Background

Research and development work in the Murray Valley has traditional been undertaken by NSW Agriculture – and has been production driven and focussed.

The work done by NSW Agriculture has been highly regarded and valued by the local community – with invaluable work being done in the areas of rice production, irrigated winter cropping and pasture production, use of saline water and gypsum application.

NSW Agriculture continues to have an important role to play in these areas. And increasingly, private industry is becoming involved with specific production-based research, development and extension activities.

However, the local communities believed further work was required – focussing particularly on sustainability issues. It was given such importance that each of the four Murray Land and Water Management Plans (LWMPs) set aside significant funding for R & D as part of their negotiations with State and Federal Governments.

This resourcing was to be used for issues of specific importance to the LWMPs – which otherwise may not have been undertaken.

More recently, a regional body – the Murray Research and Development Council – has been established to provide some overall direction and co-ordination for R & D activities in the Murray Valley of southern NSW. This body is in its infancy – and is a farmer based, non-profit organisation focusing on the promotion of the benefits of R & D for profitable and sustainable irrigated agriculture in the Murray Valley.

This document is focussed specifically on the Murray LWMP R & D program and vision. It identifies the aims and objectives, and sets priorities for future planning.

1 INTRODUCTION

The Murray Land and Water Management Plan (LWMP) is composed of the Berriquin, Cadell, Denimein and Wakool LWMPs. These Plans are action plans aimed at securing the economic, social and environmental future of the Murray Valley of southern NSW.

The Plan has a number of key components – on farm works, channel seepage minimisation, surface drainage, monitoring and review and a range of institutional arrangements – including funding, education and extension, research and development and operational programs.

The Plan itself was agreed to by all stakeholders in March, 1996. Implementation by the local communities commenced shortly after.

2 R & D COMMITTEE STRUCTURE

The Research and Development (R & D) program was initiated in 1997. Initially, informal arrangements existed to determine priorities and funding levels.

A more formal structure was established in 1998 – whereby two representatives of each of the four community LWMP Working Groups, the Murray Irrigation Limited (MIL) Environmental Manager and the MIL LWMP Manager comprised the Murray LWMP R & D committee.

This committee met on a semi-regular basis to discuss research proposals and make funding recommendations. Prospective researchers would make formal submissions and presentations to the committee, who would then prioritise activities.

A revision to the make up of the R & D committee was made in 1999. Table 1 outlines the current membership of the R & D committee.

Table 1. Murray R & D committee

Murray Irrigation Limited (as Implementation Authority)	**1 representative**
Berriquin Land and Water Management Plan	**2 representatives**
Cadell LWMP (including one East Cadell representative)	**2 representatives**
Denimein Land and Water Management Plan	**2 representatives**
Wakool Land and Water Management Plan	**2 representatives**
NSW Government agency (including one representative with a linkage to the MDBC Strategic, Investigations and Education program	**2 representatives**
External technical expert (to be appointed by the committee)	**1 representative**

In addition, the following arrangements will exist.

1. An annual reporting and future directions workshop to be conducted.

2. The R & D committee would call for, review and recommend to the implementation authorities project proposals for funding under the LWMP R & D program.
3. That for a project to be funded will require the support of all organisations represented on the committee.
4. That any individual associated with a project proposal not be present for the review of the proposal.
5. The committee elect its own chairman.
6. MIL to provide secretarial support to the committee.
7. A five year strategic plan will be developed and only those projects that address the strategic plan will be funded.
8. An annual report will be required by all projects by June 30. No report, no further funding.
9. The committee to have the authority to invite individuals with technical expertise as it considers appropriate to assist in it's determinations.

3 FUNDING ARRANGEMENTS

Overall funding for the R & D program is derived from three sources:

Murray LWMP communities	50%
Federal Government	25%
State Government	25%

In total, approximately $4 million is available for R & D activities under the Murray LWMPs.

