as storage well and headworks construction, metering, and the hydrogeological criteria (Appendix 1).

Registration will require the submission of a completed "Temporary Storage Registration Application".

Registration of a temporary storage operation will remain in force until:

- there is a change in ownership of the property,
- the Licensee fails to submit an annual temporary storage return,
- in the opinion of the Minister continued temporary storage at the site will result in environmental problems such as rising water tables, salinisation or water logging.

Licensees seeking a temporary storage credit will be required to ensure that all water extracted from Lake Alexandrina and put underground for storage is measured in accordance with the minimum requirements for metering and that their temporary storage return includes all meter readings and other information specified.

Endorsement of a temporary storage credit on a groundwater licence may attract a fee to cover the cost of administration.

Temporary storage credits cannot be sold or transferred from one licensee to another or from one licence to another. However when a property is sold, any temporary storage credits endorsed on the licence can be transferred with the licence to the new owner.

Private arrangements for access to pipelines owned by other licensees for the pumping of River Murray water may be approved provided both licensees have a River Murray licence, there is a written agreement between the parties and meter readings are taken to ensure that water is allocated to the correct licence. These readings may attract a charge to cover administration.

#### 4. RIVER MURRAY POLICIES

##### 4.1 PERIODS OF BELOW ENTITLEMENT FLOWS

At times of actual or expected shortages in the availability of water the Minister for the Environment and Natural Resources may direct that for a specified period:

- (a) water may only be diverted for specified purposes,
- (b) not more than a specified proportion of the water otherwise authorised may be diverted, or
- (c) the terms and conditions of any licence shall be varied or modified as directed.

##### 4.2 PRIVATE STOCK AND/OR DOMESTIC DIVERSIONS

Landowners whose properties directly abut the waters of Lake Alexandrina are entitled by riparian right to take water without a licence for Stock and/or Domestic Purposes for use on the subject land.

No diversions for other purposes by such landowners are permitted unless a licence has been issued to them for those purposes.

Domestic purposes means ordinary household purposes and includes the irrigation of a noncommercial garden used in conjunction with a dwelling and not exceeding 0.4 hectare. Stock purposes means the provision of drinking water for grazing stock only.

Where a licence is issued for irrigation and a provision for stock and/or domestic purposes is appropriate (ie a non riparian licensee), a separate allowance is included on the Irrigation Licence for those purposes where the water so used passes through the irrigation meter. If the water for stock or domestic purposes does not pass through the irrigation meter a separate licence is necessary.

##### 4.3 SALE OF PROPERTIES WITH RIVER MURRAY ALLOCATIONS

When land the subject of a licensed River Murray water allocation changes ownership the licence remains in the possession of the previous land owner. If the licence is to be transferred to the new owner advice must be received from the previous land owner requesting the transfer.

If land with a licensed River Murray water allocation is subdivided the licence holder may request the Minister for approval to divide the licensed water allocation to provide water to the land allotments created. New licences will be created in the name of the original licensee with different licenses and allocations pertaining to each parcel of land, provided that the request meets the hydrogeological criteria and that the total allocation does not exceed the previous single licence allocation.

#### 4.4 TEMPORARY AMALGAMATION OF RIVER MURRAY ALLOCATIONS WITHIN THE ANGAS BREMER WATER RESOURCE MANAGEMENT AREA

River Murray allocations may be amalgamated for periods up to twelve months. All amalgamations will expire at the end of that licence period, but may be renewed. Applications for temporary amalgamations will be approved if the application satisfies the hydrogeological criteria. Amalgamations will be reviewed at the end of the twelve month period and may not be renewed if contrary to an earlier report there is evidence that the amalgamation is detrimental to basin management.

#### 4.5 LONG TERM AMALGAMATION OF RIVER MURRAY ALLOCATIONS WITHIN THE ANGAS BREMER WATER RESOURCE MANAGEMENT AREA

The only provision for long term amalgamation of River Murray allocations within the area will be for allocations held by one licensee. Applications for long term amalgamation will only be approved if the application meets the hydrogeological criteria.

Any existing long term amalgamations of River Murray allocations not held by the one licensee will continue until the amalgamation period ends.

