Pike River Upgraded LWMP

Pike River

Upgraded Land and Water Management Plan

Final, November 2006

RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

Government of South Australia
Department of Water, Land and Biodiversity Conservation

Government of South Australia
South Australian Murray-Darling Basin Natural Resources Management Board

action Salinity & Water AUSTRALIA

Australian WATER Environments

Pike River Upgraded LWMP

Renmark to the Border LAP

Pike River LWMP Area

LWMP Upgrade to Guideline Standards

Final
November 2006

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Table of Contents

List of Tables

List of Figures

Appendix

ACRONYMS

CDS – Comprehensive Drainage Scheme

CSIRO – Commonwealth Scientific and Industrial Research Organisation

CWMP – Catchment Water Management Plan

DWLBC – Department for Water Land and Biodiversity Conservation

EC – Electrical Conductivity (measure of water salinity)

IFMP – Integrated Floodplain Management Plan

IIEP – Improved Irrigation Efficiency Program

INRM – Integrated Natural Resources Management

LAP – Local Action Plan (or Planning)

LWMP – Land and Water Management Plan (or Planning)

MDBC – Murray Darling Basin Commission

NPV – Net Present Value

PIRSA – Primary Industries and Resources South Australia

PRLMG – Pike River Land Management Group

RDC – Riverland Development Corporation

SAMDB NRM Board – South Australian Murray Darling Basin Natural Resources Management Board

SARDI – South Australian Research and Development Institute

SIS – Salt Interception Scheme

WAP – Water Allocation Plan

WUE – Water use Efficiency

Foreword

European descendants settled the Pike River/Lyrup area in the late 19th century and from that early stage there was concern over the salt in the Pike River anabranch.

The Col Col embankment, although not known when constructed, is shown in government survey maps of 1910. It was built to hold back fresh water in the Pike following the then annual high river flows regulated now by the construction of the locks and weirs. It is also recorded that there were pools of saline water in the area formed by the groundwater leakage down the cliff face from the higher country, well before the irrigation areas were established. At this time most of the high country was farmed to wheat and wool. Murray River steamers ventured up the Pike River to an area near to where Simarloo is today to load wheat and wool.

Following the war and with the influx of refugees the highland area was opened to irrigation with the consequential increase in salinity. In the late 1950's this increased salinity forced irrigators to find a better way to irrigate with them changing from overhead sprinklers to under tree units; these irrigators were at the forefront of innovation.

Little has changed today. The river is still highly regulated; irrigators are still pursuing better and more efficient ways to irrigate; salt is still entering the river and at a higher rate.

It is with this background that a group formed in the early 1990's to formulate plans to fix the problems. A Land and Water Management Plan was commissioned at this time, however it had little input from the local community and did not properly reflect community values and aspirations.

With the community at odds over why nothing on ground was being done, study after study followed all showing that the Pike system contributes one of the greatest loads of salt to the river. At the suggestion of the Renmark to the Border LAP the committee was reformed as the Pike River Land Management Group (PRLMG) on the promise that the area was to be taken seriously and the problems addressed.

There are 3 key issues:

- High salt loads entering the River system
- Poor flow regime through the anabranch
- Degraded floodplain

The PRLMG aims are:

- To contribute to and foster the Lyrup/Pike River community through maintaining existing employment;
- Work towards the establishment of more employment opportunities by expanding the irrigation district through the sustainable use of our land and the installation of a Salt Interception Scheme, and

- At the same time, work towards the rehabilitation of the river systems (both Pike and Murray) for the enjoyment and prosperity of future generations.

The PRLMG acknowledges that the Pike River Irrigation Association is the oldest irrigation association in the area, and also recognises the important role that the Lyrup Village Association has had in managing the land for over 100 years. All landholders and irrigators are committed to best practise irrigation and land use methods and they will continue to work with all stakeholders to find the correct solution. All are looking for security of tenure as the area has soils especially suited to the current range of crops. The local community has an aquatic playground on their doorstep and all are committed to the restoration of the floodplain.

The PRLMG believes that the installation of a Salt Interception Scheme is vital otherwise saline water will continue to enter the river environment. Current estimates indicate that on ground salt interception works will cost around $25M. Whilst this may seem large, the cost of doing nothing could be greater. The salt loads will increase with consequential problems for every downstream user. Any on ground works to address flows and the restoration of the floodplain will be in vain unless the salt is first intercepted. We are not opposed to the construction of an irrigation water supply pipeline to facilitate floodplain management as long as irrigator flexibility in access to and timing of water use is not diminished. Addressing the salinity and flows issues will allow rejuvenation of the floodplain to commence.

As chairperson, and on behalf of the PRLMG, we appreciate the roles of DWLBC and the SA MDB NRM Board in accessing funding through the National Action Plan for this study. We look forward to your strong support and involvement in the implementation of our upgraded Land and Water Management Plan.

Bruce Hewett

Chairman

Pike River Land Management Group

1. The Pike River LMWP Area

1.1 General Description

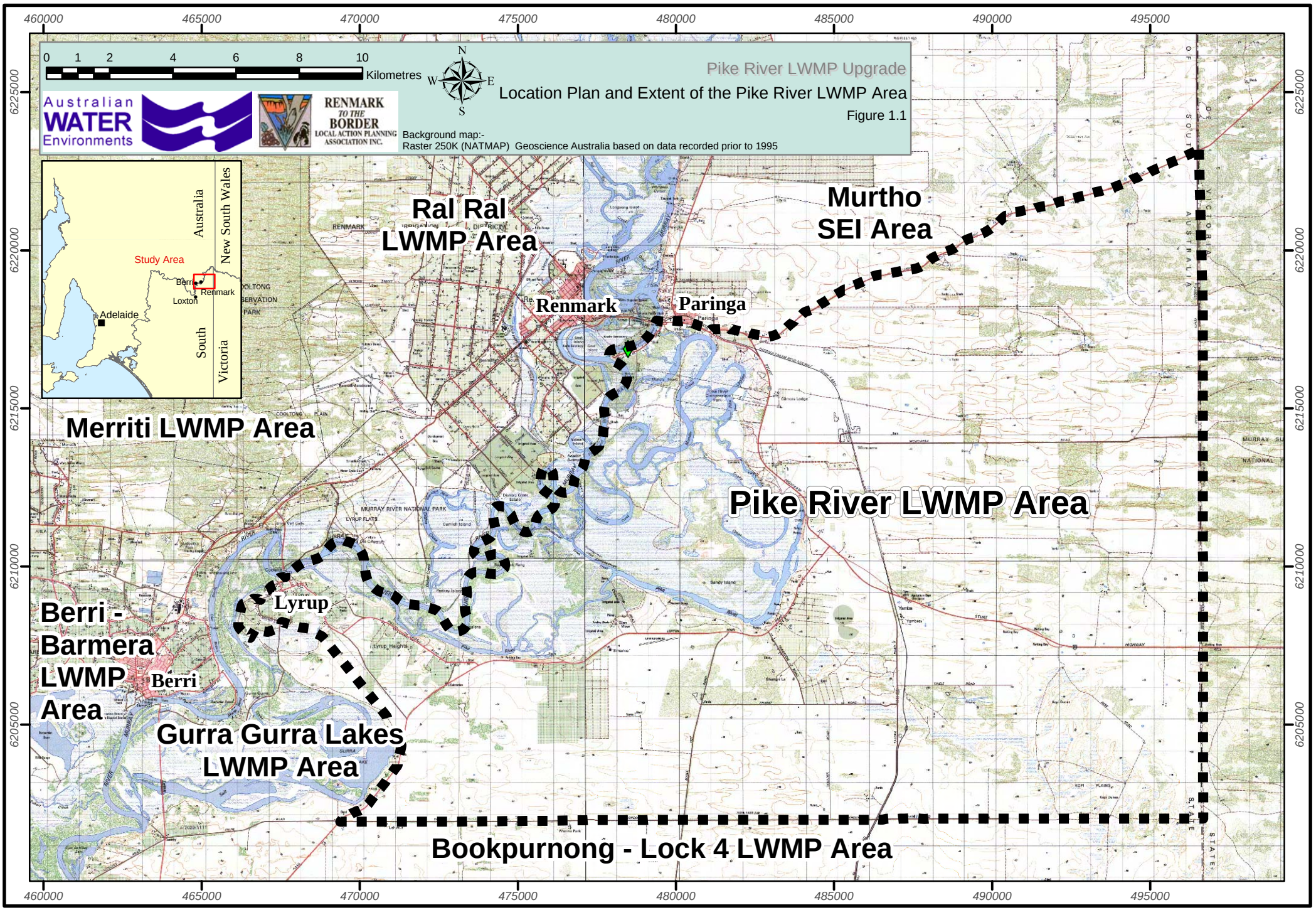
The Pike River Land and Water Management Plan (LWMP) area extends from the Gurra Gurra Lakes complex east to the SA/Victoria border as shown on Figure 1.1. It includes the irrigation areas of the Upper, Mid and Lower Pike, Simarloo and Lyrup / Lyrup Heights. The area also encompasses the floodplain, creeks and backwaters of the Pike River system, and includes the highland across to the SA / Victoria border.

The area was originally mallee scrub in the highland, with River Red Gums and Black Box dominating the floodplain vegetation. Clearance of native vegetation on both the floodplain and highland occurred following European settlement to facilitate the establishment of an irrigation industry. Major irrigation development occurred in the 1960s. The area now contains almost 2,400 hectares of irrigated land comprising a range of crops. Dryland farming is also undertaken as well as floodplain grazing.

Like many other areas in South Australia's Riverland district, the combination of vegetation clearance and irrigation development has increased the discharge of natural high salinity groundwater into the floodplain environment and river with a loss of environmental value and salinisation of the river and floodplain.

The upgrade of the Pike River LWMP has been undertaken to address the following key issues:

- Ensuring the continued viability of irrigation and farming.
- The reduction of off-farm impacts
- To provide an impetus for continued on-farm high irrigation efficiency levels.
- The improved management of local wetlands and floodplains.
- The production of minimal drainage and responsible drainage disposal.
- To maintain and improve environmental amenity and biodiversity.
- The continued use of waterways for recreational purposes.



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1.2 Aboriginal People's Use of the Environment

Aboriginal occupation along the River Murray system dates back more than 30,000 years at Lake Mungo to the east. The Dreaming story of Ngurunderi, tells of the creation of the River Murray, from the junction of the Darling and Murray to the Murray Mouth and Coorong. According to Tindale (1974) the local Aboriginal peoples around Renmark were known as Erawirung and Ngintait, sub-groups of the Meru (men).

There is much historical documentation of the use of the local environments by Aboriginal people and the descriptions tend to reflect the varied nature of food and other resources provided by the river and surrounding floodplain and highland environments. A detailed review and presentation of this material has been prepared by Pring (2006).

The most detailed description of Aboriginal interaction with the local environment is sourced from Edward John Eyre (1845). The following paragraphs are provided as a sample of the ways in which Aboriginal people interacted with and depended on the environmental resources of the district:

- 'Fish are procured in different ways, eg 'weirs or dams, large seines (nets) made of string manufactured from the rush, and buoyed up with dry reeds, bound into bundles, and weighted by stones tied to the bottom.'

- Watercress was collected from the borders of lagoons at the Murray. The tops, leaves and stalks were steamed in a ground oven, providing a favourite and inexhaustible supply of food.

- 'the bulbous roots of a reed called the belillah (probably bulrush) , certain kinds of fungi dug out of the ground, fresh-water mussels …' were eaten.

- 'Fresh water turtles, varying in weight from three to twelve pounds' were caught similarly to fish.

- Small individual hooped nets were used by the group as well to scoop fish. Other types of nets and fish traps were also used seasonally 'catching fish weighing from twenty to seventy pounds'. As a group between 5 and 40 men dived to spear fish when the water levels were low.

- At flood time, spearing of fish was practiced from canoes made from the bark of the gum tree. The spears were made from native pine. Freshwater lobsters weighing from two to four pounds are also speared, sometimes ten to sixteen in an hour or two.

- Frogs, rats, lizards and other reptiles are eaten as well as grubs from trees and the ground.

- The roots of various plants are eaten including the 'flag' or cooper's reed 'which grows in marshes or alluvial soils that are subject to periodical inundations. It is used all year but best after floods. The root is roasted in hot ashes. The 'belillah' is another, about the size of a walnut, hard and oily and roasted and pounded into a thin cake. 'Immense tracts of country are covered with this plant on the flats of the Murray …'.

- A small berry or currant, called by the natives of Moorunde 'eertapko', coloured red and an agreeable acid flavour, growing upon a low creeping tap-rooted plant, of a salsolaceous character, found in the alluvial flats of the Murray, among the polygonum bushes and other places.

- When hunting possum up in a smooth trunked tree, a stone hatchet or strong sharp-pointed stick is used to make notches in the bark for toe holds.

- Swans and brolga (native companions) were speared or killed with clubs. Swans were caught easily in the waterholes or lakes when mounting, as they are then unable to fly.

- Birds are killed with clubs, by spearing, snaring, by noosing and by netting.

- Nets for netting birds are as large as thirty to sixty feet broad and from twenty to forty deep, formed from lacing together pieces of old fishing nets.

There are recordings of burial places in the Cobdogla area so it could be assumed that this would be the case along the river to the east. Burials are often in sand, rather than clay, for ease of digging.

There are many sites of cultural significance along the River Murray and consideration must be given to these when developing environmental management options such as flow management strategies or floodplain watering.

1.3 Socio-Economic Base

1.3.1 General

The Pike River area of the Riverland provides significant horticultural production to South Australia. Table 1.1 indicates that 44% of the horticultural area is made up of vines, followed by relatively equal proportions of citrus, nuts and stone fruit (data from RBLAP crop survey).

Table 1.1: Horticultural Area of Production (2004/05)

Crop Type	Area ha	Area %
Vines	1,053	44%
Citrus	384	16%
Nuts	383	16%
Stone Fruit	325	14%
Other	135	6%
Land in transition	108	5%
Total	2,388	100%

It is difficult to obtain economic data specifically from the Pike River area and so the 2001 ABS Census data for the broader Renmark area has been used to describe the area of Pike River and its local economy. Table 1.2 provides an overview of some of the population statistics from this area.

Table 1.2: Population Profile

	Number of People
Total Persons	6,215
Ages 15 years and over	4,857
Unemployed	95
Employed	2,983
In the labour force	3,232
% Employed in Agriculture, Forestry & Fishing	40%
% Employed in Manufacturing	11%
% Employed in Wholesale Trade	8%
% Employed in Retail	11%

These figures indicate the significance of agricultural production on the local economy with 40% of the population working in Agriculture, Forestry & Fishing. There is also a significant, impact on the region of the migrant population where 10% of this regions population were born in a country other than Australia. A significant number of migrants come from Greece and the United Kingdom. Also, a number of the population speak Greek, Iranian, German and Persian.

1.3.2 Irrigation and Drainage

The Pike River LWMP district includes the irrigation areas of the Upper, Mid and Lower Pike, Simarloo and Lyrup / Lyrup Heights. The extent of the irrigated areas is shown on Figure 1.1. Recent crop surveys indicate that almost 2,400 ha of irrigated crops are present in the district with the main crops being grapes, citrus, nut trees and stone fruit (Figure 1.3). Other crops grown include vegetables and tropical fruits (e.g. avocado). The horticultural value of the area is highlighted by the figures which show that the district produced 29% of the Riverlands' stonefruit, 16% of its nuts and almost 10% of its citrus in the 2003/04 season.

More than 80% of crops are irrigated either by drip or under canopy systems. Recent change and growth in the area is indicated by the fact that around 30% of the irrigated crops are less than 6 years old.

Drainage water is collected via a Comprehensive Drainage Scheme at Lyrup Village / Heights and discharged to the Lyrup East and Lyrup South basins. The Mid Pike basin is a part of the Yamba salina complex and receives drainage and seepage from irrigation to the west and south of the Mid Pike area. Further details of drainage and basin infrastructure are provided in a number of existing reports (e.g. Woodward Clyde 1999, Teoh and Giffen 1995).

Water use efficiency (WUE) data provided by the SAMDB NRM Board for the 2003/04 irrigation season is summarised on Figure 1.2. The information indicates that most of the area is calculated to have a theoretical WUE of more than 100%, that is, less water is applied than the crops require. Whilst it is possible for this to occur, it is not desirable over the longer term as salinisation of the shallow soil systems could occur. It is more likely that the very high WUE figures are affected by uncertainty in parameters used to calculate the WUE, for example the crop co-efficients assumed for different types and ages of crops.

Figure 1.2: Water Use Efficiency Estimates

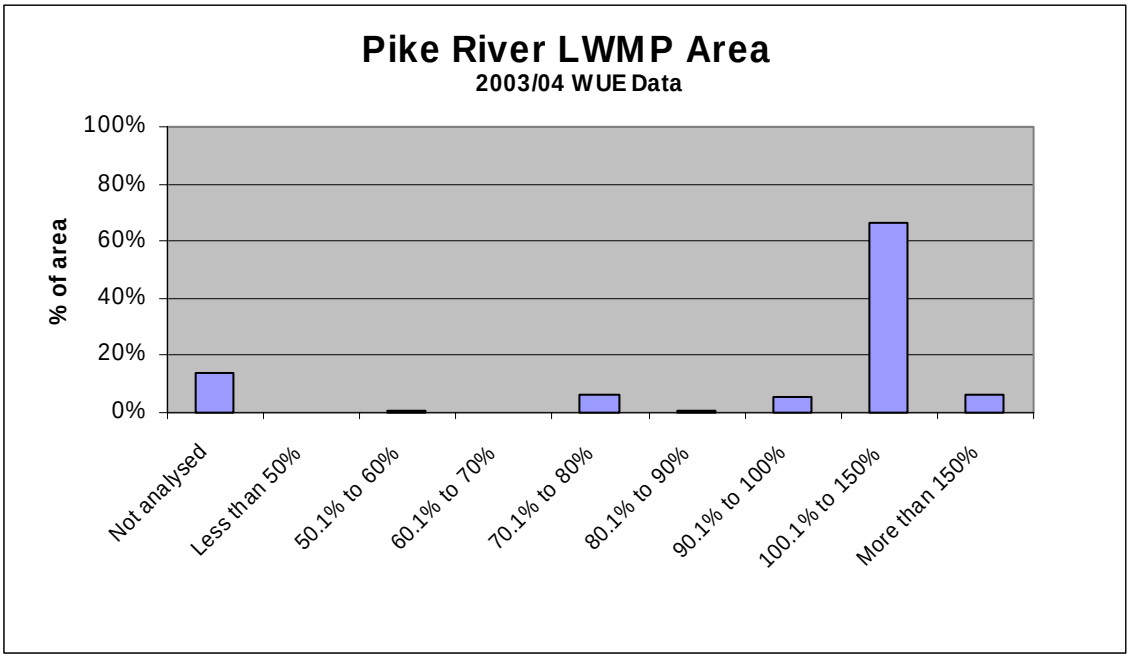


Figure 1.3: Crop and Irrigation Statistics (2004/05)

Main Land Uses		
Crop Type	**Area (ha)**	**% Area**
Citrus	384.21	16.09
Grapes	1052.98	44.09
Nut Trees	382.6	16.02
Stone Fruit	325.36	13.62
Land in Transition	107.98	4.52
Other	135.34	5.67
Total	**2388.47**	**100**

Main Irrigation Types		
Irrigation Type	**Area (ha)**	**% Area**
Drip	512.25	21.52
Under Canopy	1429.08	60.03
Overhead	309.71	13.01
Other	53.67	2.25
None/Land in Trans	76.01	3.19
Total	**2380.72**	**100**

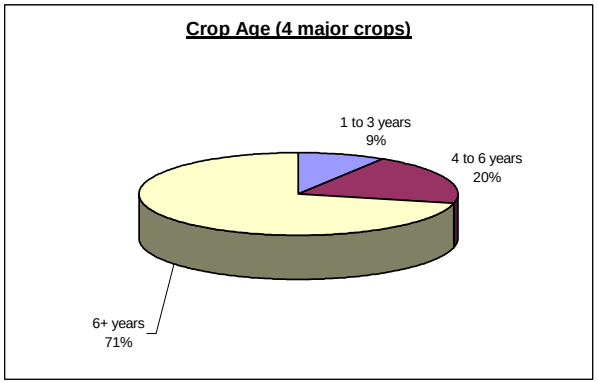
Dominant Crop Types	Crop Area (ha)	First Planted (approx)
Citrus	384.21	1949
Grapes	1052.98	1920
Nut Trees	382.6	1968
Stone Fruit	325.36	1956
Land in Transition	107.98	-
Other	135.34	-

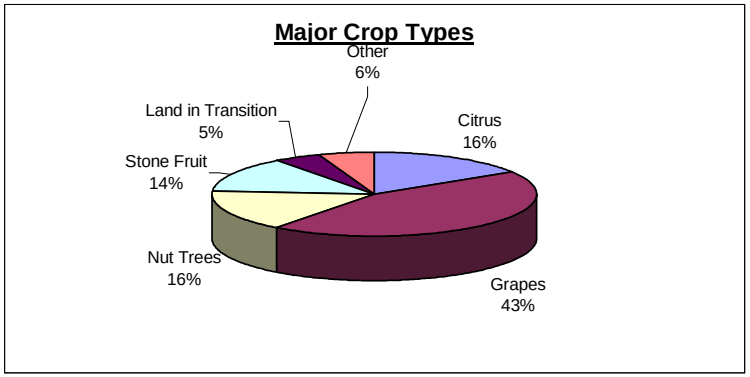
Grapes		
Age	**Area (ha)**	**Area %**
0 to 3	59.57	5.66
4 to 6	242.04	22.99
6+	751.38	71.36
Total	**1052.99**	**100**

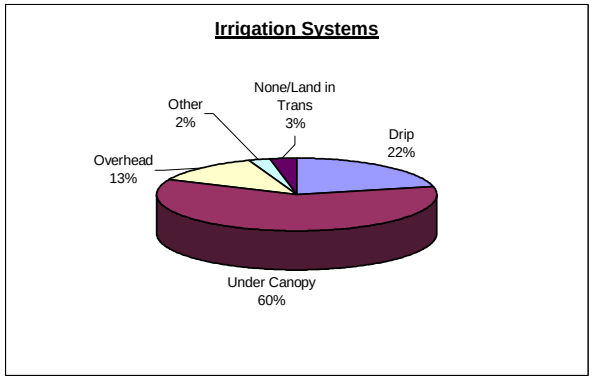
Citrus		
Age	**Area (ha)**	**Area %**
0 to 3	30.22	7.87
4 to 6	39.65	10.32
6+	314.34	81.81
Total	**384.21**	**100**

Nut Trees		
Age	**Area (ha)**	**Area %**
0 to 3	73.76	16.67
4 to 6	80.44	18.17
6+	288.4	65.16
Total	**442.6**	**100**

Stone Fruit		
Age	**Area (ha)**	**Area %**
0 to 3	30.9	9.5
4 to 6	72.62	22.32
6+	221.84	68.18
Total	**325.36**	**100**







1.4 Natural Resources of the District

1.4.1 The Pike River System and Floodplain

Hydrology

The Pike River anabranch extends over 4,000 ha of River Murray floodplain between Paringa and Lyrup village. It is a complex system of creeks, backwaters and lagoons and the system can be broadly divided into:

- The Upper Pike River and Mundic Creek area which extends from the inlets from the River Murray to the Col Col embankment.
- The lower Pike River and Rumpagunya Creek area extending from the Col Col embankment to the downstream confluence of the River Murray and the Pike River.

Water flows into the upper system from the River Murray through 2 inlets located between 600 m and 1,200 m upstream of Lock 5. These inlets feed into Deep Creek and Margaret Dowling Creek, both of which then connect into the Mundic Creek. Small watercourses then transport this water to the Pike River via the Pike Lagoon. Water levels in the upper Pike River are controlled by the Col Col embankment to maintain sufficient water depth for irrigator pumps along this length of the Pike. Most of the water flow in the lower Pike River and Rumpagunya Creek is received directly from the River Murray via Rumpagunya Creek.

The extent of the Pike River complex is shown on Figure 1.4, together with key hydrological features and surface water monitoring stations.

