



Water Wheel

National Program for Irrigation Research and Development

KNOW THE FLOW WEBSITE

A new website (Know the Flow) was demonstrated at the ANCID conference held in Toowoomba in September this year. The site is being developed under a project funded by NPIRD. The aim is to centralise information on flow metering equipment as used by rural water suppliers to supply irrigation water to farms.

Better flow metering can result in better control, management and efficient use of water through:

- ❑ Better decision making about distribution of the resource
- ❑ More accurate information about flows and losses
- ❑ Meeting critical crop water requirements with the right quantity at the right time
- ❑ More accurate understanding of how much water is used and remaining to be used.

The site is expected to be operational by the end of the year. Water supply agencies, meter manufacturers, testing authorities and the general irrigation community are being invited to provide information for the site.

The site contains a searchable database on seven types of flow meters:

1. Dethridge meter
2. Dethridge-Long meter
3. Propeller meter, closed type
4. Open flow propeller meter
5. Ultrasonic water meter
6. Electromagnetic flow meter
7. Paddle wheel meter.

For each meter type there will be generic information on: description and function; application and use; accuracy; and advantages and limitations.

If available, the site will also include information on experience in the use of each meter. This information will be sourced from independent test information, both *in situ* and field, and case studies from users of different types of meters. An on-line proforma will be available for people to send their test data and case studies directly to the site manager.



KTF project manager, Alison Carmichael discusses the website with Dale Harris from Amiad at the recent ANCID conference.

Potential users of the site have said that they wanted to be able to contact people for more information. Therefore there will be a range of contacts on the site including:

- ❑ Contact details of users of different types of meters
- ❑ Contact details of manufacturers of different types of meters
- ❑ Links to manufacturers websites for further commercial information.

An online discussion group will be set up for those who may wish to share their experiences and to post queries.

For more information contact project manager, Alison Carmichael, phone 02 6628 7079 or email <alison@naturallyresourceful.com.au>.

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Partners: LWRDRC - CSIRO - Department of Natural Resources (QLD) - Department of Land and Water Conservation (NSW)
Goulburn-Murray Water - NSW State Water - NSW Irrigators - Southern Rural Water Authority - Sunraysia Rural Water Authority
Wimmera Mallee Water Authority - Water and Rivers Commission (WA) - Ord Irrigation Cooperative
South West Irrigation - Agriculture (WA)



**Land & Water
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This publication is managed by the Land & Water Resources Research and Development Corporation (LWRDRC), GPO Box 2182, Canberra ACT 2601.

LWRDRC's mission is to provide national leadership in utilising R&D to improve the long-term productive capacity, sustainable use, management and conservation of Australia's land, water and vegetation resources. The Corporation will establish directed, integrated and focused programs where there is clear justification for additional public funding to expand or enhance the contribution of R&D to sustainable management of natural resources.

LWRDRC's Home Page is:
www.lwrddc.gov.au



THE CONDAMINE-BALONNE

Compared with Victoria and southern NSW, irrigation on the Condamine-Balonne river system in southern Queensland has had a relatively short history, with the first irrigated crops grown in the 1960s.

Today cropping is concentrated mainly on broadacre monoculture with grain crops being grown in winter and summer and cotton the major summer crop. Horticultural crops are grown, mainly at the top end of the basin.

Agriculture, including irrigated agriculture, contributes generally to the local economy of the Darling Downs and St George areas and supports service industries in urban centres such as Toowoomba, Warwick, Dalby and St George.