4 CURRENT R & D PROGRAM

Approximately 17 projects have, or are continuing to be, funded by the Murray LWMP. These cover a diverse range of activities – from determining salt and water balances at the farm level, aquaculture to soil moisture monitoring for farmers. Appendix 1 gives a brief summary of the projects funded to date.

5 PRIORITIES AND STRATEGIES

The Murray LWMP's R & D program is focussed on issues of sustainability. The work done by other organisations and agencies on production must continue. The objective of the Murray LWMPs R & D efforts must be on those issues which directly influence or impact LWMP implementation.

The three priority areas neatly fall into the Irrigation Regions Program of the Murray-Darling Basin Commission. These areas are:

1. Sustainable agricultural productivity
2. Water quality
3. Nature Conservation

The community needs to identify their research needs and priorities -

5.1 Sustainable Agricultural Productivity

Sustainable agricultural productivity is the major priority of the current research. "Sustainable" is defined from economic, social and environmental perspectives.

This encompasses a wide range of resource management issues, and should be considered as part of the whole-irrigated farming system.

The main objectives would be to identify best management practices and identifying production and productivity benchmarks.

It is important that this be done over the whole farm system – and not specific enterprise types. Indicators of sustainability developed as part of a typical farming system will provide invaluable information to landholders in terms of land management options. There is the need to develop a long-term research program to explore the ideal broadacre cropping rotations for the Murray Valley.

5.1.1 Salt and Water Balance

One of the main aims of the LWMPs was to achieve a water balance at the farm and more importantly, District level. Much progress has been on developing a program which will allow individuals to achieve this, whilst at the same time maximising returns. It is important that further verification work be completed to prove the outputs generated by the modeling process. This is a high priority activity.

Levels of recharge need to be determined as part of the whole farming system. Whilst recharge under a growing rice crop has been measured, what are the winter recharge impacts, and what management activities (other than establishing a winter crop) can minimise accessions.

5.1.2 Irrigated crop water use

A further important area of research is focussing on crop wateruse. Ultimately, all irrigated crops and pastures should have target wateruse figures. This would remove the reliance on soil criteria as the determinant of rice growing suitability. Such a strategy would remove the criticism from the rice industry that rice growing is highly regulated, whereas other irrigators are able to apply water to crops basically unregulated.

Benchmarks need to be determined to cater for varying irrigation regimes – particularly for pastures and other intermittently irrigated enterprises.

There is a greater need to match soil type and irrigation technique, or at least develop wateruse targets for all irrigated crops and pastures. This will minimise the need to use subjective soil criteria as an indicator of soil suitability. This work would link with the SWAGMAN Farm modeling investigations being undertaken. "Acceptable" levels of recharge would be determined. Ultimately, this would link total farm wateruse with production, and minimise the current ability of landholders to incorrectly state water usage.

Matching crop water requirements will improve yield and possibly reduce recharge under non-flooded conditions. Further work should be undertaken to determine the applicability of scheduling techniques on a range of irrigation soils and enterprises.

5.1.3 Soil fertility

Evidence suggests traditional cultivation practices are degrading soils. Adoption of minimum till/conservation tillage regimes is on the increase – what effect is this having on improvements to soil structure and fertility, and do the increased investments in machinery justify any of these improvements?

Opportunities exist to undertake some long-term trial work into these questions.

Soil acidification is the newest threat facing Murray Valley irrigators. Further initial investigations are required to quantify the current extent of acidification. Some experimentation is necessary to be able to determine soil acidity quickly, similar to the way soil changes are currently identified via EM31 technology.

5.1.4 Stubble management

High yielding irrigated crops produce large quantities of stubble. Disposing or managing this stubble is difficult. Does stubble retention or incorporation have long term benefits compared with traditional burning? Is baling or other stubble removal feasible, and is there a locally accessible market? Are there other possible end-users – conversion into "renewable" energy sources such as methanol, which may have additional environmental benefits.

Work is currently underway around Griffith investigating these options for maize stubble. Such work should be encouraged locally, particularly focussing on rice stubble. Valuable information could be derived from a long-term project, which could link with that identified in 5.1.3.

