# Report of the National Program for Irrigation R & D Benchmarking Project

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# Glossary

| | |
|---|---|
| Adjusted EBIT | Earnings before interest and tax relating to water distribution (note below re pre exceptionals) with depreciation of water distribution assets added back |
| Assets | Valued at written down replacement cost |
| Bulk Purchasers | Customers which redistribute water for town or stock league (see stock league) use |
| CAD | Computer aided drawing |
| Channel districts | Irrigation areas primarily supplying water using open channels |
| Corporatisation | The transition of business entity from government department to a separate business subject to corporations law, while still being under government ownership |
| Cost Recovery Ratio | Excludes depreciation |
| Customer | A purchaser of retail water |
| Deliveries | Water delivered to a customer |
| Demand forecasting | Forecasts of the demand for water by customers |
| Dethridge Wheels | Wheel and meter system at a delivery point which measures water flow |
| Diversions | Water taken by irrigation providers from the river system |
| Diverters | Irrigation users who divert directly from the river system |
| DLWC | Department of Land and Water Conservation, NSW |
| Ece | Saturated Soil Extract |
| Enterprise | A farm business eg. dairy |
| EPA | Environmental Protection Authority |
| Escape/Outfall | Water which is allowed to escape from the channel system. This is usually planned and measurable |
| Exceptionals | Includes both abnormals and extraordinaries |
| Farm | Titled area of farming land |
| Farm Deliveries | Water delivered to a farm customer for irrigation purposes |
| Garden and stock | Customers using water for stock watering and household use |
| GIS | Geographic information systems |
| GPS | Global positioning system |
| Infrastructure | Assets used for the delivery of water |
| Irrigation intensity | The proportion of a base area being measured used for irrigation |
| Irrigation Providers | Distributors of water for retail use, including towns and factories |
| Irrigation revenue | Total sales to irrigators and includes moneys for asset renewals |
| Irrigator | Customer using water on-farm |
| km infrastructure | Refers to infrastructure for water supply, not drainage |
| Load (water quality) | The quantity of an element being carried by water given volumes and concentration |
| LWMP | Land and Water Management Plans |
| LWRRDC | Land and Water Resources Research and Development Corporation |
| MDBC | Murray Darling Basin Commission |
| MIS | Management information systems |
| MRL | Maximum residue limits |
| Non-technical innovation | Managerial innovation |
| OM & A | Operations, maintenance and administration |

| | |
|---|---|
| Operating expenses | Operating expenses excluding depreciation |
| Operating measures | Exclude interest |
| Pesticide events | Occurrences where pesticide levels exceed MRLs |
| Primary Irrigation Area | The licences area of irrigation farms |
| Privatisation | The transfer of ownership from public (government) to private sector (usually customers) |
| Pump districts | Irrigation areas primarily supplying wateruse pipes |
| Renewal | The replacement of infrastructure |
| Revenue | Turnover plus non irrigation sales revenue |
| Salinity | Concentration of salts in irrigation water |
| SCADA | Remote site monitoring and control technology, stands for Supervisory Control And Data Acquisition |
| Stakeholders | Organisations and/or people who can effect, or who are affected by, irrigation. |
| Stock Leagues | An aggregate group of Stock and Rural Household users who purchase water as one entity |
| Technical innovation | Innovation in processes, products and/or R&D |
| Total Area Irrigated | The area actually irrigated |
| Total Irrigation Area | The area within the boundaries of the region in which the irrigation provider operates |
| Turbidity | Soil content of water |
| TWA | Transferable Water Entitlements |
| Water exiting the scheme | Water which returns to a water way |

# 1 Summary Report

## 1.1 Genesis of the Program

In Australia, interest in and development of irrigation systems began in the latter half of the 19th century. This interest was stimulated by an expanding and spreading population, closer settlement and the impact of severe droughts. Governments became seriously involved in the development of ambitious projects involving water catchment, storage and distribution. For many years the extension of water storage became a national goal. In the first half of the 20th century, irrigation became a mechanism to increase agricultural intensity and provided an avenue for soldier settlement, following both the first and second world wars.

In later years environmental demands and an increasing need for urban water have created greater competition for water allocation. Moreover, the impact on the environment from externalities caused by irrigation, such as salinity, have led to mounting pressure for improved management practices.

These structural, competitive and environmental pressures and changes have been the genesis of the National Program for Irrigation R&D Benchmarking Project.

A scoping study was commissioned as a preliminary to the benchmarking project contracted by Land and Water Resources Research and Development Corporation (LWRRDC). LWRRDC'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. As part of this mission, LWRRDC is committed to assist Australian irrigation authorities to achieve best practice for all their activities. The scoping study investigated the scope and the processes required for an irrigation provider benchmarking program.

## 1.2 Objectives and Methodology

The objectives of the irrigation benchmarking program are to measure aspects of irrigation supply which incorporate the holistic aim of LWRRDC, through the National Program for Irrigation R&D (NPIRD), which are to focus on sustainable irrigation with minimal impact on the external environment while incorporating:

- sustainable resource use;
- ecological performance;
- wateruse efficiency; and
- economic performance, including productivity.

The measures analysed are applicable to all irrigation providers and are therefore relevant throughout Australia and internationally for piped as well as channel systems and for pumped as well as gravity systems.

Benchmarking has been undertaken at two key levels:

- firstly, to measure the current situation using:
  - output measures;
  - impact measures; and
  - some process measures.
- secondly, to motivate and drive improvement using:
  - process measures; and
  - a change process of continuous improvement from the existing level of performance of each participant.

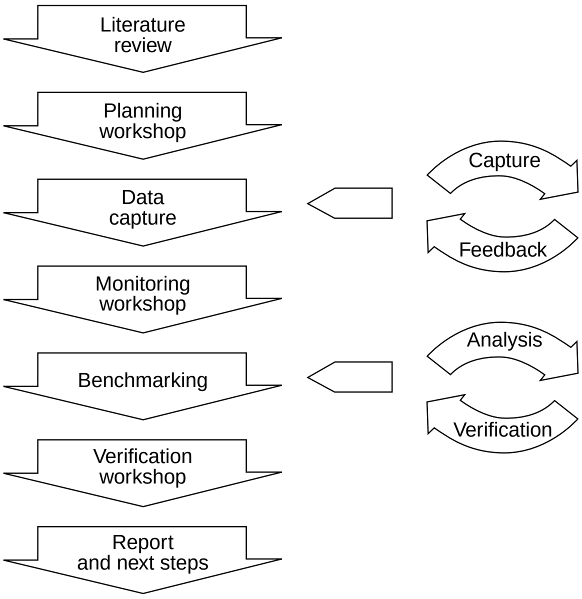
The project methodology has been constructed on a cyclical learning process which not only generates the specific project outcomes but also permits a high degree of learning for the participants in relation to benchmarking. It also increases their understanding of the irrigation industry and of their own organisations.

Several data collection iterations were undertaken to facilitate the evolutionary nature of the process, enhance data capture and maximise the input of participants (Fig. 1).

The benchmarks used cover five primary activity areas:

1. wateruse;
2. farm revenue;
3. hydraulic performance;
4. environmental performance; and
5. business performance.

**Figure 1.** Project methodology




## 1.3 The Participants

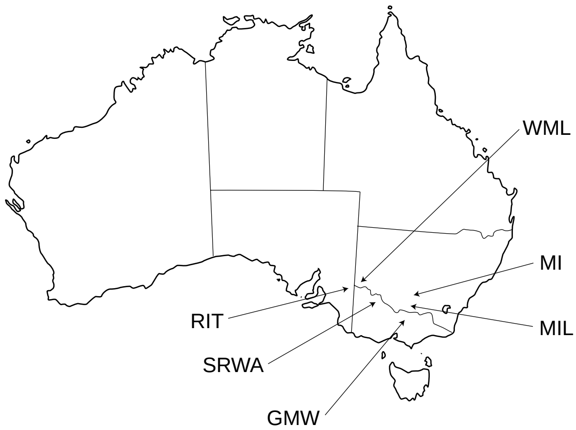
Six irrigation providers, representing three States, have participated in this project. These are:

- Goulburn Murray Water (GMW), Victoria;
- Murrumbidgee Irrigation Corporation (MI), NSW;
- Murray Irrigation Limited (MIL), NSW;
- Renmark Irrigation Trust (RIT), SA;
- Sunraysia Rural Water Authority (SRWA); Victoria; and
- Western Murray Irrigation Limited (WML), NSW.

Irrigation providers are the organisations which undertake retail water distribution, primarily to agricultural and horticultural irrigators but also to agricultural stock water users, rural house and garden users and bulk purchasers. Bulk purchasers include rural towns, factories and industry, and stock and domestic leagues (groups of agricultural stock and rural house users).

The location of the region and the irrigation providers is indicated on Figure 2.

**Figure 2.** Location of irrigation providers. See text for full names




The six participating irrigation service providers have the characteristics summarised in Table 1.

GMW is the largest provider in terms of water delivery, numbers of customers and area serviced. GMW also covers the most diverse variation in regions and water uses. MI and MIL have a number of similarities in terms of climate, land type and land uses. However, MI has a greater proportion of intensive horticultural irrigation. RIT, SRWA and WML generally supply irrigation water for horticultural production.

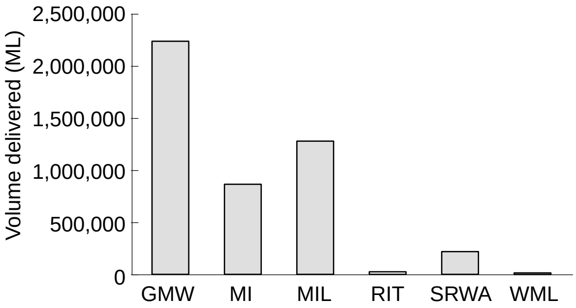
**Table 1.** Comparative data an irrigation service providers

| | GMW | MI | MIL | RIT | WML | SRWA |
|---|---|---|---|---|---|---|
| Year established | 1905 | 1912 | 1929 | 1893 | 1914 | 1917 |
| Ownership structure | Corp. | Corp. | Priv. | Trust | Corp. | Priv. |
| ML/annum | 2,243,865 | 876,400 | 1,291,181 | 37,524 | 240,459 | 29,675 |
| No of customers (billings) | 22,525 | 3,024 | 2,419 | 1,123 | 2,727 | 461 |
| No of ha in region | 915,461 | 483,000 | 749,202 | 7,585 | 27,627 | 4,432 |
| No of ha irrigated | 568,761 | 119,000 | 411,532 | 4,084 | 10,672 | 4,154 |
| km pipe (supply) | 163 | 44 | 0 | 140 | 727 | 121 |
| km channel (supply) | 5,487 | 2,489 | 3,800 | 0 | 65 | 0 |
| No of employees | 539 | 263 | 160 | 24 | 52 | 10 |
| Irrigation revenue $mil | 67.20 | 13.19 | 16.03 | 1.72 | 8.00 | 1.82 |

Notes:
Corp. = Public Corporation, Priv. = Private Company, Trust = Statutory Trust.
ML delivered is the total for all uses.

Figure 3 shows the comparative scale of the participating organisations in terms of MLs delivered.

**Figure 3.** Amounts of water (megalitres) delivered by each provider




GMW, MI and MIL deliver water primarily with earthen channel systems while RIT, SRWA and WML have fully or mainly piped infrastructure.

## 1.4 The Irrigation System

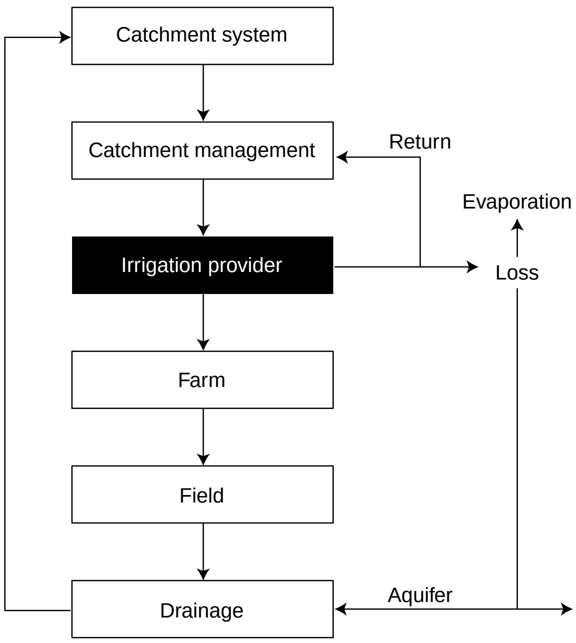
The irrigation industry is a part of the overall water system. The irrigation industry provides one part of the sustainable management of a key natural resource and competes in demand for and supply of water with environmental and urban needs. All key stakeholders involved in the management of water are therefore part of a wider system and should be aware of the impact of their actions on all parts of the overall water system.

A subset of the water supply chain is the irrigation supply chain. The irrigation supply chain can be depicted using value chain concepts, as illustrated in Figure 4.

## 1.5 Benchmark Findings

When best practice is reviewed, the performance of irrigation providers for any one aspect cannot ultimately be judged in isolation. For example, the lowest cost performer per ML may be achieving that level of performance by under-investing in environmental management. Therefore, best performance needs to be achieved across a number of factors to ensure best practice.

**Figure 4.** The irrigation system




### 1.5.1 Customers

Irrigation customers are segmented in the following categories:

- diverters—water users who divert water directly from the river systems;
- irrigators—water users who use water for agricultural/horticultural crop or pasture production;
- domestic and stock or house and garden users—these customers use small quantities of water for stock water and personal uses only, they do not undertake direct agricultural production; and
- bulk purchasers—which are towns, industry and domestic and stock leagues, who purchase water in bulk quantities.

These segments are mutually exclusive, ie. customers only appear in one segment. Table 2 shows customer numbers for each provider according to each of these broad customer segments.

Diverter wateruse is not monitored by providers who are not included in the benchmarking analysis.

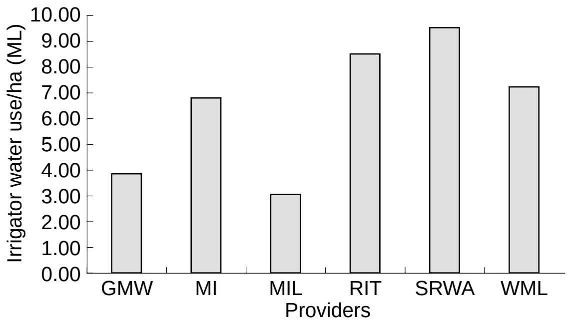
**Table 2.** Customer numbers by type for each irrigation provider

| Customer numbers | GMW | MI | MIL | RIT | SRWA | WML |
|---|---|---|---|---|---|---|
| Diverters | 3,277 | 0 | 0 | 15 | 1,079 | 0 |
| Irrigators | 11,381 | 1,964 | 2,288 | 696 | 1,552 | 384 |
| Garden and stock | 7,247 | 1,044 | 127 | 412 | 1,036 | 77 |
| Bulk purchases | 620 | 16 | 4 | 0 | 0 | 0 |
| Total | 22,525 | 3,024 | 2,419 | 1,123 | 3,739 | 461 |

Comparison of wateruse between providers highlights the differences in water requirements between relatively extensive agriculture and intensive horticulture.

Water requirements for large area crops, except for rice, are generally lower than for horticulture. GMW and MIL have the highest proportion of extensive or 'broad acre' crops under irrigation, which accounts for their lower average water application rates. By comparison, RIT, SRWA and WML (crop data not provided) have a high proportion of horticultural crops within their areas. MI is somewhere in between, having considerable horticulture as well as large areas of winter cropping and rice production. These comparisons are shown in Figure 5.

**Figure 5.** Comparison of water volumes (ML/ha) used by irrigators serviced by each provider

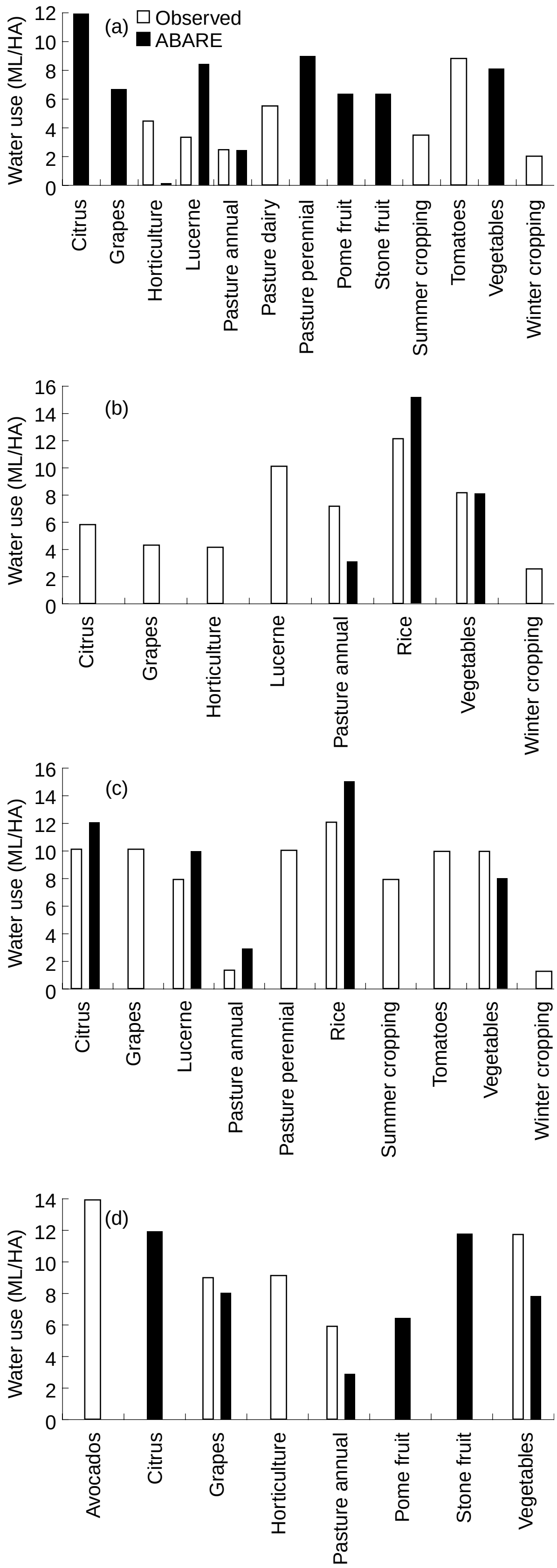



The providers benchmarked do not maintain complete sets of data on water application rates for specific crops. Rice is the one exception where, because of environmental requirements, this information is fully maintained.

Analysis of MLs per hectare provides comparative information about the different systems. It does not suggest incremental benefits but simply says water is being used. Where the figure is lower it may suggest a rationing of water. True assessment of the efficiency of wateruse needs to be related to dollars earned per ML or hectare.

Figure 6 shows crop wateruse in four of the provider regions where records have been provided. The information listed as 'observed' has been drawn from data collected from a combination of the latest ABS statistics survey, provider censuses, statements of intent at water ordering by customers, farm consultant surveys and agricultural departments' generic gross margins. To benchmark the accuracy of this information, ABARE statistics have been juxtaposed with the observed information in the graphs.

**Figure 6.** Regional crop water uses (Hall et al. 1993). (a) GMW; (b) MI; (c) MIL; (d) SRWA



Analysis of farm revenues provides an assessment of agricultural production, in terms of returns for crops produced and aggregate returns within each provider region. Farm revenue assessment has been included in the full report. However, only low levels of data of variable accuracy were available. In future this would be valuable as a bottom line benchmark to irrigation performance. There would also be a number of uses for economic performance benchmarks, including:

- enhanced customer understanding to enable an assessment of ability to pay and for making pricing decisions;
- providing benchmarks to customers on economic performance, as a service offering;
- identification of high return and low water requirement crops, for issues such as environmentally fragile areas;
- use for prioritising new infrastructure investment, where appropriate; and
- lobbying the benefits of irrigation using measured economic productivity.

### 1.5.2 Customer management

Customer management is defined as the way in which providers manage and interact with clients. The processes benchmarked include:

- service performance;
- customer interaction; and
- communication to and from customers.

Providers have been deemed best in their class on the basis of overall management of one of these processes. Where other providers have components of processes which are seen as valuable, they too have been identified along with the key feature being considered. All providers were able to contribute to best in class processes in business management, and the detail of this information has been included in the full report.

### 1.5.3 Water delivery

The benchmarking analysis takes a value chain approach to viewing water delivery. While the focus is on providers, the linkages up and down the system are also considered. Figure 7 illustrates the related flows of water and information in the water delivery system.