#### 4.6 TRANSFER OF RIVER MURRAY ALLOCATIONS (By Sale or Lease)

##### 4.6.1 Transfer within the Angas Bremer Water Resources Management Area

Applications for transfer of River Murray allocations or part thereof within the Angas Bremer Water Resources Management Area will be considered provided that the application meets the hydrogeological criteria.

An application to transfer an allocation for recreation/environment purposes or part thereof for any other purpose will not be approved.

Applications for transfer of any River Murray licence must be accompanied by a satisfactory Irrigation Drainage Management Plan (see Appendix 2) for the portion of land to which the licence is to be transferred.

Where the whole of a River Murray allocation is to be transferred to other land the licensee must immediately make identifiably inoperable the means by which the water has been diverted to the satisfaction of the Department of Environment and Natural Resources.

#### 4.6.2 Transfer Outside of the Angas Bremer Water Resources Management Area

Applications for transfer of River Murray allocations or part thereof outside of the Angas Bremer Water Resources Management Area will be considered. Consideration will be in consultation with the body responsible for management of the area to which the allocation is to be moved, provided that the transfer complies with River Murray policies.

Allocations of River Murray water granted from the additional 6 000 ML made available by the Minister for the Environment and Natural Resources for use in the Angas Bremer Area in September 1994, will not be approved for transfer outside of the Angas Bremer Water Resource Management Area.

Applications for transfer outside of the Angas Bremer Water Resource Management Area will be subject to policies currently in place for the particular area.

#### 4.7 PROVISION FOR EXCESS USE OF RIVER MURRAY WATER

Where an irrigator uses in excess of the total licensed River Murray allocation, excess water will be charged at the following rates:

- 5c per kL for excess up to 10% of the licensed water allocation
- 10c per kL for excess use between 10 - 20 % of the licensed water allocation
- 25c per kL for all use above 20% of the licensed allocation

#### 5. METERS

By 30.6.97 all licensees will be required to become responsible for their meters if they have not already done so under the provisions of the previous Angas Bremer Proclaimed Wells Area Management Plan 1992-97.

The responsibility for ensuring that a meter is accurately recording consumption remains with the licensee at all times. Where a meter is not recording or it is believed that it has not been recording an estimate will be made of consumption based on factors such as electricity usage, the area of crop irrigated and rainfall during the irrigation season. Excess charges can be levied on the basis of such an estimate.

Meters shall be calibrated a minimum of once every five years by a qualified person and notification of this shall be supplied to the committee within 14 days of calibration.

#### 6. LAND MANAGEMENT POLICIES

The Angas Bremer Water Resources Committee supports the activities of the Bremer Barker and Angas River Catchment groups along with Landcare

groups and community environment groups, which address rising water tables and dryland salinisation in the Upper Catchment.

The Committee will continue to provide representation to ensure the technical, financial and community support for their projects is maintained. The Committee will actively support approaches to the Murray Darling Basin Commission, Land and Water Resource Research and Development Corporation and National Landcare Program for funding community projects within the catchment.

The Committee will encourage licensees to participate in programs such as property management planning or irrigation workshops.

## 6.1 ANNUAL REPORTS

The Committee will foster the adoption of best irrigation practices through requiring all licensees to prepare an Annual Report on irrigation practices, to be submitted by 31 July each year. Information provided in Annual Reports will be summarised and feedback provided to licensees. Details of the information required is outlined in Appendix 2.

## 6.2 IRRIGATION AND DRAINAGE MANAGEMENT PLANS

Approval for transfer of licensed allocations and new irrigation development will be subject to the preparation of a satisfactory Irrigation and Drainage Management Plan. Details of the information required is outlined in Appendix 2.

## 6.3 WATERTABLE MONITORING

All licensees shall install a minimum of 1 monitoring well per property on which a licensed water allocation or part thereof is used, within 12 months of the commencement of the plan (see Appendix 3).

For the purposes of this policy contiguous properties under common ownership shall be considered to be a single property.