5.1.5 Groundwater

The use of groundwater (particularly that obtained from deep aquifers) has increased significantly in the MIL area over the past five years.

Whilst much research has been completed on plant productivity impacts, little quantitative work has been completed in terms of the long term impacts on soil structure and fertility. This should be an area of high priority, as the impacts of the use of groundwater will impact significantly on the LWMP's.

If watertables do continue to rise, shallow groundwater pumping will become increasingly necessary. Better methods need to be developed to determine aquifer reliability and sustainable pumping rates before pumping infrastructure is established.

Groundwater pumping may become necessary from low yielding aquifers. Whilst work has been done with the use of airlift pumps, some reliability problems have been encountered. The high cost of materials is also a deterrent. Further experimentation

should be undertaken to evaluate the various options, and to determine the areas that can be protected given the range of soil types in the area.

On-farm evaporation basins have been investigated previously. Whilst technically this is a viable option, further work is necessary to determine if they cannot be made more cost effective. There are several options currently being investigated such as inland aquaculture and seaweed production. This work needs to be expanded to the farm level, with the possibility of establishing some demonstration sites locally.

5.2 Water Quality

License conditions imposed by both DLWC and EPA set upper limits on the quality of water exported from the LWMP areas.

Nutrient export rates at the farm level are therefore important to quantify. Work elsewhere has tended to focus on nutrient export from dairying and perennial pasture situations.

With the high level of adoption of drainage reuse and storage systems in the LWMP areas, irrigation farms are effectively becoming 'closed systems' in terms of nutrient export. An ongoing monitoring program is needed to evaluate nutrient movement at the farm level over the range of irrigation enterprises practiced.

Associated with this is the operation of farm storages. The main priority of these farm storages is for the capture of all irrigation runoff and the initial flush of rainfall runoff. Landholders must be encouraged to manage their storages in such a way as to be able to be able to cater for such events. This will have an impact on the quality of water discharging from farms.

Creation of artificial wetlands for nutrient stripping has been discussed. However, it's practicality in the Murray LWMP environment should be determined. The use of District drainage schemes will increasingly become low frequency, high volume episodes. Will long periods of dry conditions impact on the wetlands ability to filter nutrients?

Long drainage lines are typical of the works constructed in the Murray LWMP areas. Will re-vegetation of these lines, coupled with their length, reduce nutrient export through longer retention times? These questions need to be considered and investigated.

The quality of the groundwater system is an important issue. Groundwater (particularly shallow groundwater) is used for irrigation and stock and domestic purposes. The AGSO completed investigations in the early 1990's to determine changes to the quality of the groundwater in some key locations. This work needs to continue on a regular basis (every five years), and the results need to be made available to the general community.

5.3 Nature Conservation

With the increasing emphasis on protection and enhancement of the environment, landholders are under greater pressures to implement 'biodiversity' type strategies on farm.

Whilst many landholders are implementing such activities, there is still some broad scepticism about the value of such measures – particularly in a highly modified irrigation environment.

The benefits of native vegetation (and perennial vegetation generally) in our current (and expected) farming systems must be identified and quantified.

The LWMPs need to develop a regional 'biodiversity' strategy. This strategy would move away from having set areas of vegetation on each holding, and look to identify localities and specific sites where significant regional and environmental benefits could be generated.

There are a number of benefits which need to be quantified to gain broader acceptance by the farming community. Such things include:

5.3.1 Native perennial grasses

These are obviously suited to environmental conditions experienced locally. The benefits of these species are likely well known – however, these need to be extended to the local community. Quantification of benefits is an important component of this – and should initially focus on production and recharge. Further information needs to be provided to outline establishment techniques, grazing strategies and nutritional requirements.

5.3.2 Establishing non-commercial tree plantings

Tree plantings may provide an opportunity to minimise recharge and to act as pumps to actively utilise groundwater. There may be specific areas such as the prior streams, where plantings of this nature may be desirable.