### 1.5.4 Hydraulic performance

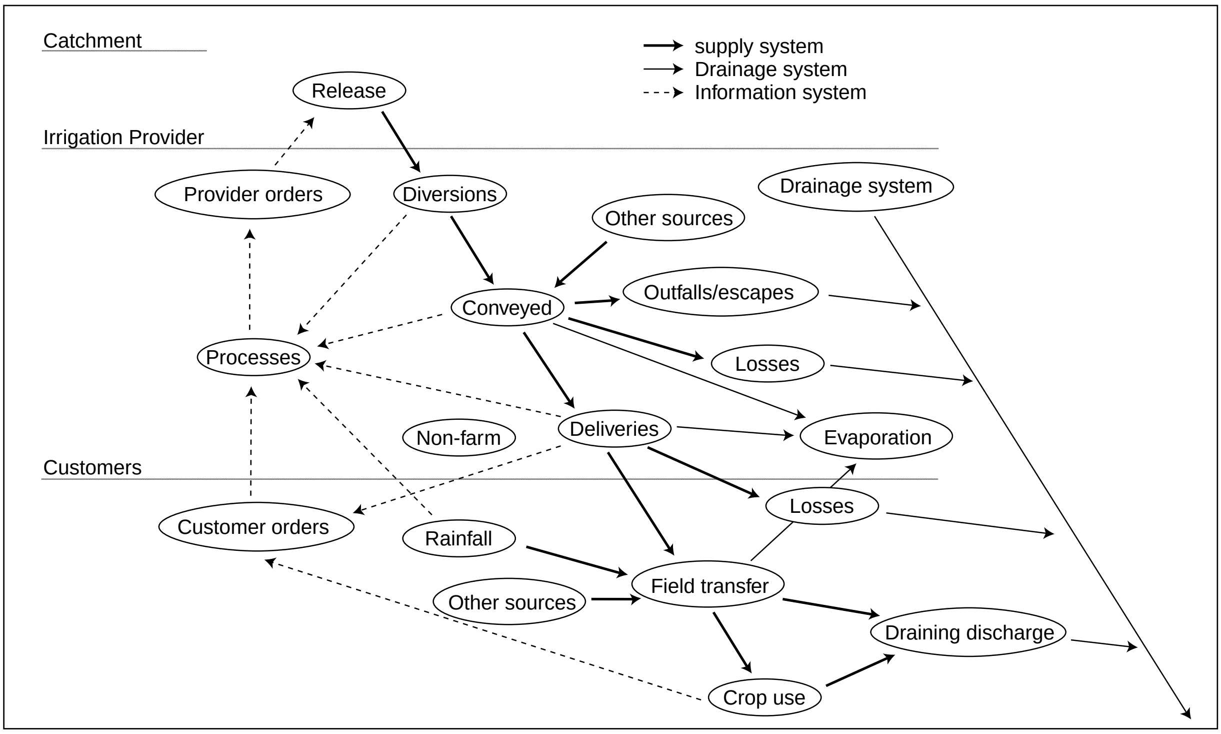
Hydraulic performance assesses the primary operations of irrigation providers in the diversion/ capture, conveyance and delivery of water, from source to field.

A summary of hydraulic performance for each provider is given in Table 3. The major measure of overall hydraulic performance is percentage water diverted that is actually delivered. The other sections are constructed in a cumulative manner, to illustrate losses at each stage of the water distribution system.

**Table 3.** Hydraulic performance of irrigators showing cumulative losses (percentages)

| **RIT** | **GMW** | **MI** | **MIL** | **RIT** | **SRWA** | **WML** |
|---|---|---|---|---|---|---|
| Deliveries/diversions | 74 | 80 | 85 | 99 | 80 | 90 |
| **Diversions** | **GMW** | **MI** | **MIL** | **RIT** | **SRWA** | **WML** |
| Provider orders/diversions | n/a | n/a | n/a | n/a | 1 | n/a |
| Conveyance/diversions | 96 | 95 | 95 | 99 | 99 | 100 |
| Outfalls/diversions | 4 | 5 | 5 | 1 | 1 | 0 |
| **Conveyance** | **GMW** | **MI** | **MIL** | **RIT** | **SRWA** | **WML** |
| Deliveries/conveyance | 77 | 84 | 90 | 100 | 82 | 90 |
| Losses/conveyance | 23 | 16 | 10 | 0 | 18 | 10 |
| **Deliveries** | **GMW** | **MI** | **MIL** | **RIT** | **SRWA** | **WML** |
| Customer orders/deliveries | n/a | n/a | n/a | n/a | 103 | n/a |
| Field transfer/deliveries | unknown | unknown | unknown | unknown | unknown | 0 |
| Losses/deliveries | 0 | 0 | 0 | 0 | 0 | |
| **Field transfer** | **GMW** | **MI** | **MIL** | **RIT** | **SRWA** | **WML** |
| Crop use/field transfer | n/a | n/a | n/a | n/a | 72 | 87 |
| Drainage/field transfer | n/a | n/a | n/a | n/a | 28 | 13 |
| Field transfer/diversions | n/a | n/a | n/a | n/a | n/a | n/a |

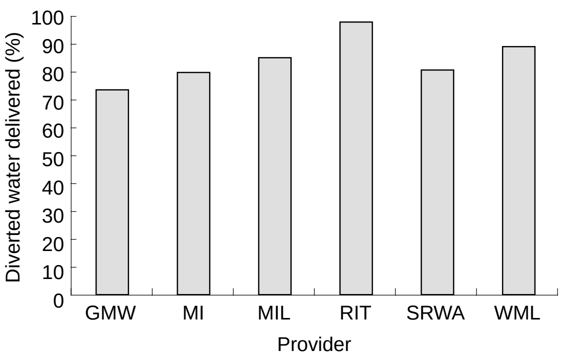
**Figure 7.** Water and information flows pertaining to water delivery




Comparative performance of providers, in terms of percentage of water diverted which is actually delivered, is provided in Figure 8.

Overall, piped irrigation systems are the most hydraulically efficient. Within the piped systems benchmarked, RIT had minimal losses. WML losses appear to be larger than they actually are because of a proportion of unmetered house and garden deliveries and SRWA has a 65 km channel which negatively affects hydraulic efficiency.

**Figure 8.** Comparison of provider delivery efficiency

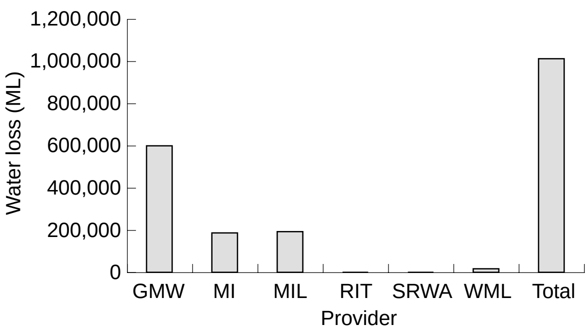



MIL has the most efficient delivery of water of the channel systems benchmarked. Their higher delivery efficiency is due to lower conveyance losses. MIL lose 10% at this stage, compared to 24% and 18% for GMW and MI respectively.

### *The opportunity cost of water loss*

When actual water losses are calculated by applying percentage losses to diversions, a tangible picture of system losses can be painted, as illustrated in Figure 9.

**Figure 9.** Water losses (ML)




The opportunity cost of this loss is substantial in terms of income forgone, especially if measured in dollars of agricultural production, either for new land irrigation or increased allocations for existing areas.

### *Water efficiencies before providers*

Providers are charged for water diverted, not water ordered or released. The corollary of this is that pre-diversion water does not have to be valued by irrigation providers at its true economic cost. This enables providers to trade off river wastage for either increased levels of customer service (by having a shorter customer order time than travel time from headworks), limited investment in water management or poor system management.

It should be noted that releases not diverted do not necessarily constitute wasted water as this water may provide environmental benefits to the river system. It should be ensured that this water is accounted for, given the current demands by environmental groups to increase river flows.

*Water flows after providers*

Past the point of water delivery by providers to farmers there are few data available. While there is a body of work being undertaken assessing 'on farm' use and the effects of irrigation, much is still at a research level rather than at a systems level, which limits the transferability of this information for commercial use.

Irrigation providers are usually the focal point for hydraulic assessment as they are focused in the water provision business. Providers are not usually in control of activities up and down the value system and, therefore, it is in the interest of providers that more data be collected, both on farm and from river operators. This constitutes an important area for future research.

### 1.5.5. Environmental management

Environmental performance of irrigation providers can be defined as the way in which organisations respond to:

- environmental impacts from actions under their own control; and
- environmental impacts from the actions, either intentional or unintentional, caused by others, not under the control of providers.

The key environmental performance indicators that are measurable and comparable between organisations include:

- water quality (both entering and leaving the irrigation system)
  - salinity
  - nutrients; and
- watertable levels and salinity of groundwater soil salinity status.

The key processes that provide a comparison between the environmental management of irrigation providers include:

- environmental risk assessment and management; and
- relationships of organisations with land and water management plans.

In the long term, the ability of providers to assess and manage environmental risks will be dependent on their power to enforce policies and practices. At present this is not well defined. Moreover, it appears that the integration between those who collect the information (this is often external to the providers) and environmental management is not clearly inter-linking. Therefore, the relationship between these components needs to be monitored during benchmarking in future years.

### 1.5.6 Financial performance

Financial measures benchmarked include:

- return to investment;
- asset management;
- efficiency and productivity; and
- leverage and liquidity.

Providers at present focus on a zero rate of return and enjoy both secure solvency and liquidity either internally or through government guarantees. Asset management is still evolving and benchmarks need further development, as systems evolve to assess this level of performance. Hence, efficiency and productivity are the most pragmatic current components of financial performance.

The information used for the financial analysis has been derived from the statutory reports of the providers, who then have had the opportunity to adjust the figures where they saw fit, to represent their businesses more accurately. Recognition is needed that providers vary significantly from each other and comparisons should be made carefully.

Efficiency and productivity of irrigation businesses can be assessed by considering five key facets of their operations, which cover infrastructure, revenues, operations and marketing. These facets are:

- assets;
- costs;
- returns;
- employees; and
- customers.

Each of the above is analysed as a numerator by four of six possible denominators, to allow the development of comparable benchmarks. These denominators are:

- megalitres;
- employees;
- customers; and
- kilometres.

Conclusions need to be drawn after considering the non-efficiency or productivity drivers for each of the above factors. The drivers for the numerators have been discussed individually in the body of the report. The drivers of the denominators are common to all and include:

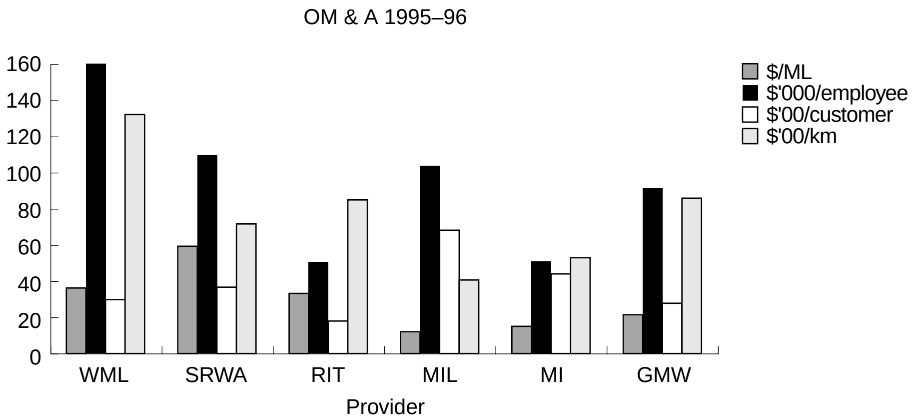
- Megalitres
  - – type of system, eg. pipe or channel
  - – point of measurement, eg. diversions compared to deliveries
  - – accuracy of measurement;
- Employees
  - – type of system
  - – length of system
  - – services provided and/or demanded by customers, eg. frequency of supply
  - – technology, eg. level of SCADA use;
- Customers
  - – types of regional agricultural production
  - – size of properties; and
- Kilometres
  - – length of system
  - – make-up of system, eg. combinations of channel and pipe

This summary report has focused on the main aspect of non-profit business, namely the costs of operations, maintenance and administration (OM & A), which is analysed in Figure 10. The full report analysis covers

**Figure 10.** Efficiency of operations, maintenance and administration

OM & A

| $A | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 1,493 | 2,939 | 1,725 | 1,599 | 0 |
| SRWA | 4,596 | 5,465 | 6,429 | 5,695 | 6,330 |
| RIT | 1,086 | 1,203 | 1,192 | 1,212 | 1,384 |
| MIL | 11,039 | 13,901 | 8,873 | 15,966 | 0 |
| MI | 13,207 | 15,226 | 13,135 | 13,723 | 14,022 |
| GMW | 37,257 | 53,378 | 61,772 | 49,563 | 50,337 |




| Relative position | ML | Employees | Customers | km |
|---|---|---|---|---|
| WML | 5 | 1 | 3 | 6 |
| SRWA | 6 | 2 | 4 | 3 |
| RIT | 4 | 6 | 1 | 4 |
| MIL | 1 | 3 | 6 | 1 |
| MI | 2 | 5 | 5 | 2 |
| GMW | 3 | 4 | 2 | 5 |

| Average position | |
|---|---|
| WML | 4 |
| SRWA | 4 |
| RIT | 4 |
| MIL | 1 |
| MI1 | 2 |
| GMW | 2 |

return on investment, asset management and leverage and liquidity.

The two most meaningful components of the analysis are ML and employees. Customers and kilometres are subject to greater levels of influence from external drivers. On a ML basis, piped systems carry higher operating costs because of energy expenses but on the other hand lower labour requirements. Clearly the two types of system need to be separated for benchmarking while still making comparisons across systems to maximise learning opportunities for continuous improvement.

Of the channel systems, MIL demonstrates the highest level of efficiency for both ML and employee based analysis. WML, as a piped system, is the most efficient for employees and RIT for ML.

As the relationship with customers does not reflect how providers operate in terms of efficiency and productivity, the aggregation of the measures one to four provides the most realistic assessment of overall financial efficiency and productivity.

Care must be taken when drawing conclusions from the financial analysis, as the benchmarks do not accurately place providers on a ‘level playing-field’, but rather provide a weight of evidence as to comparative efficiency productivity. To fully understand this level of performance of providers, the related business processes need to be reviewed in parallel.

### 1.5.7 Business process performance

Benchmarking of business performance has been a subjective assessment of the business processes undertaken by irrigation providers. The providers participating were also given the opportunity to review the findings and provide input supporting their own processes where they deemed it appropriate.

The processes benchmarked included:

- infrastructure management;
- strategic planning;
- human resources;
- R&D and innovation; and
- quality systems.

For the overall management of each process, best practice providers were identified along with the key features of their activities. Other providers particularly good at components of the processes were also identified. All irrigation providers benchmarked have skills and systems that can benefit others. This information is detailed in the full report.

## 1.6 Next Steps

### 1.6.1 Continue and refine the process

*Annual benchmarking*

The benchmarking program carried out in 1997 is designed to be the beginning of an ongoing and improving process. The process should be continued and improved on an annual basis. Three key benefits will occur:

- the measures will identify improvements made by each participant over time;
- the measures will be refined over time to better reflect the key performance areas, resulting from an increased understanding of the key

**Figure 11.** Productivity and efficiency summary

Relative Position Summary

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Relative position | Assets | OM & A | Adj. EBIT | Employee | Customer |
| WML | 6 | 4 | 4 | 1 | 1 |
| SRWA | 4 | 4 | 1 | 4 | 4 |
| RIT | 3 | 4 | 2 | 6 | 3 |
| MIL | 2 | 1 | 6 | 2 | 4 |
| MI | 1 | 2 | 5 | 5 | 6 |
| GMW | 5 | 2 | 3 | 3 | 2 |

| Relative position | All | 1–4 |
|---|---|---|
| WML | 3 | 5 |
| SRWA | 4 | 2 |
| RIT | 5 | 5 |
| MIL | 1 | 1 |
| MI | 6 | 2 |
| GMW | 1 | 2 |

performance drivers and as more relevant information is captured; and

- the information available to support ongoing performance improvement will be provided by continuing the benchmarking process.

### *Implement improvements identified*

The benchmarking study was conducted to enable each participant to learn from the others, especially the best in class for each process, and improve performance. The opportunities identified during the study will allow each organisation to implement changes leading to improved performance. Some motivation may be required to focus management attention away from pressing day-to-day activities, or working in the business, to working on the business.

### *Pursue key issues in greater depth*

The benchmarking program has identified a number of factors which would benefit from further research. These include:

*Hydraulic loss*. The significant volumes of water lost within the system provide an opportunity to better identify the main areas of loss and to reduce it. The two primary areas for investigation are within the supply system and on-farm. GMW and MI have submitted proposals to undertake further research on hydraulic losses. An additional focus is suggested as approximately one million megalitres per annum are lost within the systems of the six participating providers. These losses do not account for any on-farm wastage.

*Environmental performance*. Environmental performance is becoming increasingly important for all aspects of agricultural management including the irrigation process. Significant effort has been taken in measuring, monitoring and managing changes in the environment. However, it appears that environmental management is undertaken in a fragmented manner. Each of the participating providers undertakes different activities in environmental management. This study has highlighted the opportunity to improve the coordination between different environmental stakeholders to improve the overall environmental management and performance.

*Linkage of water supply to farm productivity*. The true measure of irrigation effectiveness is the increment in benefits to agricultural production and value. At present there is a lack of accurate and coordinated information on farm production as a result of irrigation. The effective management of the scarce water resource requires an understanding of the ultimate economic benefits because of the supply of water, which in turn requires a whole-of-system approach. The current water management system does not reflect a whole-of-system approach.

Improved measures may be developed as the information of irrigation provider and on-farm is further integrated. ML per ha measures are non-transferable because of differences in crop, rainfall, season, etc. Better measures include ML per unit of produce and ML per production value (although this measure is altered by moving market values).

*Drivers of irrigation provider productivity*. The introduction and better use of information systems and technology will provide an opportunity to continually improve performance. All aspects of water delivery may be able to be improved including operations, maintenance, capital works and administration. Opportunities exist to learn from the more advanced organisations in the industry as well as to leverage from similar industries such as the urban water suppliers and other large utilities (gas and electricity).

*Innovation*. A continued focus on innovation including commercially focused R&D will ensure further improvement to systems, service, processes and performance. Opportunities exist for improved asset management and better data and process management using geographical information systems.

*Asset management*. Systems to manage long-life assets are being developed with considerable potential for future gains. The coordinated development of effective asset management techniques should be a key priority.

*The use of geographic information systems*. The use of geographic information systems (GIS), linked to modern data and process management, will facilitate better management of the overall system including irrigation provider and on-farm performance. A coordinated approach by the irrigation industry to the development of these systems will benefit the industry as a whole.

*Best in class criteria*. The development of criteria and weighting for measuring best in class makes a more objective assessment possible. One potential method is to lay out the criteria and rate each organisation on each contributing aspect. This was not done during this study which aimed to create impetus for change rather than provide performance comparisons.

*Improve measures*. Some of the measures in the study are affected by external changes including rainfall, market prices and crop differences. As the whole system is better understood, the measures used will be further refined to better reflect the performance of the irrigation process on the production of sustainable produce.

### 1.6.2 Extend the focus

*Value chain (whole-of-system) management*

Historically, the irrigation system has been viewed as a collection of separate activities with differing purposes and differing stakeholders. Consequently, research has focused on the individual components of the system. Future research and management should be focused on a whole-of-system approach. This will better achieve improved overall water management performance, thus meeting LWRRDC's objectives of resource sustainability, ecological performance, wateruse efficiency and economic performance.

*National extension*

Significant benefits have already been demonstrated as a result of this benchmarking project. Extending the focus to include all Australian providers is expected to provide two benefits. The first is a larger database of best practice management which will enable each provider to have greater opportunity to improve. The second is that more irrigation providers will be able to make improvements from shared information and coordinated improvement activities.

A coordinated irrigation industry has the added benefit of being in a position to become more proactive in managing the development of the irrigation industry and its regulation.

### 1.6.3 Making it happen — championing the cause

Recognising the benefits of the opportunities is only the first step. Achieving them will require enthusiasm, effort and resources. Some person or entity must accept responsibility for continuing and developing the process. A champion or champions will be required to make it happen.

