

On Farm Change for Regional and District Riverine Improvement: A Case Study Perspective in SA's Riverland

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Abstract

The most significant contributor to increased salinity in the River Murray in South Australia is irrigation development along the river. Localised groundwater mounding, seepage and an increased rate at which the saline regional groundwater moves to the river can all be attributed to irrigation development.

The following paper outlines a process of change made by a concerned irrigation community in the Bookpurnong Lock 4 area when they began witnessing significant degradation of the local floodplain. A preliminary Land and Water Management Plan for the district was established outlining options such as engineering solutions and on-farm change to ensure long-term sustainability of irrigation development in the area. Detailed hydrogeological investigations were undertaken to assist the community in understanding the problem and to further investigate the feasibility of developing a salt interception scheme.

A case study incorporating a range of tools and actions aimed at improving on-farm irrigation management to minimise drainage to 10-15% of any one application has also been established. The case study includes improving technology on-farm, trialling locally sited and accurate equipment, mentoring between irrigators to foster participation, and the establishment of an environmental enhancement program.

Keywords

Community, Drainage, Efficiency, Irrigation, Salinity, Tools

INTRODUCTION

The Bookpurnong Lock 4 Land and Water Management Plan district, located between Loxton and Berri on the River Murray in South Australia (Figures 1&2), includes an area of around 1500 hectares of irrigated horticulture including citrus, table and wine grapes, stone fruit and pome fruit. The irrigated area continues to grow with significant patches of dryland property earmarked for irrigation subject to approvals.

The area was originally mallee scrub in the highland, with floodplains in the lower areas dominated by River Red Gums and Black Box. The clearance of the native vegetation on both the floodplain and highland occurred following European settlement. Major irrigation development at Bookpurnong began in the 1960s. This combination of mallee clearance and irrigation development has led to highly saline groundwater impacting on the floodplain and river.