These benefits, plus any additional benefits in terms of biodiversity need to be quantified.

5.3.3 Farm forestry

Farm forestry across the Districts is a viable enterprise. Irrigated farm forestry is an option, but does not fall into this strategy. The forestry industry is well advanced in terms of developing an R & D program, and the LWMPs do not need to actively pursue other R & D programs.

In terms of other tree planting activities, there is potential to undertake some additional work in terms of strategic placement of tree blocks or the like.

The benefits in terms of recharge control and salinity prevention need to be quantified. Further work is needed to better identify these benefits in specific circumstances – eg. plantings in known recharge areas.

Rotating tree crops (or deeper rooted species generally) with annual cropping/pasture systems may have some benefits in terms of drying soil profiles.

All these options involve an attempt to obtain a local hydrological balance through controlling recharge.

6 NOMINATION OF PROJECTS

The Murray LWMP's should consider making the general research community more familiar with the current research activities and priorities, and encourage interested bodies/organisations to develop research proposals.

Serious consideration should be given to operating the R & D program along similar lines to other applications for funding. MIL should develop a simple application form which potential researchers would be required to complete.

Set timeframes for proposals and funding should be developed. This would allow a level of consistency when assessing and recommending projects.

There should be two rounds of formal assessment for proposals – the first would rank proposals on the basis of an initial application, and the second would require potential proponents to make a formal presentation to the R & D committee.

Proponents would need to clearly identify project outcomes, how the project and its outcomes specifically relate to implementation of the Murray LWMP's, and how the results will be extended to, and used by, the community.

7 EXTENSION OF RESULTS

It is imperative that research results are extended to the broader community. It has been a general criticism of the research fraternity that this does not occur – and in some cases results which have not been favourable have not been reported.

It is important that there is an open and transparent process for informing the community of research results.

The Murray Valley community is generally well-served through existing extension services – researchers should capitalise on the existing infrastructure and resources to inform the community of any results. The LWMP's have facilitated the development of an excellent network of extension – such as community meetings, field days and community newsletters – which would provide ideal opportunities to disseminate information.

A major workshop should be conducted annually to allow major stakeholders to view the progress of individual projects. Consideration should also be given to conducting a similar workshop, specifically aimed at the farming community.

The Murray LWMP's should also consider publishing a R & D booklet, similar to that produced by the IREC. This would outline the current research, how it is being done and any results, recommendations and conclusions.

8 AVAILABLE RESOURCES

Many of the issues and options identified previously require field work and long-term monitoring.

There has been a long history of co-operation between researchers and collaborative farmers. This relationship needs to be continued, as results obtained in this way are much easier for the wider farming community to accept.

Other resources do exist within the region. The largest under-utilised resource exists to the north of Deniliquin – the Faulkiner Memorial Field Station. With over 3,000 ha of land available, and a management structure which has been established to encourage focussed and applied research, an unparalleled opportunity exists to establish a significant research and demonstration facility.

There are several demonstration sites previously established throughout the area. These need to be widely identified and publicised, and should become the focus sites for locally applicable research.

9 LINKAGES

It is important that strong linkages be created between different researchers, landholders, industry and the community generally both intra and inter valley.

There are common interests and issues facing irrigators across the State and the Nation. Whilst there must be a local focus, communication lines must be maintained between all stakeholders. For example, if the rice industry is researching a certain set of environmental guidelines, should water providers be heading in a different direction?

Developing an overall Plan for R & D activities and strategies is a necessary step toward achieving a sustainable irrigation industry and region.

The MRDC is itself developing a long-term strategy to lead irrigated agriculture research, marketing and diversification in this region. Strong relationships should be developed with the MRDC.

It is important that an inventory of research results carried out in the region to date be undertaken. This would allow gaps in the current knowledge base to be determined, and may provide some useful start points for new work.

It is also important that the results of this research which have not been published previously be made available to the farming community.