# 2 Introduction

## 2.1 Brief History of Irrigation in Australia

In Australia, interest in and development of irrigation systems began in the latter half of the 19th century. This interest was stimulated by an expanding and spreading population, closer settlement and the impact of severe droughts. Governments became seriously involved in the development of ambitious projects involving water catchment, storage and distribution. For many years the extension of water storage became a national goal. In the first half of the 20th century, irrigation became a mechanism to increase agricultural intensity and provided an avenue for soldier settlement, following both the first and second world wars.

These projects brought about a rapid expansion of irrigated agriculture and horticulture in Australia and made a substantial contribution to the agriculturally led economic boom of the 1950s. Throughout this period, irrigation infrastructure has been owned and operated by the governments of each state. Recently, during the contemporary period of deregulation and micro-economic reform, there has been a move to establish irrigation providers as independent centres of responsibility. Irrigation providers are now generally corporatised public utilities or privatised organisations. This hiatus in the history of irrigation services has afforded the opportunity to review the comparative performance of irrigation providers. This will ensure the provision of efficient and effective supply of water on behalf of the new owners, beneficiaries and stakeholders of Australia's irrigation infrastructure.

In later years environmental demands and an increasing need for urban water have created greater competition for water allocation. Moreover, the impact on the environment from externalities caused by irrigation, such as salinity, have led to mounting pressure for improved management practices.

These structural, competitive and environmental pressures and changes, have been the genesis of the National Program for Irrigation R&D Benchmarking Project.

## 2.2 The Scoping Study

The Scoping study was commissioned as a preliminary to the benchmarking project contracted by Land and Water Resources Research and Development Corporation (LWRRDC). This is in line with LWRRDC's mission 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. As part of this mission, LWRRDC is committed to assist Australian irrigation authorities to achieve best practice for all their activities. The scoping study investigated the scope and the processes required for an irrigation provider benchmarking program and had the following outcomes.

1. It developed an agreed scope, structure and process for benchmarking irrigation providers in terms of resource sustainability, environmental impact, hydraulic performance, service delivery and economic performance.
2. It identified R&D areas and projects where funding by LWRRDC (NPIRD) could support the development of a national benchmarking system.
3. It developed a clear strategy for encouraging participation and the Australia-wide use of the results, which were internationally comparable.

## 2.3 Objectives of the National Program for Irrigation R&D Benchmarking

The objectives of this program are to measure the aspects of irrigation supply which incorporate the holistic aim of LWRRDC, through the National Program for Irrigation R&D (NPIRD), to focus on sustainable irrigation with minimal impact on the external environment while incorporating:

- sustainable resource use;
- ecological performance;
- wateruse efficiency; and
- economic performance, including productivity.

The measures analysed are applicable to all irrigation providers and are therefore relevant throughout Australia and internationally for piped as well as channel systems and for pumped as well as gravity systems.

The benchmarks used cover five primary activity areas:

1. wateruse;
2. farm revenue;
3. hydraulic performance;
4. business performance; and
5. environmental performance.

The project follows the methodology as defined by AusIndustry's *Benchmarking Self Help Manual* as an ongoing systematic process to search for and introduce best practice management into an organisation or industry, structured in such a way that all parts of the organisation and industry understand and achieve their full potential. The power of benchmarking lies in its objectivity.

Benchmarking has been undertaken at two key levels:

- Firstly, to measure the current situation using:
  - output measures;
  - impact measures; and
  - some process measures.
- Secondly, to motivate and drive improvement using:
  - process measures; and
  - a change process of continuous improvement from the existing level of performance of each participant.

When best practice is reviewed, the performance of irrigation providers for any one aspect cannot ultimately be judged in isolation. For example, the lowest cost performer per ML may be achieving that level of performance by under-investing in environmental management. Therefore, best performance needs to be achieved across a number of factors to ensure best practice.

# 3 Methodology

The project methodology (see Figure 1, page 2) has been constructed on a cyclical learning process which not only generates the specific project outcomes but also permits a high degree of learning for the participants in relation to benchmarking, as well as increasing their understanding of the irrigation industry and their own organisations.

Three data collection iterations were undertaken to facilitate the evolutionary nature of the process, enhance data capture and to maximise the input of participants.

The project began with a comprehensive literature review and the development of plans, before an initial workshop. This workshop was attended by two representatives from each of the participating organisations, two from Barraclough & Co., and one each from LWRRDC and the Murray–Darling Basin Committee (MDBC). This workshop was used to select the benchmarking measures to be investigated by the project. The workshop also, importantly, developed the dynamics of the group. The workshop successfully agreed on the measures to be investigated, involved all attendees in presentations and developed good working relationships between all the participants in the project.

Immediately after this first workshop an input data document was circulated for the collection of hydraulic data, financial data and process information for the measures selected. Each internal investigator then spent up to 50% of their time over the following weeks in collating the necessary information to assist the consultants during their on-site visits. This period of internal investigation has exposed team members to all aspects of their respective organisations.

Subsequently, the consultants undertook on-site visits to each of the six irrigation providers to collect the required information.

The information collected was then compiled into individual documents for each irrigation provider and circulated immediately before a second workshop. This workshop was attended by the seconded representatives from the four large irrigation providers, GMW, MI, MIL and SRWA. The workshop confirmed the measures selected and data being collected, agreed on definitions and assumptions, identified information gaps and set plans for the next stages.

During the week following the second workshop, irrigation providers collected information necessary to close the information gaps identified. At the same time an environmental consultant visited each provider and collected the information necessary to benchmark environmental performance.

After information sharing, feedback and verification between the consultants and each of the six participating organisations, an aggregated working document was compiled. The core sources of information were the information maintained by participants from their operations, information which can be generated from internal data and that which is readily available in the public domain. From this document a draft report was compiled which was then reviewed, refined and ratified by the project team at a third workshop.

The comparative data, hydraulic data and general information used in the benchmarking study was for the financial year 1995–96, except where stated otherwise. Financial information was collected for five years, from 1992–93 to 1996–97, to provide a combination of trend information and the most contemporary data set. It should be noted that the majority of providers benchmarked underwent differing degrees of change in structure, ownership and reporting requirements during this period, as they moved from being pure public utilities. This has led to some anomalies in particular years for individual providers. Where substantial comparative differences are identified, these alternative causes should be investigated before allocating performance-based conclusions.

Throughout the process, close consultation was maintained with the project steering committee that was established after the scoping study. The steering committee critically reviewed the Milestone 1 report and the draft report, before the submission of the final report of the benchmarking program.

# 4 Irrigation Providers

Irrigation providers are the organisations which undertake retail water distribution, primarily to agricultural and horticultural irrigators but also to agricultural stock water users, rural house and garden users and bulk purchasers. Bulk purchasers include rural towns, factories and industry, and stock and domestic leagues (groups of agricultural stock and rural house users).

Irrigation providers divert water from the river systems released on an allocative basis which is matched to specific orders of irrigation providers. In the Murray valley the release and diversion of water is overseen by the Murray–Darling Basin Commission and the operation of storages and structures is undertaken by the Rural Water Commission of Victoria, the Department of Land and Water Resources in New South Wales and the Engineering and Water Supply Department of South Australia. The operation of the Murrumbidgee river system in New South Wales is undertaken by the Department of Land and Water Resources

## 4.1 Participants

Six irrigation providers, representing three States, have participated in this project. These are:

- Goulburn Murray Water (GMW), Victoria;
- Murrumbidgee Irrigation Corporation (MI), NSW;
- Murray Irrigation Limited (MIL), NSW;
- Renmark Irrigation Trust (RIT), SA;
- Sunraysia Rural Water Authority (SRWA); Victoria; and
- Western Murray Irrigation Limited (WML), NSW.

**Table 4.** Comparative data on nine strategic business units of Goulburn Murray Water (GMW)

| | GMW-She | GMW-CG | GMW-Ro | GMW-PB | GMW-MV | GMW-Torr | GMW-T-Ny | GMW-T-TR | GMW-DIV |
|---|---|---|---|---|---|---|---|---|---|
| Ownership structure | SBU | SBU | SBU | SBU | SBU | SBU | SBU | SBU | SBU |
| ML/annum | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No of customers (billings) | 2,304 | 3,751 | 1,725 | 1,027 | 2,062 | 2,857 | 250 | 164 | 8,385 |
| No of ha in region | 82,431 | 172,125 | 117,048 | 186,044 | 128,250 | 176,478 | 1,613 | 1,902 | 49,570* |
| No of ha irrigated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| km of pipe | 12.35 | 20.14 | 37.16 | 0.2 | 0.53 | 4.4 | 48.44 | 39.31 | 0 |
| km of channel | 693 | 141 | 728 | 1,463 | 980 | 1,482 | 0.25 | 0 | 0 |
| No of employees | 31 | 72 | 41 | 40 | 50 | 73 | 13 | | |
| Irrigation revenue ($m) | 5.07 | 10.67 | 5.35 | 5.63 | 7.94 | 11.05 | 0.47 | 0.42 | 2.05 |

* Licensed irrigation area for diverters
Notes:She – Shepparton; CG – Central Goulburn; Ro – Rochester; PB – Pyramid Boort; MV – Murray Valley; Torr – Torrumbarry; Torr–NY – Torrumbarry–Nyah; Torr–Tr – Torrumbarry-Tresco; Div – Diverters.

Staff members from GMW, MI, MIL and SRWA were seconded on a part-time basis to participate in the project and have been compensated for their time. Representatives from RIT and WML have voluntarily contributed their time. The location of the region and the irrigation providers is shown in Figure 2 (page 2).

## 4.2 Provider Comparisons

The six participating irrigation providers have the characteristics summarised in Table 1 (page 2).

GMW, because of its large scale, has also been considered in nine Strategic Business Units (SBUs) (Table 4).

GMW is the largest provider in terms of water delivery, numbers of customers and area serviced. GMW also covers the most diverse variation in regions and water uses. MI and MIL have a number of similarities in terms of climate, land type and land uses. However, MI has a greater proportion of intensive horticultural irrigation. RIT, SRWA and WML generally supply irrigation water for horticultural production.

**Figure 12.** Infrastructure of providers

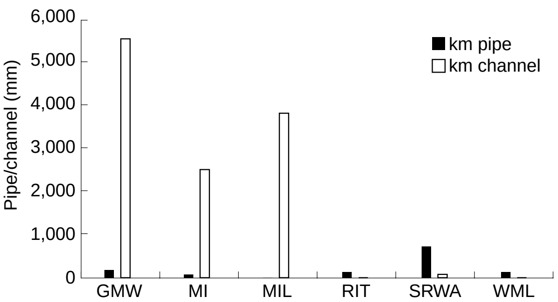
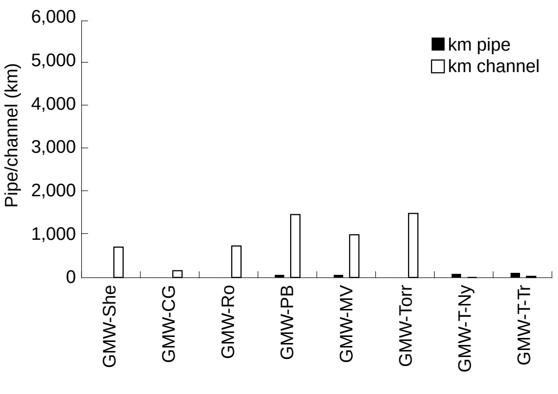



**Figure 13.** Infrastructure of GMW strategic business units




Figures 3 and 12–13 indicate the comparative scales of the participating organisations in terms of volumes delivered (Fig. 3) and infrastructure (Figs 12 and 13).GMW, MI and MIL deliver water primarily with earthen channel systems while RIT, SRWA and WML have fully or mainly piped infrastructure. There is a similar relationship between providers in terms of MLs of water delivered per km of infrastructure as there is for total water delivery.

WML is now a piped system but operated for part of 1995–6 with a major channel, which does not truly reflect its current and future hydraulic performance. As a result, 1996–97 hydraulic data have been used for WML to permit a more comparable assessment of hydraulic performance.

The irrigation system has a unique variation in water uses when compared with other systems such as metropolitan water supply. This is illustrated in the charts in Figure 14. Each provider produces a relatively distinct mix of crops, each with inherent differences in water requirements. The graphs show the broad groupings of crop/pasture production but even within these there are further substantial differences. These differing requirements relate to the timing (seasonal), frequency and quantity of customers' water demands. This is particularly evident when MLs used per hectare are benchmarked, as discussed in section 6.2, Wateruse.

RIT region is 100% horticulture and WML are unable to provide a breakdown of crops produced. MIL figures are for the percentage of water being delivered to each crop type.

## 4.3 Climatic Conditions

Rainfall and evaporation data provide an indicative profile of the climate in which each of the irrigation providers operates. While rainfall information has been collected to provide comparisons between providers and to acknowledge rainfall as an input to the irrigation system, the data have not been used in the benchmarking analysis, as annual averages do not necessarily relate to seasonal crop husbandry requirements. Rainfall and evaporation variation can be as great within regions as they are across regions; and rainfall volume does not provide information on soil infiltration and runoff. Several crop water balance models have been developed in Australia to provide an improved basis for comparison. Oram and Dumsday (Vic), Watbal (CSIRO), and Perfect, Medli and Apsim (Qld) have developed models which incorporate crop, soil properties, evaporation, rainfall and irrigation. The use of these models assists wateruse efficiency and groundwater recharge measurement.

Figure 15 provides an estimate of the need for irrigation, where rainfall minus evaporation approximates the rainfall deficiency of the region.

**Figure 14.** Crop production characteristics within provider regions. (a) GMW; (b) MI; (c) MIL

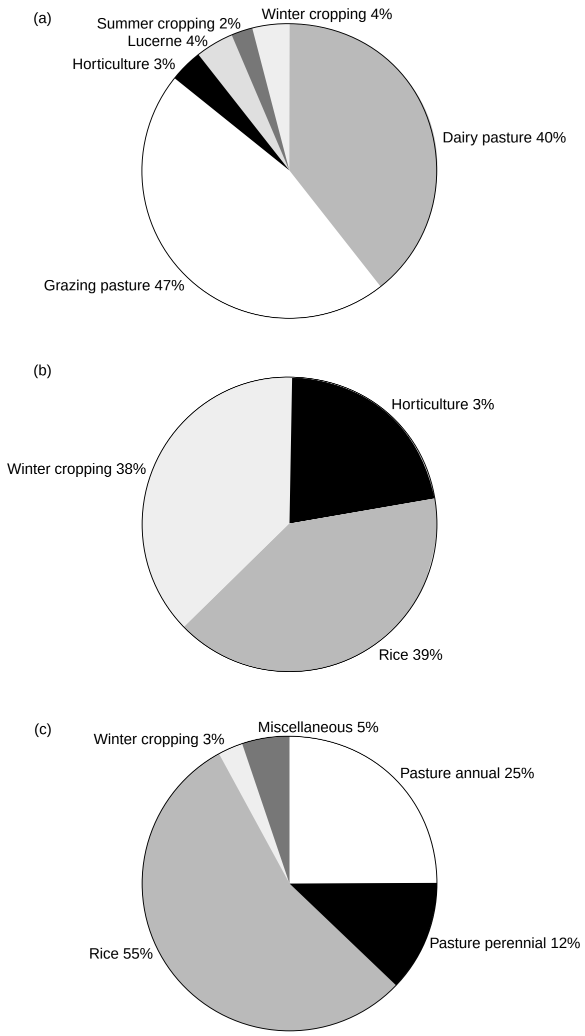
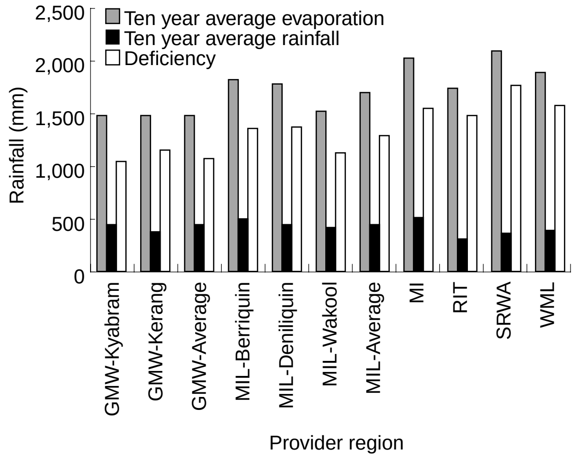



**Figure 15.** Climate summary — rainfall deficiency




## 4.4 Irrigation Provider Survey

The participating irrigation providers all have relatively distinct irrigation systems which supply different regions with varying agricultural and horticultural production systems. Consequently, benchmarks relating to wateruse, farm production, hydraulic performance, environmental management and financial performance all are affected by the different nature of each provider. This leads to a level of complexity for benchmarking irrigation providers which requires consideration of a number of performance measures rather than any one measure in isolation.

Measures relating to customer management and business processes are affected to a far lesser degree by the different systems, as they assess management practices rather than the delivery of products and services.

# 5 The Irrigation System

The structure of Australia's irrigation system and its evolutionary development has had a major impact on its operation and its management. The causes of these issues include the following.

- The selection of areas for the development of irrigation systems was based on a need to ameliorate deficient and variable rainfall, access to water, topography and availability of land. While these factors were understandably the primary drivers of the time, today's requirements would include a greater assessment of soil types, watertables and drainage. Consequently, some of the soil types and situations are less than ideal which adds to the difficulty in the operation and sustainable management of the irrigation system.
- The age of the system means that much of the infrastructure is aged too. There are only a relatively small number of new systems built using piped infrastructure, which provides the most hydraulically efficient form of water delivery.
- The high level of government involvement, combined with the state separatism inherent in Australia's constitution, has led to a somewhat convoluted system of interaction between irrigation providers, state managed river storages and the tri-state controlled Murray–Darling Basin management.

## 5.1 Providers' Place in the System

The irrigation industry is a part of the overall water system. The irrigation industry provides one part of the sustainable management of a key natural resource and competes in demand for and supply of water with environmental and urban needs. All key stakeholders involved in the management of water, therefore, are part of a wider system and should be aware of the impact of their actions on all parts of the overall water system.

A subset of the water supply chain is the irrigation supply chain. The irrigation supply chain can be dissected using value chain concepts. The irrigation supply chain is made up of:

- the water source (surface, in-ground, dam, river, rainfall and waste water);
- catchment management;
- irrigation provider;
- on-farm irrigation system;
- on-farm field irrigation;
- agricultural production; and
- drainage (back to water source).

This system can be depicted as shown in Figure 4 (page 3).

Bos and colleagues, in their paper presented to ICID in 1993 (Bos et al. 1993), recognise the difficulty in assessing and improving the performance of irrigation systems because of the complexity of the overall water system. They presented a nested system framework which provides a structure and linkages for the different levels of system. The five nested systems are the irrigation system, the irrigated agriculture system, the agricultural economic system, the rural economic system and the national political system. This benchmarking study recognises the need to consider irrigation as a part of this holistic framework.

Within the irrigation supply chain there has been significant higher-level focus on the stages before and after the irrigation system. This focus has included some national policy issues, catchment management issues, on-farm field irrigation linked to agricultural production, as well as the returns to the catchment system. Significant work on these issues is being carried out by state governments and the Murray–Darling Basin Commission. There has also been a substantial body of work carried out on the urban water supply issues through WSAA and others.

There has been a relatively small amount of research carried out on irrigation provider systems, other than by individual providers themselves. The geographical distance between these providers has hindered the sharing of this work to date. This project provides the opportunity to create benefits in the industry through the benchmarking of the key processes undertaken by irrigation providers.

### Demand for water

The demand for water in most areas of Australia exceeds supply. There is demand for water from environmental, agricultural, industrial and urban users. Within these agricultural uses there are competing demands between differing geographic regions, differing crop types and the various irrigation providers. Although irrigation providers are an integral part of the supply chain, they are purely a conduit and do not significantly influence demand-based decisions. However, these decisions have the potential to significantly affect the operations of the irrigation providers. It is, therefore, critical for irrigation providers to maintain good levels of information and strong linkages to the demand for water.

### Catchment management

There is a significant focus on overall catchment management by bodies such as the state governments and the Murray Darling Basin Commission. Irrigation providers have little control over catchment management policies. However, changes in policy and activities at catchment management level can have a significant effect on the irrigation system. This is made even more complex because of the multi-layered effect of different regional inputs on the overall catchment management process. Therefore it is crucial for irrigation providers to maintain similar levels of information and linkages with these ‘upstream’ organisations as well.

### On-farm field irrigation processes and agricultural production

On-farm issues have also been an area of attention in catchment management by bodies such as DPIE, state agriculture departments and the Murray Darling Basin Commission. Irrigation providers are recognised as the most useful juncture from which to monitor and manage on-farm wateruse, because of their greater level of concentration and direct linkages to farms. However, beyond normal commercial arrangements and prescribed regulatory obligations, irrigation providers are not in a position to manage on-farm use. As with the upstream activities, it is imperative that information and linkages between providers and users are established and maintained to maximise the benefits to all stakeholders. This will achieve by the maximisation of wateruse efficiency throughout the supply chain in order to optimise sustainable economic production.