Figure 1. Murray Darling Basin SA

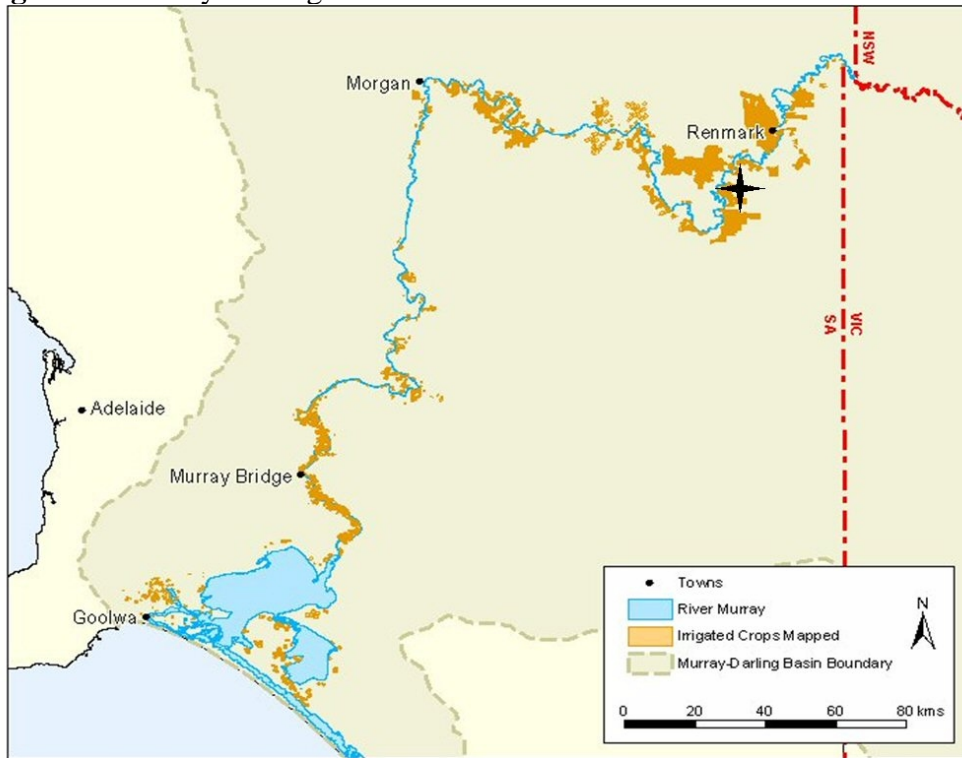
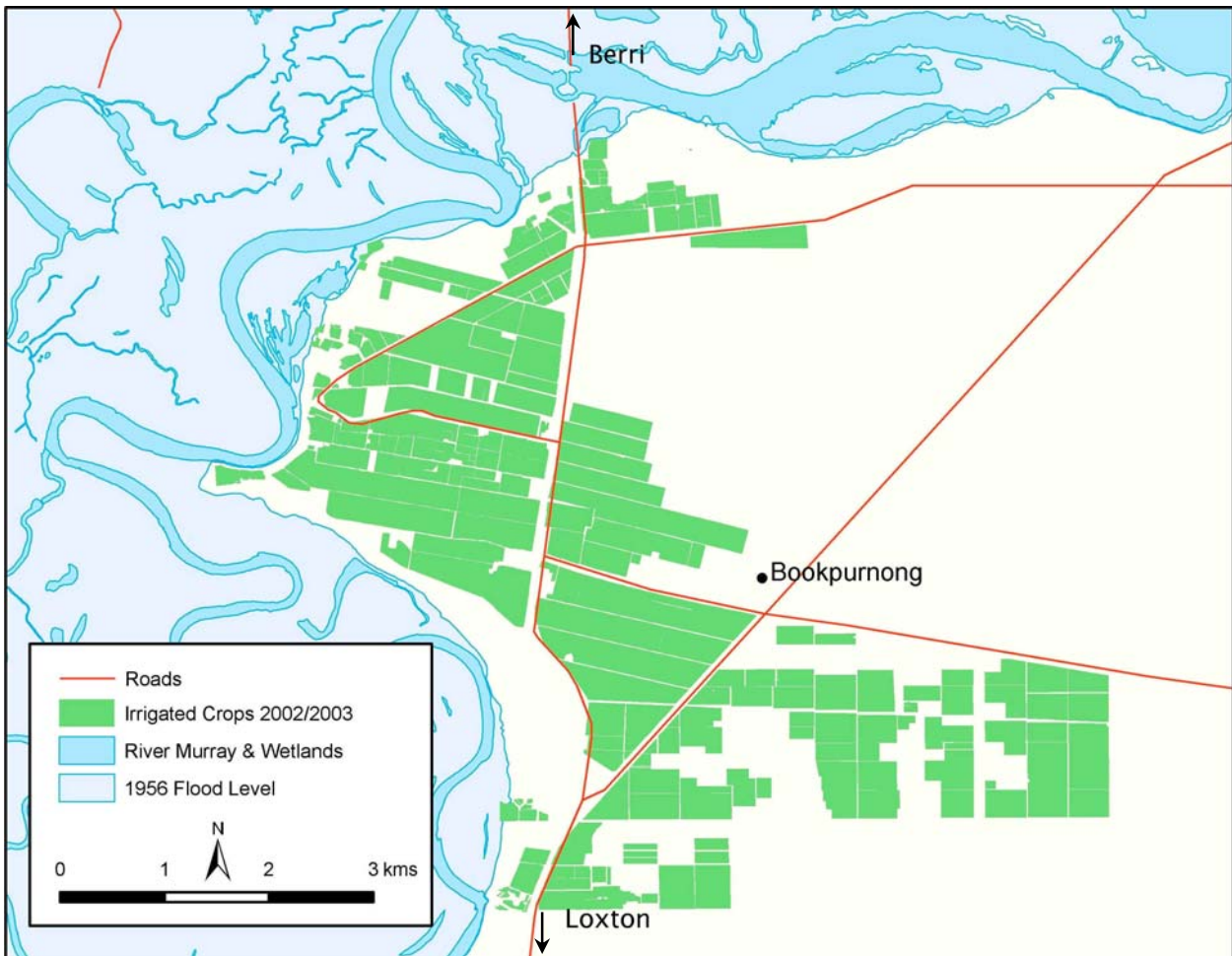
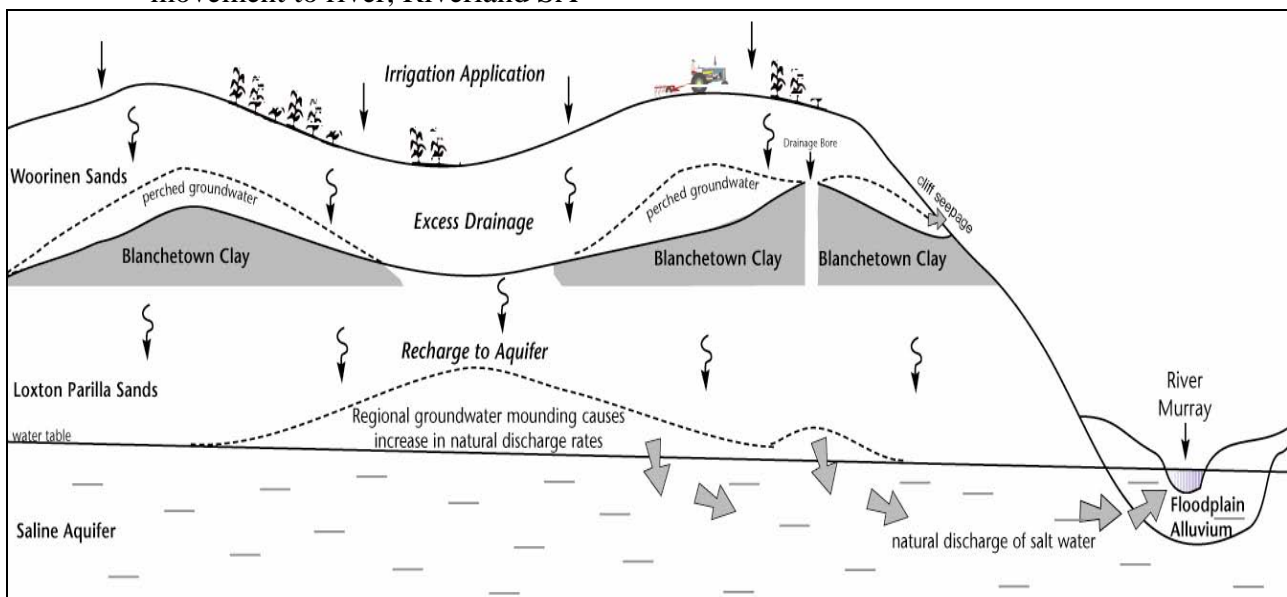