Licensees with a total licensed allocation (groundwater + River Murray) which is greater than .500 ML shall install a minimum of 2 wells. Licensees shall submit quarterly readings for September, December, March and June each year as part of the Annual Report to the committee managing the area (or in the absence of a committee, to the Water Resources Group of the Department of Environment and Natural Resources).

## 7. SALINITY INVESTIGATION POLICIES

Investigations being carried out into the variation in salinity in the Bremer River will continue and similar investigations will be undertaken for the Angas River. A more streamlined system will be developed and implemented for notifying irrigators of stream salinity.

## 8. COMMUNITY EDUCATION

Regular promotion of information and factors affecting irrigators will continue to be provided through a variety of channels as a means of involving the community in decision making in the basin.

## APPENDIX I

### ANGAS BREMER WATER RESOURCE MANAGEMENT AREA - HYDROGEOLOGICAL CRITERIA

The following criteria have been established to assist the committee decide whether to support applications for the following;

- New licences following the subdivision of land with a licensed water allocation.
- Temporary amalgamation of licensed water allocations (including renewal).
- Long term amalgamation of licensed water allocations.
- Transfer of licensed water allocations.
- Artificial recharge or temporary storage operations

The restoration of groundwater flow through the basin will increase upward pressure from the confined aquifer on the unconfined aquifer. This, together with the importation of large volumes of River Murray water into the area for irrigation, has created a risk of rising watertables. Rising watertables could lead to saturation in the root zones of some crops grown in the area including vines. Perennial horticultural plantings would be the first affected followed by perennial pasture and finally annual horticulture and pastures. In addition there is the risk of salinisation resulting from evaporation from high watertables. In the extreme watertables could rise to the surface causing inundation, which would compound drainage of flood waters in flood periods.

The criteria are aimed at protecting the resource on a broad scale. Any impacts that occur are likely to be localised initially. Such occurrences should be immediately investigated.

The Hydrogeological Criteria need to be satisfied in the following circumstances:

#### 1. Alterations to Groundwater and River Murray licences:

- Following land subdivision on application for new licences.
- On initial application for temporary amalgamation of licences (and their renewal).
- On application for long term amalgamation of licences.
- On application for transfer of licensed water allocation.

#### 2. Artificial recharge:

- For registration of an artificial recharge operation using Angas or Bremer\_ river water.
- For registration of temporary storage of River Murray water.

APPLICATIONS WILL BE CONSIDERED BY THE COMMITTEE WITH ADVICE FROM MINES AND ENERGY SOUTH AUSTRALIA.

## HYDROGEOLOGICAL CRITERIA

The hydrogeological criteria are aimed at protecting the groundwater resources of the basin. Factors to be considered include the depth to the watertable (unconfined aquifer), depth to water within the confined aquifer and the salinity of groundwater within the confined aquifer. Each case will need to be considered individually.

### 1. Alterations to Groundwater Licences

#### 1.1 Depth to water in the confined aquifer

Transfer of licensed water allocations are encouraged out of any cone of depression if it is considered to be a problem, as defined by the most recent end of irrigation period potentiometric surface.

#### 1.2 Salinity of groundwater in the confined aquifer

Transfer of licensed water allocations are not permitted from an area of higher salinity to one of lower salinity.

### 2. Alterations to River Murray Licences

#### 2.1 Depth to watertable (unconfined aquifer)

Transfer of licensed water allocations are not permitted into areas where the depth to watertable is less than or equal to 3 m.

### 3. Artificial Recharge/Temporary Storage

#### 3.1 Depth to watertable (unconfined aquifer)

Artificial recharge/temporary storage operations are not permitted where the depth to watertable is less than 3 m, due to the increased pressure and resultant upward leakage.

#### 3.2 Interference with adjacent artificial recharge/temporary storage operations

If adjacent operations are expected to be seriously affected, due to lack of distance between the sites, approval may not be granted.

## APPENDIX 2

### ANNUAL REPORTS AND IRRIGATION AND DRAINAGE MANAGEMENT PLANS

The Management Plan requires that each licensee submit an Annual Report on irrigation activities over the preceding 12 month period (1 July to 30 June) by 31 July each year.

When a water allocation is transferred or a new irrigation development is undertaken, the plan requires that the licensee prepare an Irrigation and Drainage Management Plan (IDMP).