Irrigation in the basin

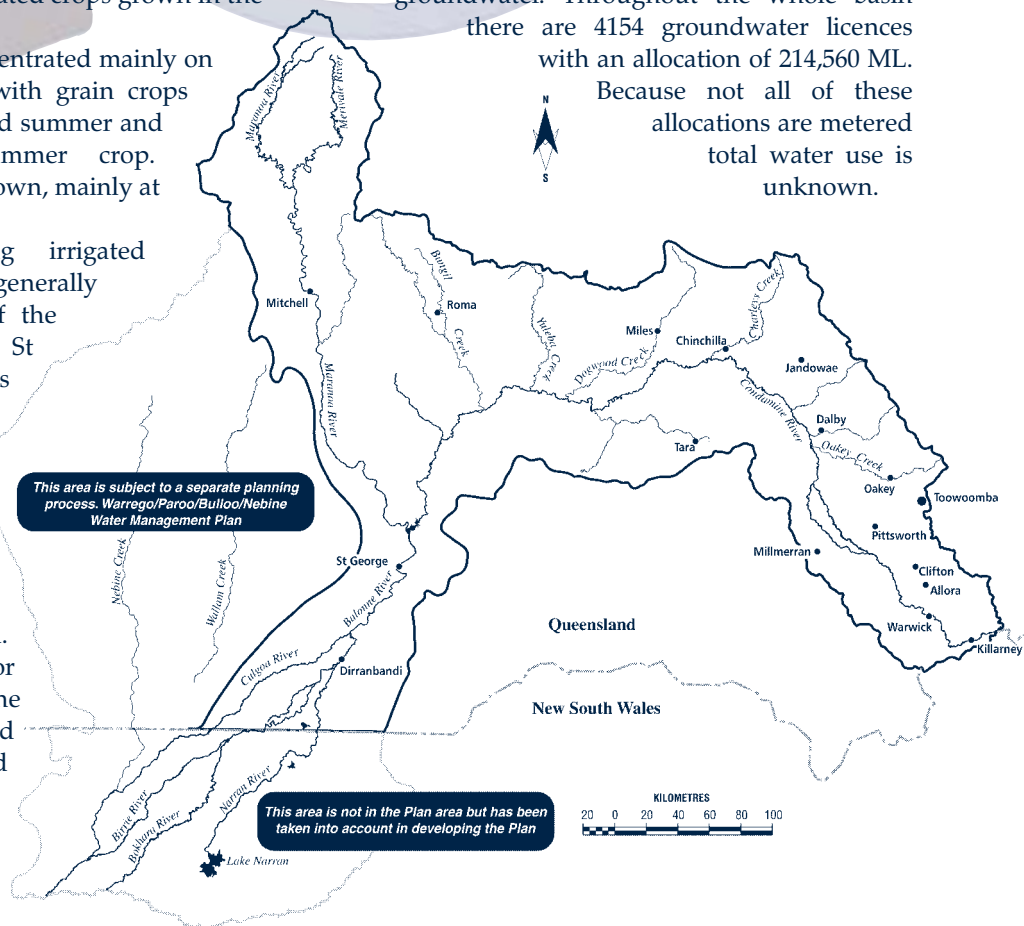
There are 1300 surface water licences in the basin. Estimated diversions for the Condamine, Balonne and Culgoa systems, based on regulated, unregulated and overland flow, are shown in Table 1. The simulated mean annual diversion for mid 1999 development was about 650,000 ML. This represents almost a doubling of diversions compared with 1993-94 levels of development, when the simulated mean diversion was estimated at 385,000 ML. The increase is due mainly to sleeper licences being activated as there has been a moratorium on issuing new licences for the last 5 years.

Table 1. Annual estimated diversions, Condamine, Balonne and Culgoa systems.

YEAR	STREAM DIVERSION (ML)	OVERLAND FLOW DIVERSION (ML)
1993-94	265,000	Unknown
1994-95	110,000	Unknown
1995-96	382,000	Unknown
1996-97	346,000	Unknown
1997-98	545,000	62,000
1998-99	467,000	80,000

Groundwater is also an important source of water for irrigation. This is especially the case in the Condamine, where 40% of farms use mainly groundwater. Throughout the whole basin there are 4154 groundwater licences with an allocation of 214,560 ML.