Figure 2. Bookpurnong Lock 4 LWMP District



The River Murray in South Australia for the most part is a gaining stream. That is, the natural regional groundwater movement is into the river system. Drainage past the rootzone of irrigated crops, essential for the flushing of salts, places pressure on the regional groundwater system increasing the rate of movement to the river. It is estimated that in the Bookpurnong area, a salt load of 70 tonnes per day is added to the river by the regional groundwater from a combination of natural and irrigation induced inflows. Groundwater modelling suggests that the salt load will continue to increase to more than 200 tonnes per day by 2030 (Australian Water Environments, 2002). Additionally, excess drainage causes problems with localised groundwater mounding occurring under considerable areas in the Bookpurnong Lock 4 district (Figure 3).

Figure 3 Diagrammatic cross-section showing groundwater mounding and increased salt movement to river, Riverland SA



Increased regional groundwater movement from irrigation development not only impacts on the river but the floodplain as well. At several locations in Bookpurnong, groundwater has risen to a level that is causing seepage onto the floodplain or is close enough to the floodplain surface that evaporation is leaving a build up salts in the soil profile. The combination of salt accumulation in the soil, seepage and the high groundwater levels in the floodplain has caused widespread vegetation death and salt crusting (Figure 4).

Figure 4. Clark's Floodplain, Bookpurnong, SA



Concern over the significant impacts being witnessed on the floodplain as a result of local irrigation development motivated a group of irrigators to form the Bookpurnong Lock 4 Environmental Association (BL4EA) to start tackling the problem. The group began investigating both on-farm and district scale options to manage salinity in their area through the development of a preliminary Land and Water Management Plan (LWMP) for the Bookpurnong Lock 4 area. The plan outlined a range of strategies, some of which were already in the early stages of being implemented by irrigators, for example, technical research, improving on-farm irrigation practices and reducing rootzone drainage. A key element of the plan was the development of a salt interception scheme between the irrigation district and the river (Australian Water Environments, 1999).