### Discharge back to the catchment system and thus the environment

Irrigation providers are ultimately viewed as being responsible for the management of the water system, which includes the return of water to the overall system. It is therefore crucial that irrigation providers understand and monitor the quality of water returning to the overall system.

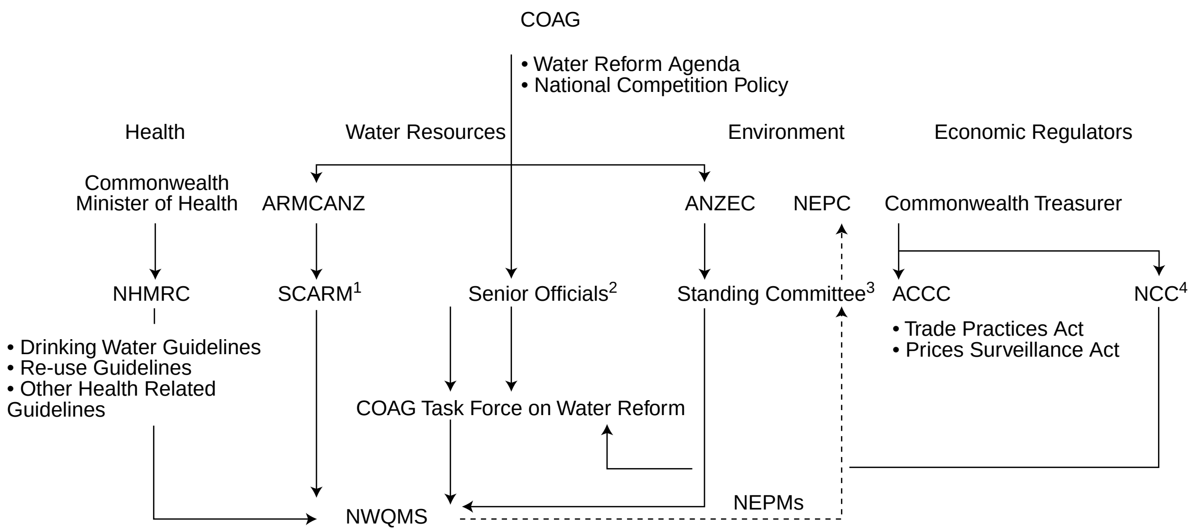
## 5.2 Policy and Regulatory Framework

The provision of water services is the responsibility of the States and Territories. The Commonwealth Government takes responsibility for policy development. The role of each level of government is discussed in this section respectively.

### National

The national policy and regulatory framework is illustrated in Figure 16.

**Figure 16.** National policy and regulatory framework




Source: WSAA (1997)

Notes: 1. Department of Primary Industries and Energy services ARMCANZ; 2. Heads of Prime Minister’s and State Premiers’ departments; 3. Department of Environment, Sport and Territories services ANZECC; 4. Set up with agreement of all jurisdictions.

Acronyms: ACCC, Australian Competition and Consumer Commission; ANZECC, Australia and New Zealand Environment and Conservation Council; COAG, Council of Australian Governments; NEPM, National Environment Protection Measure; NCC, National Competition Council; NEPC, National Environmental Protection Council; NHMRC, National Health and Medical Research Council; NWQMS, National Water Quality Management Strategy; SCARM, Standing Committee on Agriculture and Resource Management

There are three primary avenues for government policy development, which are currently stimulating national water industry reform.

1. *The Council of Australian Governments (COAG) Water Reform Agenda*

This framework has developed a set of Generic National Milestones. These milestones are intended as the basis for the negotiation of specific milestones for each State and Territory. These reforms include:

- arresting widespread natural resource degradation and monitoring the effects of this on industry and the community;
- water pricing and cost recovery being achieved for rural water supply;
- separation of institutional roles;
- performance monitoring and best practice for delivery of water entitlements;
- allocation and trading of water entitlements;
- environment and water quality; and
- public consultation and education.

2. *National Competition Policy*

The key features are derived from the Competition Principles Agreement, which include:

- allowance for States to request the Australian Competition and Consumer Commission to become the regulator of prices for water services through the *Prices Surveillance Act 1983*;
- competitive neutrality;
- structural reform of public monopolies, eg. to conform to Corporations Law;
- review of legislation in terms of anti-competitive elements; and
- access to services of significant infrastructure facilities.

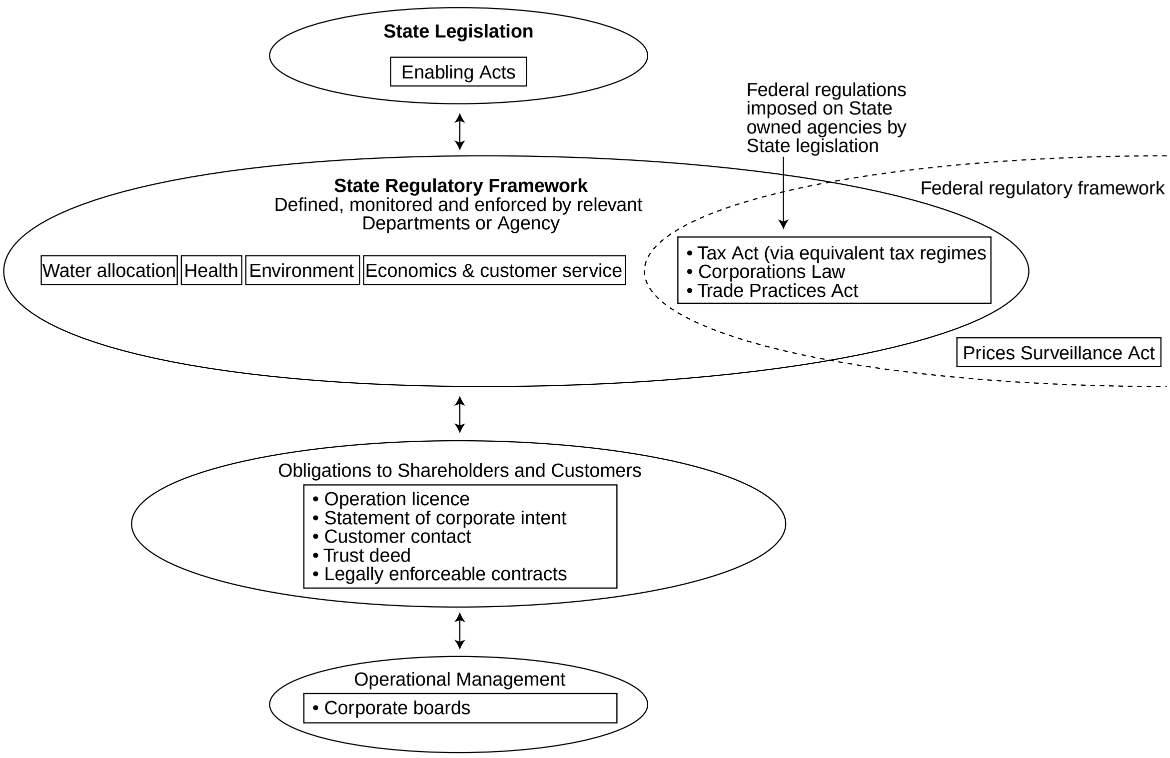
The Commonwealth will make substantial payments to States for the achievement of the milestones set.

3. *The National Water Quality Management Strategy*

This is a joint strategy of the Australian and New Zealand Environment and Conservation Council (ANZECC) and ARMCANZ, which represent environment and water resource interests, respectively.

These areas of policy development influence the operations and reporting requirements of irrigation providers. In accordance with the nested systems framework, it is important that irrigation industry and stakeholders keep up to date with these developments, both in terms of communicating the

**Figure 17.** Generic State policy and regulatory framework



needs and views of the industry to government and by facilitating changes dictated through policy development.

### States and Territories

States and Territories are responsible for their own constituencies, with consequent variations in operations and structural reform. However, a consistent approach is emerging regarding the regulatory framework and reform process. This is represented in Figure 17.

Regulatory functions and water businesses are being separated by all the States but economic regulation is less advanced. NSW and Victoria are the only two to set up economic regulators. NSW is the most advanced, where the establishment of commercial water businesses requires separate roles of ownership, commercial operation and price regulation.

In terms of environmental regulation in NSW, the three irrigation providers operate under clearly documented Department of Land and Water Conservation (DLWC) Works Licences and Environmental Protection Authority (EPA) Pollution Licences. The irrigation providers are the designated Implementation Authorities for their respective Land and Water Management Plans (LWMPs). Their licences require annual reporting to meet the requirements of the LWMPs, EPA and DLWC and they specify in detail the environmental monitoring parameters to be reported.

In Victoria, the rural water authorities operate under the Water Act which requires that they do not cause off-site damage as a result of their business operations. They operate under the EPA State Environmental Protection Policies (SEPPs) which relate to the authorities' management of surface and groundwater resources and drain management (particularly dairy effluent management in GMW's case). Similarly, the Catchment and Land Protection Act and Local Government Planning legislation provide opportunities for the authorities, as well as Victorian Department of Natural Resources and Environment (DNRE), EPA and local government, to reduce environmental degradation by implementing the respective regional salinity management and water quality improvement strategies.

In Victoria, while DNRE or GMW may be lead agencies in implementing the LWMPs in various regions, they do not have sole responsibility. The responsibility is now in the hands of the new Catchment Management Authorities (Goulburn Broken and North Central CMA in GMW's area of influence and the Mallee CMA in SRWA's case).

Again, these are important issues within the nested systems framework; particularly since the relationship between state government and irrigation providers is becoming 'at arms length', as providers move towards corporatisation and privatisation.

# 6 Customers

## 6.1 Profile

A profile of customers can be constructed by considering the segments served by irrigation providers. These include:

- diverters — water users who divert water directly from the river systems;
- irrigators — water users who use water for agricultural/horticultural crop or pasture production;
- domestic and stock or house and garden users — these customers use small quantities of water for stock water and personal uses only; they do not undertake direct agricultural production; and
- bulk purchasers — which are towns, industry and domestic and stock leagues, who purchase water in bulk quantities.

These segments are mutually exclusive, ie. customers only appear in one segment. Table 2 (page 3) shows customer numbers for each provider according to each of these broad customer segments.

Diverter wateruse is not monitored by providers who are not included in the benchmarking analysis. Benchmarking, in terms of wateruse and customers, is focused on the irrigator customer segment.

## 6.2 Wateruse

Comparison of wateruse between providers highlights the differences in water requirements between relatively extensive agriculture and intensive horticulture. The mix of crops grown within the regions of each provider is shown in Figure 14. Sustainability indicators are intended to provide a common understanding of what is understood by sustainable systems and a process to monitor trends. Monitoring Sustainability In The Grain Industry: A Central Queensland Pilot Study by Dalal et al. concluded that gross margin per ha per mm per annum was the most integrative indicator of crop productivity. The measure is responsive to change in management practices, easily captured, can be aggregated from paddock to catchment, is stable, inexpensive, measured annually and is expected to have high acceptance by the industry.

Water requirements for large-area crops, except for rice, are generally lower than for horticulture. GMW and MIL have the highest proportion of extensive or 'broad acre' crops irrigated, hence their lower average water application rates. By comparison, RIT, SRWA and WML (crop data not provided) have a high proportion of horticultural crops within their areas. MI is somewhere in between because of considerable horticulture combined with large areas of winter cropping and rice production. These comparisons are depicted in Figure 5 (page 4).

Analysis of MLs per hectare provides comparative information about the different systems. It does not suggest incremental benefits but simply says water is being used. Where the figure is lower it may suggest a rationing of water. True assessment of efficiency of wateruse needs to be related to dollars earned per ML or hectare.

MIL usage per hectare is relatively low considering that 55% of the irrigated rice area is used for rice production. However, MIL place a cap on total wateruse per farm of four ML per hectare. This is set subjectively, and requires further research, but is designed as a precursor to setting environmentally sustainable limits.

This information can be further delineated to provide a breakdown of wateruse for specific crop types. ML per ha is a relatively crude measure, the reliability of which will be reduced by high and low rainfall over a period of time.

The providers benchmarked do not maintain complete data sets on water application rates for specific crops. Rice is the one exception where, because of environmental requirements, this information is fully maintained. The information provided on crop wateruse has been extrapolated from a combination of past customer surveys (or censuses), information provided by customers at the point of ordering and/or standard application rates. To benchmark the accuracy of this information, ABARE statistics on crop wateruse have been juxtaposed with the observed information in the graphs which follow.

There is a substantial variance in application rates for differing crops from the information supplied, as illustrated in Figure 18. This is highlighted by comparing application rate benchmarks between other crops with that of rice, where this information is maintained as a regulatory requirement. For rice there is only a 0.33% difference between the application rates of the two providers concerned.

**Figure 18.** Regional crop water uses (Hall et al. 1993). (a) GMW; (b) MI; (c) MIL; (d) SRWA

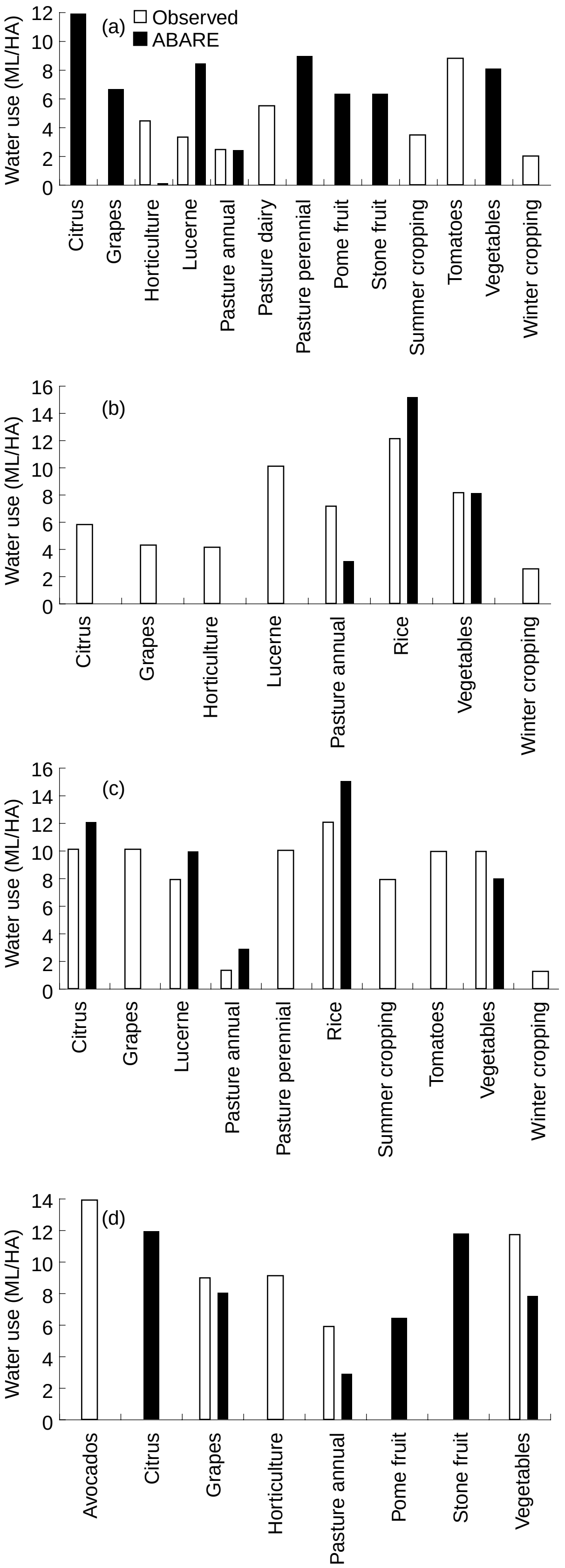
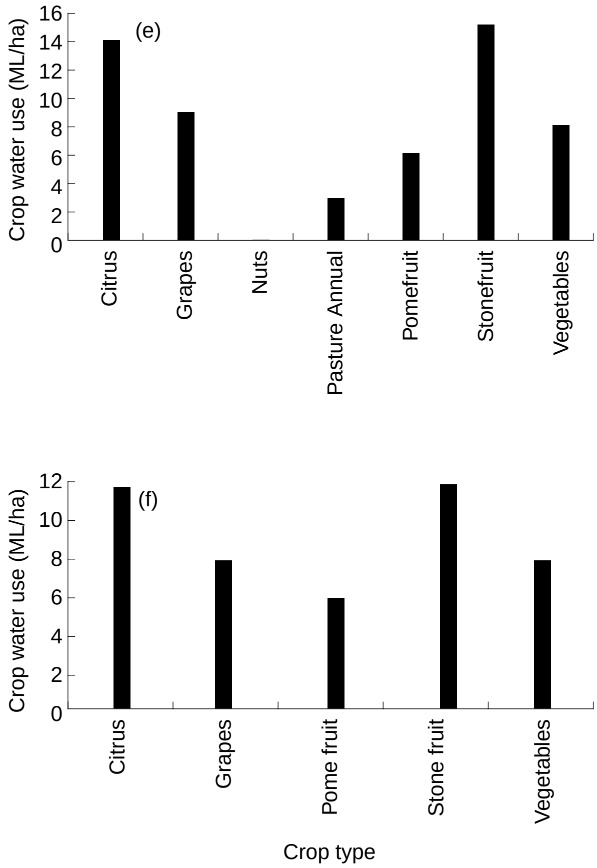



**Figure 18.** Cont'd. (e) RIT; (f) WML




It should be noted that variation in water application rates can arise from factors other than data accuracy, including the following:

- crop type (and variety);
- double cropping (more than one crop planted on the same area in a year);
- region;
- climate; and
- season.

There is also considerable difference between the information collected by providers and that collected by ABARE. This is most probably because the ABARE information was collected in 1993, three years before the collection of provider information. Since that time there have probably been changes in irrigation management practices, as well as differences in water allocation between the years being compared.

WML and RIT were unable to supply crop wateruse information and the ABARE data have been used for these providers.

Systematic monitoring of this information would assist irrigation providers in the following ways.

- *Environmental performance*—Minimum application rates are being set for rice production but these limits are not empirically based. Monitoring this data will aid in these decisions and can be correlated with climatic regions, soil types etc. It is likely in the future that such limits will be set for all crop types. Therefore it is in the interests of customers to assist in the gathering of this information.
- *Customer service*—This information will provide benchmarks which will aid irrigators in their crop-husbandry decision-making.
- *Water forecasting*—Extrapolation of historical application rates for crops during irrigation seasons can be used to fine tune water ordering by providers. This would have a two-fold effect:
  1. more accurate headwater releases, thus minimising losses to the system; and
  2. assisting water planning based on likely demands and capacity to deliver.

## 6.3 Farm Revenues

Analysis of farm revenues provides an assessment of agricultural production, in terms of returns for crops produced and aggregate returns within each provider region. A more appropriate measure will be yield per ML (both rain and irrigation) as market values may vary over time.

Only low levels of information on agricultural production and value are available to irrigation providers. The information listed as ‘observed’ consists of data collected from a combination of the latest ABS statistics survey, provider censuses, statements of intent at water ordering by customers, farm consultant surveys, and agricultural department generic gross margins. Again, to benchmark the accuracy of this information, the ABARE statistics have been juxtaposed with the observed information in the tables which follow.

There are differences in the information collected by providers and that collected by ABARE. This is most probably because of the following factors:

- timing differences between the 1993 ABARE report and now, affecting market prices, water allocations and crop management practices;
- differing sampling techniques; and
- a lack of data available to providers.

### Benefits of farm revenue analysis

The are a number of uses for economic performance benchmarks, including:

- enhanced customer understanding to enable an assessment of ability to pay and for making pricing decisions;
- providing benchmarks to customers on economic performance, as a service offering;
- identification of high return and low water requirement crops, for issues such as environmentally fragile areas;
- use for prioritising new infrastructure investment, where appropriate; and
- promoting the benefits of irrigation using measured economic productivity.

The development of technology such as user-friendly databases software, GPS and GIS will make the sourcing, storage and manipulation of this type of information easier in the future.

Four irrigation providers were able to supply analysable information. This information can be used to compare performance in the following ways:

- historical performance;
- comparison between broad enterprises, eg. agriculture to horticulture;
- comparison between crop types; and
- comparisons within and across provider regions.