Because not all of these allocations are metered total water use is unknown.



Trends in development

In recent years most development has come as a result of the construction of off stream storages associated with waterharvesting licences. This is particularly so for the Balonne Region downstream of St George. According to the Draft WAMP for the Condamine-Balonne Basin, published by the Queensland Department of Natural Resources in June this year, "the total size of these storages throughout the basin has increased from an estimated 247,000 ML in 1993/94 to 827,000 ML as of mid 1999, resulting in a large increase in water diversions and agricultural production across the basin." (The figures for mid 1999 were recently revised and now show total storage capacity as being at 1,360,000 ML.)

This increase in agricultural production has had a major impact on regional economic growth, particularly in the lower catchment area.



Yarramalong Weir, on the Condamine River.

Issues

Future development. The recently released draft WAMP (Water Allocation Management Plan) highlights a major issue in the Condamine-Balonne, that of future development. Extraction levels along the two rivers vary. Upstream, in the Darling Downs reach, extraction averages around 32% of total flow. According to the WAMP, this level is on the limit of sustainable use. Along the mid stretch extraction is around 20% of total flow, while at the bottom of the system, around St George, extraction is at 55%.

This variation in development and extraction levels makes the decision on how water will be allocated in future difficult and complicates any plans for further development. Until there is a decision on the WAMP a moratorium on any development, which was announced in September this year, will stay in place.



The practice of strip cropping across the fall of the land on the Darling Downs produces this patchwork effect (photo courtesy Irrigation Australia).

Use of recycled water. Plans have been mooted, under the stewardship of a group called Darling Downs Vision 2000, to pipe recycled water from Brisbane to the Lockyer Valley and the Darling Downs. While this is physically possible, a big question mark remains over how much end users will have to pay for the water and what viable production options there will be.

Water use efficiency. As with irrigation generally, water use efficiency is an important issue in the Condamine-Balonne. A major initiative was announced by the Department of Natural Resources last year allocating \$41 million over 4 years to "help rural producers make better use of existing irrigation water resources".

Some important initial research that was done was an audit of irrigation and water use efficiency. The research was commissioned by the Department of Natural Resource's Rural Water Use Efficiency Initiative and the cotton, sugar, dairy and horticultural industries in Queensland.

The resulting report highlighted a need for extension officers, WUE research, irrigation training, information management systems and technology transfer. For more information see website <<http://www.dnr.qld.gov.au>>.

Research in the basin

A major player in research in the basin is the National Centre for Engineering in Agriculture. The centre is a joint venture of the Queensland Department of Primary Industries (QDPI), the Queensland Department of Natural Resources (QDNR), and the University of Southern Queensland (USQ), located in Toowoomba.

The Centre has an irrigation program that currently attracts funding of about \$700,000 a year and operates with seven full-time staff and a range of part-time professionals.

Dr Steven Raine, Principal Irrigation Scientist at the NCEA, believes the centre's main irrigation expertise lies in the areas of both whole farm and in-field irrigation performance evaluation as well as in the provision of irrigation training.

"Our whole farm and in-field irrigation evaluation work in the Queensland cotton, horticultural and sugar industries has shown that a 10-15% improvement in irrigation performance can generally be made relatively easily", he said.

NCEA irrigation projects relevant to the Condamine Balonne

1. Maximising Irrigation Efficiency in the Australian Cotton Industry
 2. Decision Support Systems for Improving Water Use Efficiency in the Northern Murray-Darling Basin
 3. FIDO v2: Furrow Irrigation Design Optimiser
 4. Technical support for the QFVG "Water for Profit" adoption program
 5. Implementing efficient on farm water use practices
 6. Quantifying the Socio-Economic Impact of Harvesting Residue Retention Systems
- For more information on the NCEA irrigation program go to website <<http://www.ncea.org.au>>.