Flow

Flow into the Pike River system via the inlet pipes above Lock 5 is relatively constant under present operating conditions, at 310 to 330 ML/day. When flow in the River Murray reaches 35,000 to 40,000 ML/day, additional flow into the Pike system occurs through B Bank and over C Bank.

Flow over the Col Col embankment varies widely due mainly to seasonal irrigation requirements during entitlement flow in the River Murray. Partial control of outflow is achieved by the operation of a sluice gate which serves to maintain water levels upstream of the embankment.

Photo: Barry Porter (DWLBC)

Continuous flow and salinity recorder mounted on pontoon at Lettons

Photo: Barry Porter (DWLBC)

DWLBC undertaking a salinity survey along the Pike River

Murtho SEI Area

A1 Bank 1050mm inlet pipe Deep Creek

A Bank 1000mm inlet pipe Margaret Dowling Creek

Lock 5

AW426512

AW426513

Ral Ral LWMP Area

Pike River LWMP Area

B Bank

C Bank

H Bank

G Bank

E Bank

F' Bank

F Bank

D Bank

A4261055

A4261054

Coombs Bridge

Berri Barmera LWMP Area

AW426663

A4261023

AW426644

Lettons

AW426645

Col Col Embankment with pipes

A4261053

A4261052

Simarloo PS

Gurra Gurra Lakes LWMP Area

0 0.5 1 2 3 4 5 Kilometres

465000 470000 475000 480000 485000

6215000 6210000 6205000

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Background map:-
TopoMapSA (DEH) based on data recorded prior to 1991
GDA (Zone 54)

LWMP Area boundary

DWLBC monitoring sites

Pike River LWMP Upgrade

Pike River System

Figure 1.4

Job No. 44667a - 102

The flow in Rumpagunya Creek can be more than 20% of the flow in the River Murray. There is also a minor amount of flow of around 20 ML/day through a concrete pipe in F Bank into Tanyaca Creek.

DWLBC gauges flow at monthly intervals at the inlets upstream of Lock 5. Continuous electronic flow and salinity loggers are installed along the Pike River at various locations as shown in Table 1.3 below.

Table 1.3: DWLBC Monitoring Stations along the Pike River

Station ID	Station name	Water level	Salinity
AW426512	Lock 5 Upstream (562.4 Km) DAILY	M	M
AW426513	Lock 5 Downstream (562.4 Km) DAILY	M	No
A4261023	Upstream Pike River Outlet (547.2 km)	No	C
A4261055	PIKE RIVER @ U/S COOMBS BRIDGE	C	C
A4261054	PIKE RIVER @ D/S COOMBS BRIDGE	C	No
A4261053	PIKE RIVER @ U/S COL COL BANK	C	C
A4261052	PIKE RIVER @ D/S COL COL BANK	C	No
AW426644	PIKE RIVER @ Lettons D/S Rumpagunya Creek	C	C
AW426645	PIKE RIVER @ Picnic Grounds U/S Murray River	C	C
AW426663	Lyrup Pumping Station (537.7km)	C	C

C = continuous logged data

M = monthly gauging

In addition to the above monitoring stations, DWLBC also carries out monthly flow gaugings along the Pike River at Col Col embankment, Rumpagunya Creek and the Lower Pike (Lettons).

Salinity and Salt Loads

The Renmark to the Border LAP has been monitoring salinity along the Pike system on a monthly basis since June 2004. The average of the recorded data is shown on Figure 1.5 and indicates that a significant salinity increase is measured along the Pike River - the average EC more than doubles with most of this increase occurring from Pike Lagoon to just downstream of Col Col embankment.

The average increase is approximately 280 EC (154 mg/L). If it is assumed that the average Run-of-River (ROR) salt load increase of 70 t/d is discharging into the Pike River at an average flow of 320 ML/d, a salinity increase in the Pike River of 400 EC (220 mg/L) is implied. These figures have been used to guide the later analysis of LWMP options, but a more detailed analysis of the available flow and salinity data is required to refine these estimates.

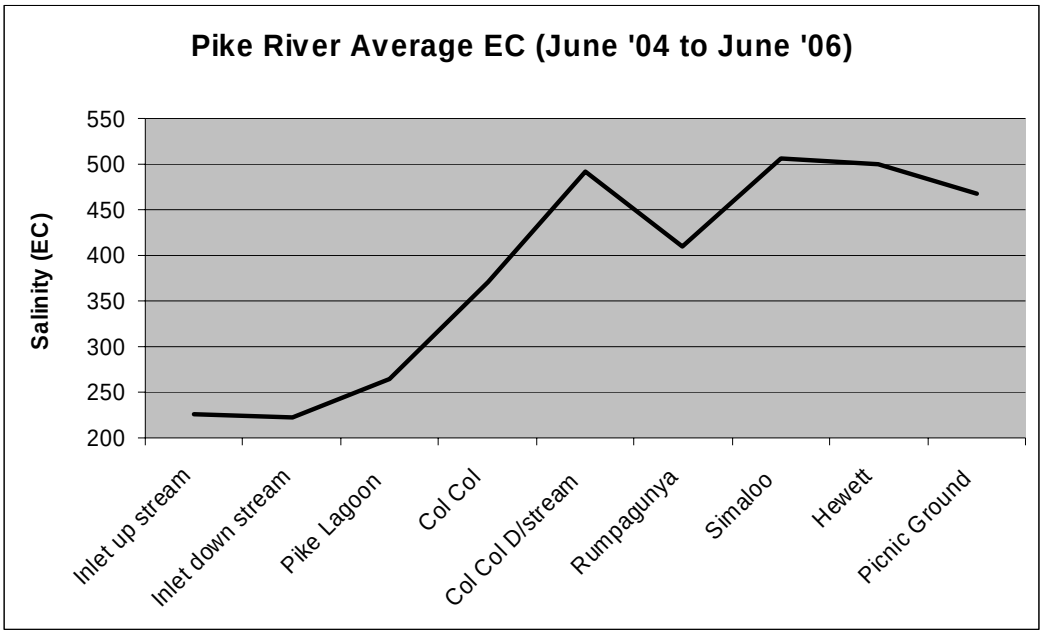


Figure 1.5: Pike River Salinity Data

1.4.2 Salt Loads to the River Murray and Floodplain

Salt Load Sources

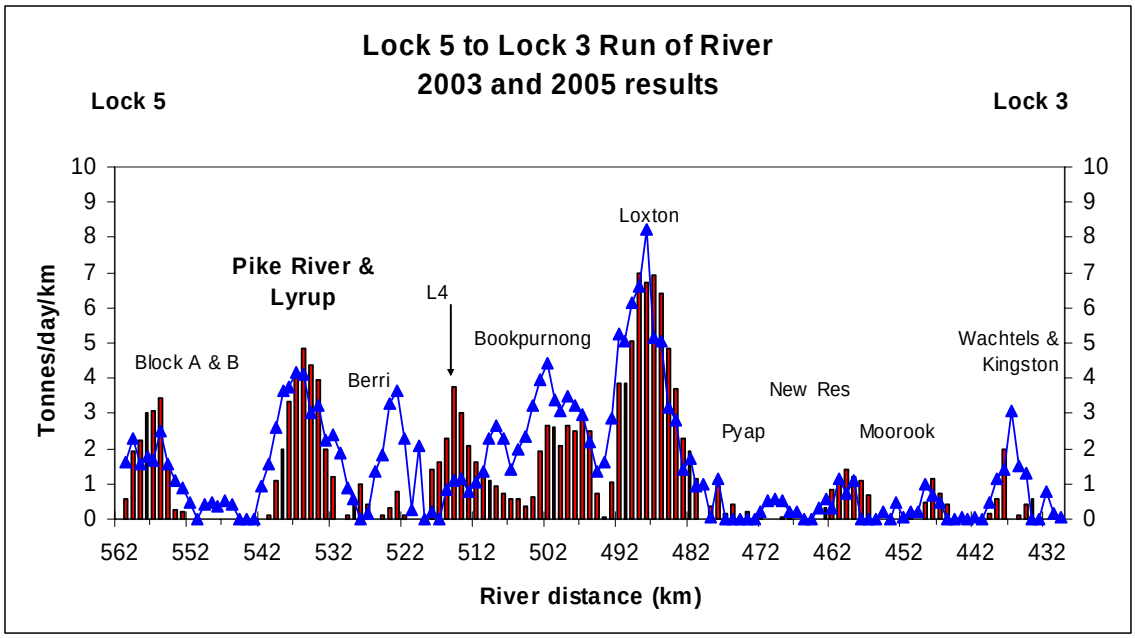
The Murray-Darling Basin is a naturally saline environment and the basin exports salt via discharge to the River Murray and its tributaries out to sea. Human influences over the past 100 years or more including river regulation, land clearance and irrigation development have modified the way in which salt moves through the landscape. These practices have increased the rate at which water and salt can move from the soils into the water table and then to the floodplain environment, creeks and river channels. Increased salinisation of the floodplain, rivers and creeks in the Pike River LWMP area are a result of:

- The naturally high salinity levels of the groundwater.
- The fact that the river and floodplain is the discharge or drainage point for the surrounding groundwater systems.
- Raised water tables on the floodplain due to the installation of locks and weirs.
- Iirrigation activities which create drainage even at efficient irrigation levels, which then raises groundwater levels increasing the rate of discharge to the river and floodplain.
- Clearance of native vegetation which has increased the amount of rainfall which can reach the water table (known as “dryland recharge”) with a resulting rise in the rate of groundwater discharge to the river and floodplain.

River Salinity Surveys

River salinity surveys (Run-of-River or ROR) are periodically undertaken by DWLBC in the main river channel. Data from surveys to date indicate that on average, around 70 t/d of salt discharges from the Pike River system back into the River Murray. The most recent surveys in 2003 and 2005 (Figure 1.6) indicated salt loads of 31 t/d and 27 t/d, respectively. These lower than average results may be a result of the recent drought conditions which have returned low salt loads in other regions along the River Murray, possibly due to declining rates of groundwater discharge arising from low rainfall conditions.

Figure 1.6: 2003 and 2005 ROR Survey Results



Note: Bars show 2005 data, triangles show 2003 data

Future Salt Loads

The results of groundwater modelling provided by DWLBC indicate that total salt loads discharging to the Pike River area will increase from the current levels of 170 t/d to 208 t/d by 2050. These salt loads have been adopted as the in-stream impacts, but there is a significant discrepancy between the current measured in-stream salt load of around 70 t/d and the modelled salt load of 170 t/d. For the purposes of the LWMP options analysis the salt loads reported in the approval submission have been adopted, however further work should be done to resolve the discrepancy between modelled and measured salt loads.

The discrepancy may be largely explained by the modelled salt loads representing the total salt flux into both the rivers and creeks which are directly measured as increased salinity levels, and also that salt which is stored within the floodplain aquifers and causes floodplain salinisation. The stored salt can also be released following flood events which can create high salinity spikes on flood recessions. In the case of the Pike floodplain which is highly salinised it is likely that

the storage of floodplain salt is a significant process. The data in Table 1.4 includes an estimate of floodplain salt load storage rates and future in-stream salt loads assuming the storage rate remains constant. These data have not been used in any further economic analysis of LWMP options as they are inconsistent with DWLBC data, but they provide an indication of the potential significance of floodplain salt storage and the need for further investigations to quantify the process.

Table 1.4: Modelled Salt Load Trends

	Modelled Salt Load (t/d) - DWLBC			
Sub-area	**2005**	**2015**	**2025**	**2050**
Upper Pike	43	47	54	68
Mid Pike	64	65	64	66
Simarloo	36	42	42	44
Lyrup and Salt Creek	27	25	26	30
Total	**170**	**178**	**186**	**208**
Measured	80	-	-	-
Implied salt load storage (%)	53%	Storage rates assumed to remain constant		
Possible future in-stream salt load (t/d)	**-**	**84**	**88**	**98**
Possible future stored salt (t/d)	**-**	**94**	**99**	**110**

1.4.3 Floodplain and Highland Vegetation

Floodplain

Approximately 5,657 hectares of remnant vegetation occurs on the floodplain of the Pike River LWMP area (MDBC data set). Of the remaining floodplain vegetation, 227 hectares is protected in the Pike River Conservation Park. There are no Heritage Agreements within the floodplain.

The various plant communities present are discussed below.

River Red Gum (*Eucalyptus camaldulensis var. camaldulensis*) and River Box (*E. largiflorens*) Open Forests and Woodlands

Red Gum and River Box Forests and Woodlands cover approximately 3,000 hectares of floodplain in the Pike River LWMP area (Figure 1.7). *Eucalyptus camaldulensis* communities are located along the main channel and wetlands while *E. largiflorens* occurs adjacent to, and/or in association with, *E. camaldulensis* on slightly elevated terraces and floodplains.

These communities usually support understories dominated by Lignum (*Muehlenbeckia florulenta*), Cooba (*Acacia stenophylla*), chenopod shrubs, sedges and/or grasses.

River Red Gums require flooding approximately every 2 years to promote germination and maintain health and vigour, while River Box require flooding every 10 years (Kahrimanis et al, 2001). As a result of altered flooding regimes (due to the installation of locks, weirs and other structures along the river) there has been a deterioration in the health and reproductive capacity of many of the floodplain populations.

Analysis of DEH data sets indicate that 21% of Redgum and Black Box is classed as healthy, 73% unhealthy and 6% dead. Much of the unhealthy vegetation, both Red Gum and River Box, is found throughout the LWMP area fringing the main river channels and backwaters (Figure 1.8).

Management issues which may negatively impact on remnant vegetation communities on the floodplain include raised water tables which can waterlog and salinise root zones; grazing (both stock and rabbits) which impedes regeneration, removes understorey vegetation, compacts soils and causes erosion; competition from weeds, in particular woody weeds such as willows; and recreation activities such as camping and boating which have the potential to fragment, trample and/or damage native vegetation.

A graphic model of the risks to floodplain health is presented on Figure 1.9 which illustrates the range of factors that need to be considered for vegetation and floodplain health management.

Other plant communities that occur on the floodplain are discussed below:

Lignum (*Muehlenbeckia florulenta*) Tall Shrubland over Ruby Saltbush (*Enchylaena tometosa*), Samphire (*Halosarcia pergranulata ssp. pergranulata*) and Austral Seablite (*Suaeda australis*). Lignum shrublands depend on regular patterns of flooding, however they can

survive for long periods without rainfall or flooding and prolonged flooding may in fact result in the death of Lignum plants.

***Atriplex lindleyi ssp. lindleyi* Low Open Shrubland** +/- Bindyi (*Sclerolaena muricata*) +/- Berry Saltbush (*Atriplex semibacata*).

Bindyi (*Sclerolaena tricuspis* / *S. brachyptera* +/- Hard-head Daisy (*Brachyscome lineariloba*) +/- Clay Plantain (*Plantago cunninghamii*) Low Sparse Shrubland occurs on clays on the plains and lakes.

Desert Glasswort (*Pachycornia triandra*) +/- Round-leaf Pigface (*Disphyma crassifolium* ssp. *clavellatum*) Low Open Shrubland.

Cane-grass (*Eragrostis australasica*) Hummock Grassland occurs on seasonally wet clay soils, but not in saline depressions. Lignum (*Muehlenbeckia florulenta*) is also present.

Salt Couch (*Sporobolus virginicus*) +/- Rat-tail Couch (*S. mitchellii*) +/- Bindyi (*Sclerolaena tricuspis*) Low Grassland has been recorded on the floodplain and on the edges of billabongs. Salt Couch is usually recorded as an understorey species in *E. camaldulensis, E. largiflorens* and *M. florulenta* communities and is possibly increasing in abundance where the soils are more saline.

Bulrush (*Typha domingensis* and *Typha orientalis*) Tall Sedgelands in swampy areas.

Poached-egg Daisy (*Polycalymma stuartii*) / Ruby Saltbush (*Enchylaena tomentosa*) Forbland.

Highland

Approximately 6,216 hectares of remnant mallee, shrubland and grassland communities occur across the highland areas of the Pike River LWMP area. These remnants tend to be sparse and isolated with little or no connectivity to the river corridor and floodplain environment. Of the approximately 6,216 hectares of highland vegetation remaining, 895 hectares of native vegetation is conserved in one Heritage Agreement in the highlands of the Pike River LWMP area. There are no NPWSA Reserves.

The biodiversity of these remnants is often subject to the negative impacts of a number of factors, including grazing (both stock and feral animals), weed invasion, tracks and trails, wildfire, wood collecting, and the effects of adjacent farming practices (i.e. fertiliser/pesticide/herbicide spray drift).

Remnant plant communities that occur in the highlands of the Pike River LWMP area include the following:

Yorrell (*E. gracilis*) / Red Mallee (*E. oleosa*) is the most common mallee community remaining. It occurs on sand to clay loams across the plains, hills and dunes and dominant understorey species include Dryland Tea-tree (*M. lanceolata*), Bindyis (*Sclerolaena diacantha* and *S. uniflora*), Spear-grass (*Austrostipa* sp.), Pointed Twinleaf (*Zygophyllum apiculatum*) and Erect Bluebush (*Maireana pentatropis*).

Narrow-leaved Mallee (*E. leptophylla*)/Red Mallee (*E. socialis*) over Dryland Tea-tree (*Melaleuca lanceolata*) and Spinifex (*Triodia irritans*) also occurs on dune crests, plains and swales.

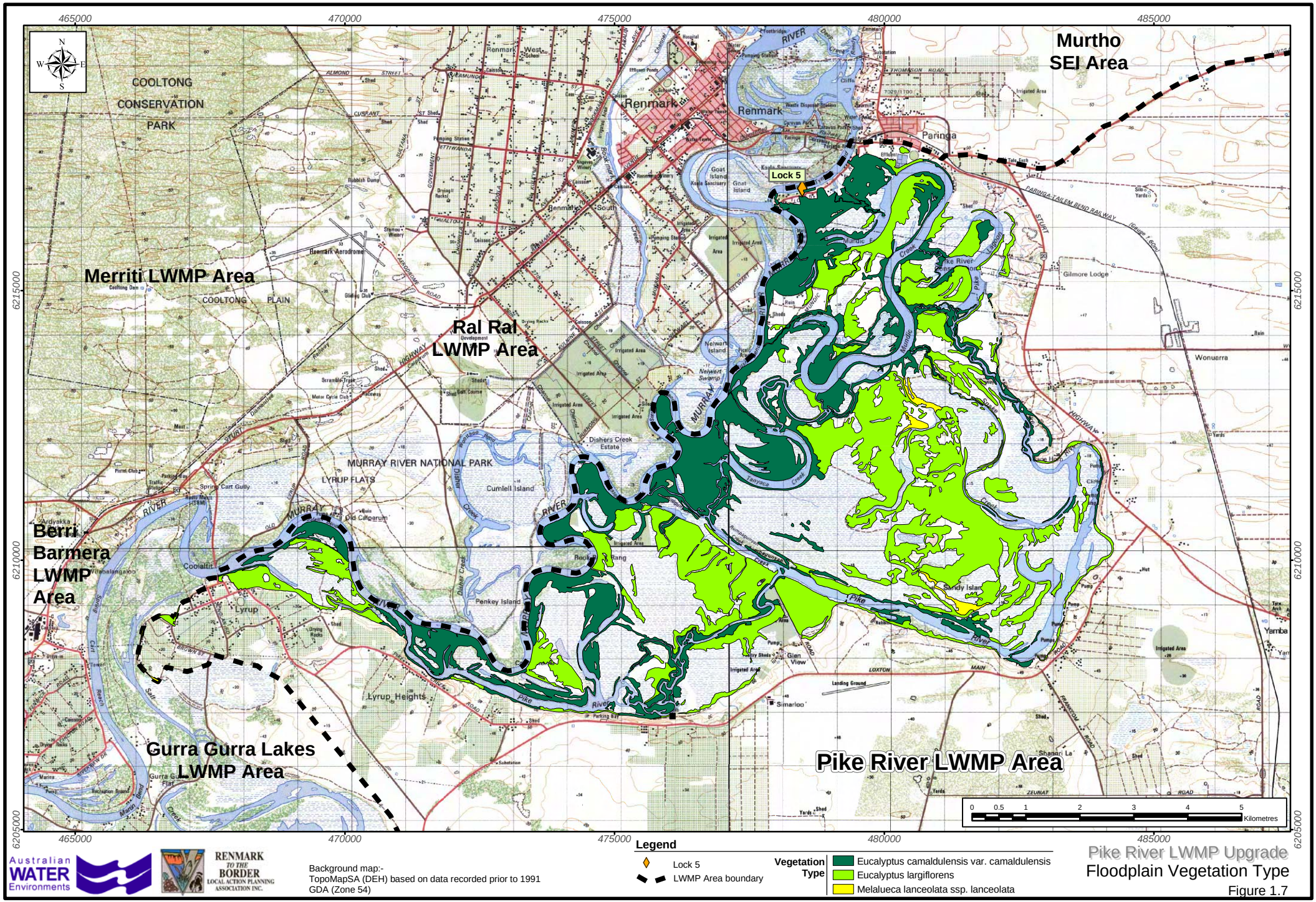
Small patches of **Blue-leaf Mallee (*Eucalyptus cyanophylla*) +/- Red Mallee (*E. socialis*)** occur on dune crests in the Pike LWMP Area. The understorey is mapped as Dark Turpentine Bush (*Beyeria opaca*), Spinifex (*Triodia irritans*) and chenopod shrubs. *E. cyanophylla* is endemic to the mallee in far north-western Victoria and the upper Murray Mallee in South Australia. It is considered to be a poorly conserved plant community (DEH, 2001) and most remaining areas are small and/or degraded.

Black Oak (*Casuarina pauper*) Woodland occurs on deep red-brown loamy sand in interdune areas above the first terrace of the River Murray. The open shrubby understorey includes Bullock Bush (*Alectryon oleifolius* ssp. *canescens*), Senna (*Senna artemisioides*) and Ruby Saltbush (*Enchylaena tomentosa*).

Spine Bush (*Acacia nyssophylla*) and Hop-bush (*Dodonaea viscosa* ssp. a*ngustissima*) Shrublands occur on the plains

Black Bluebush (*Maireana pyramidata*) Shrubland over Stipa sp. Tussock grasses. Associated species include Spiny Saltbush (*Rhagodia spinescens*) and Ruby Saltbush (*Enchylaena tomentosa*).

Scattered patches of **Spear-grass (*Austrostipa* sp.) Low Open Tussock Grassland**. Other sub-dominant species recorded include Bindyis (*Sclerolaena diacantha, S. obliquicuspis* and *S. uniflora*) and Ruby Saltbush (*Enchylaena tomentosa*). These areas may once have supported at least a sparse covering of trees and/or shrubs.