### Data analysis

Customer economic performance has been analysed in terms of returns per ha and per ML. A comparison of gross margins (gross revenue less direct costs) on a per ha and ML basis is provided in Table 5.

The high value of horticultural crops on a land use basis is clearly evident in the tables overleaf, as shown by SRWA’s (92% horticultural production) regional return per Ha. This is four times that of GMW (97% agricultural production). While there are substantial gains to horticultural production on a ML basis as well, these are substantially reduced because of associated higher water demands. On a ML basis, SRWA regional returns are 1.7 times those of GMW.

## 6.4 Customer Summary

The irrigation system is a supply chain within the agricultural system designed to provide an added input to agricultural and horticultural production. An analysis of customers has provided three important areas of information for ongoing benchmarking and management. These are:

1. the value of farm production benefiting from the supply of irrigation services, the ‘bottom line’ evaluation for non-profit irrigation providers;

**Table 5.** Gross margins per ha and per ML for specific crops in each irrigation provider region: (a) gross margins ($/ha)

| Gross margin ($/ha ) | Pasture annual | Avocados | Citrus | Pasture dairy | Grapes | Horticul-ture | Lucerne | Nuts | Pasture perennial | Pome fruit | Rice | Stonefruit | Summer cropping |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GMW | | | | | | | | | | | | | |
| Observed | 451 | | | 1,739 | | 7,830 | 769 | | | | | | 1,044 |
| ABARE | | | 3,357 | | 3,629 | | 992 | | 1,764 | 4,344 | | 6,068 | |
| MI | | | | | | | | | | | | | |
| Observed | 113 | | 2,444 | | 3,988 | 4782 | 746 | | | | 1,802 | | |
| ABARE | 154 | | | | | | | | | | 754 | | |
| MIL | | | | | | | | | | | | | |
| Observed | | | | | | | | | | | | | |
| ABARE | 153 | | 5,310 | | 3,144 | | 941 | | | | 869 | | |
| SRWA | | | | | | | | | | | | | |
| Observed | | | | | | 5,802 | | | | | | | |
| ABARE | (23) | | 10,662 | | 5,802 | | | | | 1,576 | | 5,071 | |
| RIT | | | | | | | | | | | | | |
| Observed | | | | | | | | | | | | | |
| ABARE | 157 | | 7,745 | | 5,416 | | | | | 2,457 | | 6,447 | |
| WML | | | | | | | | | | | | | |
| Observed | | | 4,581 | | 13,329 | | | | | | | | |
| ABARE | | | 4,948 | | 2,776 | | | | | 2,454 | | 6,401 | |

**Table 5.** Gross margins per ha and per ML for specific crops in each irrigation provider region: (b) gross margins ($/ML)

| Gross margin (ML/ha) | Pasture annual | Avocados | Citrus | Pasture dairy | Grapes | Horticul-ture | Lucerne | Nuts | Pasture perennial | Pome fruit | Rice | Stonefruit | Summer cropping |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GMW | | | | | | | | | | | | | |
| Observed | | | | 310 | | 1,702 | 220 | | | | | | 290 |
| ABARE | 173 | | 280 | | 538 | | 117 | | | 724 | | 1,011 | |
| MI | | | | | | | | | | | | | |
| Observed | 16 | | 415 | | 911 | 1,112 | | | | | 62 | | |
| ABARE | 51 | | | | | | | | | | | | |
| MIL | | | | | | | | | | | | | |
| Observed | | | | | | | | | | | | | |
| ABARE | | | 443 | | | | 94 | | | | 58 | | |
| SWRA | | | | | | | | | | | | | |
| Observed | | | | | | 631 | | | | | | | |
| ABARE | (8) | | 889 | | 725 | | | | | 263 | | 423 | |
| RIT | | | | | | | | | | | | | |
| Observed | | | | | | | | | | | | | |
| ABARE | 52 | | 553 | | 602 | | | | | 410 | | 430 | |
| WML | | | | | | | | | | | | | |
| Observed | | | | | | | | | | | | | |
| ABARE | | | 412 | | 347 | | | | | 409 | | 533 | |

2. the allocation and extent of wateruse by area and crop type, which will assist in sustainability planning and monitoring; and
3. provider system differences and similarities to assist in evaluating their relative performance.

# 7 Customer Management

Customer management is defined as the way in which an organisation manages and interacts with its clients. Best in class evaluations were made to enable each organisation to compare its own practices with the best identified and agreed in the study.

## 7.1 Service Performance

### Customer participation

*Best in class*
GMW

*Key features*

- Customer Services Committees
- Liaison with Area Managers
- Elected representatives of irrigators
- Includes non-voting representatives from GMW and DNRE
- Linked to Catchment Management

*Description*
Best in class organisation for customer involvement in provider decision making is GMW. Each irrigation area is represented by a Water Services Committee. Area Managers liaise with their own committee on strategic area issues. The committees represent irrigators and can influence services and asset management procedures which both in turn can influence the price of services delivered by GMW. The committees comprise elected irrigation representatives and non-elected and non-voting participants from GMW and Victorian Department for Natural Resources and the Environment (DNRE). These customer committees are linked to Catchment Management Authorities through their sub-committees.

GMW also undertakes customer consultation concerning drainage. Farmers from 23 catchments have provided feedback and have assisted in setting priorities, which has enabled a balance of economic and social issues to be considered for the implementation of drainage strategies.

*Best in class features of other providers*
MIL, SRWA, RIT and WML

- Privatised with irrigator board representation
- Greater trust relationship developing with growers because of closer relationship
- Higher level of responsibility is being taken by growers concerning issues and actions which affect their organisation
- Reduced need for customer committees thanks to direct representation and ease of access to board members by irrigators. The board is becoming a surrogate for committees.

MI

- MI have area committees much the same as GMW. MI also have regular interaction with the representative organisations for the two major commodity groups of the region, Ricegrowers Association and Horticultural Council, and attend their half-yearly meetings.

### Performance monitoring

*Best in class*
GMW

*Key features*

- Review of customer services for all irrigation areas in each of the last three years
- Professionally compiled qualitative and quantitative surveys covering:
  – perceptions of irrigators and staff;
  – irrigation service;
  – provider performance;
  – communications;
  – farmers' future needs; and
  – providers' future services.
- Goal to benchmark level of service across all areas
- Water services committees have been implementing recommendations

*Description*
These surveys are conducted using a census approach. Survey construction and analysis is outsourced to suitably qualified experts. A staff member is put in charge of the delivery and receival of surveys and transfer to the outsourced survey organisation. An area of weakness is the customer data base which can not be sorted to provide an accurate list of customers.

*Best in class features of other providers*
SRWA

- Compilation of monthly complaints report by Operations Manager
- Uses complaints system developed by the City of Bendigo
- Complainant is informed of response

MIL

- Every time customers order, one of six crop types has to be nominated. If rice is being grown an area also needs to be nominated. This is part of the IVR system.
- Utilises surveys carried out by other organisations. In the last three years this has included surveys carried out through Land and Water Management Plans (LWMP) and the MDBC. MIL show a heightened awareness of these activities. In contrast, some providers have been surveying this year at the same time as the ABS census which puts added work on customers and duplicates some of the information being collected. This can have a flow-on effect, being that customers may view providers as being unprofessional because of this duplication.

*Gaps/opportunity*
Many providers use the survey approach to capture information on crop production. This is relatively inaccurate depending on the level of effort by the customer to fill out the survey form as well as the less than complete normal response rates received.

## 7.2 Customer Interaction

This process is the combination of activities involved in water ordering, planning and delivery.

### Water delivery

*Best in class*
RIT, SRWA and WML

Ordering facilities are available seven days a week for SRWA. Immediate supply is provided if capacity available. If the head (pressure) drops, more pumps automatically cut in.

*Best in class features channel providers*
MI

- 24 hours notice to delivery is provided to customers. This is three days earlier than the next best channel provider.

### Water Ordering—Channel Systems

*Best in class*
MI, MIL and GMW

*Key features*
- IVR telephone ordering system (MI has half of its area on central telephone water ordering)
- Data base of water orders is stored for delivery date
- Central water orders are placed by provider after adjustment based demand and supply (eg. rainfall) forecasting.

*Description*
Interactive voice response (IVR) telephone ordering system links customers to planning system and enables orders to be entered and start times confirmed before delivery. GMW’s system enables customers also to leave messages for appropriate water planners.

First priority is given to orders placed with the required notice. Next priority level is that everyone gets an equal share of available water.

### Water ordering—pipe systems

*Best in class*
SRWA, RIT and WML

*Key features*
- Immediate approval if supply available
- Farmer can start own supply immediately
- First-in-first-served supply system
- SRWA provides ordering facilities nine hours a day, seven days a week

## 7.3 Communication to and from Customers

*Best in class*
MIL

*Key features*
- Weekly updates on remaining allocation
- Bi-monthly newsletter
- Quarterly usage report sent to customers

*Description*
MIL provides the most direct communication, by being the only provider to do all of the above at that level of frequency. MI also provide regular customer newsletters, an abbreviated annual activity report and participates at promotional field days. GMW provides high levels of communication on a general level which is discussed below.

*Best in class features of other providers*
GMW

- Corporate communications policy directs these activities

- Implementation by a dedicated public communications officer
- Activities include:
  - press/media releases;
  - advertorial (paid-for editorial) space in local newspapers for regular column with industry information;
  - field days; and
  - sponsorship (linked to marketing).

## 7.4 Customer Management Summary

Key best practice activities at this stage include the following:

- Direct customer participation in strategic planning for their irrigation area's operational performance, as well as a direct line of communication to provide feedback on water delivery issues.

  The most productive and participative opportunity has occurred with the corporatisation and privatisation of irrigation businesses. This allows direct customer representation on a board that manages their own business. MIL have noticed a considerable and positive change in customer attitude since this level of 'ownership' has been established. This also provides a more direct link for irrigation and environmental management at a catchment, system and farm level.

- Performance monitoring that captures information on customer water uses in terms of crops produced, crop areas and crop water application rates. This can ultimately be linked to LWMPs and allow for optimal planning of on farm production in terms of sustainability.

  This is not currently being undertaken by the providers being benchmarked but is best practice elsewhere in Australia.

- IVR telephone ordering systems linked to water planning and management.
- Communication to customers that provides updates on remaining water allocation, usage reports and other information.

# 8 Water Delivery

The benchmarking analysis takes a value chain approach to viewing water delivery. While the focus is on providers, the linkages up and down the system are also considered. Figure 7 (page 6) illustrates the related flows of water and information in the water delivery system.

## 8.1 Water Stocktake

For each provider a water stocktake, as illustrated in Table 6, has been compiled and is used as the basis for hydraulic performance analysis.

The three main figures supplied by the majority of providers in the water stocktake are:

- diversions;
- deliveries; and
- outfalls/escapes.

These figures have been included as provided. The difference between diversions less outfalls/escapes and deliveries has been calculated and is listed as 'conveyance losses' which ostensibly act as a 'plug'. Customer and provider orders have been incorporated where proffered. No information on releases has been supplied. Other sources relate to groundwater, re-use systems etc. MI operates a re-use system which has been included as part of its water in. In relation to water out, non-farm delivery has been included to complete the water stocktake picture. This figure has been incorporated in analysis relating to diversions and excluded in analysis pertaining to deliveries, where the focus of the benchmarking study is on the irrigation system.

For on-farm delivery, rainfall has been shown, to again complete the irrigation water cycle. These data have not been used in any analysis because of their

**Table 6.** Sample water stocktake (1995–96)

| SRWA | Ordering | Water in | Transfers | Water out | Farm in | Transfers | Farmout |
|---|---|---|---|---|---|---|---|
| Customer | 83,673 | | | | | | |
| Provider | 155,979 | | | | | | |
| Releases | | 0 | | | | | |
| Diversions | | 105,227 | | | | | |
| Other sources | | | | | | | |
| Outfalls/escapes | | | 1,000 | | | | |
| Conveyance | | | 104,227 | | | | |
| Conveyance losses | | | | 18,736 | | | |
| Non-farm delivery | | | | 4,413 | | | |
| Farm deliveries | | | | 81,078 | 81,078 | | |
| Rainfall | | | | | 28,067 | | |
| Other sources | | | | | | | |
| Field transfer | | | | | | 81,078 | |
| Drainage/discharge | | | | | | | 22,908 |
| Crop/pasture use | | | | | | | 58,170 |
| Total | 239,652 | 105,227 | 105,227 | 104,227 | 109,145 | 81,078 | 81,078 |
| Note: Evaporation occurs during conveyance on-farm tranfer and in field. | | | | | | | |

inherent inaccuracies. No data are available on other on-farm sources.

Water out on-farm includes field transfer losses which are conveyance losses on-farm. Some of the pipe districts have estimated this figure. Crop production use is the volume of water actually used in-field. Information was not available for this component of the water stocktake. Drainage and discharge is water not used on-farm which re-enters the catchment system.

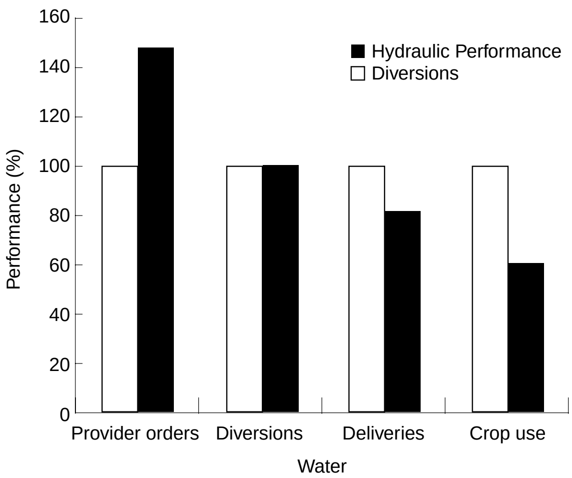
## 8.2 Hydraulic Performance

Hydraulic performance assesses the primary operations of irrigation providers in the diversion/ capture, conveyance and delivery of water, from source to field.

A summary of hydraulic performance for each provider is included in Table 3 (page 5). The major measure of overall hydraulic performance is percentage water diverted that is actually delivered. The other sections are constructed in a cumulative manner, to illustrate losses at each stage of the water distribution system.

The most complete data set has been provided by SRWA. It includes water orders and estimates of on farm losses. Drainage losses are based on subsurface drainage at measured sites which have been extrapolated over the entire irrigation region. There would be further unmeasured losses as all districts have a perched water table. In SRWA's case, Figure 26 illustrates the actual proportion of water that is delivered to field from diversion and which can be used to enhance agricultural productivity.

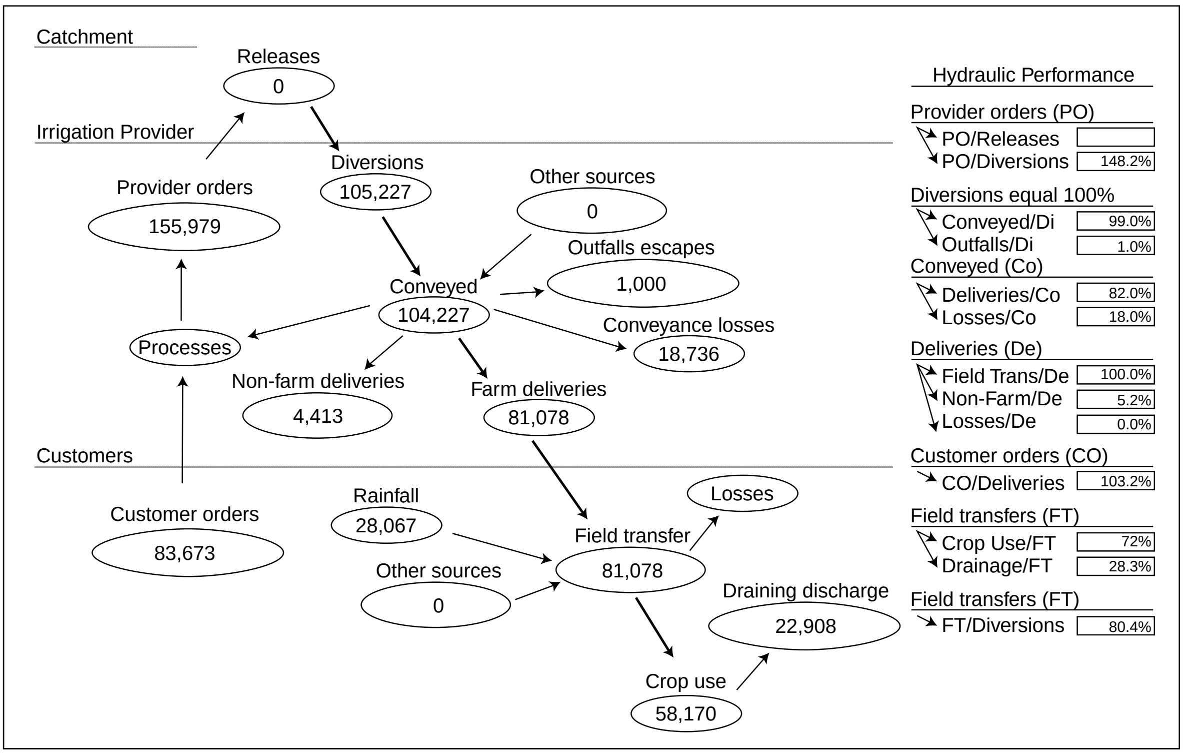
**Figure 20.** SRWA — hydraulic performance




Comparative performance of providers, in terms of percentage of water diverted, which is actually delivered, is provided in Figure 8 (page 6).

Overall, piped irrigation systems are the most hydraulic efficient. Within the piped systems benchmarked, RIT had minimal losses. WML losses appear to be larger than they actually are because of a

**Figure 19.** Example of a hydraulic performance flow chart



proportion unmetered house and garden deliveries and SRWA has a 65 km channel which negatively affects hydraulic efficiency.

MIL has the most efficient delivery of water of the channel systems benchmarked. Their higher delivery efficiency is because of lower recorded conveyance losses. MIL lose 10% at this stage, compared to 24% and 18% for GMW and MI respectively. This is most probably because of the management of systems to supply differing crops which require varying watering frequencies.

### The opportunity cost of water loss

When actual water losses are calculated by applying percentage losses to diversions, a picture of system losses can be painted, as illustrated in Figure 9 (page 6).

The opportunity cost of this loss is substantial in terms of income forgone, especially if measured in dollars of agricultural production, either for new land irrigation or increased allocations for existing areas.

If the opportunity cost of these losses can be reconciled to a stakeholder willing to pay eg. catchment management authorities, irrigation providers or farmer groups, then it is plausible to suggest that the value of these future cashflows could be used to fund investment in piped infrastructure.

### The source of water losses

Figure 21 shows that the majority of water loss is unmeasured. While in channel systems it is not possible to measure a significant proportion of losses because of factors such as seepage, maximising the measurement of losses will increase the opportunity to respond. There are a number of reasons why much of the water loss remains unmeasured, including:

- slow measurement, in general, is not accurate (Dethridge wheels etc.);
- it is difficult to measure channel losses because of the effects of surface area, soil permeability and wettable area; and
- the cost/return relationship is less attractive than other investment opportunities for irrigation providers.

### Piped versus channel systems

Figure 22 shows significant differences between piped and channel systems. Excluding WML, the average delivery efficiency of the two types of systems is as follows:

- channel 80%; and
- pipe 90%.

Efficiency per km provides a comparative perspective by which channel systems can be benchmarked.

Figure 22 needs to be read in the context of the nature of the region being irrigated in terms of agricultural production and on-farm practices as well as the services provided to customers. Irrigation providers offer two service delivery components to clients. The first is to deliver water and the second is to vary the frequency changes provided for that water. Changes refer to how often water is started and stopped for one connection. These changes affect water losses as they require channels to be filled and refilled more often to permit supply. GMW naturally has a far greater number of changes than either MI or MIL as 40% of GMW deliveries are for dairy pastures, which require a high frequency of water.

**Figure 21.** Sources of total provider losses. Note that measured losses are outfalls/ escapes and unmeasured losses are conveyance losses.