The Rural Water Use Efficiency Program is also a research funder. For more information contact Don Yule, phone 07 3362 9388, email <Don.Yule@dnr.qld.gov.au>.



Water for Profit

SOIL WATER MONITORING

The last few years have seen increasing pressure on irrigators to manage water more efficiently. This pressure has contributed to the huge growth in the range of equipment available for measuring soil water status, which is important information required to schedule irrigation correctly.

The key to efficient irrigation water management is knowing how much water in the soil profile is available to the crop and how much the crop needs to grow (soil water status).

Measuring and monitoring soil water status are essential to avoid:

- ❑ economic losses due to the effects of either under irrigation or over irrigation on crop yields and quality
- ❑ the environmentally costly effects of over irrigation: wasted water and energy, leaching of nutrients or agricultural chemicals into groundwater supplies, and degradation of surface waters with contaminated irrigation water runoff.

Different ways of measuring soil water status

There are essential two ways of measuring how much water is in the soil (other than drying soil samples, known as gravimetry). These are:

- ❑ by suction methods e.g. porous media and wetting front detectors
- ❑ by measuring volumetric water content via:
 - Soil dielectric, e.g. time domain reflectometry, frequency domain reflectometry (FDR or capacitance)
 - Neutron moderation
 - Heat dissipation.

Choosing a soil moisture sensor for your situation

There are a variety of ways to choose a soil moisture sensor that suits your situation, e.g. talk to technical experts such as consultants, agency staff or technical sales representatives; talk to

others who already use soil moisture equipment; and read up on the literature.

Some of the important attributes to consider when you are comparing equipment include the following:

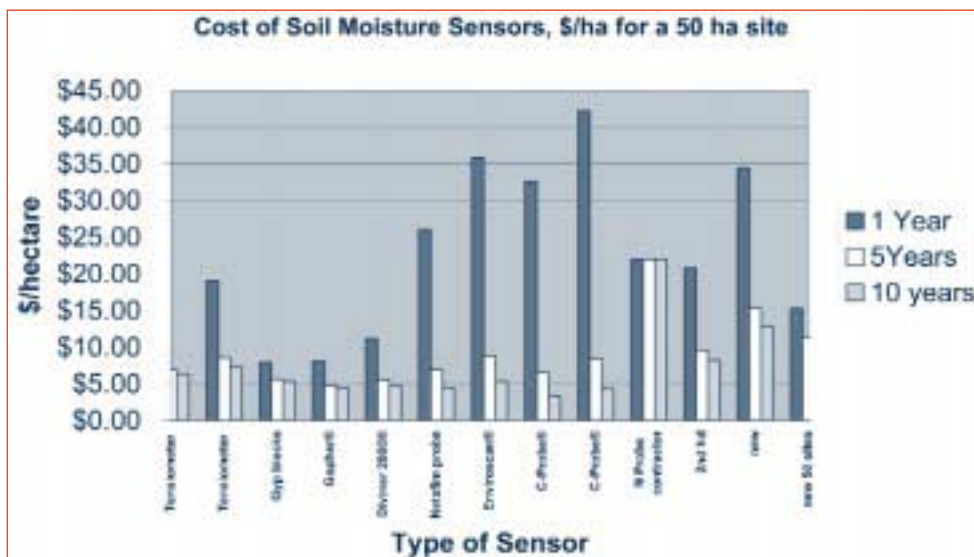
- ❑ reading range, logging capability and output reading
- ❑ irrigation system the equipment is suited to
- ❑ soil type it is suited to
- ❑ whether it is affected by salinity
- ❑ stated accuracy
- ❑ volume of soil measured by the sensor
- ❑ installation method and whether there is potential for expansion
- ❑ whether it can be accessed remotely
- ❑ availability and quality of technical support
- ❑ whether it can be linked to other equipment and whether it interfaces with a PC
- ❑ power source
- ❑ application
- ❑ capital cost and annual operating cost.