Legend

- Lock 5
- LWMP Area boundary

Vegetation Type

- Eucalyptus camaldulensis var. camaldulensis
- Eucalyptus largiflorens
- Melalueca lanceolata ssp. lanceolata

Background map:-
TopoMapSA (DEH) based on data recorded prior to 1991
GDA (Zone 54)

Australian WATER Environments

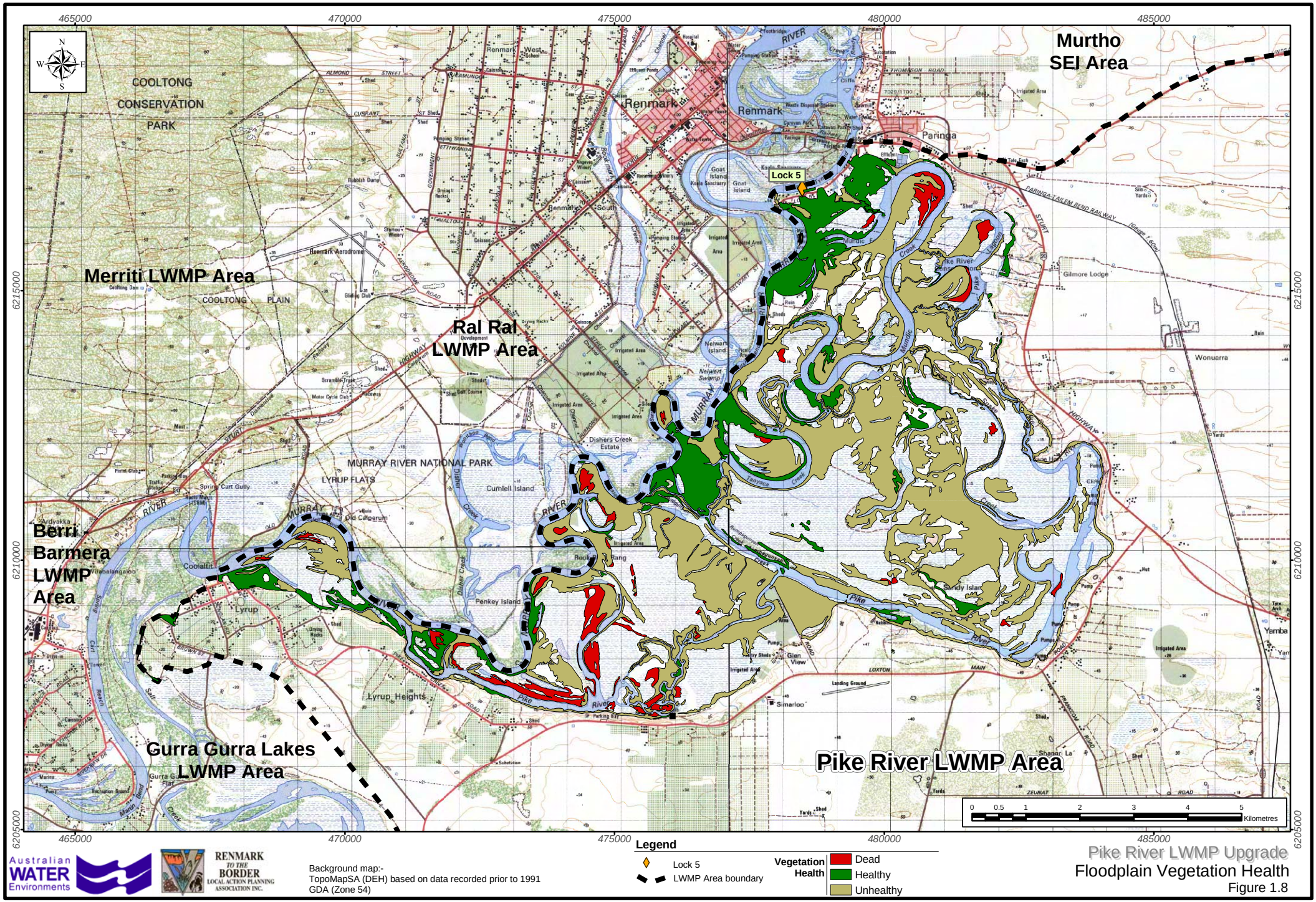
RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

Pike River LWMP Upgrade

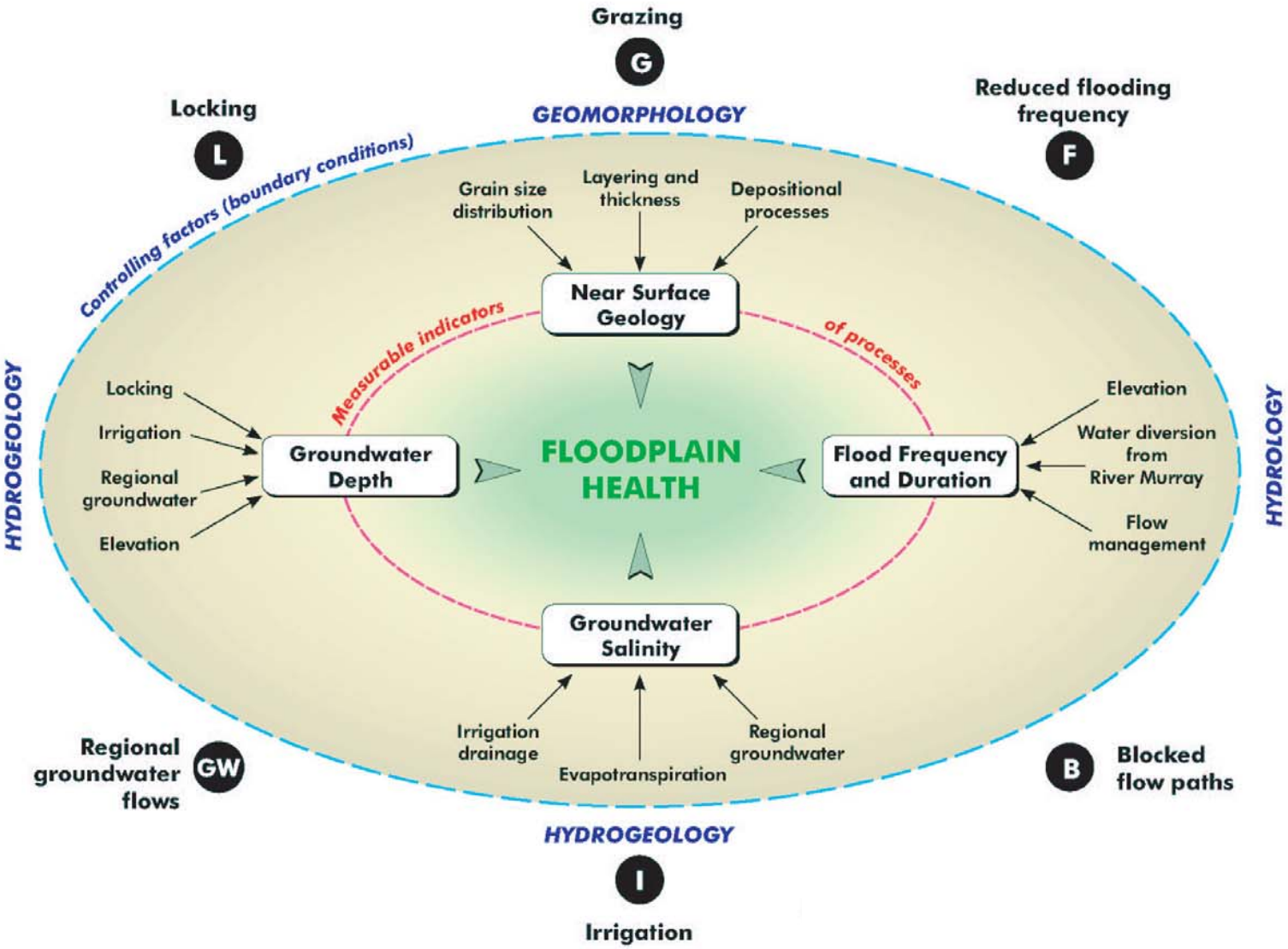
Floodplain Vegetation Type

Figure 1.7

Job No. 44667a - 103



Job No. 44667a - 104



Source: AWE (2000). Pyap to Overland Corner Floodplain Vegetation Assessment. Prepared for the Loxton to Bookpurnong Local Action Planning Association.

Pike River LWMP Upgrade

Floodplain Health Model: Potential Risk Factors

Figure 1.9

Job No. 44667a - 105

1.4.4 Floodplain and Wetlands

There are no Ramsar sites listed within the Pike River LWMP area, however the entire complex is listed in the "Directory of Important Wetlands" (Woodward Clyde 1999).

The Pike floodplain is also registered on the Australian Heritage database with the following statement of significance:

"This area is situated immediately below Lock 5; the water level thus fluctuates in a way approximating original conditions. The dense vegetation of red gum and lignum is therefore of great conservation value. Of high educational significance as it is an example of currently eroding processes and exposes the various geological strata."

(http://www.deh.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;place_id=7859).

A graphic which summarises the processes which affect floodplain health is presented on Figure 1.9. Many of these processes are active in the Pike River LWMP area and it is understood that the Pike floodplain will be the subject of a further study into floodplain health management in late 2006.

1.4.5 Aquatic Biodiversity

A recent study was undertaken to assess barriers to fish passage in off-channel habitats along the River Murray in SA (SARDI 2005). The study highlights that the Pike/Mundic anabranch system represents an important area for fish habitat and passage due to the physical nature of the backwaters and the fact that the system bypasses Lock 5. The system is known to support diverse fish assemblages including threatened migratory species such as Murray cod. The study ranked the structures on the Pike/Mundic system according to their potential impact on fish passage. The highest ranking barriers were found to be those that are on primary or secondary anabranches leading directly to the river and which have good in-stream habitat such as woody debris and aquatic vegetation.

1.4.6 Hydrogeology

Groundwater Flow

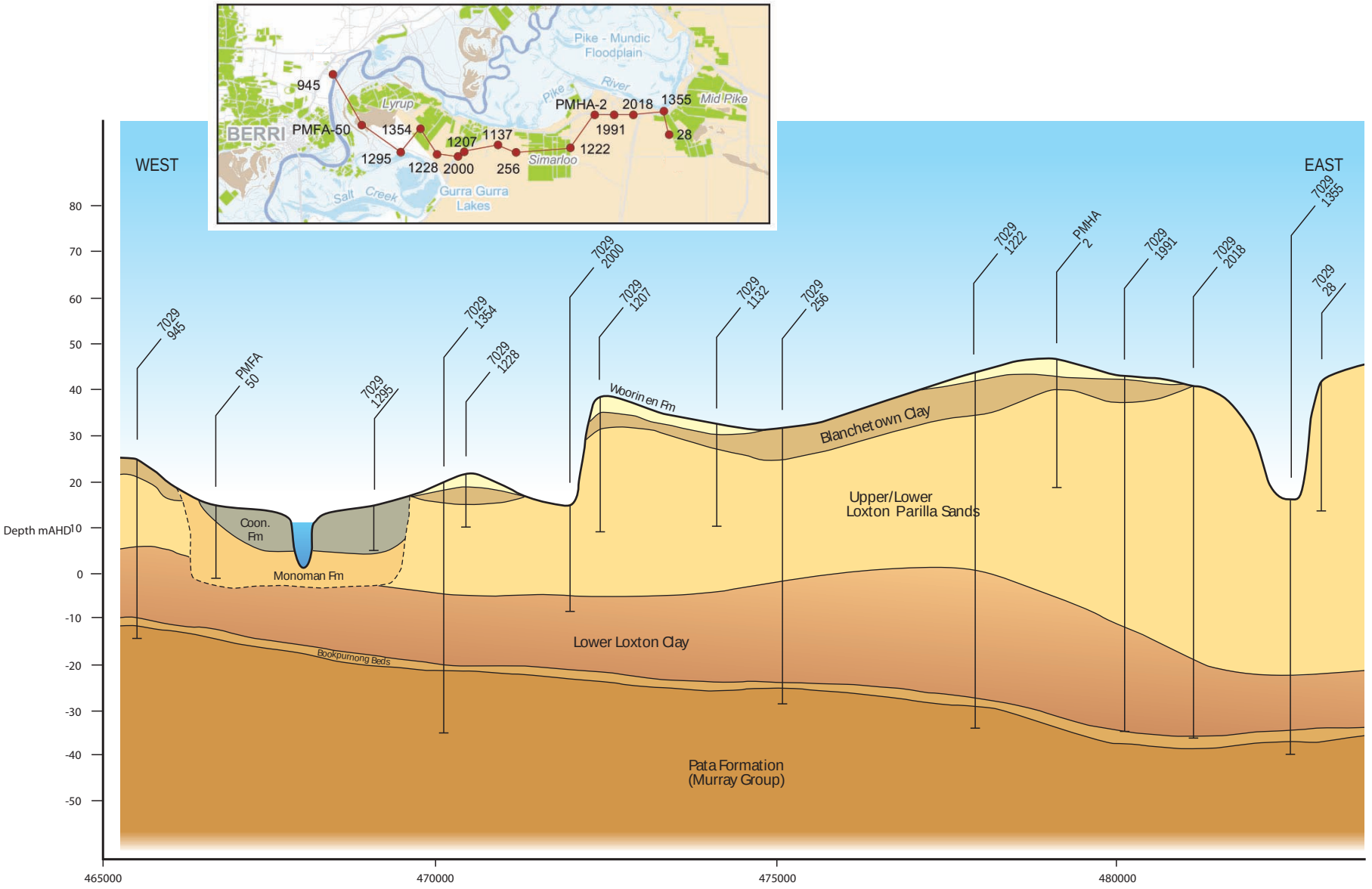
The regional water table in the Pike River district lies within the Pliocene Sands aquifer outside of the river valley, and in the Monoman Formation sands on the floodplain. The deeper confined Murray Group Limestone aquifer is separated from the water table aquifers by the combined Lower Loxton Sands and Bookpurnong Beds aquitard. The relationships between these aquifers are shown on the cross section (Figure 1.10).

The River Murray is a drain for the regional groundwater systems. Groundwater flow from the east converges on the Pike River anabranch and flow from the south converges on the Loxton to Pike River area. The Pike River area is therefore a major discharge zone for regional saline groundwater flow. These discharge zones are displayed as red hatching on Figure 1.11 which

shows flow from beyond the Sunraysia district in Victoria discharging to this area. Discharge from the confined Murray Group Limestone is low in the Pike River area but increases to the west of Overland Corner. Locally, the recharge of irrigation drainage to the water table has modified groundwater flow directions and created groundwater mounds in some areas. These effects are shown on Figure 1.12

Groundwater Salinity

In the Riverland Region of South Australia the groundwater is highly saline as a result of many thousands of years of salt accumulation, both locally and from eastern areas of the Murray-Darling Basin. Natural groundwater salinity in the district generally ranges from 20,000 EC to more than 80,000 EC (sea water is around 50,000 EC). The higher values are found in areas where water tables are shallow and evaporation from the water table causes a concentration of the salts. This occurs in an area extending from the Mid Pike to the southeast, and from Gurra Gurra Lakes towards Noora (Figure 1.13). In localized areas under irrigation, the passage of irrigation drainage to the water table has resulted in dilution of the natural groundwater, so for example at Lyrup heights groundwater salinity of less than 10,000 EC has been measured. These effects would vary greatly throughout the irrigated areas depending on the age of irrigation and the nature of the soils between the ground surface and the water table. However, because of the very slow rates at which groundwater moves, there is still many decades of high salinity groundwater that will continue to discharge to the river and floodplain environment.



Pike River LWMP Upgrade

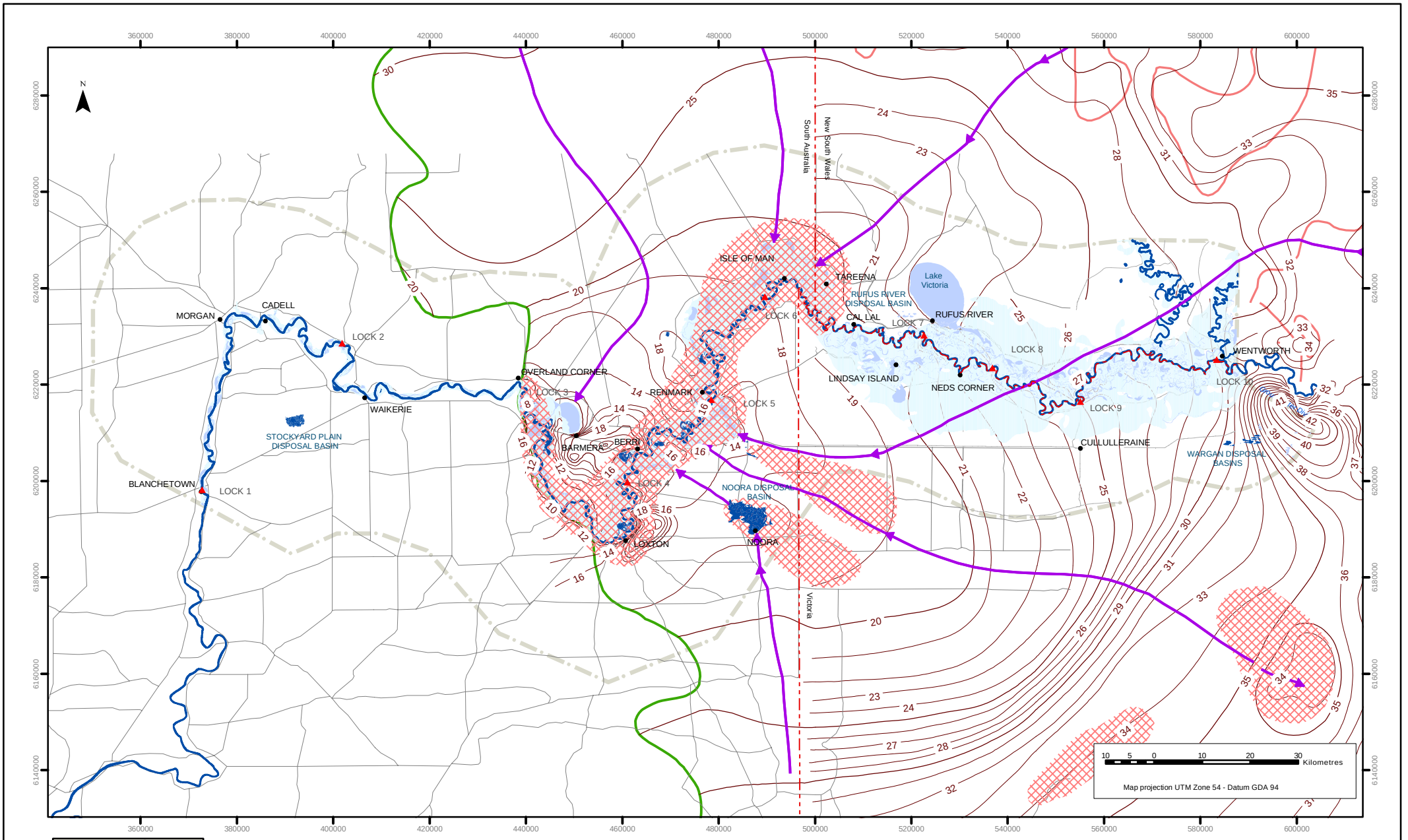
Hydrogeological Cross Section

Figure 1.10

Australian WATER Environments

RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

Job No. 44667a - 106



Location Map

RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

Australian WATER Environments

Date: Mar. 03
Data Source:
SA base data, apart from some water related layers, obtained from DEH.
SA layers relating to surface and groundwater obtained from DWLBC.
Victorian base layers obtained from NRE.
NSW base layers obtained from DWLC.
NSW and Victorian wetland layers obtained from NSW Murray Wetland Working Group.
New layers have been created by AWE, which may include info. from some base layers.
Groundwater contours provided by MDBC except for minor amendments made by AWE.

LEGEND

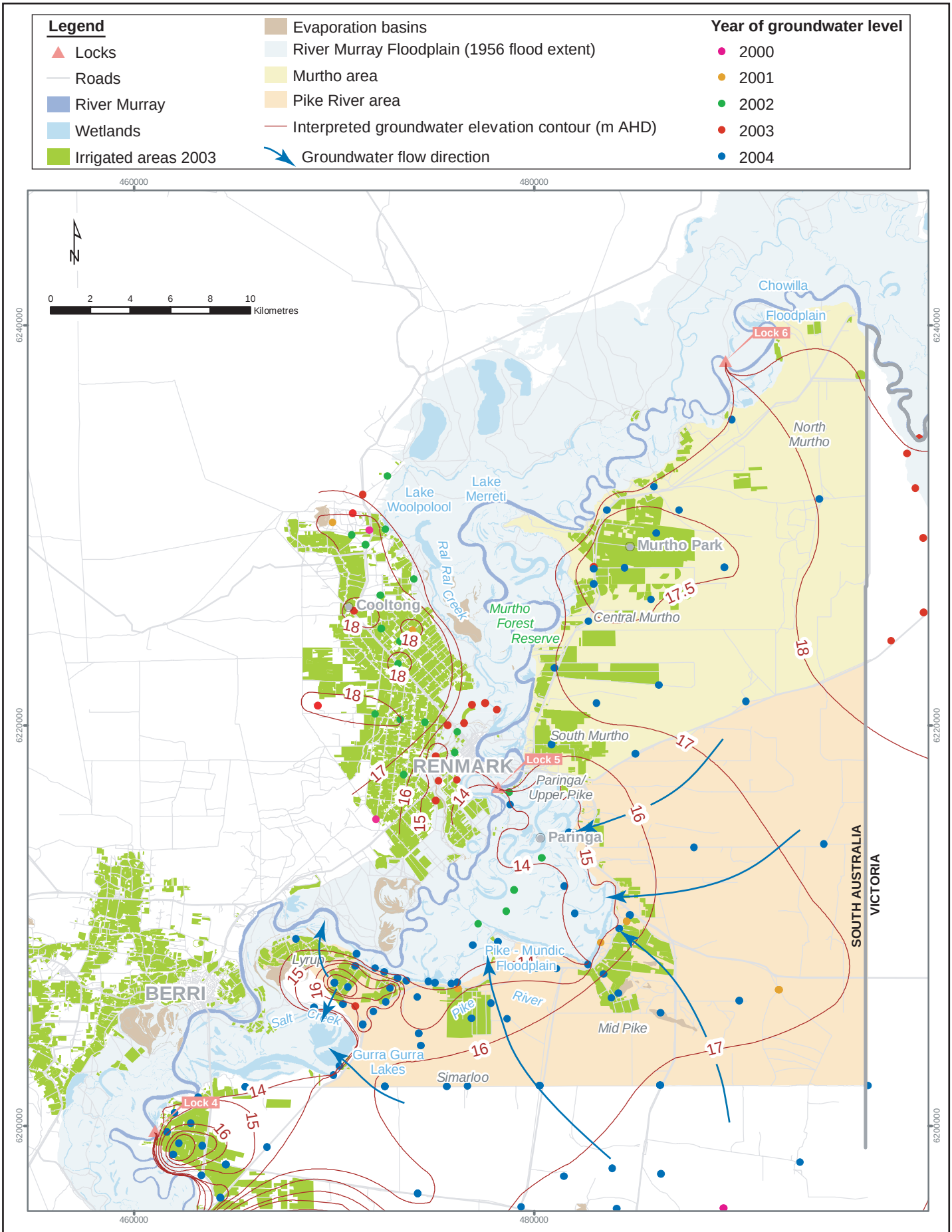
- Direction of Groundwater Flow
- Aquifer Boundary
- Confined / Unconfined Boundary (Ticks Point Towards Confined)
- 1997 Groundwater Elevation (mAHD)
- Discharge Area
- River Murray
- Wetlands
- Disposal Basins
- Flood Extent
- RDS Study Area
- Locks
- Major Towns
- Roads
- State Border

Pike River LWMP Upgrade

Regional Groundwater Flow
(Pliocene Sands Aquifer)

Figure 1.11

Job No. 44667a - 107



Pike River LWMP Upgrade

Local Groundwater Contours and Flow Directions

Australian WATER Environments

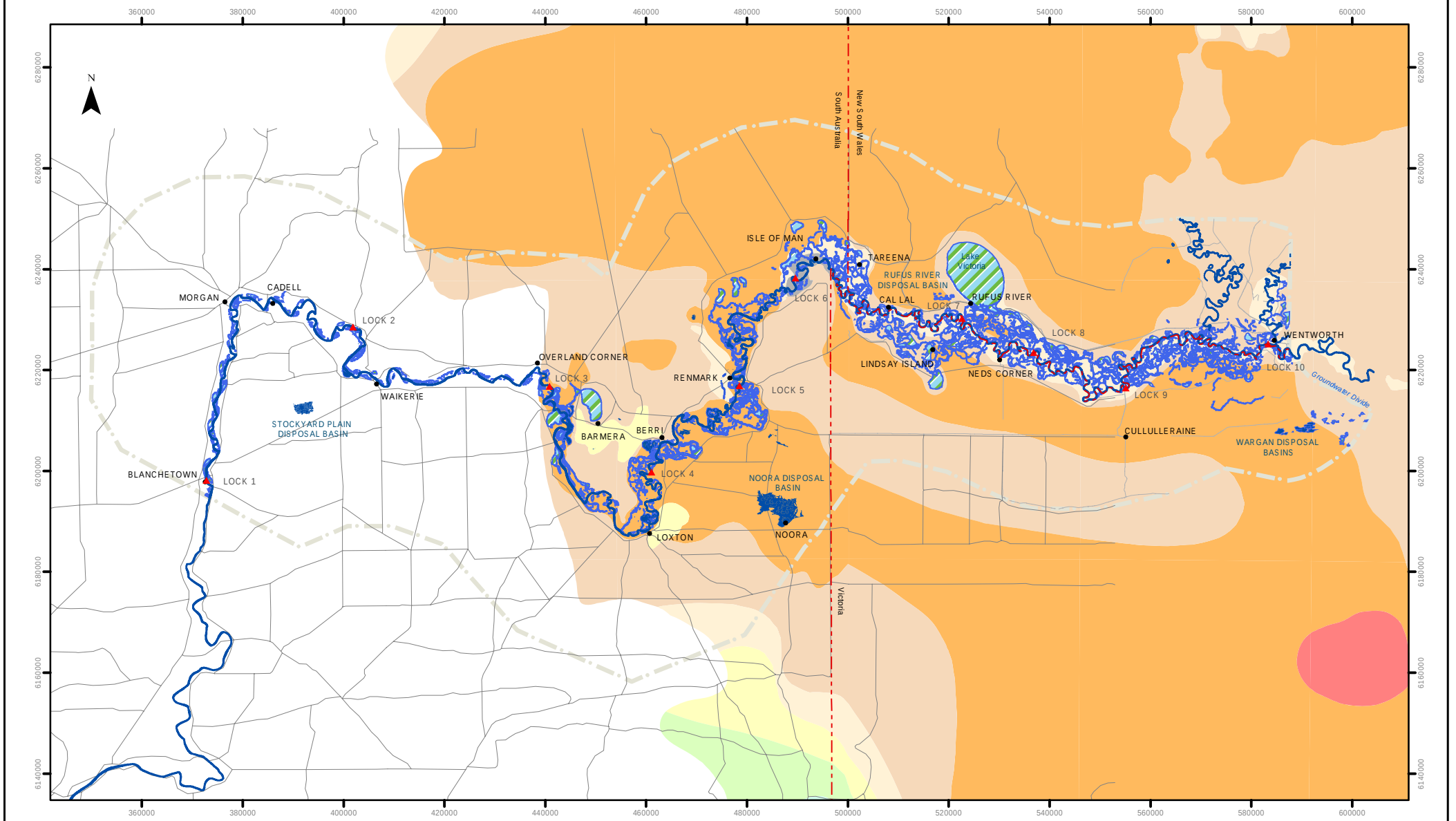
RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

GDA (Zone 54)

Figure adapted from "DWLBC *et. al.*, 2005"

Figure 1.12

Job No. 44667a - 108



Location Map

RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

Australian WATER Environments

Date: Mar. 03
Data Source:
SA base data, apart from some water related layers, obtained from DEH.
SA layers relating to surface and groundwater obtained from DWLBC.
Victorian base layers obtained from NRE.
NSW base layers obtained from DWLC.
NSW and Victorian wetland layers obtained from NSW Murray Wetland Working Group.
New layers have been created by AWE, which may include info. from some base layers.