The BL4EA sourced funding through the Natural Heritage Trust and engaged consultants, Australian Water Environments, to undertake a series of hydrogeological investigations. These investigations were aimed at improving the understanding in the Bookpurnong district of the geological structure, stratigraphy, aquifer parameters of the subsurface, patterns of groundwater flow, relationships between aquifers, and interactions between the floodplain and the river (Department of Water, Land and Biodiversity Conservation [DWLBC], 2003).

Results from the hydrogeological investigations identified the Bookpurnong area as an ideal location for intercepting saline regional groundwater prior to discharging in the river. The Bookpurnong community put forward a Statement of Offer to the South Australian government to be involved in the construction, operation and maintenance of a salt interception scheme. Schedule C of the Murray-Darling Basin Agreement establishes the formal relationships between New South Wales, Victoria, South Australia and the Commonwealth with regards to salinity accountability. It obliges each of the states to offer any salt interception scheme that intercepts natural saline groundwater inflows, inflows as a result of land clearing or inflows from irrigation established before 1 January 1988 as a Joint Works project for the three states and the Commonwealth Government. As a result of this obligation, it is extremely difficult for a community group such as the BL4EA to be involved at the proposed level in the Statement of Offer. The hydrogeological information was subsequently handed over by the Bookpurnong community to the South Australian Minister for the River Murray to underpin further investigations in the Bookpurnong area to assist in the design of the Bookpurnong salt interception scheme. The scheme is now under construction and due to begin pumping in December 2004.

In response to the initial Statement of Offer, the Minister made a commitment to work with the Bookpurnong Lock 4 community to further develop strategies complimentary to salt interception and focus on assisting the community to establish itself as a leading example of sustainable irrigated horticulture. In January 2003, a project management committee was formed involving relevant stakeholders to ensure appropriate community input into the construction, operation and maintenance of a salt interception scheme, and the policy requirement for irrigators to be accountable for all post 1988 salinity impacts. A result of this management committee has been a change in direction for the BL4EA, which is now working on a 'Resource Management Case Study' (case study) to address their salinity impacts and manage for the sustainable future of their district.

A draft Memorandum of Understanding has been developed to formalise a long-term commitment (five years with an option to extend for five years) by all key stakeholders to assist the BL4EA to move forward in the development and implementation of a Land and Water Management Plan for their area through the case study. The Memorandum of Understanding establishes a case study group with representatives of the key stakeholders including complete membership of the BL4EA to provide guidance in the establishment and implementation of the case study.

RESOURCE MANAGEMENT CASE STUDY

The purpose of the case study is to establish a dynamic framework that provides an integrated and cooperative approach between key stakeholders to implement on-ground actions and achieve outcomes that meet the strategic objectives at the State, Catchment and local district level. It aims at working together in partnership to further develop and implement a comprehensive LWMP for the Bookpurnong Lock 4 area that assists in sound decision making and provides for environmentally, socially and economically sustainable irrigated agriculture (DWLBC, 2004).

A number of key components underpin the evolution of the case study to date. They include:

- **Existing programs and activities** - Programs already being implemented throughout the SA Murray Darling Basin are being used as a basis for the case study. These programs include irrigator training in irrigation scheduling, soil properties, pump efficiency and systems assessments, installation of perched groundwater monitoring wells, and detailed crop mapping down to rootstock using digital orthophotography and on-ground irrigator surveys.
- **Improving technology on-farm** - The case study incorporates a range of additional tools and actions aimed at improving technology on-farm to facilitate the use of best available information in day-to-day irrigation scheduling. The goal of this program of activities is to minimise drainage so that it doesn't exceed 10-15% of any one application. A trial of soil moisture monitoring probes linked to a weather station in the district is providing localised information on climatic and soil moisture conditions, and ultrasonic flow meters with high accuracy levels are being trialled to give precise data on extractions from the river. This information is then utilised by the grower to accurately schedule irrigation to ensure best use of the water applied. Additional benefits to the irrigator from access to the weather station include disease prediction modelling, frost alarms and improved spray management.
- **Data collection and recording** – Irrigators in the Bookpurnong area are adopting a process of recording each irrigation event down to the individual valve unit level using the recently developed Farm Level Water Management Module (FLWMM). The FLWMM involves a highly detailed survey of crops and irrigation system practices at the farm level. It incorporates a process that enables irrigators to adaptively manage day-to-day irrigation and periodically throughout the irrigation season fine-tune water application (Meldrum, et al, 2004). The FLWMM also generates simulated drainage data that can be used to advise policy decisions such as reviewing the capacity of a salt interception scheme.
- **Mentoring** - Mentoring between irrigators to foster participation and assist each other to achieve targets is considered one of the key reasons for the level of success the case study has had to date. Members of the BL4EA breakdown tasks and actively seek input from and provide advice to other irrigators in the district. With the support of the various case study partners, the BL4EA provide updates through regular community meetings and newsletters. The South Australian Government and the River Murray Catchment Water Management Board further enhance the mentoring process through the provision of one-on-one technical support.