Checklist

Realistically, a big factor that will influence the selection process will not be physical/plant/soil based but will be the trade-off between initial capital investment and ongoing labour cost. For example, a tensiometer is relatively inexpensive but must be read daily and maintained weekly. A modern multi-depth logging system is relatively expensive to buy but data can be sent straight to the office PC and viewed with little labour input. A further intangible consideration is that it requires great discipline to maintain a regime of manual readings.

Because of this it is sensible to include the lifetime cost of a product in the selection process.

The figure shows the relative costs of buying and operating a number of soil moisture sensors. It follows the method and calculations used by David Williams from NSW Agriculture.



Note. On the figure, "N probe contractor", "2nd hand", "new" and "new 50 sites" are all neutron probes.



The figure shows the cost in dollars per hectare to equip and monitor a 50 ha site based on prices in early 1999. The costs are shown for one year, five years and ten years.

The figure shows the relatively high capital and establishment cost of some sensors, for example C-Probes and Enviroscan, in the first year. However, after ten years of use, the cost per hectare is less than \$10 per hectare for all sensors, except the neutron probe service.

While cost is very important it is only one factor to be considered when choosing a soil water sensor.

Irrigation Insights

To help irrigators and others involved in irrigation find their way through the maze of soil moisture monitoring equipment available, NPIRD have funded the production of an Irrigation Insights information package on this issue.

This package brings together information on current equipment and techniques for measuring and monitoring soil water status, extending to their use as controllers in automatic irrigation systems.

The hub is a collection of tables summarising the main product features. With this you can quickly compare product features. In addition to technical data, commercial information regarding suppliers, contact details, availability and price are also presented. Case studies from personal experience and from the literature provide further insight into the advantages and limitations of each device in relation to potential applications.

It can be viewed on the NPIRD website <www.npird.gov.au>. For publication ordering details contact Anne Currey, phone 02 6628 7079, email <anne@naturallyresourceful>

ANCID Irrigation Award Winners 2000

The Australian National Committee on Irrigation and Drainage announced the winners of this year's ANCID Irrigation Awards at their conference dinner, held in Toowoomba in September.

The winners were

▣ Improvements in Commercial Water

Distribution Works – South West Irrigation, Western Australia

▣ Effective Water Use on Farm – Rob and Cheryl

Hosking, "Riverside Park", Leaghur, Victoria

▣ Improved Practices in Drainage Management –

Donald and Sheelagh Watson, Lockington, Victoria

▣ Working Relationships in the Water Industry –

Sunraysia Rural Water Authority, Mildura, Victoria



(l to r) Ian Eckersley South West Irrigation; Sheelagh Watson; ANCID Chairman, Steve Mills; Louis Mills (Steve's father and award presenter); Don Rowe, Sunraysia Rural Water Authority and Editor of The Irrigator; and Rob and



A well known figure to many in the irrigation industry, especially in the water supply business, is John Mapson, from Goulburn-Murray Water. John, who also provides secretariat support to ANCID through Goulburn-Murray Water compered the award presentation.

Sponsors of the awards were Pivot Ltd, Agriculture Fisheries and Forestry Australia (AFFA) and the Murray Darling Basin Commission. ANCID also paid tribute to the awards judging panel of Dr Roy Green, Neil Inall and Donald McGauchie.



NPIRD sponsors successful growers' update

More than 140 farmers came along to catch up with the latest in research and technological developments at the GRDC Irrigation Growers Update, held at Mathoura in Victoria in August.

The update was organised jointly by the Victorian Irrigated Cropping Council (VICC) and the Murray Research and Development Council (MRDC). NPIRD sponsored the day, along with GRDC, Pioneer Hi-Bred, NSW Land and Water Management Plans and the Irrigated Cropping Forum.

Principal research scientist, Dr John Blackwell from CSIRO Griffith gave the opening address outlining the challenges ahead for irrigators.