LEGEND

Salinity Levels

- No Data Available
- < 500 mg/L
- 500 - 1000 mg/L
- 100 - 1500 mg/L
- 1500 - 3000 mg/L
- 3000 - 7000 mg/L
- 7000 - 14000 mg/L
- 14000 - 35000 mg/L
- 35000 - 100000 mg/L
- > 100000 mg/L
- River Murray
- Wetlands
- Disposal Basins
- RDS Study Area
- Locks
- Major Towns
- Roads
- State Border

Pike River LWMP Upgrade

Regional Groundwater Salinity

Figure 1.13

Job No. 44667a - 109

2. LWMP Development in the District

2.1 LWMP Investigations to Date

2.1.1 Previous LWMP Investigations

The Land and Water Management Planning process in the South Australian Murray-Darling Basin over the last decade or so has provided an opportunity, through the Local Action Planning process, for communities to become closely involved in the management of their local natural resources. In the Riverland of SA, this has created a strong focus on the investigation and development of management strategies for irrigation water use, wetland and floodplain health and salt loads to the River Murray, caused by the interactions of irrigation and the naturally saline groundwater environment.

Concern over the level of impact occurring in the Pike River area resulted in the Renmark to the Border Local Action Planning Committee helping to establish the Pike River Land Management Group (PRLMG). Through this group, Natural Heritage Trust funding was sought and consultants were engaged in the early 1990s to undertake a range of assessments culminating in the delivery of the Phase 1 LWMP in 1999 (Woodward Clyde 1999).

The plan outlined a range of strategies, some of which were already in the early stages of being implemented by irrigator's i.e. improving on-farm irrigation practices and reducing water use. Key strategies identified included Salt Interception Scheme (SIS), education and change program, revegetation program and provision of increased flow into the Pike system. Further details of these and other recommended strategies are detailed in the Phase 1 LWMP (Woodward Clyde, 1999).

2.1.2 LMWP Guidelines and Case Study

Following the recognition that various LWMPs throughout SA were being developed to different levels and with inconsistent community consultation programs, guidelines were produced for the future development and upgrading of LWMPs (Marsden Jacob 2004). The guidelines provide a consistent series of steps which can be followed to produce a LWMP that is technically rigorous and provides linkages with other programs, but above all is developed with an appropriate community consultation process that ensures the resulting plan is owned by the community it represents.

Following the development of the guidelines, a LWMP case study was implemented which firstly involved the comparison of a number of LWMPs against the guidelines. The LWMPs selected were Pike River, Murtho, Bookpurnong Lock 4 and Taylorville North and the detailed results of the study are reported in RMCG (2005). Whilst the existing plan provided a comprehensive collection and presentation of the available technical data, the key outcomes from the review for the Pike River LWMP were that the community felt they had minimal

opportunity for input into plan development and that the LWMP as it stands is a lengthy and technically detailed document which creates difficulties for community understanding and ownership.

The study recommended that in order to upgrade the plan to guideline standard the following process is needed:

- Build skills and capacity within the committee to assist in the development and implementation of the plan but also to function as an effective committee.
- The approach for the upgrade of the plan must ensure that there is effective community consultation (both committee and more widely).
- Assess issues and options in initial goals setting.
- Develop a project plan.
- Use an assessment of assets and threats to establish LWMP priorities.
- Community participation in priority setting.
- Use an easily understood and transparent process for evaluation of options.
- Involve the community in options evaluation.

Specific content requirements for the upgraded LWMP were identified as:

- If possible, update the production and social factors associated with the plan including history and trends.
- Establish targets for the management strategies.
- Look at both on-farm and off farm management options.
- Include monitoring and reporting programs in the plan.

2.2 Pike River Land Management Group

A committee was established in the early 1990's to drive the initial development of the LWMP.

With the recent need to upgrade the Pike River LWMP to guideline standard a renewed opportunity has arisen for the Pike River Land Management Group (PRLMG) to drive the process. In this context the PRLMG has identified that its major aims are as follows:

- To contribute to and foster the Lyrup/Pike River community through the maintaining of existing employment.
- To work towards the establishment of more employment opportunities by expanding the irrigation district through the sustainable use of our land.

- To promote and actively seek the installation of a Salt Interception Scheme.
- Work towards the rehabilitation of both the Pike and Murray Rivers for the enjoyment and prosperity of future generations.

In order to achieve these major aims the PRLMG has identified that its key roles must be:

- To provide a leadership role in the community, especially to other irrigators and industry groups within the region.
- To act as a community advisory group in the development of legislation and policy.
- To represent the views of the irrigators and wider community in the Pike River irrigation area.
- To foster improved irrigation practices in the Pike River area through actions such as best management practice, water use measurement and evaluation, case study implementation, research and development projects and individual and district monitoring and reporting.
- To refine and self manage salinity accountability and offer offset options at the individual and district scale.
- To coordinate the collection of data from irrigators and report at a district scale.
- To contribute to broader environmental programs through upgrading and implementation of the Land and Water Management Plan.
- To provide in-kind work and on-farm assistance where practical.

2.3 LWMP Upgrade Project

This current study has been instigated through the Renmark to Border LAP to ensure that the Pike River LWMP is upgraded to meet the guideline standards. It is desirable that the upgraded plan will:

- Provide a complete LWMP that reflects the desired actions, outcomes and projects agreed by the community.
- Include achievable work plans and projects driven by the community.
- Consider the environmental, social and economic implications on achieving outcomes.
- Describe the process undertaken in the development of the LWMP to guideline standard including lessons learnt and recommendations for the development of subsequent LWMP documents.

Whilst much of the technical background requirements have been previously documented there is a requirement to update this information with the results of recent studies including SIS investigations, wetland management investigations, detailed irrigation crop mapping and irrigation efficiency reporting. Where appropriate this project has upgraded the technical information to current levels.

Most importantly, the project has included a staged community consultation program designed to meet the guideline requirements that the community injects their knowledge into the identification and ranking of LWMP assets and threats. The process also ensures that the preferred LWMP strategies and options are developed by the community resulting in a LWMP which the community will take forward and use to address the key issues for their district.

The information in Table 2.1 compares the scope of the LWMP upgrade project with the requirements for the upgrade process as identified in RMCG (2005).

Table 2.1: LWMP Upgrade Process

LWMP Upgrade Process Requirement	**Project Methodology**
Build LWMP committee skills and capacity	Comprehensive staged consultation program
Ensure that there is effective community consultation	As above
Assess issues and options in initial goals setting	As above
Develop a project plan	LWMP implementation and monitoring and evaluation strategies
Use an assessment of assets and threats to establish LWMP priorities	Analysis of community identification of assets and threats
Community participation in priority setting	Comprehensive staged consultation program
Use an easily understood and transparent process for evaluation of options	LWMP Guidelines methodology adopted for analysis of options
Involve the community in options evaluation	Comprehensive staged consultation program

3. Community Engagement Program

A staged community consultation program was developed in consultation with the PRLMG and the LAP. The process is described below.

Initial scoping meeting (August 29th 2005) – the LWMP Steering Committee comprising members from the Pike River community, the LAP, SAMDB NRM Board and DWLBC met with representatives from the project team to identify the most appropriate methods for consultation with the Pike River community. It was concluded that the first meeting should be between the project team and a broad representation of the irrigator community.

Irrigator Representatives Meeting (12th September 2005) – this workshop provided an opportunity for the irrigator representatives to discuss their ideas for the LWMP process and to inform the project team of issues that they considered to be of high priority. An outcome of this meeting was the need for information on SIS investigations to be delivered to the group and subsequently the wider community.

DWLBC Salinity Presentation (11th October 2005) **–** Phil Cole (DWLBC Manager Salinity Program) presented a comprehensive overview of the current salinity program initiatives that were being implemented by DWLBC. The material presented included a history of the salinity problem in SA, the development of SIS works, an explanation of the MDBC salinity register and the need for SA to be accountable for its decisions which contribute to post-1988 salt loads. Details on key current programs included the current SIS works and investigations at Pike River, Bookpurnong Lock 4, Loxton and Murtho, and the implementation of a salinity zoning policy effective July1 2005.

First Community Discussion Meeting (18th October 2005) – the first community meeting was held at the Lyrup Club and attracted in excess of 50 community members. The meeting included an overview of the need for a LWMP by Bruce Hewett (Chairperson of the PRLMG). The attendees were then divided into small groups of 8 to 10 people to hold facilitated discussion on their values, issues and future vision for their area. A full transcript of the small group discussions is provided in the appendix.

Technical Information Sheets – following the first community meeting a series of technical information sheets were developed by the project team covering some of the key issues highlighted at the meeting. The information sheets were designed to provide additional detail for community consideration prior to the second meeting. A copy of the information sheets is provided in the appendix.

Second Community Discussion Meeting (7th December 2005) – the second community meeting was held at the Lyrup Club and attracted in excess of 30 community members. The meeting was designed to provide an opportunity for the attendees, in facilitated small groups, to specifically document their LWMP assets, the value and trend of the assets, threats to the assets and what actions they would like to see to address the threats. A full transcript of the small group discussions is provided in the appendix. This data was used to then develop the analysis of district assets, values and threats leading to the development of the preferred LWMP strategies developed in the following sections of this report.

Identification of LWMP Targets and Strategies – the PRLMG, in consultation with the broader Pike River community, analysed the major threats identified previously to determine specific targets for each of these. Strategies were identified to achieve these targets and available resources identified, ranging from community involvement with LAP support to technical input from SA MDB NRM Board, DWLBC and MDBC. This process was completed during July-August 2006.

4. District Assets, Values and Threats

A full description of the district assets, values and threats identified by the Pike River community is included in the community discussion meeting transcripts provided in the appendix. The material covers a broad range of diverse issues ranging from discussions on property values to global market forces and from maintenance of environmental amenity to the economic development of the region through expansion of irrigated horticulture and tourism.

Following the first and second community discussion meetings the data obtained was used to summarise the assets, threats and potential LWMP actions to mitigate the threats. The methodology used to undertake this analysis was adapted from the LWMP Guidelines, and comprised the following.

Major Assets – those assets which were identified by all groups as being significant to consider within the LWMP process are included in Table 4.1 along with information on the scale of the asset, the asset condition and condition trend as identified by the community. A priority score from 1 to 10 (highest priority) is assigned to the asset based on an average of the small group scores.

Asset Threats and Priorities – the major threats as identified by the community are listed in Table 4.2. A threat risk rating was assigned based on community input from 1 to 5 (highest risk) and a threat trend was also assigned as 1 to 5 (worsening trend).

Asset and Threat Interactions – in order to identify the preferred LWMP strategies it is important to provide a focus on those processes which are creating the highest risks to the assets with highest values. This has been achieved by the asset / threat interaction matrix shown in Table 4.3. This process has identified that the greatest risks for the community and the Pike River LWMP area are posed by salinity, lack of flow in the Pike River system and declining water quality.

Mitigating Actions – data presented in Table 4.4 shows the threats across the top ranked according to the previous analysis step, and possible mitigating strategies identified by the community. The matrix provides a visual assessment of which strategies will address the highest priority threats and clearly shows that the key LWMP strategies which the community has identified are:

- the establishment of a Salt Interception Scheme;
- the provision of increased environmental flow down the Pike River system, and
- the continued adoption by irrigators of best practise irrigation management procedures and ongoing training and development.

Table 4.1: Major Assets Identified by the Community

Asset	Scale	Condition	Trend	Priority Score[4]	Comment
Natural Environment[1]	4,000 ha	Poor	Decline	10	Urgently requires an Integrated Floodplain Management Strategy
Water Resources[2]	320 ML/d	Good	Stable to decline	9	Includes water quality, availability and access
Farm size	Generally small to medium	Good	Stable	9	Generally smaller family holdings
Lifestyle	-	Good	Stable	9	
Property Values	$0.1 to $1.0 M	Good	Stable	9	
Land Productivity[3]	Economic analysis to provide	Good	Stable to decline	8	Includes soil conditions and capacity to provide livelihood
Recreation and Tourism	Economic analysis to provide	Good	Increase	7	

Notes:

[1] River Murray floodplain

[2] Flow in the Pike system

[3] Horticultural production

[4] 10 = highest priority

Refer to appendix for detailed community responses

Table 4.2: Asset Threats and Priorities

Threat	Risk rating (1)	Trend (2)	Priority (3)	Comment
Salinity	5	5	10	
Lack of flow in Pike system	5	5	10	Includes closure of Pike system
Development control / allocation restrictions	5	5	10	
Declining water quality	5	5	10	
Decline in biodiversity and environmental health	5	4	9	
Loss of land value	5	3	8	
Soil degradation / salinisation	5	3	8	
Lack of promotion of district	4	2	6	
Recreational impacts	2	2	4	
Poor irrigation management	2	2	4	Irrigation efficiency too high or too low
Erosion	1	1	2	

Notes:
(1) 1 to 5 with 5 as highest risk
(2) 1 to 5 where 5 is worsening trend
(3) Equals Risk Rating+Trend

Refer to appendix for more details

Table 4.3: Asset and Threat Interactions

			ASSETS							
			Natural Environment	Water Resources	Farm size	Lifestyle	Property Values	Land Productivity	Recreation and Tourism	**Total Score**
			10	9	9	9	9	8	7	
THREATS	River/creek salinity	10	20	19		19	19	18	17	**112**
	Rationalisation of flow in Pike system	10	20	19		19	19	18	17	**112**
	Development control / allocation restrictions	10				19	19	18		**56**
	Declining water quality	10	20	19		19	19	18	17	**112**
	Decline in biodiversity and environmental health	9	19	18		18	18		16	**89**
	Loss of land value	8			17	17	17	16	15	**82**
	Soil degradation / salinisation	8	18		17	17	17	16	15	**100**
	Lack of promotion of district	6				15	15		13	**43**
	Recreational impacts	4	14	13		13	13		11	**64**
	Irrigation management	4	14	13	13	13	13	12	11	**89**
	Erosion	2	12	11	11	11	11	10	9	**75**

Table 4.4: Mitigating Actions

	THREATS										
Possible Mitigating Action(s)	River and creek salinity	Rationalisation of flow in Pike system	Declining water quality	Soil degradation / salinisation	Decline in biodiversity and environmental health	Irrigation management	Loss of land value	Erosion	Recreational impacts	Development control / allocation restrictions	Lack of promotion of district
Salt Interception Scheme	√		√		√		√			√	
Increased Environmental Flow	√	√	√		√		√				
Water supply pipeline		√									
Improved irrigation management				√		√					
Grower education				√		√					
Revegetation			√	√	√			√			
Improved land management								√			
Develop tourism strategy and controls									√		
Develop district advertising strategy									√		√

5. LWMP Targets and Strategies

The following tables contain a detailed assessment of each of the key threats identified by the community. The assessments include targets for the threats, description of preferred strategies to achieve the targets and an indication of what resources are available to implement the strategies. Many of the strategies will address more than one threat so the strategies have been numbered for ease of reference. The strategy numbering is also included on the LWMP implementation program described later in this document.

Threat: ***Salinity and Declining Water Quality***

Target	Comments	Strategy	Strategy number	Resources
Installation of a **SIS** to reduce Pike salinity by 117 EC by 2035 and River Murray salinity by 12 EC at Morgan by 2035.	Inhibit further salt in system, identify future opportunities for the district.	Completion of **LWMP**, promote district efficiency (through a district efficiency report using real data to Minister for RM) and why SIS needed (health of RM). Work with DWLBC on submission to show community support to MDBC. Participation on SIS Project Steering Committee.	1	Officer support to assist with setting up projects, DWLBC Technical support, MDBC.
Investigate **capacity to expand SIS** & Noora by 2007as well as other disposal options.	Potential further development, greater pumping capacity. Community involvement.	Participate in policy development, ensure adequate capacity at Noora for all future Pike SIS water.	2	Traveling fees for interested committee members to attend key meetings in Adelaide.
Optimise irrigation scheduling and drainage across the district commencing immediately 2007 (through **IRES**).	To set a **benchmark** for irrigation drainage using real figures to eventually modify state and MDBC models for drainage.	Training, mentoring, participation in R&D trials, monitoring using real data that is on farm. System assessments are mandatory in undertaking IRES so field data out puts are entered and not manufacturers specifications.	3	**IRES** more work needed on software to download EtO forecasts and historical data, drainage trial, subsidies for scheduling equipment. SAMDB NRM - **IIEP.**
Investigate opportunity for **private ownership and operation of SIS** and **salt credits**, working with policy development 2007.	To increase capacity for irrigation behind scheme by 50 % by 2050 (to be mapped in GIS).	Training, mentoring, participation in R&D trials, monitoring using real data that is on farm. Participate in development of Pike SIS approval submission.	1, 3	Traveling fees for interested committee members to attend key meetings in Adelaide.
Ensure **nutrient levels** do not increase above baseline 2006 levels.	RBLAP will ensure samples are taken along the system twice yearly.	If a noticeable increase is measured, experts need to be consulted and strategy developed.	n/a	Analysis each year.
Best Irrigation management practice to reduce drainage. Development of **district code of practice** by end of 2007.	Although Guidelines are not completed yet, committee will use this to develop a CoP to be implemented throughout region.	Develop a district **Code of Practice** with all landholder support and review in 5 years time.	4	LAP officer support, DWLBC Technical and Policy divisions.
Develop a **flow regime** to allow for adequate extraction and ecological benefits by 2008.		Participate in **Integrated Floodplain Management Plan.**	5	LAP officer support, DWLBC Technical Support, SA MDB NRM Board.

Threat: ***Lack of Flow in the Pike System***

Target	Comments	Strategy	Strategy number	Resources
Develop a **flow regime** to allow for adequate extraction and ecological benefits by 2008.		Participate in **Floodplain Management Plan**	5	LAP officer support, SA MDB NRM Board lead, DWLBC
Freshen water up in the lower sections of the system by 2007.		Dredge mouth of Rumpagunyah for better quality water to enter system	6	DWLBC Technical, SA MDB NRM Board
Ensure all properties have been involved in **irrigation management courses** by completion of 2007, and continually explore new courses specific to the needs of irrigators in the district and the crops grown to optimise extraction volumes.		Continue to actively promote the **IIEP project,** identify future course topics and explore additional courses.	7	Funding for courses to be run in the district
Best Irrigation management practice to reduce drainage. Development of **district code of practice** by end of 2007.	Although Guidelines are not completed yet, committee will use this to develop a CoP to be implemented throughout region	**Develop a district Code of Practice** and review in 5 years time	4	LAP officer assistance, DWLBC Technical, SA MDB NRM Board

Threat: *Soil Degradation and Salinisation*

Target	Comments	Strategy	Strategy number	Resources
Ensure capacity to meet land use is not affected (or is improved).	Land uses include - irrigation, saltbush, remnant scrub, dry land, Floodplain.	Through community identify areas at risk and map on GIS layer.	8	LAP officer support, SA MDB NRM Board.
		Ensure local management contacts are in place to address management.	8	LAP officer support - when addressed follow up with specialist contacts.
		Ensure local management actions and develop education tools to assist landholders e.g. fact sheet.	8	LAP officer assistance.
		Active participation in **Floodplain Management Plan.**	5	LAP Officer support , DWLBC Technical, SA MDB NRM Board.
Improvement in social and environmental amenity over the next 5 years.	Rationalisation of camping and recreation areas; revegetation and remnant protection to 30 ha of floodplain over this time.	**Development of frontage action plans.**	9	LAP Officer assistance, MDA Sustainable Recreation Officer.
Best irrigation management practice to reduce drainage. Development of district code of practice by end of 2007.	Although Guidelines are not completed yet, committee will use this to develop a CoP to be implemented throughout region.	Develop a **district Code of Practice** with all landholder support and review in 5 years time.	4	LAP officer support, DWLBC Technical support.
Ensure all properties have been involved in i**rrigation management courses** by completion of 2007, and continually explore new courses specific to the needs of irrigators in the district and the crops grown.		Continue to actively promote the **IIEP project,** identify future course topics and explore additional courses.	7	Funding for courses to be run in the district.

Threat: *Decline in Biodiversity and Environmental Health*

Target	Comments	Strategy	Strategy number	Resources
Installation of a **SIS** to reduce Pike salinity by 117 EC by 2035 and RM salinity by 12 EC at Morgan by 2035.	Inhibit further salt in system.	Completion of LWMP, promote district efficiency (through a district efficiency report using real data to Minister for RM) and why SIS needed (health of RM).	10	LAP Officer support, DWLBC Technical, MDBC.
Develop a flow regime to allow for adequate extraction and ecological benefits by 2008.		Participate in **Floodplain Management Plan.**	5	LAP officer employment, SA MDB NRM Board.
Improvement in social and environmental amenity over the next 5 years.	Rationalisation of camping and recreation areas; revegetation and remnant protection to 30 ha of floodplain over this time.	**Development of frontage action plans.**	9	LAP Officer support.
Aquatic biodiversity Study of the Pike anabranch by 2008.	Was mentioned in " A Preliminary Prioritisation of Barriers to Fish Passage Within Anabranches and Off Channel Habitats along the River Murray SA' as potentially having significant breeding grounds for native fish.	SARDI to complete an Aquatic Biodiversity Survey.	11	SARDI to complete study in March 2008.
Develop economic value for the floodplain		Review available methods and studies and refine for the Pike district	12	SA MDB NRM Board, DWLBC, MDBC, CSIRO

Threat: *Irrigation Management*

Target	Comments	Strategy	Strategy number	Resources
Best Irrigation management practice to reduce drainage. Development of **district code of practice** by end of 2007.	Although Guidelines are not completed yet, committee will use this to develop a CoP to be implemented throughout region.	Develop a district **Code of Practice** and review in 5 years time.	4	LAP officer employment, DWLBC technical, SA MDB NRM Board.
Ensure all properties have been involved in **irrigation management courses** by completion of 2007, and continually explore new courses specific to the needs of irrigators in the district and the crops grown.		Continue to actively promote the **IIEP project,** identify future course topics and explore additional courses.	7	IIEP.
Optimise irrigation scheduling and **drainage** across the district commencing 2007.	To set a **benchmark** for irrigation drainage using real figures to eventually modify State and MDBC models for drainage.	Training, mentoring, participation in R&D trials, monitoring using real data that is on farm.	3	**IRES**, drainage trial, subsidies for scheduling equipment, SA MDB NRM Board, DWLBC Technical.