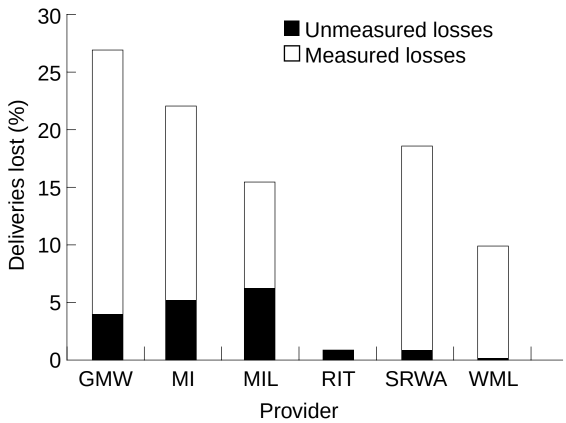
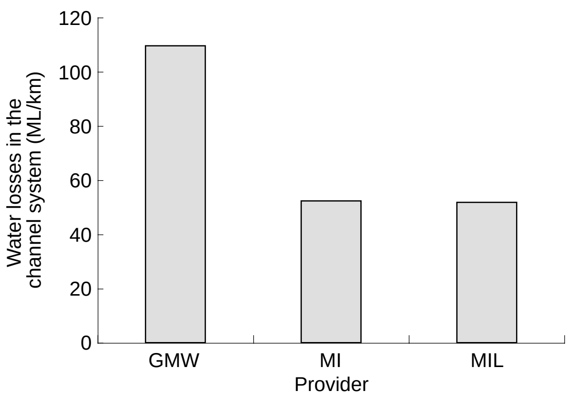



**Figure 22.** Channel system losses per km




### Water efficiencies before providers

Providers are charged for water diverted, not water ordered or released. The corollary of this is that pre-diversion water does not have to be valued by irrigation providers at its true economic cost. This enables providers to trade off river wastage for either increased levels of customer service (by having a shorter customer order time than travel time from headworks), limited investment in water management or poor system management.

However, there are two associated factors which further complicate this issue. Firstly, efficient farmers require 'just in time' supply systems which enable a rapid response to be made to closely monitored crop requirements (as do inefficient farmers, to compensate for poor planning). Secondly, it is inevitable that the water supply system will fall behind the development of on-farm technology, at the current rates of improvement of both. The result will be increasing difficulty for providers to meet customer needs which are likely to become more sophisticated, as on-farm technology increases productive information available to farmers.

The current irrigation system, in general, is not capable of meeting the needs of such micro-management. The question becomes a tradeoff between:

- fixing the system by providing intermediate storage capacity to ensure just-in-time supply with minimal 'wastage';
- to continue wasting large quantities of water by providing customer service levels which exceed the capacity of the system; or
- to constrain on-farm production.

It should be noted that releases not diverted do not necessarily constitute wasted water, as this water provides environmental benefits to the river system. It should be ensured that this water is accounted for, given the current demands by environmental groups to increase river flows.

### Water flows after providers

Past the point of water delivery by providers to farmers few data are available. While there is a body of work being undertaken assessing the on-farm use and effects of irrigation, much is still at a research level rather than at a systems level, which limits the transferability of this information for commercial use.

Irrigation providers are usually the focal point for hydraulic assessment as they are focused in the water provision business. Providers are not usually in control of activities up and down the value system and, therefore, it is in the interest of providers that more data be collected, both on-farm and from river operators. This constitutes an important area for future research.

## 8.3 Water Delivery Summary

Water delivery encompasses the flow of water and information into and along the irrigation supply chain, losses from the system and drainage out of the system.

Hydraulic performance is the key assessment of best practice and in this area included the following:

- Channel system deliveries as a percentage of diversions of 85%.
- Pipe system deliveries as a percentage of deliveries of 99% (subject to measurement error).
- The maintaining of a complete water stocktake data set, which includes water orders and on-farm losses.
- The use of SCADA technology to measure and control flows.

There are real opportunities for improvement in hydraulic performance through improved measurement as the majority of losses remain unmeasured. The industry as a whole needs to become more aware of the extent and value of losses which for these six providers totals 1 million ML (excluding on-farm losses).

# 9 Environmental Management

Environmental performance of irrigation providers can be defined as the way in which organisations respond to:

- environmental impacts from actions under their own control; and
- environmental impacts from the actions, either intentional or unintentional, caused by others, not under the control of providers.

In the long term, the ability of providers to assess and manage environmental risks will be dependent on their power to enforce policies and practices. At present this is not well defined. Moreover, it appears that the integration between those who collect the information (this is often external to the providers) and environmental management is not clearly inter-linking. Therefore, the relationship between these components needs to be monitored during benchmarking in future years.

The key environmental performance indicators that are measurable and comparable between organisations include:

- water quality (both entering and leaving the irrigation system)
  - – salinity
  - – nutrients
  - – turbidity
  - – pesticides
- watertable levels and salinity of groundwater
- soil salinity status.

The key processes that provide a comparison between the environmental management of irrigation providers include:

- environmental risk assessment and management
- relationships of organisations with land and water management plans.

The six points listed above are discussed individually in the following sections.

## 9.1 Water Quality

Irrigation providers distribute water to maximise returns to water users, while at the same time aiming to minimise the adverse external impacts of water that discharges from the system. Monitoring of water quality, salinity and nutrient data, entering and leaving the system is a requirement for MDBC Salinity and Drainage Strategies and is used to manage the potential for negative external impacts from wateruse.

The providers benchmarked monitor supply salinity and flow on a daily or continuous basis. Supply nutrient levels are usually measured (if at all) on a weekly or monthly basis. Table 7 provides the data for each of the providers.

Care needs to be taken when comparing providers with the information supplied in Table 7. There are a number of differences which arise from variation between regions.

These variations include:

- hydrology
- land uses
- irrigation delivery systems
- climate
  - – rainfall
  - – soil saturation levels
  - – evaporation
  - – temperature ranges

Table 7 provides information on concentration levels and resulting loads in the system, based on concentration and flows. Providers monitor concentration levels to manage loads, in terms of imports and exports of soil, nutrients and chemicals.

Since the data are for one year only, and there are considerable regional differences, it is not possible to draw clear conclusions. In future, this information needs to be gathered over time, enabling providers to be benchmarked on the following two factors, which will assist to circumvent regional differences:

1. trends
2. position in relation to defined environmental impact threshold levels.

## 9.2 Watertable Levels and Salinity of Groundwater

The depth of the watertable, or more importantly, the relative piezometric pressures of the shallow and

**Table 7.** Irrigation provider water quality data 1995–96

| Water quality | Salinity | | Turbidity | Phosphorus | | Nitrogen | | Pesticide events |
|---|---|---|---|---|---|---|---|---|
| | EC | Load | NTUs | mg/L | Load | mg/L | Load | >MRL |
| GMW | | | 1 | | | | | |
| At major intakes | 60–300 | | 0–50 | 0.035–0.11 | | 0.45–0.8 | | N/A |
| At major transfer sites | 150 | | 16 | 0.035 | 2 | 0.63 | | N/A |
| At drainage points | | | | 0.197–0.995 | 57,000 | 1.234–2.56 | 1,614,000 | N/A |
| Exiting the system | | | | | | | | |
| MI | | | 1 | | | | | |
| At major intakes | 100–230 | 78,532 | 4 | 0.3–0.23 | 47 | 0.07–0.72 | | |
| At major transfer sites | 600 | | 100 | 0.162–0.235 | | 1.07–2.29 | | |
| | | | | | | NOx | | Molinate |
| At drainage points | 140–1680 | 62,598 | | 0.053–0.21 | | 0.012–2.9 | | Diazinon |
| Exiting the system | 258–862 | | | 0.084–0.274 | | 0.107—1.65 | | Atrazine |
| MIL | | | | | | | | |
| At major intakes | 66 | 598,013 | 14 | 0 | 63 | 0 | 0 | N/A |
| At major transfer sites | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| At drainage points | 67 | 16,610 | 31 | 0 | 5,254 | 0 | 80,555 | Molinate* |
| Exiting the system | | | | | | | | |
| RIT | | | | | | | | |
| At major intakes | 180–560 | | N/A | N/A | N/A | N/A | N/A | N/A |
| Average | 350 | | | | | | | |
| At major tranfer sites | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Exiting the system | | | | | | | | |
| SRWA | | | | | | | | |
| At major intakes | 150–400 | N/A | 3-122 | 0.10 | N/A | 2.00 | N/A | N/A |
| At major transfer sites | 150–400 | N/A | 3-122 | 0.10 | N/A | 2.00 | N/A | N/A |
| At drainage points | 1000–3000 | N/A | 10 | <0.1 | N/A | 2.00 | N/A | |
| Exiting the system | | | | | | | | |
| WML | | | | | | | | |
| At major intakes | 150–400 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| At major transfer sites | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| At drainage points | 290–7440 | | | 0.03–0.735 | N/A | 0.60–19.0 | N/A | Diuron |
| Exiting the system | 733–2950 | | | | | | | |

deeper aquifers for a given location, provides a measure of the relative salinity risks across the region. A generally upwards movement in watertable levels over time implies a greater soil salinity risk if management of irrigation is below best practice. Allocation policies by irrigation providers can have a direct adverse impact on watertable levels if hydraulic loading is not considered.

Such data (Table 8) provide a means for predicting the current and future location of discharge sites and salinity risk areas. They also provide a key indicator of the long-term effectiveness of integrated catchment management programs.

Again, this information should ideally be developed for trend analysis to enable across provider comparison.

**Table 8.** Percentage of irrigation area watertables at a range of depths

| Depth to watertable % of total area | Depth range (m) | | | | |
|---|---|---|---|---|---|
| | <1 | 1–2 | 2–3 | 3–4 | >4 |
| GMW | 25 | 20 | 18 | 37 | |
| Murray Valley | 9 | 23 | 21 | 47 | |
| Shepparton | 1 | 8 | 15 | 76 | |
| Central Goulburn | 45 | 32 | 11 | 12 | |
| Rochester | 35 | 22 | 17 | 27 | |
| Tragowel | 90 | 10 | | | |
| MI | 19 | 53 | 15 | 5 | 8 |
| MIL* | | | | | |
| Berriquin | | 24 | 27 | 11 | 38 |
| Cadell | | 8 | 25 | 27 | 40 |
| Denimein | | <1 | 6 | 15 | 78 |
| Wakool | 6 | 37 | 57 | | |
| SRWA | N/A | | | | |
| WML | N/A | | | | |
| RIT | N/A | | | | |

* Column 2 is the percentage from 0–2 metres.
Note: Seasonal trends occur due to rainfall patterns

### Water table monitoring

*Best in class*
GMW and MIL

*Key features*
- Annual production of watertable maps (GMW back to 1982)
- GMW reads bores annually, MIL twice yearly
- Extensive use of maps in community salinity awareness program
- Maps and data used to develop groundwater control strategies in LWMPs

*Description*
- An intensive network of bores is monitored across the regions
- GMW contract out the task of reading bores
- GMW read bores in August (end of non-irrigation season)
- MIL read bores in September and February (end of rice season)
- MIL reports both shallow and deep aquifer pressures in Annual Environmental Report as required in its licence

*Best in class of other providers*
- MI produces ‘Groundwater Conditions’ in MIA Annual Report which has potential to be developed into LWMP implementation tool.

*Other providers’ activity and opportunity*
The piped regions (RIT, SRWA and WML) have full groundwater control provided by tile drains. There has been a concern expressed in the Sunraysia Salinity Management Plan that groundwater mounds are developing adjacent to the designated irrigation regions.

## 9.3 Soil Salinity Status

Salinity distribution over a region provides key information for the management of high saline environments. Most of the areas in which a detailed knowledge of soil salinity distribution is essential for good management have watertables close to the surface (less than one metre, see Table 9) with highly saline ground water.

**Table 9.** Percentage of irrigation area at a range of salinity concentrations

| Soil salinity status % of total area | Salinity class Ece (dS/m) | | | | | |
|---|---|---|---|---|---|---|
| | 0–2 | 2–3 | 3–4 | 4–6 | 6–8 | >8 |
| GMW | | | | | | |
| Kerang | | | 47 | 23 | 10 | 20 |
| Sepparton* | | | 75 | 22 | 3 | > |
| Tragawel | | | 55 | 25 | 9 | 11 |
| MI | 74 | 8 | 4 | 4 | 2 | 8 |
| MIL | | | | | | |
| SRWA | N/A | | | | | |
| WML | | | | | | |
| RIT | | | | | | |

*Estimates from trials

Table 10 provides the information that was collected on soil salinity status. Information has only been supplied for two providers. Again, this may be because of poor links between information collection and environmental management.

### Soil salinity surveys and mapping — EM38

*Best in class*

GMW—Pyramid, Boort and Torrumbarry irrigation areas (undertaken under DNRE supervision as part of LWMP)

*Key features*

- Key farm management tool in high salinity areas, enabling water and other farm inputs to be allocated to low salinity soils where responses may be gained

*Description*

EM38[1] survey of 120,000 ha on a 30 × 60 m grid producing farm contour maps showing location of Class A, B, C and D soils has been successfully implemented. The base grid survey was undertaken by survey consultants and soil surveys by trained landholders. The resulting maps have been prepared by survey consultants. Large areas can be mapped and surveyed in a season and enable a high level of community ownership of the process at a relatively low cost. ECe (saturated soil extract) is used as the gauge to describe soil salinity. Cost benefit analysis should be undertaken of soil salinity measures to ensure economic benefit. EM38 measures on a field scale are expensive and estimates can be obtained through extrapolation and shallow wells. The important aspect is how frequently and effectively the data are used.

*Best in class of other providers*

GMW–Shepparton irrigation area

*Key Features*

- EM38 is undertaken in ‘hot spots’.
- Transect surveys are used with salinity distribution interpolated.
- MI and MIL use a similar approach.

*Related issues*

- Use of 1:2 soil:water samples as a measure of soil salinity for use in estimating plant response is not as reliable as saturated extract (ECe).
- Transect surveys rely on a high degree of interpolation of results and are useful for gaining an indicative view of soil salinity but are less useful in making farm-based resource allocation decisions.

1. Electromagnetic survey to measure soil salinity in plant root zones at 10, 30 and 60 centimetres.

- A key component of LWMPs in high salinity areas.

*Opportunities*

The selection of ECe as the standard measure to report soil salinity distribution between all regions will provide uniformity and assist in continuous improvement.

## 9.4 Environmental Risk Assessment and Management

*Best in class*

GMW

*Key features*

- Stated ‘Business Risk Approach’ (also adopted by MI and MIL).
- Has in place an Environmental Management Structure from the Board of GMW to operational levels.
- The structure results in a Business Risk Management approach aimed at reducing organisational liability.
- The GMW environmental policy has in-built staff accountability at all levels within the organisation, based on specific objectives and measurable and achievable targets to be met through implementation of best practice.
- There is a Stated Environmental Policy in place (also SRWA).
- The process is auditable under an Environmental Management System (eg. ISO 14,000).

*Description*

GMW is in the process of developing and implementing an:

- Environmental Management System (ISO 14,000 which applies to those environmental aspects which the organisation can control and over which it can be expected to have influence);
- Environmental Auditing Program—trials, best practice, measurable targets and monitoring;
- Environmental Risk Management Program;
- Environmental Objectives and Targets;
- Environmental Education and Training Programs; and an
- Environmental Improvement Program.

*Best in class features of other providers*

- Chemical Control Plans — including training;
- Chemical Contingency Plans;

In NSW, the above are required for EPA licence compliance, as well as:

- Surveys of farmers for their chemical use;
- Survey of industry groups for information on farm chemical use; (most cost effective); and
- survey of key farm chemical suppliers for information on farm chemical use.

*Gaps between best in class and the remaining businesses*

The closed piped supply and drainage systems (RIT, SRWA and WMI) minimise the risk of supply contamination. A greater awareness of drainage water quality (done by WML and by SRWA as part of L&WMP requirements in Sunraysia) facilitates improvement in irrigation management and control of tile drainage effluent.

*Potential gains*

Environmental risk audits will enable all authorities to review their overall operations, set priorities and allocate funding better, leading to reduced liability.

*Related issues*

- Need to ensure that EMS considers the roles of authorities as water providers and hence develop policies that encourage responsible wateruse by irrigators who make use of the assets of authorities.
- Need to ensure that authorities are cognisant of potential long-term external effects resulting from their operational policies and subsequent liabilities, eg. current and future policy regarding hydraulic loading of rice and other crops/pastures. Issues include:
  - what are the technical, economic, environmental and social bases for allocations and pricing policy, eg. TWE rules; and
  - how should an authority interpret and implement COAG policy, including the MDBC Water Caps guidelines?

## 9.5 Relationship with Land and Water Management Plans in Region

*Best in class*

MIL and GMW

*Key features*

- Act as implementing agencies to adopt LWMP as pollution reduction program for EPA licences.
- An annual environmental report provides information on LWMP progress, being:
  - supply management;
  - drainage monitoring;
  - groundwater management; and
  - basis for recommended changes to licences.

*Description*

The Works and EPA Licences (in NSW) provide a succinct set of criteria for reporting which meets the needs of Authorities and LWMPs. The MIL environment report provides an excellent summary of all major environmental performance data (WMLs Annual Report is equally succinct).

MIL has negotiated a farm chemicals list with EPA, based on a survey of sellers and the benefit/cost of monitoring. The result enables monitoring to be confined to the chemicals listed. Aspects of the plan implementation and monitoring are contracted out to other agencies (DLWC and NSW Agriculture).

*Best features of other providers*

GMW

*Key features*

- Through Government Service Contracts, GMW undertakes a broad range of plan implementation, monitoring and R&I tasks for its region. GMW sub-lets a large component of the tasks to external consultants.
- Uses internal expert teams to benchmark private consultants, eg. drain design and construction.
- Is the implementing agency for the Shepparton Irrigation Region's Groundwater Management Plan.
- Community-based Water Service Committees give irrigator input to the GMW Board on allocation, pricing and asset renewal issues and the WSCs are represented on the Irrigation Committee of the respective Catchment Management Authorities (most highly developed in the Shepparton IR).
- Senior staff and Board members are represented on the Catchment Management Authority and its implementation committees and therefore provide a direct linkage between the planning and implementation of the LWMPs and the operations of the irrigation provider.

*Description of the activities of other providers*

In some areas, LWMPs are at a very early stage of development (RIT, WMI) or the authority has decided to focus more on the core business as irrigation provider.

*Opportunity for improvement*

In NSW, an annual review of licences to ensure the priority of issues that will meet the objectives of LWMPs.

In Victoria, a summary of key environmental data/ outcomes is included in annual reports of LWMPs, rather than the focus being placed on expenditure and program implementation rates (outputs). Also in Victoria, the data are produced annually via a multitude of reports to the CMA Implementation Committees at various times during the year. Accessing those data for collation in a single location requires the input of a small number of key specialists. If for any reason they are not available, the data will not be accessible. An ISO program may overcome this problem. This problem applies to all regions, to some extent, but is greatest in large, complex businesses.

*Related issues*

Very large organisations dealing with very large and complex LWMPs (such as Shepparton) face the risk of losing control of internal communications and data relating to their role in LWMPs, especially when they are not the implementing authority.

In Victoria, the current suite of legislation, under which implementation of the LWMPs occurs, does not fully provide the ground rules or tools to optimise implementation of the LWMPs. There is still considerable opportunity for better integration of EPA, Catchment and Land Protection, Water, Local Government Planning and Flora and Fauna Guarantee legislation.

A key element to the success of LWMPs is a pro-active and cooperative input by State and Federal EPA agencies into the LWMP planning and implementation, as well as the establishment of relevant monitoring programs.

Monitoring programs need to be sure that they are measuring parameters which can create more effective implementation of the LWMPs. These parameters will almost certainly differ in relation to each region and area where the irrigation providers operate.

## 9.6 Environmental Management Summary

### 9.6.1 Technical

Key measures of environmental management best practice include the following.

- continuous measurement and monitoring of water quality using SCADA technology, which produces real time information;
- the maintenance of trend analysis information for water quality within each system;
- the monitoring of watertables and groundwater salinity levels with the production of annual maps;
- an optimal network of monitoring bores; and
- soil salinity mapping using a base grid survey approach.

Further to current best practice a good system should include the following:

- the monitoring of biological dissolved oxygen (bdo) which is related to fish kill caused by organic matter;
- response to reports of fish kill; and
- the monitoring of soil sodicity which affects soil structure and, therefore, subsequent plant growth.

### 9.6.2 Managerial

- Environmental risk management programs which are related to objectives and targets, continuous improvement, education and program. Such programs should be auditable to an accredited system such as ISO 14,000.
- Closed supply and drainage systems which minimise the risk of cross contamination.
- Provider implementation of LWMPs.
- The production of annual environmental reports.

In the long term, the ability of providers to assess and manage environmental risks will be dependent on their power to enforce policies and practices. At present this is not well defined. Furthermore it appears that the integration between those who collect the information (this is often external to the providers) and environmental management is not clearly inter-linking. Therefore, the relationship between these components needs to be monitored during benchmarking in future years.

# 10 Financial Performance

The purpose of the financial analysis is to benchmark the financial performance of the water distribution and related activities of irrigation provider businesses, to ascertain relative performance over time and between providers.