These requirements have been included to:

- involve the community in monitoring irrigation practices
- keep watertables well below the root zone
- avoid waterlogged and/or salinised soils
- encourage irrigators to benefit from applying best practice irrigation management

### ANNUAL REPORTS

An Annual Report will provide the following information:

- Total licensed allocation (kL)
- Average irrigation depth applied to each crop type (mm)
- A measurement of the uniformity (evenness) of irrigation
- A bar chart showing the depth of water applied for each irrigation against date
- Depth to watertable (in monitoring wells) measured 4 times per year in the months: September, December, March and June
- Soil salinity at the bottom of the root zone, measured at the same location both before the first irrigation and after the last irrigation

A proforma to be completed to present the above information as the Annual Report will be provided.

Workshops will be held to explain how to use the proforma.

### IRRIGATION AND DRAINAGE MANAGEMENT PLANS (IDMP)

Before committing resources to a new development most investors find it useful to complete an IDMP. An IDMP should contain the following irrigation and soils information:

- Name of crop(s)
- Area of crop(s) (ha)
- Target Annual Irrigation Needs in a year with average weather (mm)

- Maximum monthly irrigation requirement in a dry year (mm)
- Annual volume of irrigation water (licence) needed (kL)
- Typical active-root depth of crop (m)
- Diameter of soil wetted by proposed sprinkler/dripper (m)
- Irrigation depth applied at each irrigation (mm)
- Salinity of irrigation water (dS/cm)
- Leaching fraction (%)
- Location plan of property
  - all maps should be drawn to the same scale so that one clear, planning-overlay can be used over ail maps
- Layout plan or aerial photograph of property
- Map showing surface topography to 1 m contours
- Map showing boundaries between areas with similar (expected) irrigated-root-depth
- Map overlaying the irrigation system layout on the irrigated-root-depth map
- Map showing depth of soil to watertable
- Map showing areas which will not be planted due to
  - soil type (pH, texture, structure) not suitable for crop type - soil depth not suitable for crop type
  - expected drainage problem
  - soil salinity
- Map showing topography of the surface of any sub-surface layer which will restrict water movement
- Map showing areas where soil moisture should be monitored

While doing the soil survey (by walking down backhoe pits each 1.8m deep and sited either on a grid selected by the farmer to cover the different soils or on a regular grid 75m x 75m) soil samples should be collected and sent for chemical analysis. The soil test results should be interpreted by an independent soil specialist who will provide recommendations on deep ripping and for types and amounts of fertilisers, trace elements and other soil additives to be applied before planting any perennial crop.

Additional information on the pump and the irrigation system detail can be included with the I DM P.

WHO CAN PREPARE IDMPs ?

Anyone can prepare an IDMP.

Irrigators can prepare their own plan after acquiring the necessary skills.

Specialists may be employed for particular parts of the plan.

The Department of Primary Industries (PISA (08) 8389 8800) conducts Property Management Planning Workshops which can assist irrigators to prepare IDMPs. The workshops help irrigators to:

- develop their own plans

- know how specialists can assist and
- use IDMPs

## OBSERVATION WELL CONSTRUCTION REQUIREMENTS

As indicated in the policy section of the plan, all licensees are required to establish at least one monitoring well per licensed property within 12 months of the commencement of the plan.

Licensees with allocations greater than 500 ML shall construct more than one monitoring well.

The well should be constructed to meet the following:

## OBSERVATION WELL COMPLETION DETAILS

- Total well depth 6 m.
- Casing 75 mm ID class 12 UPVC
  - the bottom 3 m slotted and covered with FILTERSOK made of Terra Firma (fibre cloth).
  - the annulus (area outside of the casing) of the bottom 4 m filled with 1.5 mm graded gravel and the top 2 m cemented to the surface.
  - the casing should extend 1 m above the ground surface (total length of casing 7 m) and be protected by the installation of an outer sleeve of galvanised pipe (4mm wall) 1.5 m long with a screw cap, set into the cement at the ground surface.
  - a PVC cap is required for the bottom of the casing.
- A well construction permit is required from the Department of Environment and Natural Resources. ..