Threat: *Loss of Land Value and Development Control*

Target	Comments	Strategy	Strategy number	Resources
No decrease in land value.		Ensure targets below are achieved.	n/a	LAP officer support.
Develop '**future SIS' Zone Policy** by 2007.	Investigate whether development can occur over and above 'prior commitment' by changing zoning to 'future SIS' zone and assist in development of rules governing this new zone.	Traveling fees for interested committee members to attend key meetings in Adelaide.	1	Traveling fees.
Investigate whether **SIS zone lines** can be refined by 2007.	By collecting and reporting real data on drainage refine State government models based on drainage rate of 120 mm/year.	Traveling fees. Participate in **IRES trial and district reporting.**	1, 3	Sitting fees. Funding to continue **IRES support** and entry of irrigation records.
Thorough investigation of piping irrigation water direct from the river by 2008.	Includes economic modelling of the benefits; provide greater security of good quality water leading to increased land values.	Have a thorough investigation undertaken in the Pike River area.	13	LAP officer support, DWLBC, SA MDB NRM Board.

Threat: *Erosion*

Target	Comments	Strategy	Strategy number	Resources
Improvement in social and environmental amenity over the next 5 years.	Rationalisation of camping and recreation areas; revegetation and remnant protection to 30 ha of floodplain over this time.	Development of **frontage action plans** in conjunction with Renmark Paringa Council.	9	LAP Officer support, DWLBC, local Council Support.
Optimise **irrigation scheduling** and drainage across the district commencing immediately 2007.	To set a benchmark for irrigation drainage using real figures to eventually modify State and MDBC models for drainage.	Training, mentoring, participation in R&D trials, monitoring using real data that is on farm.	3	**IRES**, drainage trial, subsidies for scheduling equipment, SA MDB NRM Board.
Ensure capacity to meet land use is not affected (or is improved).	Land uses include - irrigation, saltbush, remnant scrub, dry land, floodplain.	Through community identify areas at risk and map on GIS layer.	8	LAP officer funding.
		Ensure local management contacts are in place to address management.	8	LAP officer support - when addressed follow up with specialist contacts.
		Develop local management actions and education tools to assist landholders e.g. fact sheet.	8	LAP officer assistance.

Threat: *Recreational Impacts*

Target	Comments	Strategy	Strategy number	Resources
Develop district advertising strategy by 2009.	Sub committee creates a focal point for external linkages.	Establish PRLMG sub-committee to start working with other organisations through a district advertising strategy.	14	Establishment meetings costs, RDC, SA Tourism, Local Tourism.
Develop a **Recreational code of practice** 2009.	Foster sustainable recreation within the district.	Promote sustainable tourism attractions within the Pike district and a code of practice in conjunction with MDA Sustainable Recreation Officer.	15	LAP officer support , MDA Sustainable Recreation Officer, SA Tourism, Field and Game, DEH.
Ensure capacity to meet land use is not affected (or is improved).	Land uses include - irrigation, saltbush, remnant scrub, dry land, floodplain.	Through community identify areas at risk and map on GIS layer.	8	LAP officer assistance.

Threat: *Restrictions on Water Allocations*

Target	Comments	Strategy	Strategy number	Resources
Minimise the effect of restrictions by rewarding good practice by 2009.	Work to change policy so that it is not a blanket restriction covering all water licenses, sliding scale for water restrictions based on performance.	Participate in development of flexible allocation policy.	16	Traveling costs for committee members.
Ensure all properties have been involved in **irrigation management courses** by completion of 2007, and continually explore new courses specific to the needs of irrigators in the district and the crops grown		Continue to actively promote the **IIEP project,** identify future course topics and explore additional courses.	7	SA MDB NRM Board - IIEP.
Best irrigation management practice to reduce drainage. Development of district code of practice by end of 2007.	Although Guidelines are not completed yet, committee will use this to develop a CoP to be implemented throughout region	Develop a **district Code of Practice** with all landholder support and review in 5 years time	4	LAP officer support

Threat: ***Lack of Promotion of District***

Target	Comments	Strategy (number)	Strategy number	Resources
Promote tourism within the district by 2009.	Sub committee creates a focal point for external Linkages.	Establish PRLMG sub-committee to start working with other organisations through a district advertising strategy.	14, 15	Establishment meeting costs, MDA Sustainable Recreation Officer, RDC, SA Tourism.
	Foster the growth of tourism within the district and establish clear goals for growth.	Promote the tourism attractions within the Pike district with the development of a dedicated website in conjunction with Tourism SA and RDC.	14, 15	Set up website.
Promote the best practice irrigation management and quality of produce within the district by 2009.	Potential investment attraction.	Complete salinity and declining water quality target and strategies. Report on CoP achievements.	4, 14, 15	LAP officer assistance.

The community has also identified that a lack of investment in the area by the various levels of Government is a significant threat to the health and sustainability of the district. Accordingly, many of the targets and strategies described above have been developed to keep the community active and involved in policy development and in the various programs and projects which can assist in maintaining and improving the districts social, environmental and economic assets. It is through this commitment that the community will strive to attract stakeholder funding into their district.

In addition to the major LWMP actions described above, a number of other actions have been identified for the protection and restoration of environmental assets. These include:

- Reduction or removal of floodplain grazing – the community and the LAP will investigate opportunities for the removal of stock from the floodplain.
- Reduction of grazing pressure by rabbits - in consultation with LWMP group annual inspections of sites believed to harbour rabbits will be carried out. Appropriate control strategies will be defined and implemented in conjunction with SAMDB NRM Board officers.
- Weed control – annual tours will be undertaken throughout the region by the LAP officer and appropriate Departmental or Board staff to monitor location, extent and type of weed and to enable management strategies to be developed.
- Investigate the potential for connecting corridors of remnant vegetation in an integrated revegetation program.
- Removal of litter and potential pollution sources (e.g. old chemical containers on floodplain) in a coordinated manner.

6. Benefit Cost Analysis

6.1 Background

When deciding on undertaking a development, it is important to estimate all the immediate benefits and costs in order to assess the full impact the project may have on the community. Benefit cost analyses are more than financial assessments, as they take into account factors beyond the farm gate, such as down-stream salinity effects. Economists deem a project is worthy of developing if the benefit cost ratio is higher than 1.0, which means the estimated benefits have a greater value than the estimated costs.

As both benefits and costs occur at different stages over time, it is important to bring these future benefits and costs back to 'current day value' estimates in order to achieve an accurate ratio. To this effect, a net present value (NPV) is used to discount the estimated flows of benefits and costs. In this analysis, a 4% discount rate has been used, as this is the rate currently being used by the MDBC. A time period of 30 years has also been used.

It is important to note that the primary aim of a benefit cost analysis is to assess the economic viability of the project and not to estimate the financial costs of funding the project, which is the task of the financial analysis. This is usually undertaken once it has been decided that the broader benefits are greater than the costs and that the project should be supported.

Inflation is not taken into account in a benefit cost analysis, as it is assumed that inflation affects benefits and costs equally. The effect of inflation and technological advancement are anticipated to cancel each other out and as a result have not been allowed for in this analysis.

When assessing a benefit cost analysis, it is also important to compare any planned solutions against the 'no plan' option. This is known as a marginal analysis, as any additional costs and benefits are measured against the 'no plan' option. This provides an accurate assessment as to which plans provide the best solution for the irrigators and the community at large, compared to doing nothing.

In undertaking the analysis, it is important to predict what is likely occur if the 'no plan' is the chosen option. While it is tempting to assume the status quo would be maintained, this is unlikely to occur as both the underground water dynamics and the economy will continue to change.

The main features that are expected in the 'no plan' are:

- There will not be an investment for the implementation of the SIS;
- The flood plain will continue to deteriorate, and
- The salinity discharged into the river from the Pike River area will increase.

This 'no plan' option is used as the basis against which other options are measured.

6.2 No-Plan Scenario

The "No-plan Scenario" provides a baseline against which the costs and benefits of LWMP implementation can be measured. A 30 year timeframe has been adopted. The trend in key measurable parameters used to analyse the impacts of doing nothing are shown in Table 6.1. The highest ranking threats as identified by the community were adopted as the key threats for analysis of the "No-plan Scenario". These threats are compared to the major asset classes in the matrix presented in Table 6.2 to provide a summary of the expected future impacts on each of the major assets.

Some of the do-nothing impacts can be quite clearly defined based on technical studies to data while others are unable to be quantified at this stage. The following discussion of each of the threats provides further explanation of the outcomes summarised in Table 6.2.

Salinity – this threat represents the continued and increasing levels of salt discharging within the Pike River LWMP area. It also includes the salt loads being exported from the Pike River LWMP area to the River Murray and the consequential impact on river EC levels at Morgan. The salt load prediction modelling results provided by DWLBC have been adopted here to determine the impacts of future salt loads on salinity in the Pike River system and therefore on the loss of crop productivity and property values, and also on River Murray salinity. Continued salinisation of the floodplain will contribute to ongoing vegetation death, currently around 180 ha (or 6% of total) based on DEH vegetation health mapping. More than 70% of floodplain vegetation is classified as unhealthy and much of this could be dead within a 20 year timeframe based on observed trends. Because future salt load increases are relatively small, it is considered that there will be little or no impact on current recreation and tourism levels.

Lack of flow in Pike system – this threat arises from not identifying and allocating additional flow into the Pike River system i.e. it describes the impacts of maintaining current flow levels and not from a reduction in flow. It can be effectively grouped together with salinity in terms of its impacts, as salt loads to the Pike River together with a maintaining of current flows will create salinity rises which contribute to the impacts shown in Table 6.2. With a continuation of current flow levels it is estimated that the salinity of water in the Pike River could increase by 117 EC over the next 30 years as shown in Table 6.1. This has implication for the health of the river system and the floodplain as well as land productivity and property values.

Declining water quality – this threat is a result of the combination of salinity and lack of flow and the impacts can be grouped with these threats.

Soil degradation / salinisation – for the floodplain environment this process is a result of the continued discharge of salt and lack of environmental flows. The impacts on property values, land productivity and recreation/ tourism have not been quantified at this stage.

In the context of Noora Basin however, there is potential for salinisation adjacent the basin to reduce the area available for dryland farming. DWLBC are currently carrying out a study which will provide estimates of future basin area under a range of assumed disposal scenarios. It is recommended that this parameter be analysed in detail when the results of the study are available.

Decline in biodiversity and environmental health – this threat has two aspects: the threat of decline in floodplain vegetation health (terrestrial) and loss of aquatic biodiversity. The loss of floodplain vegetation has an obvious and direct relationship to the asset value of the natural environment. For analysis purposes it is assumed that the healthy fringing Redgum will remain healthy with access to fresh water. Much of the vegetation classified as unhealthy on the floodplains will continue to deteriorate with ongoing salt discharge to the floodplain and lack of overbank flows. Active management would be required to reverse this expected trend.

A loss of aquatic biodiversity has implications for water quality in that the proliferation of weed species could lead to higher nutrient and silt levels in the Pike River system.

It is difficult to quantify the impacts of these parameters on property values and tourism / recreation, but the highly visible nature of these impacts means they could be significant.

Irrigation Efficiency below WAP standard– the River Murray WAP specifies a desired irrigation efficiency level of at least 85%. The results of the SAMDB NRM Board WUE survey for the 2003/04 season indicate that the district-scale irrigation efficiency probably exceeds the WAP requirement. The community recognise that there are inaccuracies in the WUE calculations and have included actions in the LWMP which promote the goal of maximising WUE at the district and farm level.

Table 6.1: Estimated Do-Nothing Trend of Key Parameters

Parameter	Current value	2015 value	2035 value	Source / comment
Irrigated area (ha)	2,388	2,388	2,388	Assumed to remain constant due to DWLBC salinity zoning policy
Salt load to Pike River	170	178	191	DWLBC model results
Salinity increase in Pike River (EC)	-	46	117	Calculated assuming average flow condition and DWLBC model results
Salt load to River Murray (t/d)	170	178	191	DWLBC model results
EC impact at Morgan (EC)	34	36	38	Calculated using MDBC ready reckoner
Salt stored in floodplain (t/d)	Unknown pending further analysis of modelled and measured salt loads to provide estimates of salt storage rates			
Area of healthy floodplain vegetation	620 ha	620 ha	620 ha	Mostly fringing River Redgum, further decline is likely to occur within the floodplain where most vegetation is already unhealthy or dead.
Aquatic biodiversity	Unknown trend but currently high value needs to be protected			
Irrigation efficiency	Assumed to be at least 85% based on results of survey			

Table 6.2: Impacts of Do-Nothing Scenario

			ASSETS						
		Score	Natural Environment	Water Resources	Farm size	Lifestyle	Property Values	Land Productivity	Recreation and Tourism
PRIORITY THREATS	Salinity	112	Salt load to increase to 191 t/d by 2035 with continued salinisation of the floodplain and loss of vegetation. Potential salinity increase in the Pike River of more than 100 EC at current flow levels.			Impact unable to be quantified	Loss of production due to increase in Pike River salinity		Little or no impact
	Lack of flow in Pike system	112							Little or no impact
	Declining water quality	112							Little or no impact
	Soil degradation / salinisation	100	See above				Considered to be relatively stable so no significant impact		
	Decline in biodiversity and environmental health	89	Currently unhealthy floodplain vegetation could be dead within 20 years, loss of aquatic species	Higher nutrient and silt levels due to proliferation of weed species			Unable to be quantified but could be significant		Unable to be quantified but could be significant
	Irrigation management below WAP levels	89	SAMDB NRM board figures indicate WUE exceed WAP guideline levels				SAMDB NRM board figures indicate WUE exceed WAP guideline levels		

An important issue raised by the irrigator community is the implementation of the Salinity Impact Zoning policy. Under an agreement with the Murray Darling Basin Commission, SA must offset the salinity impacts of all new actions which the State has agreed to since 1988 and which contribute salinity to the river. As a result, the policy, implemented in July 2005, aims to control the future impacts of irrigation-driven salt loads by specifying the following development rules:

- **Low salinity impact zones** – licence transactions will be approved provided the salinity impacts of the proposed water use can be offset by salinity credits that are available to South Australia.

- **High salinity impact zones** – licence transactions can only occur provided the salinity impacts of the proposed licence transaction can be fully offset by the proponent. An exemption applies to transactions for developments with significant commitment prior to 30 June 2003 at the specific location, but such licence transactions are also subject to the availability of salinity credits to South Australia.

- **High salinity impact (Salt Interception) zones** – licence transactions will be approved provided the salinity impacts of the proposed water use can be managed within the available capacity of the Salt Interception Scheme servicing that zone. If there is no capacity available in the scheme, this zone will be treated as the underlying zone i.e. low or high impact zone.

The Pike River area is currently zoned 'High Impact,' which means no new development can take place unless prior commitment has been proven prior to 30th June 2003 and salinity credits are available and able to be accessed. The Pike River community consider that to secure the area's future, further irrigation development is a necessity, and the establishment of a SIS will assist this. This issue has been a major driver for the community to highlight a SIS as an integral component of their preferred LWMP strategy.

6.3 Benefit Cost Analysis

The following issues have been considered when assessing the Benefit Cost Analysis:

1. Management of the Pike River floodplain

The declining environmental health of the Pike River flood plain is an issue being addressed in the Pike River LWMP. It is felt that the declining environmental health has made the floodplain less attractive for recreational and camping use, and is a negative influence on regional tourism. Managing the environment back to improved health should encourage recreational and tourism use of this area. Unfortunately, this benefit is difficult to measure from an economic perspective as the Pike River floodplain forms part of the overall Riverland tourism environment, which attracts significant tourism benefit from boating, camping and fishing. It is difficult to assess the decline in one part of the river when other healthier areas can be easily reached to satisfy the recreational and tourist demands.

Studies are currently being conducted to assess what management options are available to assist with improving the floodplain health. One management option identified by the community is the withdrawal of grazing rights on the floodplain. Currently, two farmers on the Pike River floodplain graze cattle and sheep. It is estimated that an annual combined gross income of $110,000 is gained from grazing the floodplain and these farmers will require compensation for being prevented from commercially grazing animals on this area.

2. Future development of the horticultural area

One of the benefits quantified in earlier Benefit Costs Studies conducted on SISs' in the Riverland includes the ability for continued horticultural development. However, it appears this will not be the case at Pike River.

It is understood from discussions with DWLBC that Pike River has two areas where it can achieve salt credits: the first is salt credits that will occur due to the installation of the SIS; the second is from the state-wide salt credits that have been accumulated, and these have been distributed by a scheme know as 'prior commitments'. However, as the 'prior commitment' development areas are achieved prior to any SIS installation, they do not form a part of any SIS Benefit Cost analysis.

So, the only additional horticultural development that can occur in the Pike River area would come from local salt credits earned from the installation of the SIS. In the case of Pike River, the local salinity credit calculations indicate that there will be no allowable horticultural expansion from the current planning levels at Pike River (DWLBC pers. comm.). Hence, with no further expansion allowed, there will be no benefit from further horticultural development.

3. Salinity of irrigation water from the Pike River

Previous studies have indicated that the level of salinity from water extracted from the Pike River is expected to increase. The management of this salinity would improve with the SIS. However, in both cases, the salinity levels are not expected to reach the threshold levels that would affect production of grapes, almonds, citrus or stone fruit. Hence, again there are no benefits from the SIS maintaining or improving the salinity levels on horticultural production in the Pike River area.

4. Fish breeding environment

It has recently been acknowledged that the Pike River area provides valuable native fish breeding grounds, but other studies suggest that the salinity levels being expected before or after the SIS installation do not affect native fish breeding. So, again there are no benefits to be measured from the development of the SIS.

5. Water use efficiency of irrigators

The improvement in water use efficiency allows the saved water to be valued, and this has been valued in previous benefit costs undertaken in the Riverland where SIS have been considered. However, in the case of Pike River, the available data indicate water use efficiencies to be well above the target level of 85%. So while the Pike River LWMP will be continuing to encourage high levels of water use efficiency, it is assumed that little additional water will be saved from further improvements in efficiency and hence no additional benefits will occur.

6. SIS

The installation and maintenance costs of the Pike River SIS have been taken from the 'Pike River and Murtho Salt Interception Scheme Approval Submission – Concept Design'. These costs have been used in the Benefit Cost Analysis.

7. EC values at Morgan

The benefits of an estimated $101,000/EC unit decrease at Morgan has been used in this Benefit Cost analysis. This was also the value used in the 'Pike River and Murtho Salt Interception Scheme Approval Submission – Concept Design'.

6.3.1 Benefits and Costs

A summary of the benefits and costs when comparing the 'No Plan' and the 'With Plan' cases are shown in Table 6.3.

Table 6.3: Lists of Benefits and Costs No Plan and With Plan Cases

No Plan	
Benefits	❑ No additional expenditure on drainage or salt interception schemes would occur
Costs	❑ Continued degradation of the flood plain environment
With Plan	
Benefits	❑ The decrease of salinity discharged into the River Murray System
Costs	❑ Cost of implementing the SIS

Table 6.4 indicates the benefits and costs that have been valued in the benefit cost analysis. This table indicates that the only benefit that has not been valued is the health of the floodplain.

Table 6.4: Benefits and Costs

Benefits

Priced	Unpriced
1. Decreased salt entering the River (EC value at Morgan)	2. Improvement in floodplain environment, which would benefit regional tourism.

Costs

Priced	Unpriced
1. Cost of implementing and operating a SIS in the Pike River area 2. Cost of rehabilitating the flood plain environment at Pike River	

6.3.2 Benefit Cost Results

A great deal of detailed calculation has been performed in the benefit costs analysis constructed and reported in the 'Pike River and Murtho Salt Interception Schemes Approval Submission – Concept Design'. Hence it was felt this analysis was very suitable in reviewing this benefit costs for use in the Pike River LWMP. The results for the Pike River are reported in Table 6.5 and indicate that the implementation of the SIS is economically viable. Simply, the measured benefits are greater than the costs when measured over a 30-year time frame.

Table 6.5: Benefit Cost Analysis Results

Discount Rate	4%
Present Value of Benefits ($m)	$44.3
Present Value of Costs ($m)	$35.1
Net Present Value ($m)	$9.2
Benefit Cost Ratio	1.26

In some respects, this result can be viewed as conservative as the benefits that come from improving the Pike River flood plain environment have not been measured (Table 6.4). If they were it would be expected that the benefit cost ratio would be further improved.

7. LWMP Implementation Strategy

7.1 Stakeholder Contact

It is proposed that contact will be made with all relevant current and potential LWMP stakeholders following the completion of this upgraded LWMP for stakeholder comment and review. A working list of key external stakeholders and potential funding partners is provided below.

Local Government:

District Council of Renmark and Paringa – potential to provide assistance with district advertising and awareness strategy, promotion of tourism and promotion of irrigation management and crop produce quality from the district.

State Government:

Minister for the River Murray

SAMDB NRM Board – can provide required data sets for many applications and also administer ongoing and specific projects with high relevance to this plan including the Water Resources Act, River Murray WAP and CWMP, the INRM plan, Floodplain Management Guidelines, the IIEP, District Irrigation Code of Practice Guidelines, and technical support funding.

DWLBC – are currently investigating the Pike River SIS and also administer relevant State legislation and policies including water licensing, salinity zoning and water transfer assessments. In addition the Hydrography unit at Berri collect and store relevant hydrological data sets including the ROR surveys.

PIRSA – provides a technical resource for farm-scale assessment of soil and crop management.

SA Water – as operators of the River Murray and associated infrastructure will need to be involved in any decision which could modify the way in which the hydrology of the system is managed or changed e.g. changes to flow regimes, weir pool manipulation.

SARDI – maintain links with technical studies into aquatic ecology and other scientific research programs.

Federal Government:

MDBC – provide funding for SIS works within the Murray-Darling Basin.

Other:

The Riverland Development Corporation and Tourism SA could provide resources or assistance for the district advertising and awareness strategy, promotion of tourism and promotion of irrigation management and crop produce quality from the district.

7.2 Current DWLBC Work Program

The PRLMG and Renmark to the Border LAP have been informed that DWLBC has a budgeted program of work planned for the Pike River area over the next 12 months. This includes the following work items:

1. Assessment of floodplain surface water management options – the study will include but not be limited to investigations into options to improve surface water management that are available now, options that become available through SIS and options that become available with an alternative irrigation supply. The estimated timing of this work is over the second half of 2006.

2. Assessment of management strategies of the floodplain by undertaking floodplain salinisation and vegetation response modelling. CSIRO are already contracted to undertake this study and have commenced. Completion is aimed for 30 June 2006.

3. Undertake SIS gap analysis to enable completion of a SIS design. This project can be further spilt to identify highland and floodplain gap analysis. Highland gap analysis can commence immediately. Floodplain gap analysis can commence after the other floodplain investigations have occurred. The SIS group of DWLBC will undertake this over the second half of 2006. An additional work item which is under consideration is detailed EC surveys along the Pike River to identify if localised salt "hot spots" are evident and to enhance the understanding of the district salt and water balance.

4. Assessment of alternative grazing regimes and their impact on Pike floodplain health and management. This study will investigate and document grazing history, current grazing impact and identify limitations that current grazing practices place on the benefits that can be delivered by SIS and improved surface water management in the Pike system. This will be completed during the second half of 2006.