The financial information provided in this section needs to be read in context. Each provider varies significantly from the others and comparisons should be made carefully on this basis. Further information on the nature of each organisation is contained in sections 4.1 and 4.2 which describe and compare the irrigation providers participating in the benchmarking program.

Variation between providers also occurs with the use of different accounting standards. There have been significant changes to accounting standards for some organisations during the period under review. This has been especially relevant for MI and MIL which have been corporatised and privatised respectively.

It should be recognised that the irrigation providers benchmarked in this project all operate different types and combinations of business activities not directly related to their core activity of water distribution. This affects both revenue and expenses. The identified non-irrigation revenues and expenses have been removed for the purpose of the financial analysis. From the financial statements provided, the separation of core water distribution activities has been clearer for revenues than expenses. In future years it would be beneficial for irrigation providers to expand activity based allocations to permit a closer match between the revenues and expenses being benchmarked.

The information used for the financial analysis has been drawn from the statutory reports of the providers, who then have had the opportunity to adjust the figures where they saw fit, to represent their businesses more accurately.

## 10.1 Definitions

The following definitions have been used in the financial analysis.

| Term | Definition/inclusions etc. |
|---|---|
| Assets | Valued at written down replacement cost |
| Cost Recovery Ratio | Excludes depreciation |
| Adjusted EBIT | Earnings before interest and tax relating to water distribution (note below re pre-exceptionals) with depreciation of water distribution assets added back |
| Exceptionals | Includes both abnormals and extraordinaries |
| km infrastructure | Refers to infrastructure for water supply, not drainage |
| OM & A | Operations, maintenance and administration |
| Operating expenses | Operating expenses excluding depreciation |
| Operating measures | Exclude interest |
| Revenue | Turnover plus non-irrigation sales revenue |
| Irrigation revenue | Total sales to irrigators and includes moneys for asset renewals |

## 10.2 Financial Ratios

Figure 23 illustrates the difference in scale of the providers benchmarked, including the business units of GMW.

The financial ratios benchmarked in the following sections have been collated into four categories:

- return on investment;
- asset management;
- efficiency and productivity; and
- leverage and liquidity.

### 10.2.1 Return on investment

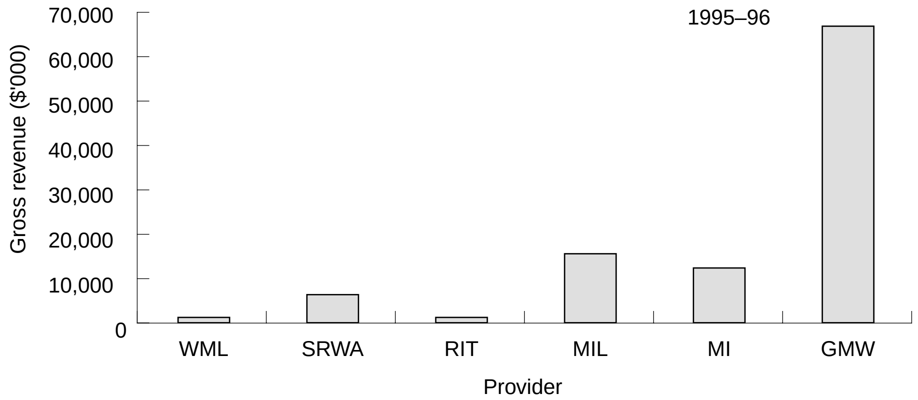
ROA for irrigation providers are low compared with other industries, as befits their non-profit charters. Highest rates of return are achieved by the two piped providers, SRWA and RIT (Figure 24). WML completed major asset renewals in 1995–96, which affected sales for the year.

Irrigation providers aim to have a cost recovery ratio of one, after capital expenditure (Figure 25). Capital expenditure is not included in the calculation so as to separate operations from asset maintenance.

**Figure 23.** Gross revenue

Gross Revenue

| Gross Revenue | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 1,395 | 1,545 | 496 | 1,817 | 2,214 |
| SRWA | 5,940 | 6,397 | 6,729 | 6,971 | 7,992 |
| RIT | 1,525 | 1,589 | 1,732 | 1,721 | 1,764 |
| MIL | 10,713 | 14,355 | 13,812 | 20,870 | 25,810 |
| MI | 18,158 | 20,592 | 17,745 | 17,072 | 18,924 |
| GMW | | | 92,097 | 67,942 | 73,454 |
| -Shepparton | 3,815 | 4,504 | 6,182 | 5,073 | |
| -Central Goulburn | 7,728 | 8,697 | 12,458 | 10,666 | |
| -Rochester | 3,728 | 4,800 | 6,088 | 5,348 | |
| -Pyramid-Boort | 4,630 | 421 | 5,051 | 5,427 | |
| -Murray Valley | 5,590 | 6,639 | 8,576 | 7,940 | |
| -Torrumbarry | 8,059 | 9,406 | 12,025 | 11,046 | |
| -Torr/Nyah | 499 | 498 | 565 | 473 | |
| -Torr/Tresco | 372 | 393 | 421 | 416 | |




Irrigation providers are still developing systems to manage and allocate resources to asset renewal. Hence it is not possible to develop a concise measure across providers, so this aspect has been benchmarked as a business process in Section 11.1.

*Conclusion*

Irrigation providers primarily aim for full cost recovery, after capital expenditure. This implies a ROA of zero, after allocations to reserves, eg. asset renewal reserves. In future, to attract further government funding and/or private sector funds on an equity basis providers will need to show positive ROAs.

However, under the current environment, a cost recovery ratio of one and a ROA of zero does not reflect poor investment performance. These figures are best considered in conjunction with efficiency and productivity measures.

### 10.2.2 Asset management

Asset management needs to be separated from operations to enable clarity of analysis and to ensure a match with sources of finance. Asset management in irrigation involves the management of long-life assets (eg. channels have a life of 80 years) and therefore is not easily related to annual operations.

Asset management is an area that has only recently been given a strong level of focus. Consequently measures to match systems being developed are still in their infancy. As a result, this area of the benchmarking has been given major consideration in the benchmarking of business processes.

Figure 26 illustrates capital expenditure in proportion to the size of the organisations. The trend over the years, shown by the table, illustrates that capital expenditure is made on an irregular basis. The relating of actual capital expenditure to accounting asset values means that this ratio is most likely to be highest for new systems and lowest for old systems, where accounting asset values are likely to be low and

**Figure 24.** Return on assets

| Return Assets | | | | | |
|---|---|---|---|---|---|
| % | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
| WML | -0.4 | -5.3 | -0.1 | 0.4 | 0.0 |
| SRWA | 6.7 | 5.4 | 4.4 | 4.3 | 3.0 |
| RIT | 4.1 | 3.7 | 5.2 | 4.9 | 3.7 |
| MIL | -0.6 | -1.3 | -0.1 | 0.0 | -1.1 |
| MI | -0.7 | -1.8 | 0.2 | 1.7 | 0.2 |
| GMW | 2.8 | 5.8 | 2.4 | 1.3 | |

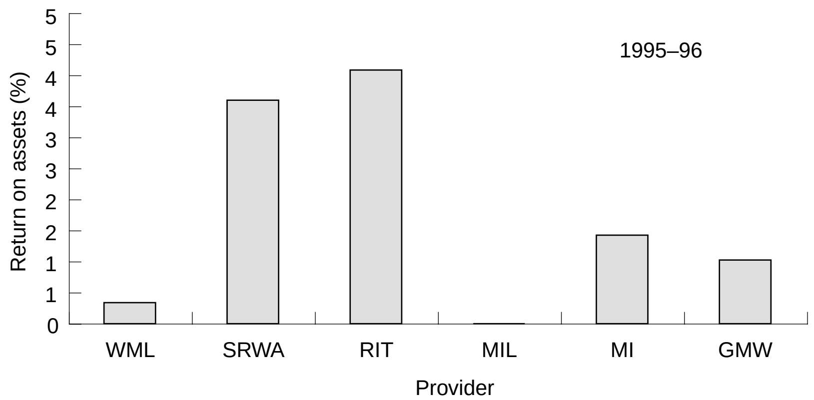



**Figure 25.** The ratio of revenue to costs

| Cost Recovery Ratio | | | | | |
|---|---|---|---|---|---|
| Ratio | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
| WML | 0.93 | 0.53 | 0.29 | 1.14 | |
| SRWA | 1.24 | 1.12 | 1.00 | 1.20 | 1.19 |
| RIT | 1.40 | 1.32 | 1.45 | 1.42 | 1.00 |
| MIL | 0.86 | 0.80 | 1.56 | 1.00 | |
| MI | 0.87 | 0.79 | 0.97 | 0.99 | 0.94 |
| GMW | 1.01 | 0.83 | 0.94 | 1.01 | 1.15 |

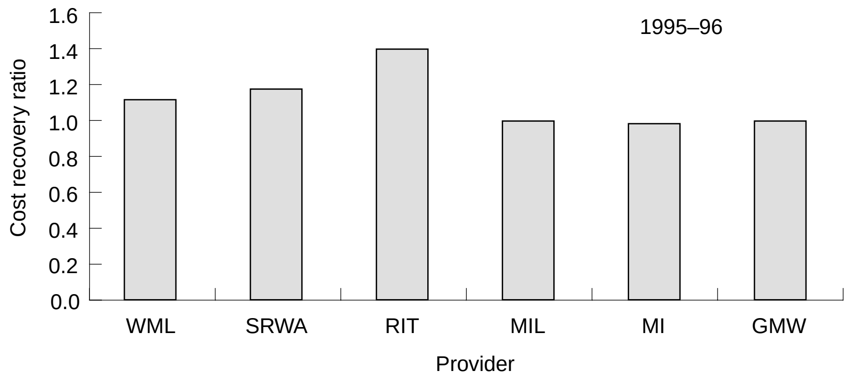
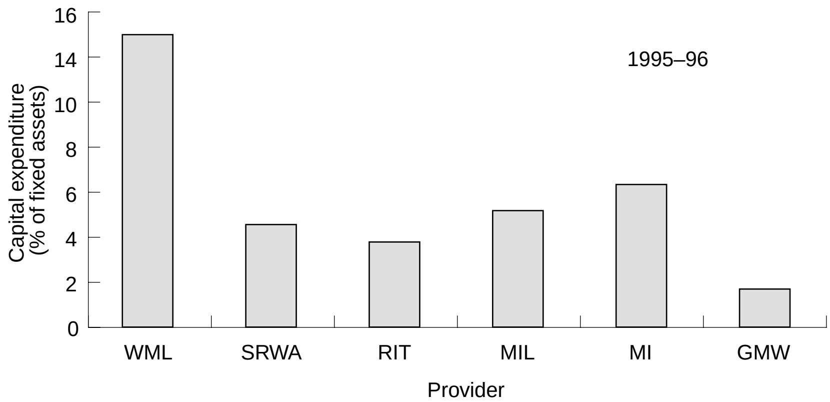


**Figure 26.** Capital expenditure as a percentage of fixed assets

Capital Expenditure Fixed Assets

| Percentage | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | n/a | n/a | 7 | 13 | n/a |
| SRWA | 18 | 20 | 12 | 5 | 4 |
| RIT | 4 | 4 | 4 | 4 | 4 |
| MIL | 2 | 3 | 5 | 5 | 7 |
| MI | 6 | 0 | 7 | 29 | 6 |
| GMW | 0 | 0 | 0 | 2 | n/a |




infrastructure is likely to require greater levels of investment.

When Figure 27 is juxtaposed with capital expenditure to fixed assets, it shows a greater consistency over time. However, it bears little resemblance to actual capital renewals. These figures are influenced by asset revaluations and accounting policies.

*Conclusion*

The two measures provided show that depreciation is not a good measure of asset management performance. Moreover, capital expenditure over one and/or five years does not match the life of the assets being managed. Future benchmarking may need to be match the twenty year rolling average of asset profiles maintained by providers.

### 10.2.3 Efficiency and productivity

The efficiency and productivity of irrigation businesses can be assessed by considering five key facets of their operations, which cover infrastructure, revenues, operations and marketing. These facets are:

- assets
- costs
- returns
- employees
- customers

Each of the above is analysed as a numerator by four of six possible denominators, to permit the development of comparable benchmarks. These denominators are:

- megalitres
- employees
- customers
- kilometres

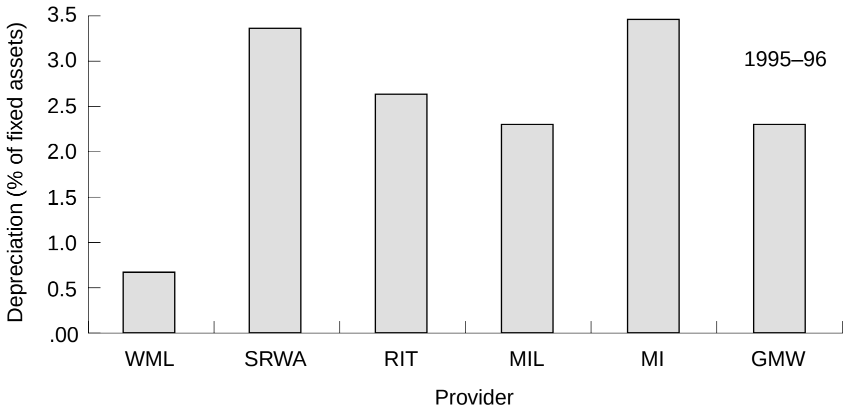
The fifth and sixth denominators not included are hectares and agricultural production. Hectares have not been included because of the low level of accuracy on actual areas irrigated within designated irrigation regions. In future this will be a valuable form of analysis as ML maximisation is not a true measure of long-term efficiency when considering irrigation as a system for sustainable production. Moreover, the relationship to agricultural production would provide bottom line efficiency and productivity of irrigation, as a system. Again, low levels of current information available on this basis, with associated low accuracies, make this level of analysis meaningless.

The matrix approach, described above, has been selected as there is considerable variation between providers and regions which can be misleading if an

**Figure 27.** Depreciation as a percentage of fixed assets

Depreciation Fixed Assets

| Percentage | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 2.9 | 4.5 | 2.0 | 0.7 | 2.2 |
| SRWA | 2.8 | 2.4 | 3.4 | 3.4 | 3.0 |
| RIT | 2.6 | 2.6 | 2.6 | 2.6 | 2.7 |
| MIL | 3.2 | 2.8 | 2.9 | 2.3 | 2.4 |
| MI | 4.8 | 6.4 | 5.1 | 21.2 | 3.5 |
| GMW | 3.1 | 2.5 | 2.2 | 2.3 | |




overall figure is taken at face value. The matrix approach can be depicted as in Table 10.

For each of the measures, relative position assessments have been made which compare the performance of each provider. Efficient and productive performance is as follows.

*Total assets and adjusted EBIT pre exceptionals*

- maximum dollars per ML
- maximum dollars per employee
- maximum dollars per customer
- maximum dollars per kilometre

*OM&A*

- minimum dollars per ML
- maximum dollars per employee
- minimum dollars per customer
- minimum dollars per kilometre

*Employees*

- maximum kilolitres per employee
- maximum customers per employee
- maximum kilometres per employee

*Customers*

- maximum megalitres per customer
- maximum customers per employee
- maximum customers per kilometre

It should be realised that customers are not a true measure of performance as they are fixed to a system, which means that customer measures should be used

**Table 11.** Efficiency and productivity matrix relationships

| Numerator/ Denominator | Assets | Costs | Returns | Employees | Customers |
|---|---|---|---|---|---|
| ML | | | | | |
| Employees | | | | | |
| Customers | | | | | |
| Kilometres | | | | | |

to compare the differences and similarities between systems.

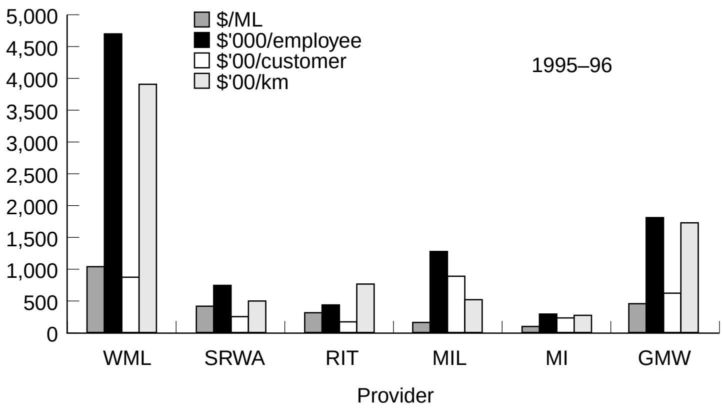
Conclusions need to be drawn after considering the non-efficiency or productivity drivers for each of the above factors. The drivers for the numerators are discussed individually for each in the following section. The drivers of the denominators are common to all and include:

- Megalitres
  - – type of system, eg. pipe or channel
  - – point of measurement, eg. diversions compared to deliveries
  - – accuracy of measurement
- Employees
  - – type of system
  - – length of system
  - – services provided and/or demanded by customers, eg. frequency of supply

**Figure 28.** Productivity of total assets

Total Assets

| $A'000 | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 30,580 | 27,024 | 40,495 | 46,892 | 477,304 |
| SRWA | 21,331 | 21,720 | 21,123 | 36,915 | 62,736 |
| RIT | 10,585 | 10,524 | 10,405 | 10,350 | 10,335 |
| MIL | 268,309 | 210,030 | 181,841 | 191,321 | 202,706 |
| MI | 164,218 | 136,213 | 139,446 | 55,661 | 168,712 |
| GMW | 147,618 | 171,054 | 961,760 | 943,979 | 0 |




| Relative Position | ML | Employees | Customers | km |
|---|---|---|---|---|
| WML | 6 | 1 | 6 | 6 |
| SRWA | 4 | 4 | 3 | 2 |
| RIT | 3 | 5 | 1 | 4 |
| MIL | 2 | 3 | 5 | 3 |
| MI | 1 | 6 | 2 | 1 |
| GMW | 5 | 2 | 4 | 5 |

| Average Position | |
|---|---|
| WML | 6 |
| SRWA | 2 |
| RIT | 2 |
| MIL | 2 |
| MI | 1 |
| GMW | 5 |

– technology, eg. level of SCADA use

- Customers

  – types of regional agricultural production

  – size of properties

- Kilometres

  – length of system

– make up of system, eg. combinations of channel and pipe

Non-efficiency and productivity drivers to total assets include:

– written-down asset value

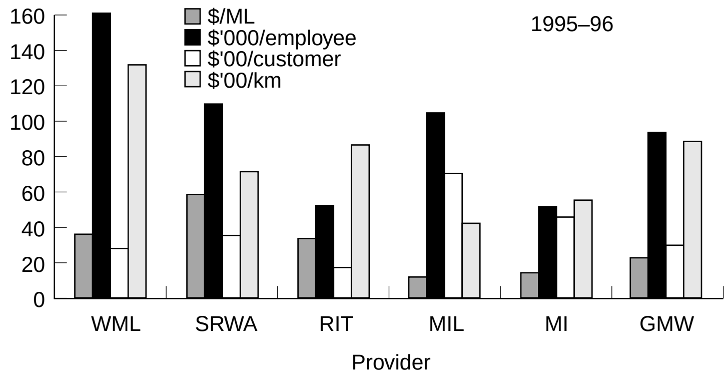
– type of system, eg. effects cost

The value of the assets affected by age, depreciation rates and revaluation can have a considerable impact on this analysis. WML has undertaken considerable

**Figure 29.** Efficiency of operations, maintenance and administration

OM & A

| $A | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 1,493 | 2,939 | 1,725 | 1,599 | |
| SRWA | 4,596 | 5,465 | 6,429 | 5,695 | 6,330 |
| RIT | 1,086 | 1,203 | 1,192 | 1,212 | 1,384 |
| MIL | 11,039 | 13,901 | 8,873 | 15,966 | |
| MI | 13,207 | 15,226 | 13,135 | 13,723 | 14,022 |
| GMW | 37,257 | 53,378 | 61,772 | 49,563 | 50,337 |




| Relative Position | ML | Employees | Customers | KM |
|---|---|---|---|---|
| WML | 5 | 1 | 3 | 6 |
| SRWA | 6 | 2 | 4 | 3 |
| RIT | 4 | 6 | 1 | 4 |
| MIL | 1 | 3 | 6 | 1 |
| MI | 2 | 5 | 5 | 2 |
| GMW | 3 | 4 | 2 | 5 |

| Average Position | |
|---|---|
| WML | 4 |
| SRWA | 4 |
| RIT | 4 |
| MIL | 1 |
| MI | 2 |
| GMW | 2 |

infrastructure renewal which has increased the value of its assets. MI and MIL have undergone considerable and variable revaluations as they and their government owners negotiated towards corporatisation and privatisation over recent years. This can be related to the fact that MI and MIL hold the highest average position and WML has the lowest average position.