Describing CSIRO's FILTER system for successful salt disposal from drainage water, Dr Blackwell cautioned farmers that good drainage and salt disposal is the key to long-term survival of the irrigation areas.

The issue of stubble management was discussed from the perspectives of both researchers and farmers. Dr Clive Kirkby from CSIRO Griffith put a strong case for effective stubble incorporation to improve nutrient retention, physical and microbiological properties of the soil.

Graeme Lawrence, who farms at Echuca, agreed with Dr Kirkby and pointed out some of the practical problems and compromised solutions to

make the practice work.

Agricultural consultant, Rob Rendell, got the audience to do a few quick calculations to determine their operating surplus after costs. Mr Rendell suggested irrigators with an operating surplus of \$100/ML are in a position to buy water but those with a surplus under \$50/ML should be selling water. He also showed how risk analysis of seasonal water availability was necessary to fix a price for irrigation water.

There were also presentations on topics including spring irrigation strategies for winter crops, acidity and alternative crop options.

"This seminar is the first and only one to specifically serve these irrigators, who annually use over 2 million megalitres of irrigation water. We were very pleased to see the interest shown by irrigators, presenters and sponsors alike for this type of forum, and we are keen to make this an annual event", said Sam Lolicato, executive officer of VICC.

To make suggestions for future seminar issues, topics and speakers and for more information on other events or services provided by the Victorian-based VICC group, contact Sam Lolicato on 03 5824 1406, and for the NSW-based MRDC contact Kelly Dal Broi on 03 5881 7990. Copies of the notes are available from Sam and Kelly (\$10 each).

Australian benchmarking process sets the standard

The World Bank and the Food and Agriculture Organisation of the UN (FAO) are developing an initiative for benchmarking performance of irrigation systems worldwide. The initiative is largely modelled on the ANCID Australian Benchmarking of Irrigation Providers with some additional elements to cater for conditions in developing countries. The project that initiated the benchmarking activity was funded, in part, by NPIRD.

The program will be supported by the International Commission on Irrigation and Drainage (ICID) through its national committees. The initiative was launched at the 51th Executive council meeting of the ICID in Cape Town, South

Africa. At the meeting, the ANCID benchmarking document together with an additional background formed the basis for the discussions.

The launch intends to bring together and obtain commitment from an initial group of countries that will participate in the initiative. As the first country in the world to undertake benchmarking of the irrigation industry, Australia will play a leading role in the initiative.

Hector Malano, from the University of Melbourne, will be responsible for liaison between Australia and the FAO.

For more information contact Hector on phone 03 9344 6645, email <hmm@devtech.unimelb.edu.au>.



Reducing erosion and increasing infiltration with PAM

Erosion from irrigation is an issue for many farms in Australia.

Recognising this, NPIRD recently sponsored Bob Sojka from the United States Department of Agriculture's Northwest Irrigation And Soils Research Lab to visit Australia and examine the potential for using polyacrylamide (PAM) to reduce irrigation induced erosion and enhance infiltration of water into the soil.

The potential for PAM in Australia

The conclusion reached by Bob Sojka was that, while there were some problems to resolve, PAM has much potential for use in Australia, particularly in furrow and flood systems.

Benefits of PAM. Some of the benefits of PAM are:

- ❑ Environmental. Many production and environmental problems in irrigated agriculture relate to the movement of suspended silt and clay during surface irrigation. Some of this matter is redeposited on the soil surface during infiltration, forming surface seals that affect infiltration. It also carries nutrients and pesticides which, when transported off field, become a major source of contamination of surface water or water delivered to users downstream. PAM can reduce these effects.
- ❑ It doesn't effect soil microbial populations.
- ❑ It doesn't adversely affect crop yields. While PAM effects on crop yields have only been sparsely documented, initial studies done in the US, mostly on field beans and maize, showed little effect on yields, probably because all treatments were supplied adequate water. Some evidence exists for Pam-related yield increases where infiltration was crop-limiting, especially

in field portions having irregular slopes, where erosion prevention eliminated deep furrow cutting that deprives shallow roots of adequate water delivery.