7.3 Implementation Program

An indicative timeline for the implementation of the LWMP strategies is illustrated on Figure 7.1.

Most of the strategies will require close liaison and consultation with a number of key stakeholders, especially DWLBC and the SA MDB NRM Board. The timing of the implementation strategy is also heavily dependent on the outcomes of work in progress and it is recognised that the program will probably require review and updating in early 2007.

7.4 Progress against LWMP Guidelines

A comparison of the progress made to date in the development of the upgraded Pike River LWMP against the suggested stages of developing a LWMP is presented in Table 7.1. The comparison indicates the status of each of the suggested stages and shows completion of the work consistent with the guidelines up to the implementation stage.

7.5 LWMP Monitoring, Evaluation and Reporting

This LWMP document provides a community driven direction for the Pike River area based on a staged consultation program and the current understanding of the irrigation and natural resources profiles of the district.

A number of significant technical studies are currently in progress including the DWLBC SIS investigations and broader work program, and the development of IFMP guidelines including a planned case study trial of guidelines implementation on the Pike floodplain. These studies will clearly have a significant impact on the way in which the LWMP is implemented and could potentially re-define some of the preferred LWMP actions and targets.

It is planned that in the short term, the LWMP actions, targets and implementation strategy will probably require a review in early 2007 to incorporate the finding of technical studies currently in progress. To facilitate this major review point an ongoing commitment is made from the PRLMG in conjunction with the Renmark to the Border LAP to continually liaise with the key stakeholders who are undertaking these studies.

The PRLMG aim to engage and keep informed the broader Pike River community through the use of the established process of regular newsletters distributed to the community. It is envisaged that community information and discussion meetings would be held at key times, for example at the finalisation of SIS investigations.

Figure 7.1: Indicative LWMP Timeline

Strategy No.	Strategy description	2007				2008				2009			
1	Involvement in Pike SIS studies, approval submissions and steering committees	Ongoing											
2	Participate in water disposal policy development	Ongoing											
3	Involvement in training, mentoring and participation in R&D trials to optimise irrigation efficiency (through IRES)	Ongoing											
4	Develop a district irrigation Code of Practice and report on achievements	Ongoing with annual reporting											
5	Participate in Floodplain Management Planning												
6	Investigate opportunity to dredge mouth of Rumpagunyah Creek												
7	Continue to actively promote the IIEP project, identify future course topics and explore additional courses	Ongoing											
8	Develop GIS land risk layers (soil degradation, erosion, recreation) and fact sheets												
9	Develop river frontage action plans in conjunction with Renmark Paringa Council												
10	Completion of LWMP and district irrigation efficiency reporting												
11	Undertake aquatic biodiversity survey of the Pike anabranch (SARDI)												
12	Review available floodplain valuation methods and studies and refine for the Pike district												
13	Detailed assessment of delivery of irrigation water direct from the River Murray												
14	Establish PRLMG sub-committee to start working with other organisations through a district advertising strategy												
15	Promote sustainable tourism attractions within the Pike district and a code of practice in conjunction with MDA Sustainable Recreation Officer	Ongoing											
16	Participate in development of flexible water allocation restriction policy												
17	Monitoring and evaluation of LWMP implementation and seek funding through available sources	Ongoing											

Table 7.1: Progress against LWMP Guidelines

Stage	Component	Status	This LWMP Upgrade Report
A – Starting Out	Getting Support	Funding, technical and management support provided from RBLAP, SAMDB NRM Board, DWLBC	
	Building a LWMP Group	Pike River Land Management Group re-formed to deliver the upgraded LWMP	The Foreword to the LWMP describes the history of the area leading to the formation of the current PRLMG
	Scoping the Plan	Delivered by RBLAP and PR:MG as consultancy brief in June 2005 to develop upgraded plan based on previous studies	Section 2 describes the history of studies in the area which have led to this upgraded LWMP
B – Setting the Scene	Gather and Assessing Data	Relevant technical data sourced and used to upgrade and augment existing technical assessments	Section 1 presents a discussion and presentation of technical data most relevant to the LWMP
	Confirm Assets and Threats	Community has identified and ranked the districts assets and threats	Section 4 of this SEI describes this process in detail using the methodology provided by the LWMP Guidelines
	Develop the No-Plan Scenario	No-Plan scenario developed	Discussed in Section 6
C – Developing the Plan	Set Initial Targets	The LWMP targets and strategies for the major threats as identified by the community are described in Section 5. This includes identification of potential available resources to assist with implementation of the strategies	
	Generate Options for Addressing Priority Risks		
	Evaluate and Prioritise Options		
	Revise Targets and Agree Work Program		
D – Moving from Words to Deeds	Implementing the Plan	To be completed - an indicative implementation timeline is discussed in Section 7 which includes the recognition that a review of the LWMP will be required following the completion of technical investigations currently in progress	
	Improving the Plan		

8. References

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Appendix

Community Engagement Program

Combined Group Outcomes

VALUES

- Natural Environment
  - Birdlife
  - Visually appealing – holistically
  - Fish/fishing
  - Whole ecosystem
  - Secluded from main river
  - Beautiful views
  - Climate

- Recreation/Tourism
  - Fishing
  - Camping
  - Amenities
  - Skiing
  - Swimming
  - canoeing
  - Visitors/locals
  - Flow – on economic effects
  - Eco-tourism/law-impact

- Access to water
  - Control
  - Availability on demand
  - Access to creeks

- Provision of livelihood

- Family holdings (as apposed to large corporations)

- Fertility of land

- Lifestyle

- Property values (waterfront land)

FUTURE

- Better health for Pike environment

- Increased flows
  - Reduce sedimentation

- Less salt at Morgan

- Secure water

- Re-vegetation

- Increased tourism potential
  - More trees
  - Better water quality
  - Visual appeal increased

- Increased development
  - Sustainability in terms of salinity outputs
  - Accountability of irrigation and environmental consequences

- Efficient irrigators rewarded

- Use of local knowledge and expertise to implement LWMP (Jack Seekamp)

- More fish/yabbies in the system – healthier environment (ecosystem)
- Community awareness of impacts of irrigation and environmental issues

- Salt interception scheme in the NEAR future

- Recover the environment
    - Less ferals (carp, rabbits, foxes)
- Encourage enterprises aside from irrigation – development
- Potential for salt harvesting
    - Return for growers???
- Maintain population and services, residential potential
- Maintain/sustain domestic pumps on Pike
- Locals engaged in environmental management (i.e. reveg)
- No grazing on the flood plain
- Improvement of infrastructure along river (bridges)

ISSUES

- Salt management protocol – Interim to SIS
    - Dissemination of information to encourage local management
    - Promote local management to wider community/publicity
- Education of broader community
- Increasing flows
- Health of floodplain
- Removal of willows, control reeds and encourage larger in-flows at the Pike's inlet
- Strong objectives which can be attained by community, supported by government, LAP, council etc.
- Work with government to achieve objectives
- Community driven
- Cost of 'Doing Nothing' to the environment, community and production.
- Encourage and enhance potential for recreation in a sustainable manner
    - Ecotourism
    - Inform visitors of the area.
    - Signage and promotion of the area
    - Lookouts and observation areas
- Look at viability of hydrologically managing wetlands
    - Mimic natural cycles
- Continue to increase WUE

Green Group

VALUES

- Beautiful area
- Lifestyle
- Tourism/visitors
- Increased flows above Col Col bank
- Increased flows in Runpagunya
- Gurra lakes – look after this area too
- If Pike dammed it would cause this area to die
- Irrigators are making changes
- Land value would crash. No-one wants to live in a salt dead area
- Better health
    - Red gum health
    - Floodplain
    - Better quality waterless salt at Morgan
- Floods more often
- More development
    - Irrigation
    - Tourism
    - Eco-host farm
    - Housing
- Maintain productive ecosystem
    - Birdlife
    - Fish passages
- Salt interception scheme up and running
    - What are the salt levels in various areas
- Maintain population and services
- Locals get involved with reveg areas – salt tolerant trees
- Creek left open
- Community being better informed on Pike Creek issues
    - Salt levels
- Comparative levels CC as the River Murray salt
-
- Protect and enhance the environment, whilst monitoring the sustainability of livelihoods
- Talk on irrigation pipeline
- Concern on damming – ANGRY

FUTURE

- Salt Interception Scheme
    - As a LAP project, organise groups to reveg
    - More efficient farming practises
    - Water

ISSUES

- Looking at viability of hydrologically managing wetlands – Gurra Gurra lakes
- Visitors need to be informed on the Pike River issues
- Form partnerships to sustainable recreation with council, visitors, LAPs, MDBC

Green and Gold Group

VAULES

- Swimming in Pike
- Fishing
- Pikes condition
- Biodiversity
- Expansion of irrigated areas
- Tourism use
- Revegetation
- Sustainability
- Viability
- Re-inundation
- Promotion of Pike into a region of its own

FUTURE

- Better flows
- Artificial flooding
- LWMP
- SIS
- Desalinisation plant
- Educate broader community
- Active committee
- Drive
- Community knowledge and expertise
- Water use efficiency
- Dredging

ISSUES

- Funding
- Government (red tape)
- Minority (votes) count
- User friendly LWMP
- Political doubt to generate interest in issues
- Too many groups in decision making process
- Acknowledgement of prior commitment to the environment
- Economic factors

IMPORTANT POINTS

- Keep creek flowing
- Monitor the worst areas so that they can be worked
- Active committee/local council
- Future for regions prosperity
- No pipeline
- Water quality

Dark Blue Group

VALUES

- Birdlife
- Flow of river for irrigators
- Recreational fishing, skiing, canoeing
- Diversity of age with residents, employment
- Tourism

FUTURE

- Development of more land (irrigation use)
- Increased health of trees/wetlands
- **increased flows**
- cycle that manages the flows better
- things done in line with recommendations
- some obvious improvements
- continued domestic use of Pike
- revegetation
- creeks cleaned out
- continuation of irrigation efficiency
- irrigation efficiency rewarded
    - individual
    - community
- recognition of irrigation efficiency
- financial irrigation efficiency rewards
- development of irrigation efficiency rewards
- local irrigation management
- increased local environmental management
- allowance in changes of river levels
- use of river salt for commercial purposes

Red Group

VALUES

- quiet
- secluded
- wildlife – ducks
- boating, swimming, skiing
- aesthetics
- property value
- fishing
- canoeing
- water on demand
    - direct pumping
- residential
- camping
- boat launching
- livelihood
- cost advantage of water

FUTURE

- healthy vegetation
- better water quality
- still used for recreation
- more water flow
- wet or dry cycle of floodplain
- residential living
- irrigated from the river (still viable)
- more tourism (eco)
- expanded irrigated areas
- SIS
- Expanding community
- Better environment
- Sustainable quality
- Less snags
- More fish and yabbies
- less than 300EC

ISSUES

- lower petrol price to encourage tourists
- get rid of salt
- water flow increased
- maintain reveg
- fish passage
- more lookout/observation areas
- type of craft/legislation
- irrigation management practises – impact

- broad understanding of SIS types and other solutions
- community support, driven and understanding
- working with government

Yellow Group

VALUES

- views
- lifestyle
- peace and quiet
- one of the best areas to grow ‘quality’ fruit
- very fertile
- diversity of life
- recreation
- climate
- opportunity to recover and develop the environment and commercial ventures
- amenity

FUTURE

- commercial
    - more development but sustainable with less salinity expenses
    - more flows
    - accountability
- recreation
    - fishing, camping, etc.
    - natural beauty of the environment
    - local communities of birds, animals etc.
- environment
    - maintenance of business, family holdings.
- Tourism
    - Visual aesthetics
    - More trees
    - Healthier water
    - Promotion

ISSUES

- Regular flows
- Salinity
- Floodplain health
- SIS
- Salt management
- Reeds
- Improve infrastructure
- Costs involved with not doing anything

Light Blue Group

VALUES

- Native fauna
- Access to water
- Recreation
- More value before than now
- Access to creeks
- Quiet waterways
- Value of land on waterway

FUTURE

- More flow
- Yabbies
- Healthier habitat
- Better quality water
- Less ferals (eg carp)
- Water is secure
- Potential for growth
- No grazing on floodplains
- More efficiency in irrigation and control
- Awareness of implications of over irrigation
- SIS

ISSUES (what and How)

- Increasing flows
    - Dredging waterways
    - Unblocking wiers – large inflow at pike mouth
    - Remove willow trees, bull rushes
- Health habitat (eg fish, yabbies, flora, fauna)
    - Increasing flows
    - Artificial flows – raising water
    - Removing ferals
- Better water quality
    - Increased flows
    - addition of SIS
    - Farming practises
    - Irrigation practises
- Secure water
    - Continue of flows
    - Keeping the creek
    - Potential for growth
    - No pipeline
- Efficiency of irrigators
    - Continue education and awareness of both interstate and Murray River users

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

RED GROUP

Table 1: Asset Importance, Condition and Trend

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
NATURAL ENVIRONMENT	11 8-11	- If it fails everything fails - interdependent with all other aspects	Terrible OK at different stages Slow decline Some areas can't get worse Improvement – H_20 seepage from cliffs Fish – improved, more cod, less carp Frog decline
RECREATION TOURISM	10 5 10	Recreation with family – skiing, fishing Involvement with water decline – only future is to promote healthy waterway Dry up river – no recreation, will have to go elsewhere	Excellent – people camping Simarloo – decreased – less canoers Potentially could overcome other industries
ACCESS TO WATER	15 5	No irrigation – horticulture dies in the area Dryland – only used for stock and domestic Too hard to order, inconvenience Irrigation creating more flow – reducing pool level and drawing water in	Good – but could be better Look at infrastructure to increase flows

[1] Ranking from 1 to 10 with 10 of greatest importance

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
AVAILABILITY	10	Too hard to order, inconvenience Irrigation creating more flow – reducing pool level and drawing water in	Issue – silting Keep Rumpagunya and main Pike channels open, wet and dry other backwaters – Snake, Swift and Tanyaca Creeks
PROVISION OF LIVELIHOOD	10 - irrigators 10 - tourism 2 - dryland	Main income Employment - others income Riverland economy monetary values $65 million	Not good – those affected by income losses – vines/citrus - fluctuating Good – life style access to water Slow declining – issues about removing stock/water
FAMILY HOLDINGS	10 Low	4th generation – important to keep small and in family Is just a business - may not come back to the business but will still come for the River	Increasing corporatisation need to be considered Stable – not affecting Increase/decrease – less families – bigger properties Corporations are only there as not enough product being supplied
SOILS & LAND	12 5	Salt pans – issues not being addressed Salt, trees dying	Steep decline – obvious changes over past 15 years
LIFESTYLE	10 3	Entertainment, access, sunrise/sets, privacy You make it what you want	Stable
PROPERTY VALUES	10	Only worth something when water present – irrigation/tourism	Increase/stable – building Decline - development

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
OTHER – Noora Basin		Potential Asset	Develop for Ecotourism - birds/fish Salt harvesting Aquaculture SIS – stop seepage

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

RED GROUP

Table 2: Asset Threats and Mitigation

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
NATURAL ENVIRONMENT	Not getting SIS Responsibility to land holders Salt Govt. Pipeline - water availability Algal blooms	5 5 5 5 5	Increasing Only talk Increase	SIS monitoring, irrigation & dumping Community meeting Government officials One standard – community & Govt.
RECREATION & TOURISM	No water / closing creek Clarity No breeding areas - fish/birds/lizards Tree health decline Employment - backpackers	5 4.5 5 5 2.5	Increasing Would like it to increase	Ecotourism Advertising region separate from Riverland Promoting facilities being built
ACCESS TO WATER	Lack of flows No water for Stock No water for livelihood	5	Nothing happening	Small pipeline to increase flow from Lock 5 No pipeline for water supply SIS

[1] Rating from 1 to 5, with 5 posing greatest risk

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
PROVISION OF LIVELIHOOD	Loss of Land Loss of income Smell Development can't happen Loss of land value	5 5 5 5 5	Increase Decrease if land can't be used Fluctuates Stand still Increasing	Responsible management Need SIS Need to be able to develop land
FAMILY HOLDINGS	Loss of land value Leased land – loss of lease Need to sell Can't develop	5	Sometimes happens Stable Increase	SIS Business planning
SOILS & LAND	Degradation - salinity - erosion Shifting salinity issues to other sites	 5 1 5	Increasing – less seepage Stable/natural Increasing	SIS, irrigation practices Increase flows Management, Govt. consultation
LIFESTYLE	Don't take creek Ruining views Killing ecosystem Less animals (unique species)	5 5 5 5	All increasing	SIS, increased flows, Govt. responsibility
PROPERTY VALUES	Loss of land value	5	Increasing	May need to sell to make worth while

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
OTHER – Noora Basin	Losing control of water	5		

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

GREEN GROUP

Table 1: Asset Importance, Condition and Trend

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
NATURAL ENVIRONMENT	10 Extremely high	Tranquillity of area Sign of greater health of area Good climate Property values based on views Ambience of natural environment	Very poor and in decline
RECREATION TOURISM	9/10 Important for both locals to enjoy and visitors to appreciate and bring tourism into the area	Potential for tourism/employment Prestige of area/attract people back to area Economic benefit/flow-on effect Important to good lifestyle (e.g. fishing etc)	Average with potential Trend – slight increase
ACCESS TO WATER	10 Biggest issue to irrigators Water on demand very Important	Increasing economic cost if we lose access to water Limitation on development	Beautiful Stable trend

[1] Ranking from 1 to 10 with 10 of greatest importance

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
PROVISION OF LIVELIHOOD	10	Area provides livelihood Population	Trend is to increase over time Good
FAMILY HOLDINGS	10	Unlike corporate divisions, family holdings have a social conscience and greater input to community Lifestyle/sense of achievement	Good condition Stable trend
SOILS & LAND	5	Managing not so good at the moment	Stable condition Slight increase over region by irrigators improving with nutrients etc.
LIFESTYLE	10	Quality of life in area	Good condition Slightly improving trend/appreciation
PROPERTY VALUE	10	Maintenance of assets $$$	Good Increasing trend
OTHER - HIGH IMPACT SALINITY ZONE/PRIOR COMMITMENT		Clarification of prior commitment/high salinity zones	

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

GREEN GROUP

Table 2: Asset Threats and Mitigation

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
NATURAL ENVIRONMENT	- Salt loads - Lack of flow - Irrigation (balance of input/output) - Current irrigation development - Balance between irrigation and natural flow in system	5 5 5/3 5/3 5/3 5/3	Salt loads increasing Lack of flows increasing Irrigation efficiency getting better	Salt Interception scheme - Govt. Scientific data to determine balance (input/output) of system - Water Department Quantify environmental information for system for community understanding - LAP's
RECREATION & TOURISM	- World issues (eg Sept 11th) - Economic issues prevent people from visiting - Lack of promotion of local industry/area - General river health	4 4 4 5	Decreasing tourism within system	SIS to increase river health - Govt. Promotion of area/amenities - LGA/tourism bodies

[1] Rating from 1 to 5, with 5 posing greatest risk

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
ACCESS TO WATER	- Restrictions on allocation - Potential for access to be removed (e.g. if pipeline is put in)	5 5	Increasing trend	Community to voice to keep good access One body to control river issues
PROVISION OF LIVELIHOOD	Water quality/access/ volume Value of water	5 4	Improving over time, particularly in last 5 years (development, increasing population)	SIS to improve water quality To a certain extent provision of livelihood is market driven and falls on everyone's shoulders
FAMILY HOLDINGS	Size of enterprise to remain economic Major retailers setting prices at market	5 5	In current climate the trend has been increasing	Market driven/farmers Availability to "new" land to expand, ties into SIS and water access
SOILS & LAND (FERTILITY)	Abuse by irrigators Land degradation Rising salt	1 1 4	Increasing with greater knowledge and better management practices	Better land managers/ individuals SIS/good river health
LIFESTYLE	Pike system closed off	5	Getting better Increase in property values	Keeping system open SIS

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
PROPERTY VALUES	- Water quality/access - Pike system to remain open - Salt loads - Loss of horticulture/industry Vegetation death	5	Increasing	See above Keeping Pike open!
OTHER				

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ORANGE GROUP

Table 1: Asset Importance, Condition and Trend

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
NATURAL ENVIRONMENT	10	- Sense of pride in environment - Need to maintain it for ourselves/future generations - Aesthetics - Encourages community activities (everyone has a vested interest in environment)	- Difference in condition along creek, top reasonable, bottom dying - Reasonable – decline in tree health Environmental conditions at present due to drought, several wet years will improve
RECREATION & TOURISM	10 to 9 High but if sacrifice had to be made this aspect would be first to go rather than irrigation If recreation is detrimental to River then has to be halted Flow an effect of	- Recreational use of area is still happening - Environmental changes along river provide different tourism potential - Tourism on the increase - Holidayers generally keep coming back to area	Trend is constant to increasing

[1] Ranking from 1 to 10 with 10 of greatest importance

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
	recognition, adds to value of asset		
ACCESS TO WATER	10 7-8 *Dependent on pipeline *Not as important as two assets above *Accessibility to river is excellent	Individual accessibility to river is excellent Cost Timing Need for water on demand is high	- If water supply pipe installed implications could be detrimental - "We need to make sure it doesn't decline"
PROVISION OF LIVELIHOOD	4 (10 Irrigators) 2 (2 Non-Irrigators)	70 irrigators along river who directly rely on the asset	Livelihood being affected by other matters than the condition of the Pike - bigger market forces If the Pike is maintained in good health then when markets increase livelihood will follow
FAMILY HOLDINGS	10	Remain small as a lifestyle choice	Static/Stable
SOILS & LAND	10	Pike known for their crop yields/quality	Decrease in water-logged soils (improvements in groundwater) Good condition/stable (fertility)
LIFESTYLE	10	Connected to other assets	Stable/good quality lifestyle

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ASSET	IMPORTANCE[1]	WHY	CURRENT CONDITION/TREND (GOOD/BAD/STABLE/DECLINING/INCREASING)
		i.e. natural environment, livelihood	
PROPERTY VALUES	10	Dependent upon the natural environment - keeping river flowing	Dependent on individual properties but general slight increase Good values
OTHER			

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ORANGE GROUP

Table 2: Asset Threats and Mitigation

ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
NATURAL ENVIRONMENT	- Lack of No Flow	5	Increasing	Get more flow down Pike Community to start mitigation by raising awareness Irrigators through better practices Government
	- Salinity	5	Consistent(?) - data to influence	Better irrigation practices SIS
	- Toxic dump in VIC	Low, dependent on many points		Community pressure to MP's
RECREATION & TOURISM	- Detrimental impacts from excessive/ irresponsible rec. users	1 to 2 Relative to number of rec. users	Stable	Community can marshal users Educating rec. users Encouraging responsible use
	- No flow	5		Increase flow, rainfall
	- Salinity	4	Data will influence	SIS, improve salinity impacts on flats to encourage regrowth
	- Decline in environmental health	5	Over 10 yrs trend increased. At present static	Environmental donations of water for rehabilitation projects Improve channel system and banks at top end of Mundic, managing open bodies of water better

[1] Rating from 1 to 5, with 5 posing greatest risk

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ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
ACCESS TO WATER	- Pipeline will reduce access and availability on demand	5	Won't be able to get enough water when you need/want it *Costs involved will be huge	If pipe put in mitigation out of control of irrigators Community pressure to show undesirable
	- Lower flows in system, higher river salinities	5	Increasing	As above in Natural Environment
	- Obstacles to flow in main supply channels i.e. logs, siltation	3	Increasing, particularly logs	Removing some logs (negotiation with relevant Dept.)
PROVISION OF LIVELIHOOD	Salinity Water Quality Supply of Water Market trends, globalisation	5 3 5 4	Increasing Increasing Increasing Increasing	As in Natural Environment As in Natural Environment As in Natural Environment Nothing we can do
FAMILY HOLDINGS	Harder to survive (returns)	3	Increasing	Nothing we can do, dependent on property
	Water restrictions (water supply/flow)	5	Increasing	Limit of water coming into state Levy payment on 100% not on restricted % (rebate) Govt. buy back from interstate to bolster supply to meet demand
	Larger corporations	4	Increasing	