Future Direction

The case study is still in its infancy and as a result additional core actions have been identified and are required to make the case study complete. Planned future activities include:

- **Land Water Management Plan** – The Preliminary LWMP for the Bookpurnong Lock 4 area was launched in December 1999. Since then, significant components of the preliminary plan have been achieved and new targets for the community need to be set. Additionally, guidelines for LWMPs in the SA Murray Darling Basin have been established defining a clear process and standard to attract investment from stakeholders. The review and upgrade of the Bookpurnong Lock 4 Preliminary LWMP is anticipated to begin towards the end of the year and will focus predominantly on continued on-farm change and progressing the environmental enhancement program component of the case study.
- **Environmental Enhancement Program** – Concern over irrigation impacts on the local floodplain was one of the driving factors in the establishment of the BL4EA. The groups environmental enhancement program includes managing on-site and off-site irrigation impacts and involvement in floodplain management, and attracting natural resource management projects to the district. Funding has been secured for fencing approximately 20km of remnant floodplain vegetation however significant work to complete the project is still required. Additionally, the BL4EA has expressed interest in becoming involved in a planned DWLBC project that will provide an understanding of relationships between watering trials and the interception of the saline groundwater from floodplain bores. The information from this trial will be used to inform projects in other areas.
- **District Irrigation Code of Practice** – The establishment of a district irrigation code of practice is one of the planned outcomes the case study. The code of practice will provide direction through incorporating targets for existing and new development, and will establish a set of agreed assessment criteria for irrigation for the district. Irrigators meeting all outcomes of the assessment criteria will, by virtue of the actions undertaken to meet the assessment, be assumed to be attaining certain levels of irrigation efficiency. This can be crosschecked with the simulated drainage data generated through the use of the FLWMM. The code of practice will be designed to be consistent with and complementary to Environmental Management Systems to minimise irrigator input.
- **District Scale Reporting** – Irrigation licence holders are currently required to report annually on each licence. Information required includes the calculation of a water use index using crop type, crop area, age, effective rainfall, evapotranspiration, crop factors and irrigation applied. The annual report also requires salinity and water level information for monitoring wells and soil moisture monitoring systems used. The information collected during the various components of the case study will provide detailed and accurate information that can be used to generate a district scale report that will, through time, reflect changes and demonstrate sustainability of the district. This district scale report may remove the need for each irrigation licence holder to report individually.

CONCLUSION

Accepting responsibility for impacts on the floodplain from irrigation development enabled the Bookpurnong community to begin the process of change. Through the establishment of a preliminary LWMP for their area they were able to define district goals and identify options and actions required. The preliminary LWMP provided a framework for sourcing funding to undertake a series of detailed hydrogeological investigations to assist in improving their understanding of what was happening in their district and to consider the feasibility of saline groundwater interception. This information was then handed to the South Australian Government to underpin further investigations in the Bookpurnong area to assist in the design of the Bookpurnong salt interception scheme.

Through the demonstrated commitment of the Bookpurnong Lock 4 community, partnerships have been established with key stakeholders through a Resource Management Case Study to assist the community in their goal of establishing themselves as a leading district in environmentally, socially and economically sustainable irrigated agriculture. Although the case study is in its infancy, evidence of changes in practices and irrigator attitude is already evident.

The lessons learnt from the implementation of the Bookpurnong Lock 4 Resource Management Case Study will assist in defining best methods for uptake of the program of activities and tools used throughout the remainder of the SA Murray Darling Basin.

Irrigators in other irrigation districts within the SA Riverland are becoming aware of the successes of the Bookpurnong community and are inspired to face the challenges in their district. The Pike River-Lyrup LWMP district and the Murtho LWMP district have recently established case study groups and have begun negotiating with key stakeholders a package of works similar to those being undertaken in the Bookpurnong area.

ACKNOWLEDGEMENTS

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