Using PAM in Australia

According to Sojka, a number of issues and conditions will need to be dealt with if PAM technology is to be adapted for Australian needs. These include problems relating to:

- ❑ irrigation scheme scale
- ❑ tailoring application techniques to irrigation system operating features
- ❑ quality of irrigation water affecting PAM efficacy (especially the impacts of salt and sodium levels)
- ❑ effect of clay size fraction, clay mineralogy and iron or other variable charge coatings on clay particles or soil aggregates
- ❑ particularly for the rice paddy system, the need to impart surface sealing before initiating flocculation enhancement.
- ❑ evaluation of the interaction of intermittent rainfall with PAM-treatment.

Despite these issues, Bob Sojka believes they are well worth the effort considering the potential for using PAM in Australia.

More information

A summary of Bob Sojka's report and his findings are available from Anne Currey, phone 02 6628 7079, email <natres@naturallyresourceful.com.au>, or you can go to NPIRD's website and find it in *project reports*.

For information about PAM go to website <<http://kimberly.ars.usda.gov/pampage.SHTML>>

What's PAM?

PAM stands for polyacrylamide. PAM is a chemical that is used to reduce soil erosion and enhance infiltration of water into the soil. For the technically minded it is a large (12-15 megagrams per mole), water soluble (non-crosslinked), anionic molecule containing <0.05% acrylamide monomer.

It has been used since 1995 in the US, where its soil stabilising

and flocculating properties have also improved runoff water quality by reducing sediments, nitrogen, phosphorus, COD, pesticides, weed seeds and microorganisms in runoff.

In a series of controlled field studies in the United States, PAM reduced sediment loss in field runoff from furrow irrigation by between 80 and 99% and increased infiltration by between

15 to 50% compared to untreated controls on medium to fine textured soils. Similar but less dramatic results have been seen with sprinkler irrigation.

Testing PAM on farm in Australia began in 1997. While results have been mixed, sediment, nutrients and pesticide reductions exceeded levels achieved by traditional conservation farming methods.



WaterWheel READER RESPONSE FORM

Please fill out this response form if you would like to receive *WaterWheel* through the mail or electronically or if you would like more information on *Irrigation Insights No. 1, Soil Water Monitoring*, or the PAM report.

1. If you would like to be added to the *WaterWheel* mailing or electronic notification list please fill in the relevant information below.

- ☐ Please add my name to the mailing list for *WaterWheel*.
- ☐ Please put me on the list to be notified electronically when a new edition of *WaterWheel* is uploaded onto the NPIRD website.
- ☐ Please take my name off the *WaterWheel* mailing list and add it to the email list so I can receive notification electronically when a new edition is published on the website.

Name

Postal address

Email address

2. Please add me to the email list to receive electronic updates about NPIRD and its activities

Email

3. I would like more information on *Irrigation Insights No. 1, Soil Water Monitoring*.

Name

Address

Email

123

**FAX TO 02 6628 7209 or
POST TO NPIRD reader response PO Box 355 ALSTONVILLE NSW 2477**

NPIRD WEBSITE

Have you checked out the NPIRD website lately?
New additions are 1999 and 2000 editions of *WaterWheel* and final reports on:

- ☐ Water Use Efficiency framework
- ☐ Nutrient control in irrigation drainage systems using artificial wetlands
- ☐ Potential use of Polyacrylamide in agriculture.

- ☐ Repair/replacement options for concrete lined irrigation channels

Also, *Irrigation Insights No. 1, Soil Water Monitoring* (read only version)

Site address: www.npird.gov.au

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NPIRD Mission. To provide leadership for national irrigation research and development and facilitate the adoption of technology that improves natural resource sustainability and the economic viability of irrigation regions.