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ASSET	RISKS/THREATS	RISK RATING[1]	TREND	MITIGATING ACTIONS
	taking more resources and producing at lower costs			
SOILS & LAND FERTILITY	Poor irrigators Over-efficient irrigators (salt build-up) Over fertilising/spraying/ chemicals	2 2 1-2	Decreasing Decreasing Decreasing	Training and Communication
LIFESTYLE	No flow/water Corporate holdings Environmental health, aesthetics	5 5 5	Increasing Static Increasing	Land holders responsibility to maintain and ensure
PROPERTY VALUES	No river/water on demand Market trends/globalisation If lifestyle decreased property value will drop	5 5 5	Increasing Stable Stable	Land holders responsibility to maintain and ensure
OTHER				

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

MAIL RESPONSE #1

Table 1: Asset Importance, Condition and Trend

Key community-identified assets of the Pike River LMWP Area	How important is this to you? Rate from 1-10	Why?	Current Condition: (excellent, good, poor, very poor?)	Condition Trend: (improving, stable, slow decline, steep decline?)
Natural Environment:				
• Ecosystem (river, birdlife, vegetation fish, forests)	10	Important for the life of the Pike	Constant water level too high, overgrazing	Steep decline
• Seclusion (from main river)	9	Proof of health		
• Views	10		Dead trees, no understorey	
• Climate	10			
Recreation/Tourism:		Tourism only destroys the natural environment, causes pollution, spreads pests and diseases, uses up the earths resources	Not suitable	Not desirable because of the adverse effects
• Fishing	4			
• Camping	1			
• Amenities	1			
• Water sports (skiing/swimming/canoeing)	1			
• Visitors/locals	1			
• Flow on -economic effects	1			
• Eco-tourism	1			

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

Access to water (for irrigation): • Control • Availability on demand • Access to creeks	10 1 5	No further irrigation areas	Little access is good	Stable
Provision of livelihood	10	Important for original settlers		
Family holdings (as opposed to large corporations)	10	Corporations are using someone elses money	Good	Corporations only worry about turnover, don't consider small family holdings
Soils and Land (fertility)	7	Overgrazing and lack of river flows	Poor	Steep decline
Lifestyle	7	Pioneer families deserve protecting	Good	Stable
Property values	5	Over-valuing means increased levies	Good	Stable
Other: Floodplain grazing should cease	10	Degrading the area	Poor	Steep decline

Pike River LWMP Upgrade
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MAIL RESPONSE #1

Table 2: Asset Importance, Condition and Trend

Key community-identified assets of the Pike River LMWP Area	Risks or threats to this asset?	How significant is the threat (1 to 5)	Trend of threat	Mitigating Actions (Community, Government)
Natural Environment: • Ecosystem (river, birdlife, vegetation fish, forests) • Seclusion (from main river) • Views • Climate	No high flows, overgrazing Dead trees Hotter	5 5 5 5	Gum trees need high flows for a short time, not constant water level No cover	Hope for a flood Lower the water level Raise the level for a short period
Recreation/Tourism: • Fishing • Camping • Amenities • Water sports (skiing/swimming/canoeing) • Visitors/locals • Flow on -economic effects • Eco-tourism	Detrimental to the natural environment Noises and disturbances Costs are greater than the income	 2 3 5 2 3 5 5		Should be kept as a wilderness type area Stop duck shooting
Access to water (for irrigation): • Control • Availability on		 1 5		

demand • Access to creeks		4		
Provision of livelihood				
Family holdings (as opposed to large corporations)		5	Taking the benefits away from the pioneers	No more corporate holdings
Soils and Land (fertility)		4	Vegetation loss	Stop grazing
Lifestyle		4	Too much Government red tape	
Property values		3	Rising	Rating should be on production, not site value
Other: Floodplain grazing				All grazing should be phased out on the floodplain and highland slopes. In the Renmark to the Border area the Sturt Highway, Loxton, Paringa Road and the Gordon Road for the southern area, and the Murtho and Wentworth Roads for the northern area should be the demarcation zones.

Other comments (e.g. future targets, key uncertainties):

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

MAIL RESPONSE #2

Table 1: Asset Importance, Condition and Trend

Key community-identified assets of the Pike River LMWP Area	How important is this to you? Rate from 1-10	Why?	Current Condition: (excellent, good, poor, very poor?)	Condition Trend: (improving, stable, slow decline, steep decline?)
Natural Environment:		This ecosystem should be improved not destroyed		
• Ecosystem (river, birdlife, vegetation fish, forests)	10		Poor	Slow decline
• Seclusion (from main river)	9			
• Views	10		Good	
• Climate	7		Good	
Recreation/Tourism:		This area is excellent for all the things said	All excellent	Improving
• Fishing	10			
• Camping	10			
• Amenities	10			
• Water sports (skiing/swimming/canoeing)	10			
• Visitors/locals	10			
• Flow on -economic effects	8			
• Eco-tourism	7			

Pike River LWMP Upgrade
2nd Community Discussion Meeting, Lyrup Club, 7th Dec 2005

Access to water (for irrigation): • Control • Availability on demand • Access to creeks	 10 10 10	Main income, employment	 Good Good Good	 Stable
Provision of livelihood	9		Good	Slow decline
Family holdings (as opposed to large corporations)	10	4 generations have farmed here		Stable
Soils and Land (fertility)	5	Salt rising		Slow decline
Lifestyle	10			Stable
Property values	10			Stable
Other:				

Pike River LWMP Upgrade
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MAIL RESPONSE #2

Table 2: Asset Importance, Condition and Trend

Not received

Flow

Flow into the Pike River system via the inlet pipes above Lock 5 is relatively constant under present operating conditions, at 310 to 330 ML/day. When flow in the River Murray reaches 35 000 to 40 000 ML/day, additional flow into the Pike system occurs through B Bank and over C Bank.

Flow over the Col Col embankment varies widely. Partial control of outflow is achieved by the operation of a sluice gate which serves to maintain water levels upstream of the embankment. The variations in flow are due mainly to seasonal irrigation requirements during entitlement flow in the River Murray.

The flow in Rumpagunya Creek is usually greater than 1 000 ML/day, and can be more than 20% of the flow in the River Murray. There is also a minor amount of flow of around 20 ML/day through a concrete pipe in F Bank into Tanyaca Creek.

DWLBC gauges flow at monthly intervals at the inlets upstream of Lock 5. Continuous electronic flow and salinity loggers are installed along the Pike River at various locations as shown in the table below.

In addition to these, DWLBC also carry out monthly flow gaugings along the Pike River at Col Col embankment, Rumpagunya Creek and the Lower Pike (Lettons).

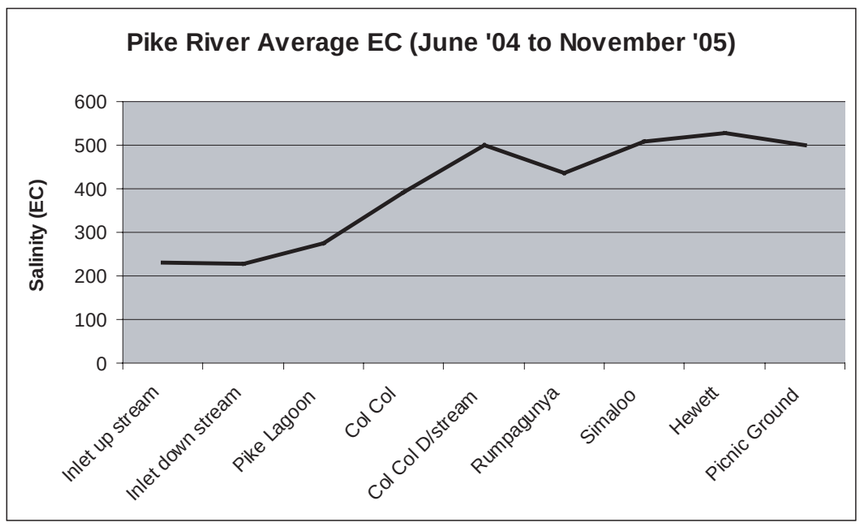
DWLBC Monitoring Stations

Station ID	Station name	Water level	Salinity
AW426512	Lock 5 Upstream (562.4 Km) DAILY	M	M
AW426513	Lock 5 Downstream (562.4 Km) DAILY	M	No
A4261023	Upstream Pike River Outlet (547.2 km)	No	C
A4261055	PIKE RIVER @ U/S COOMBS BRIDGE	C	C
A4261054	PIKE RIVER @ D/S COOMBS BRIDGE	C	No
A4261053	PIKE RIVER @ U/S COL COL BANK	C	C
A4261052	PIKE RIVER @ D/S COL COL BANK	C	No
AW426644	PIKE RIVER @ Lettons D/S Rumpagunya Creek	C	C
AW426645	PIKE RIVER @ Picnic Grounds U/S Murray River	C	C
AW426663	Lyrup Pumping Station (537.7km)	C	C

C = continuous logged data
M = monthly gauging

Salinity

The Renmark to the Border LAP has been monitoring salinity along the Pike system on a monthly basis since June 2004. The average of the recorded data is shown on the following graph and indicates that a significant salinity increase is measured along the Pike River - the average EC more than doubles with most of this increase occurring from Pike Lagoon to just downstream of Col Col embankment.



Upcoming LWMP Meeting

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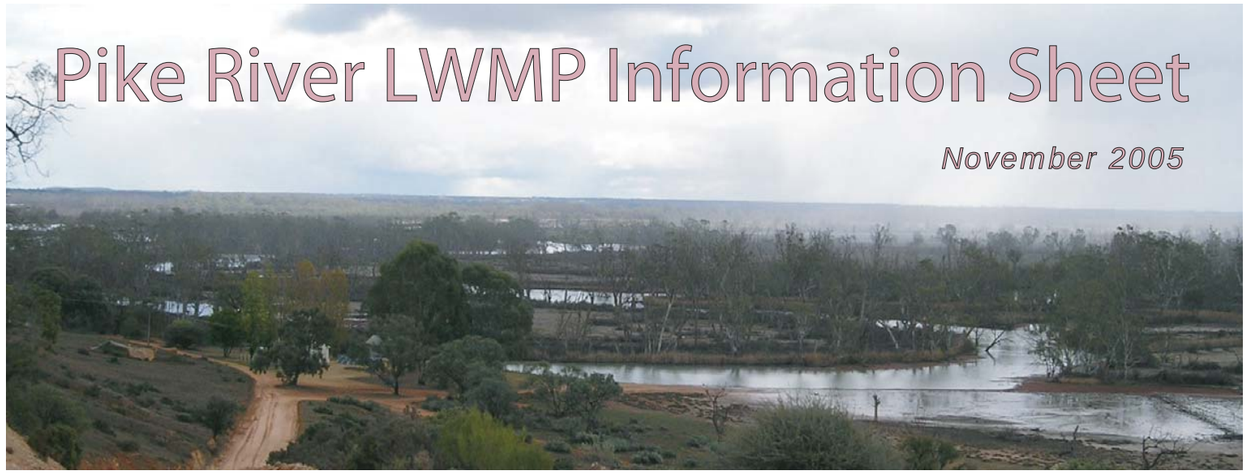
Don't forget to come to the BBQ beforehand at 6:30 pm



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* continued on-farm irrigation efficiency
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* responsible salt management and drainage disposal
* sustainable future irrigation development
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Flow and Salinity in the Pike System

Hydrology

The entire Pike River complex extends over 4 000 ha of River Murray floodplain between Paringa and Lyrup village. It is a complex system of creeks, backwaters and lagoons. The map included overleaf shows the extent of the system and highlights important features which are referred to in this sheet.

The system can be broadly divided into:

* the Upper Pike River and Mundic Creek area which extends from the inlets from the River Murray to the Col Col embankment, and
* the lower Pike River and Rumpagunya Creek area extending from the Col Col embankment to the downstream confluence of the River Murray and the Pike River.

Water flows into the upper system from the River Murray through 2 inlets located between 600 m and 1 200 m upstream of Lock 5. These inlets feed into Deep Creek and Margaret Dowling Creek, both of which then connect into the Mundic Creek. Small watercourses then transport this water to the Pike River via the Pike Lagoon. Water levels in the upper Pike River are controlled by the Col Col embankment to maintain sufficient water depth for irrigator pumps along this length of the Pike.

Most of the water flow in the lower Pike River and Rumpagunya Creek is received directly from the River Murray via Rumpagunya Creek.

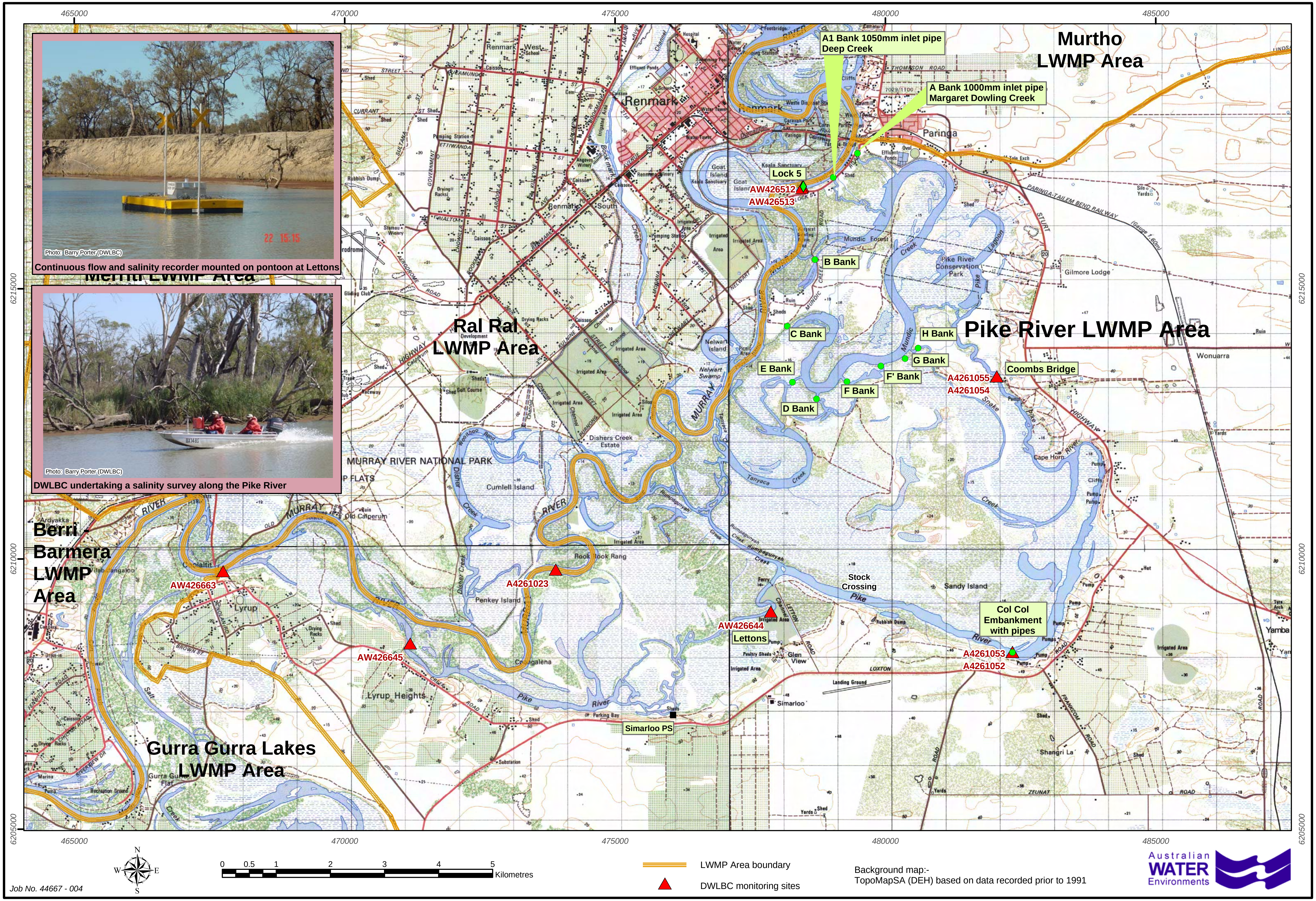

Photo: Barry Porter (DWLBC)
Continuous flow and salinity recorder mounted on pontoon at Lettons
Photo: Barry Porter (DWLBC)
DWLBC undertaking a salinity survey along the Pike River
Murtho LWMP Area
A1 Bank 1050mm inlet pipe Deep Creek
A Bank 1000mm inlet pipe Margaret Dowling Creek
Lock 5
AW426512
AW426513
B Bank
C Bank
D Bank
E Bank
F Bank
F' Bank
G Bank
H Bank
Pike River LWMP Area
Coombs Bridge
A4261055
A4261054
Ral Ral LWMP Area
Berri - Barmera LWMP Area
AW426663
A4261023
AW426645
AW426644
Lettons
Stock Crossing
Col Col Embankment with pipes
A4261053
A4261052
Simarloo PS
Gurra Gurra Lakes LWMP Area
465000
470000
475000
480000
485000
6205000
6210000
6215000
0 0.5 1 2 3 4 5 Kilometres
LWMP Area boundary
DWLBC monitoring sites
Background map:-
TopoMapSA (DEH) based on data recorded prior to 1991
Australian WATER Environments
Job No. 44667 - 004

Groundwater Salinity

Natural groundwater salinity in the district generally ranges from 20,000 EC to more than 80,000 EC (sea water is around 50,000 EC). The higher values are found in areas where water tables are shallow and evaporation from the water table causes a concentration of the salts. This occurs in an area extending from the Mid Pike to the southeast, and from Gurra Gurra Lakes towards Noora.

In localized areas under irrigation, the passage of irrigation drainage to the water table has resulted in dilution of the natural groundwater, so for example at Lyrup heights groundwater salinity of less than 10,000 EC has been measured. These affects would vary greatly throughout the irrigated areas depending on the age of irrigation and the nature of the soils between the ground surface and the water table.

Salt Loads

The Murray-Darling Basin is a naturally saline environment and the only significant way the basin exports salt is via discharge to the River Murray and its tributaries out to sea. Human influences over the past 100 years or more including river regulation, land clearance and irrigation development have modified the way in which salt moves through the landscape. Both of these practices have increased the rate at which water and salt can move from the soils into the water table and then to the floodplain environment, creeks and river channels.

It is estimated that an average of about 70 tonnes of salt a day is picked up by the Pike River as it travels along the Pike floodplain, and returned to the River Murray every day. This impact is measured by river salinity surveys undertaken by DWLBC downstream of where the Pike River rejoins the Murray. This salt load is made up of natural (or pre-irrigation) salt and salt created by irrigation drainage and the operation of the river system post-locking. The salt load is expected to remain fairly constant into the future without active intervention or further irrigation expansion, i.e. “do nothing” scenario.

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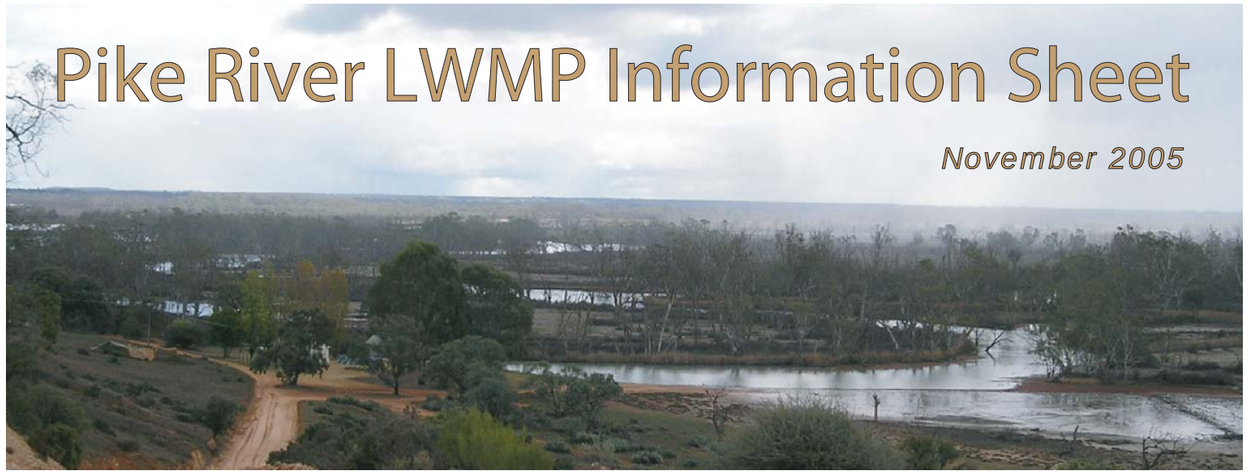

Pike River LWMP Information Sheet

November 2005

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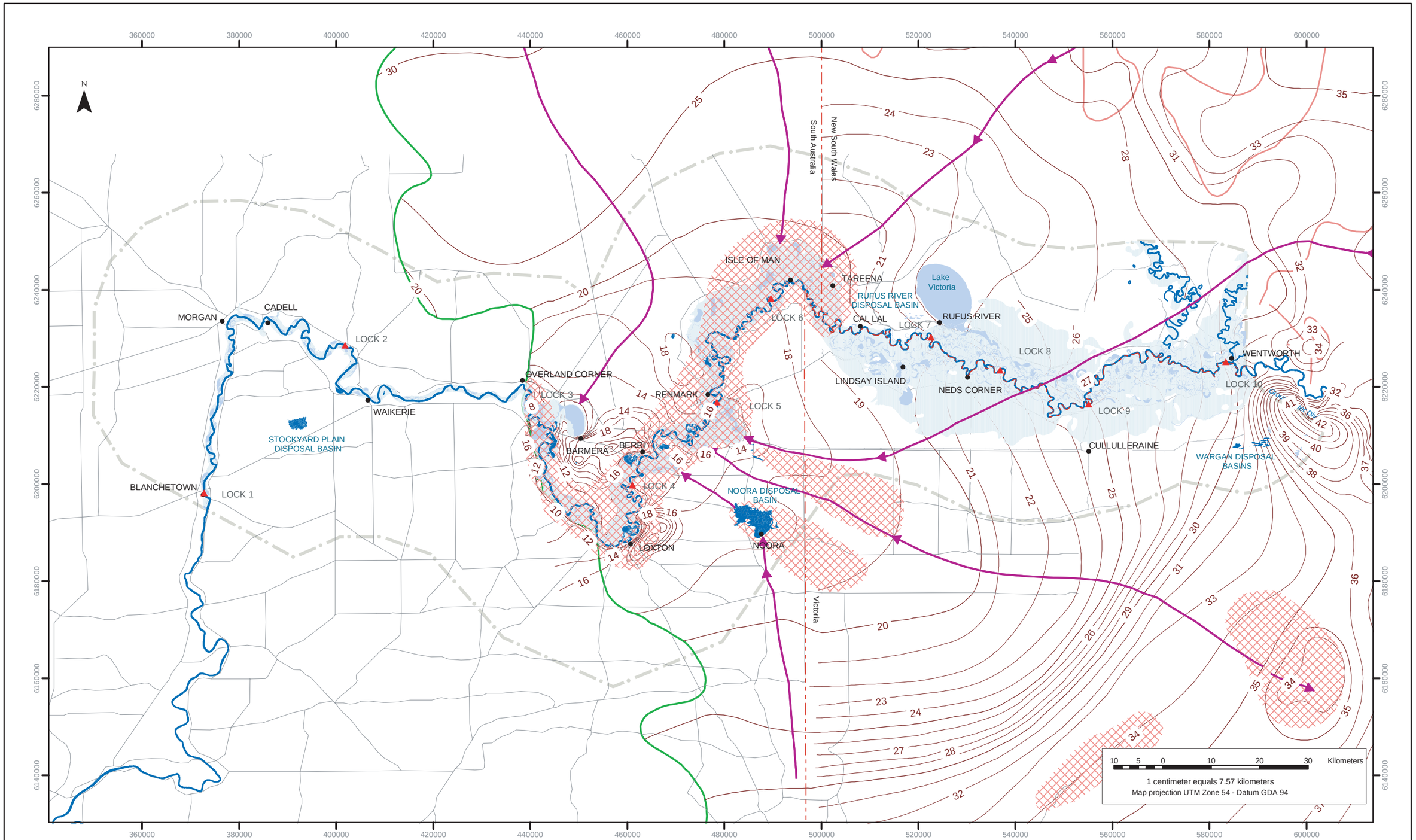
Hydrogeology and Salt Loads

Regional Groundwater Flow

The River Murray is a drain for the regional groundwater systems. In the Riverland Region of South Australia the groundwater is highly saline, which is a result of many thousands of years of salt accumulation, both locally and from eastern areas of the Murray-Darling Basin.

The regional water table in the Pike River district lies within the Pliocene Sands aquifer outside of the river valley, and in the Monoman Formation sands on the floodplain. The deeper confined Murray Group aquifer is separated from the water table aquifers by the combined Lower Loxton Sands and Bookpurnong Beds aquitard.

Groundwater flow from the east converges on the Pike River anabranch and flow from the south converges on the Loxton to Pike River area. The Pike River area is therefore a major discharge zone for regional saline groundwater flow. These discharge zones are displayed as red hatching on the map of groundwater flow which shows groundwater from at least as far away as the Sunraysia district discharging to this area. Discharge from the confined Murray Group Aquifer is low in the Pike area but increases to the west of Overland Corner.



Location Map

The Department of Water, Land and Biodiversity Conservation

Australian WATER Environments

Date: Mar. 03
Data Source:
SA base data, apart from some water related layers, obtained from DEH.
SA layers relating to surface and groundwater obtained from DWLBC.
Victorian base layers obtained from NRE.
NSW base layers obtained from DWLC.
NSW and Victorian wetland layers obtained from
NSW Murray Wetland Working Group.
New layers have been created by AWE, which
may include info. from some base layers.
Groundwater contours provided by MDBC except for minor
amendments made by AWE.

LEGEND

- Direction of Groundwater Flow
- Aquifer Boundary
- Confined / Unconfined Boundary (Ticks Point Towards Confined)
- 1997 Groundwater Elevation (mAHD)
- Discharge Area
- River Murray
- Wetlands
- Disposal Basins
- Flood Extent
- RDS Study Area
- Locks
- Major Towns
- Roads
- State Border

Regional Groundwater Flow
(Pliocene Sands Aquifer)

Job No. 44667a - 002

Salinity Zoning (cont.)

the regional and local economies and the broader environment. Under an agreement with the Murray-Darling Basin Commission, SA must offset the salinity impacts of all new actions which the State has agreed to since 1988 and which contribute salinity to the river. This is primarily irrigation development. It is also recognised that salinity management policy must link with economic development targets to ensure sustainable development.

Currently, around two-thirds of irrigation developments occur close to the river for obvious economic and logistical reasons - costly water delivery pipelines can be shorter and other infrastructure such as towns and transport has also developed along the river. Unfortunately, the closer a development is to the river, the worse the impact in terms of drainage-induced salt returns to the river and floodplain.

Salinity zoning is an initiative developed by DWLBC to address the salt load impacts of irrigation in the Riverland. The policy has been in force since July 1 2005 and sets the rules for the location of future irrigation development.

As detailed on the DWLBC web site, the following salinity zones have been established:

* **Low salinity impact zones** - licence transactions will be approved provided the salinity impacts of the proposed water use can be offset by salinity credits that are available to South Australia.

* **High salinity impact zones** - licence transactions can only occur provided the salinity impacts of the proposed licence transaction can be fully offset by the proponent. An exemption applies to transactions for developments with significant commitment prior to 30 June 2003 at the specific location, but such licence transactions are also subject to the availability of salinity credits to South Australia.

* **High salinity impact (Salt Interception) zones** - licence transactions will be approved provided the salinity impacts of the proposed water use can be managed within the available capacity of the salt interception scheme servicing that zone. If there is no capacity available in the scheme, this zone will be treated as the underlying zone i.e. low or high impact zone.

What are the implications of salinity zoning?

The key implications of the salinity zoning policy are that:

* Water transfers to high salinity impact locations may be refused.

* The SA Govt continues to carry the risk that salinity debits from low salinity impact zones can be offset.

* SA will depend in the long term on salt interception for sustainable irrigation in high impact locations.

The approximate extent of the high salinity impact zone as sourced from maps available on the DWLBC web site is shown on the map.

More information on the salinity zoning policy including a detailed fact sheet and salinity zoning maps can be found on the DWLBC web site at **www.dwlbc.sa.gov.au/murray/salinity/zoning.html**

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RENMARK TO THE BORDER LOCAL ACTION PLANNING ASSOCIATION INC.

river murray catchment water management board

The Department of Water, Land and Biodiversity Conservation

RURAL SOLUTIONS SA

DUGDALE Social and Environmental Planning Partnerships

Australian WATER Environments

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Irrigation and Salinity Zoning

Irrigation

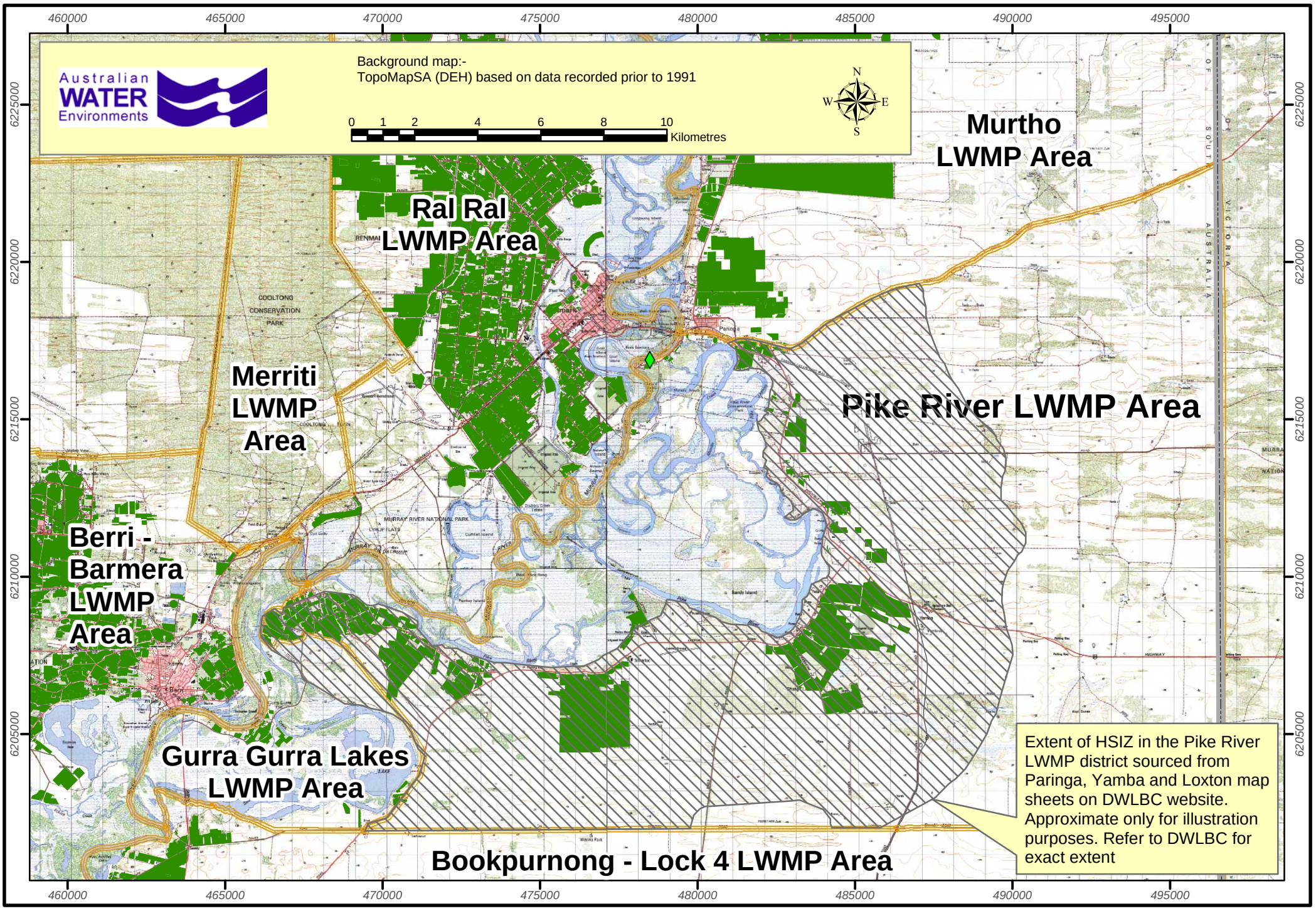
The Pike River LWMP district includes the irrigation areas of the Upper, Mid and Lower Pike, Simarloo and Lyrup / Lyrup Heights. Horticultural production in the region is significant with flow-on value to the local Riverland and broader SA economies.

Recent crop surveys indicate in excess of 2 300 ha of irrigated crops is present in the district with the main crops being grapes, citrus, nut trees and stone fruit. Other crops grown include vegetables and tropical fruits (e.g. avocado). More than 80% of crops are irrigated either by drip or under canopy systems.

The map overleaf shows the extent of irrigated area in the district at 2002 and the tables and pie charts provide statistics and an overview of the irrigation industry. Recent change and growth in the area is indicated by the fact that around 30% of the irrigated crops are less than 6 years old.

Salinity Zoning

Many recent studies into the health of the River Murray, including the salinity audits, have indicated that salinity in the river and on the floodplain is getting worse. This presents significant threats in the short and longer term to river, floodplain and catchment health,



Irrigation Crop and System Statistics

Main Land Uses		
Crop Type	**Area (ha)**	**% Area**
Citrus	384.21	16.09
Grapes	1052.98	44.09
Nut Trees	382.6	16.02
Stone Fruit	325.36	13.62
Land in Transition	107.98	4.52
Other	135.34	5.67
Total	**2388.47**	**100**

Main Irrigation Types		
Irrigation Type	**Area (ha)**	**% Area**
Drip	512.25	21.52
Under Canopy	1429.08	60.03
Overhead	309.71	13.01
Other	53.67	2.25
None/Land in Trans	76.01	3.19
Total	**2380.72**	**100**

Dominant Crop Types	Crop Area (ha)	First Planted (approx)
Citrus	384.21	1949
Grapes	1052.98	1920
Nut Trees	382.6	1968
Stone Fruit	325.36	1956
Land in Transition	107.98	-
Other	135.34	-

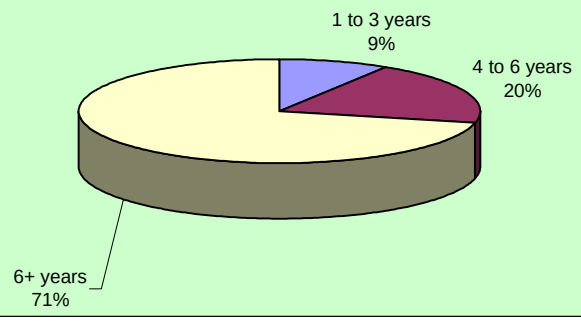
Grapes		
Age	**Area (ha)**	**Area %**
0 to 3	59.57	5.66
4 to 6	242.04	22.99
6+	751.38	71.36
Total	**1052.99**	**100**

Citrus		
Age	**Area (ha)**	**Area %**
0 to 3	30.22	7.87
4 to 6	39.65	10.32
6+	314.34	81.81
Total	**384.21**	**100**

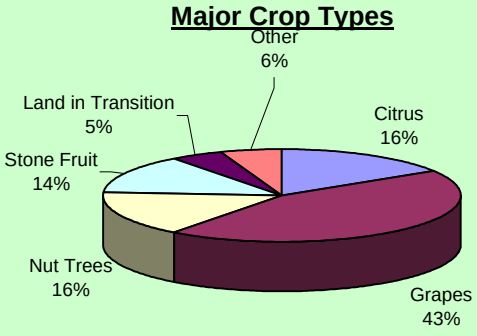
Nut Trees		
Age	**Area (ha)**	**Area %**
0 to 3	73.76	16.67
4 to 6	80.44	18.17
6+	288.4	65.16
Total	**442.6**	**100**

Stone Fruit		
Age	**Area (ha)**	**Area %**
0 to 3	30.9	9.5
4 to 6	72.62	22.32
6+	221.84	68.18
Total	**325.36**	**100**

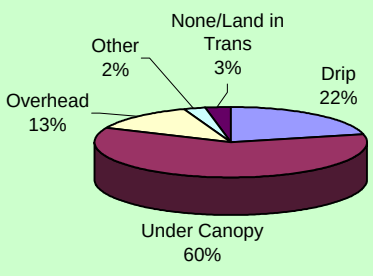
Crop Age (4 major crops)



Major Crop Types



Irrigation Systems



What has previously happened? (cont.)

water use systems to enhance irrigation water use efficiencies, and the re-instatement of ecologically significant local features (e.g. wetlands or areas of remnant native vegetation).

Recently, guidelines have been completed for the development of LWMPs and a number of the South Australian plans have been assessed against the guidelines, including the existing Pike plan. Whilst the existing plan provided a comprehensive collection and presentation of the available technical data, one of the major identified shortcomings is that it did not adequately engage the community in the LWMP process and the shaping of future directions for the district.

What is currently happening?

This current study has been instigated through the Renmark to Border LAP to ensure that the Pike River LWMP is upgraded to meet the guideline standards. It is desirable that the upgraded plan will:

* Provide complete LWMPs that reflects the desired actions, outcomes and projects agreed by the community;
* Include achievable work plans and projects driven by the community;
* Consider the environmental, social and economic implications of achieving outcomes, and
* Describe the process undertaken in the development of the LWMPs to guideline standard including lessons learnt and recommendations for the development of subsequent LWMP documents.

Community input to date

Two irrigator committee meetings have been held to develop a community involvement approach. This has included the attendance of Phil Cole (DWLBC Salinity Program Manager) at the second meeting to brief committee members on issues that faced the Pike region such as salt loads to the river, salt interception schemes and salinity zoning.

The first Pike River Community discussion meeting was held on the 19th of October at the Lyrup Club and was very well attended by over 50 community members. People had the opportunity to contribute their knowledge of the area, issues they are facing, their ideas for the future and to have a say in how the district will look in 10 years.

These views will be incorporated into the new plan, and key discussion items included:

* maintaining the health of the river system, with increased flows for environmental needs, tourism, irrigators and recreational users;
* the need to preserve wetlands/floodplains and to maintain biodiversity;
* the value of the lifestyle that many local residences enjoy and the preservation for future generations;
* the effective management of salt both on and off farm.

The management of saline drainage water, including water pumped from a SIS, was also raised as an important issue.

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Upcoming LWMP Meeting

The LWMP process will continue with a second community discussion meeting on the evening of Thursday 7th December at the Lyrup Club. The purpose of the meeting will be for people to identify threats to the districts assets and to consider options that will be presented. A representative from DWLBC will attend to assist the community to understand the options and possible timeframes for implementation of the options.

Don't forget to come to the BBQ beforehand at 6:30 pm

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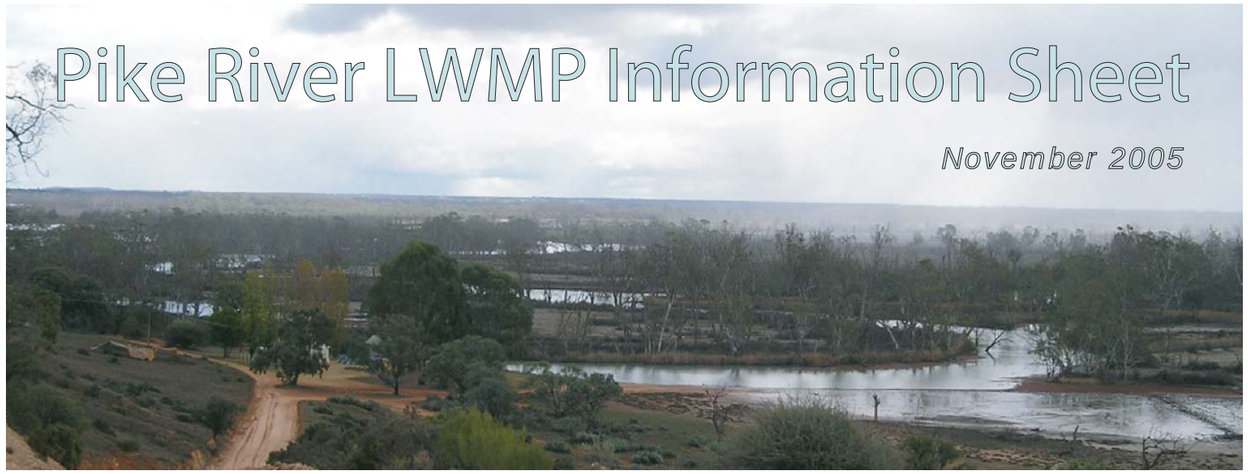
Pike River LWMP Information Sheet

November 2005



This information sheet is one of a series which has been produced for the Pike River Land and Water Management Plan Upgrade. The Renmark to the Border Local Action Planning Association has appointed a consulting team led by Australian Water Environments (Nick Watkins) and Social and Environmental Planning Partnerships (Margaret Dugdale) to undertake the upgrade. The project is part of the LWMP Case Study which aims to ensure that the plan is consistent with recently produced LWMP guidelines and that above all, the community drives the outcomes and future directions. An initial community discussion meeting held at the Lyrup Club on the 18th October identified that some of the major issues which need to be addressed by the upgraded LWMP include:

* continued viable irrigation and farming
* reduced off-farm impact
* continued on-farm irrigation efficiency
* improved management of local wetlands and flood plains
* responsible salt management and drainage disposal
* sustainable future irrigation development
* maintain and improve environmental amenity and biodiversity

The information sheets are designed to provide the community with further technical information on a range of LWMP topics so that informed decisions can be made regarding future LWMP directions.

Land and Water Management Planning

The extent of the Pike River LWMP district is shown on the map and aerial photo and includes the irrigation areas within the Upper, Mid and Lower Pike, Simarloo and Lyrup / Lyrup Heights areas. The district also encompasses the floodplain and creek systems of the Pike River system, and includes the highland across to the SA / Victoria border.

What has previously happened?

The Land and Water Management Planning process in the South Australian Murray-Darling Basin over the last decade or so has provided an opportunity, through the Local Action Planning process, for communities to become closely involved in the management of their local natural resources. In the Riverland of SA, this has created a strong focus on the investigation and development of management strategies for irrigation water use, wetland and floodplain health and salt loads to the River Murray, caused by the interactions of irrigation and the naturally saline groundwater environment. Some of the plans have evolved through to current SIS investigation (e.g. Pike River, Murtho), design (Loxton) and construction (Bookpurnong - Lock 4). Other plans have remained focussed on the value of improving irrigation water delivery and

Australian WATER Environments

Background map:-
Raster 250K (NATMAP) Geoscience Australia based on data recorded prior to 1995

0 1 2 4 6 8 10 Kilometres

N W E S

460000 465000 470000 475000 480000 485000 490000 495000

6225000 6220000 6215000 6210000 6205000 6200000

Ral Ral LWMP Area

Murtho LWMP Area

Merriti LWMP Area

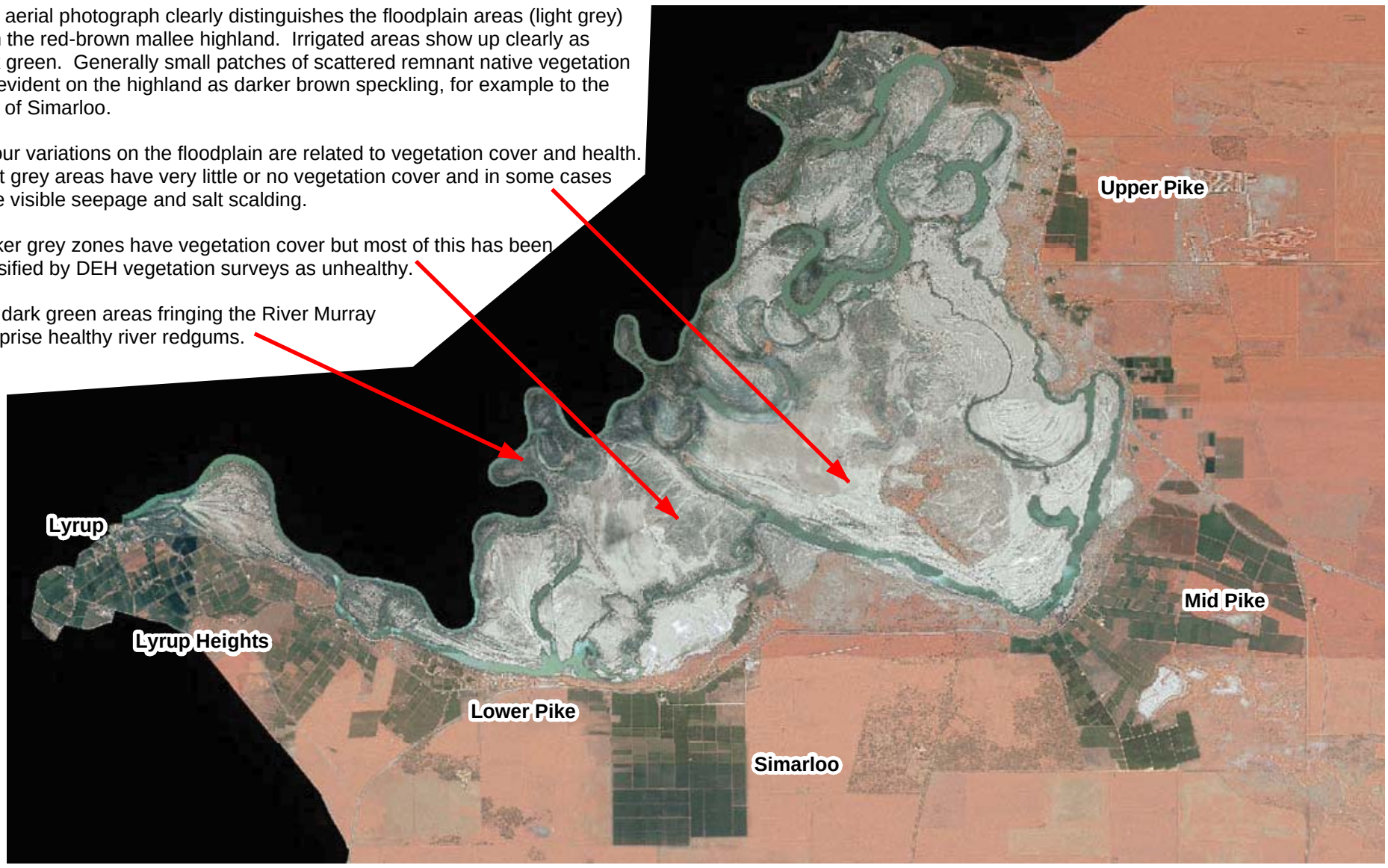
Berri-Barmera LWMP Area

Gurra Gurra Lakes LWMP Area

Pike River LWMP Area

Bookpurnong - Lock 4 LWMP Area

average height of sand ridges 3 metres
COOLTONG
quarry
channels
CONSERVATION PARK
Renmark West
Renmark
RENMARK
NATIONAL PARK
causeway
quarries
Paringa
Lock No. 5
quarry
Renmark Aerodrome
rifle range
Calperum
mast (91m)
racecourse
golf course
drain
MURRAY RIVER NATIONAL PARK
Pike Lagoon
Wonuarra
SOUTH AUSTRALIA
VICTORIA
Monash
numerous channels
Lyrup
ford
LYRUP FOREST RESERVE
BERRI
Gurra Gurra Lake
Pike River
Yamba
pumping stations
STURT HIGHWAY
ruins
quarries (disused)
riffle range
COPI



This aerial photograph clearly distinguishes the floodplain areas (light grey) from the red-brown mallee highland. Irrigated areas show up clearly as dark green. Generally small patches of scattered remnant native vegetation are evident on the highland as darker brown speckling, for example to the east of Simarloo.

Colour variations on the floodplain are related to vegetation cover and health. Light grey areas have very little or no vegetation cover and in some cases have visible seepage and salt scalding.

Darker grey zones have vegetation cover but most of this has been classified by DEH vegetation surveys as unhealthy.

The dark green areas fringing the River Murray comprise healthy river redgums.