Key OM & A non-efficiency driver is:

- type of system

The two most meaningful components of the analysis are ML and employees. Customers and Kilometres are subject to greater levels influence from external drivers. On a ML basis, piped systems carry higher operating costs because of energy expenses, but on the other hand lower labour requirements. Energy costs per ML for piped providers are shown in Figure 30. Clearly the two types of system need to be separated for benchmarking while still making comparisons across systems to maximise learning opportunities for continuous improvement.

Of the channel systems MIL demonstrates the highest level of efficiency for both ML and employee based analysis. WML, as a piped system, is the most efficient for employees and RIT for ML.

Adjusted EBIT before exceptionals adds back depreciation of water distribution assets. This has been done to provide a comparable base, which is otherwise affected by age of assets and revaluations.

A further reason for adding back depreciation is that providers maintain and charge asset renewal reserves to their accounts. This ostensibly means that asset consumption is charged twice to accounts.

Irrigation providers are not driven by profit motives but rather service motives to their owners and/or stakeholders, depending whether or not the organisation is privatised.

The major driver of this measure is:

- profit margin

SRWA is the most productive for Adjusted EBIT pre exceptionals on a relative basis primarily because the organisation generates the highest revenues from water sales.

MIL has the highest water delivery productivity (ML) per employee. However, this is influenced by the nature of the regions. MIL customers generally farm more extensively and require a lower level of service, in terms of frequency and changes in water delivery. This graph needs to be cross-referenced to customers per km which shows MIL to be among the least and RIT and WML to have the most. However, MIL has shown steady employee reductions over the last five years to support this level of efficiency. This can be collaborated by comparing MIL's position with MI which has a similar relative long channel system. The latter can be seen by considering employee efficiency per customer of which MI and MIL have the two lowest relative positions.

**Figure 30.** Energy costs per ML (pipe pystems)

Energy Costs per ML (Pipe Systems)

| | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | | | 8 | 8 | 9 |
| SRWA | | | | 10 | |
| RIT | 8 | 8 | 7 | 7 | 7 |

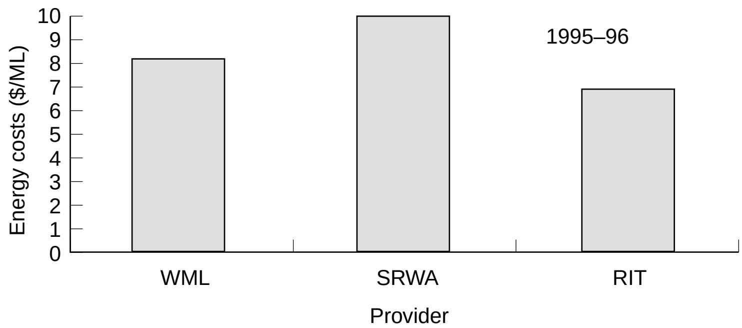


Figure 33 should not be considered a measure of efficiency or productivity as it relates more to the environment in which providers operate than how they actually operate. This measure is affected by all the non-efficiency and productivity measures listed at the start of this section. This measure should be used to support understanding of the other measures listed.

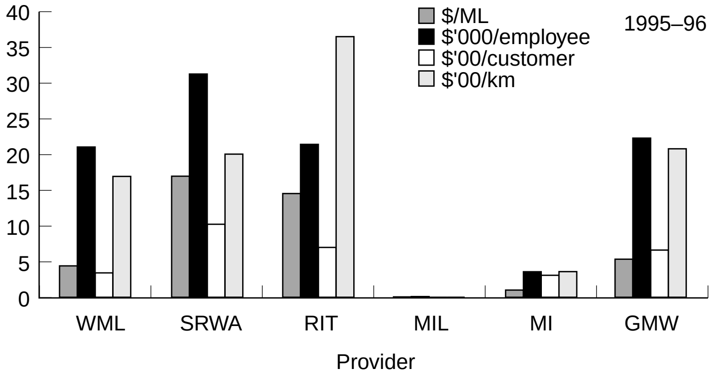
As the relationship with customers does not reflect how providers operate in terms of efficiency and productivity, the aggregation of the measures one to four provides the most realistic assessment of overall financial efficiency and productivity.

Care must be taken when drawing conclusions from the financial analysis, as the benchmarks do not accurately place providers on a 'level playing field' but rather provide a weight of evidence as to comparative efficiency productivity. To fully understand this level of performance of providers, the

**Figure 31.** Profit related productivity

Adjusted EBIT pre Exceptionals

| $A'000 | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | (133) | (1,419) | (49) | 206 | 0 |
| SRWA | 1,420 | 1,182 | 925 | 1,599 | 1,897 |
| RIT | 439 | 386 | 540 | 509 | 380 |
| MIL | (1,533) | (2,773) | (223) | (3) | (2,150) |
| MI | (1,170) | (2,417) | 285 | 941 | 338 |
| GMW | 4,130 | 9,841 | 23,258 | 11,831 | 14,178 |




| Relative Position | ML | Employees | Customers | km |
|---|---|---|---|---|
| WML | 4 | 4 | 4 | 4 |
| SRWA | 1 | 1 | 1 | 3 |
| RIT | 2 | 3 | 2 | 1 |
| MIL | 6 | 6 | 6 | 6 |
| MI | 5 | 5 | 5 | 5 |
| GMW | 3 | 2 | 3 | 2 |

| Average Position | |
|---|---|
| WML | 4 |
| SRWA | 1 |
| RIT | 2 |
| MIL | 6 |
| MI | 5 |
| GMW | 3 |

related business processes need to be reviewed in parallel.

### 10.2.4 Leverage and liquidity

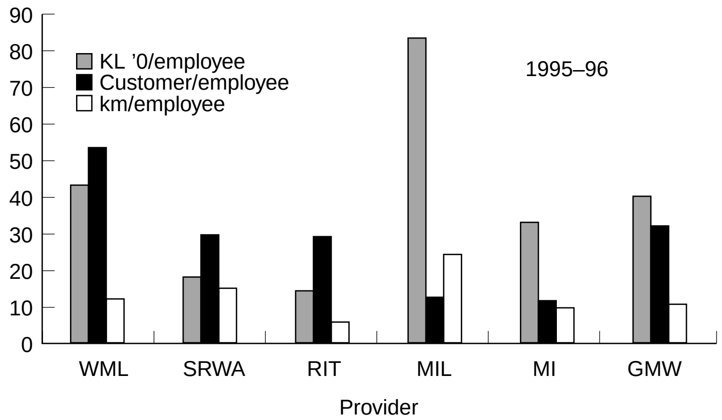
Current ratio is a measure of short-term liquidity. This is of most importance for privatised providers who do not have the benefit of ongoing government support. While current ratio is not an issue for providers at present, it may increase in importance if strategic direction leads to greater profit motives and diversification.

Working capital turnover illustrates how efficiently working capital is managed to generate revenue. The average ratio for similarly sized Australian businesses is approximately five. Working capital turnover is affected by cashflow and credit management.

**Figure 32.** Employee productivity

Employees

| | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 10 | 10 | 10 | 10 | 10 |
| SRWA | 52 | 52 | 52 | 52 | 52 |
| RIT | 24 | 24 | 24 | 24 | 24 |
| MIL | 210 | 179 | 158 | 155 | 141 |
| MI | 271 | 270 | 260 | 263 | 258 |
| GMW | 547 | 547 | 539 | 539 | 524 |




| Relative Position | ML | Customers | km |
|---|---|---|---|
| WML | 2 | 1 | 3 |
| SRWA | 5 | 3 | 2 |
| RIT | 6 | 4 | 6 |
| MIL | 1 | 5 | 1 |
| MI | 4 | 6 | 5 |
| GMW | 3 | 2 | 4 |

| Average Position | |
|---|---|
| WML | 1 |
| SRWA | 4 |
| RIT | 6 |
| MIL | 2 |
| MI | 5 |
| GMW | 3 |

Times interest covered is a measure of long-term solvency. The formula is only applicable when EBIT is positive and Net Interest is negative. In 1995/96, both MI and GMW had positive net interest positions.

## 10.3 Financial Performance Summary

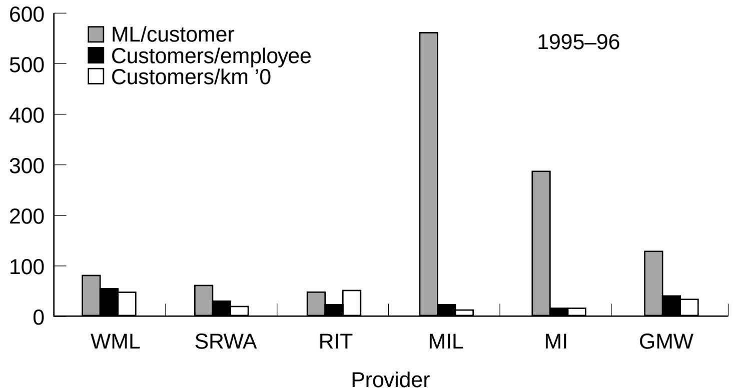
Key areas of best practice include the following financial benchmarks:

- Cost recovery ratio greater than one which includes capital expenditure or after the allocation of provisions for future capital expenditure.
- The separation of asset management from operations in financial benchmarks chosen, to enable the full understanding and monitoring of both.
- The following OM&A efficiency and production levels:

**Figure 33.** Customers to provider system

Customers

| $A'000 | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 542 | 542 | 542 | 542 | 551 |
| SRWA | 1,552 | 1,552 | 1,552 | 1,552 | 1,552 |
| RIT | 696 | 696 | 696 | 696 | 696 |
| MIL | 2,288 | 2,288 | 2,288 | 2,288 | 2,288 |
| MI | 3,024 | 3,024 | 3,024 | 3,024 | 3,024 |
| GMW | 17,263 | 17,263 | 17,263 | 17,263 | 17,263 |




| Relative Position | ML | Employees | Customers | km |
|---|---|---|---|---|
| WML | 4 | 1 | 2 | 4 |
| SRWA | 5 | 3 | 4 | 3 |
| RIT | 6 | 4 | 1 | 1 |
| MIL | 1 | 5 | 6 | 6 |
| MI | 2 | 6 | 5 | 5 |
| GMW | 3 | 2 | 3 | 2 |

| Average Position | |
|---|---|
| WML | 1 |
| SRWA | 4 |
| RIT | 3 |
| MIL | 4 |
| MI | 6 |
| GMW | 2 |

| | | | |
|---|---|---|---|
| – Channel Systems | | – Piped System | |
| – OM&A/ML | –$12 | – OM&A/ML | –$34 |
| – OM&A/Employee | –$160,000 | – OM&A/Employee | –$160,000 |
| – ML/Employee | –8,300 ML | – ML/Employee | –4,400 ML |

**Figure 34.** Productivity and efficiency summary

Relative Position Summary

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Relative Position | Assets | OM & A | Adj. EBIT | Employees | Customer |
| WML | 6 | 4 | 4 | 1 | 1 |
| SRWA | 2 | 4 | 1 | 4 | 4 |
| RIT | 2 | 4 | 2 | 6 | 3 |
| MIL | 2 | 1 | 6 | 2 | 4 |
| MI | 1 | 2 | 5 | 5 | 6 |
| GMW | 5 | 2 | 3 | 3 | 2 |

| Relative Position | All | 1 - 4 |
|---|---|---|
| WML | 4 | 6 |
| SRWA | 1 | 1 |
| RIT | 5 | 5 |
| MIL | 1 | 1 |
| MI | 6 | 3 |
| GMW | 1 | 3 |

**Figure 35.** Ratio of current assets to current liabilities

Current Ratio

| $A'000 | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
|---|---|---|---|---|---|
| WML | 8.4 | 5.1 | 6.5 | 6.0 | 5.0 |
| SRWA | 2.9 | 0.1 | 0.0 | 0.1 | 0.1 |
| RIT | 1.6 | 1.4 | 1.1 | 1.4 | 1.8 |
| MIL | 6.5 | 6.9 | 7.2 | 4.8 | 2.9 |
| MI | 7.3 | 8.6 | 7.1 | 6.8 | 6.5 |
| GMW | 5.2 | 3.5 | 2.2 | 2.2 | 2.9 |

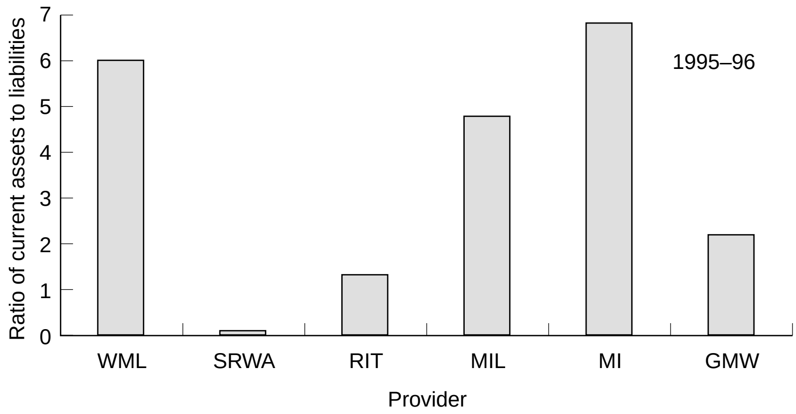


**Figure 36.** Revenue as a multiple of working capital

| Working Capital Turnover | | | | | |
|---|---|---|---|---|---|
| $A'000 | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
| WML | 0.7 | 0.6 | 0.1 | 0.2 | 0.5 |
| SRWA | 5.9 | -3.2 | -0.9 | 0.6 | -3.0 |
| RIT | 13.1 | 15.9 | 55.9 | 15.8 | 8.2 |
| MIL | 0.7 | 1.1 | 1.2 | 1.4 | 1.9 |
| MI | 0.9 | 0.9 | 0.8 | 0.7 | 0.7 |
| GMW | 4.2 | 4.1 | 3.7 | 3.0 | |

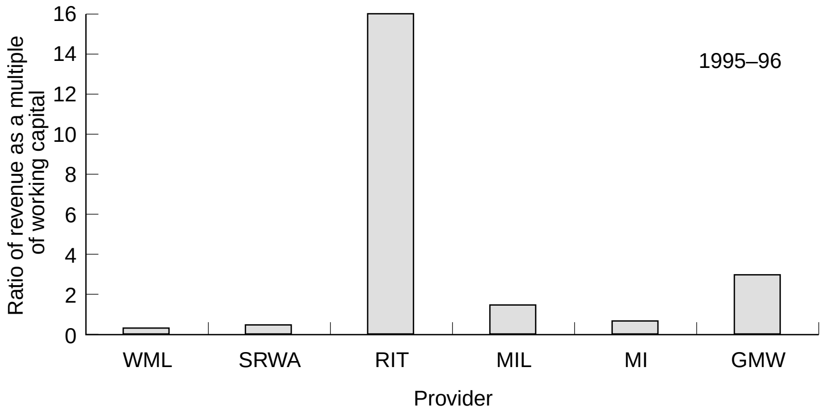
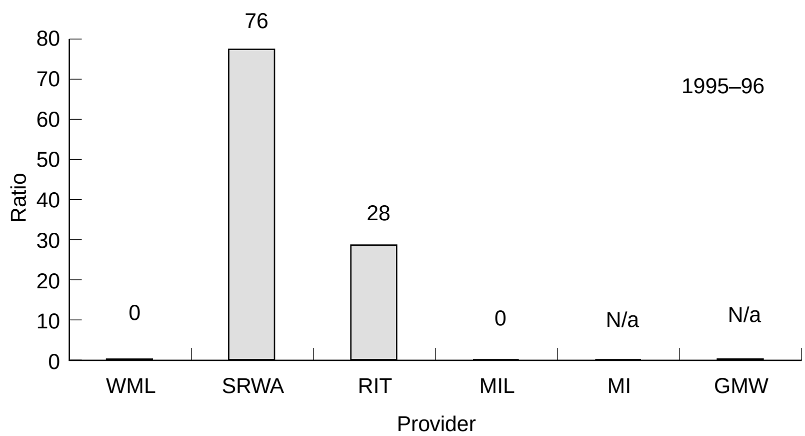



**Figure 37.** The multiple by which profit exceeds interest

| Times Interest Covered | | | | | |
|---|---|---|---|---|---|
| $A'000 | 1992–93 | 1993–94 | 1994–95 | 1995–96 | 1996–97 |
| WML | N/a | N/a | N/a | 0 | N/a |
| SRWA | 23 | N/a | 40 | 76 | 237 |
| RIT | 18 | 19 | 34 | 28 | 19 |
| MIL | N/a | N/a | N/a | 0 | N/a |
| MI | N/a | N/a | N/a | N/a | N/a |
| GMW | N/a | N/a | N/a | N/a | N/a |



# 11 Business Performance

## 11.1 Infrastructure Management

*Best in class*
MIL

*Key features*
- Global Positioning System (GPS)
- Geographic Information System (GIS)
- Computer Aided Drawing (CAD)

*Description*
GPS is being used to locate assets physically with verification being done at the same time. This information is then placed on GIS with 'ArcView' CAD drawing overlays for information display.

Consulting engineers are used annually to review assets. Samples of assets (the same five assets per each of three districts) are reviewed every five years to assess deterioration which will be used to adjust the strategic approach to asset management, if required.

*Best in class features of other providers*
GMW

- Three integrated software programs which link financial reporting, infrastructure and renewals planning and maintenance planning (see Information Systems 10.2.2)
- 'ArcView' information display capability, but this has not yet been completed for each region.

## 11.2 Infrastructure Valuation

Most providers find the need to have one valuation system for accounting purposes and another for operational planning purposes. Most providers use historical cost valuations for financial reporting and renewals accounting for forward planning.

*Best in class*
MIL and GMW

*Key features*
- Application of individual asset IDs
- Asset write down to value of government dowry at time of corporatisation (MIL)
- Sinking fund to finance asset renewals
- Independent annual assessment of asset condition by consulting engineers to ensure adequacy of the sinking fund
- Establishment of remaining life profiles for all assets based on planned economic life and direct assessment of remaining life
- Asset renewals to be financed by real interest earned on the sinking fund

*Description*
MIL, following research with UK water authorities, decided to implement renewals accounting for financial reporting, as UK accounting standards for non-current assets are the same as Australia's. The UK approach does not include depreciation, since the use of a sinking fund debits the balance sheet for asset replacement provisions. However, Australia will not approve the UK approach to renewals accounting and this will result in double dipping for asset replacement, since under the articles of association water prices must be set for zero profit, which includes depreciation.

## 11.3 Business Processes

### 11.3.1 Strategic planning

*Best in class*
GMW

*Key features*
- Plans cover five year period
- Current plan 1997–1998, 2001–2002
- Approved by Board
- Ratified by the Minister
- Strategic planning includes:
  - Corporate plan;
  - SBU plans; and
  - Headwork plan.
- Annual update
- Performance indicators set and monitoring of achievement undertaken

*Description*
The plan is approved by the Board before 30 April in any year. The Minister has until 30 June to request amendment or note the plan. Once the plan is noted by the Minister, GMW implements the plan.

Strategic programs in the plan include:

- Customer Service
- Water and Environmental Management
- Asset Management
- Workforce and Organisational Development
- Financial Management
- External Relations

Strategies, action plans and performance measures are developed for each program.

Area business plans have been developed for each of the six irrigation areas. These plans match the time period and the strategic programs of the corporate plan. The Area business plans describe the issues confronting each area and incorporate local solutions for these issues. The GMW Board reviews and approves the Area business plans.

The Headworks division has also developed a business plan for the period 1997–1998, 2001–2002. The plan is in its first year and will be improved again next year. The Headworks division business plan is compatible with the corporate plan.

The corporate plan, area business unit plans and headworks business plan are updated on an annual basis with a rolling five-year outlook.

### 11.3.2 Information systems

*Best in class*
GMW

*Key features*

- Professionally developed software to accumulate, store, analyse and retrieve data on:
  – asset management;
  – financial management;
  – customer information and billing; and
  – records management.
- Linkages between each of these systems
- Use of outsourced expertise on a regular basis to develop software and information systems.

*Description*

*Asset management*. Asset Management is provided through three systems: FAME (Financial Management), AMS (Asset Management) and FMMS (Asset Maintenance Planning) (Figure 38).

FAME contains the basic fixed assets register with a financial focus and does not contain the same level of detail as the AMS system.

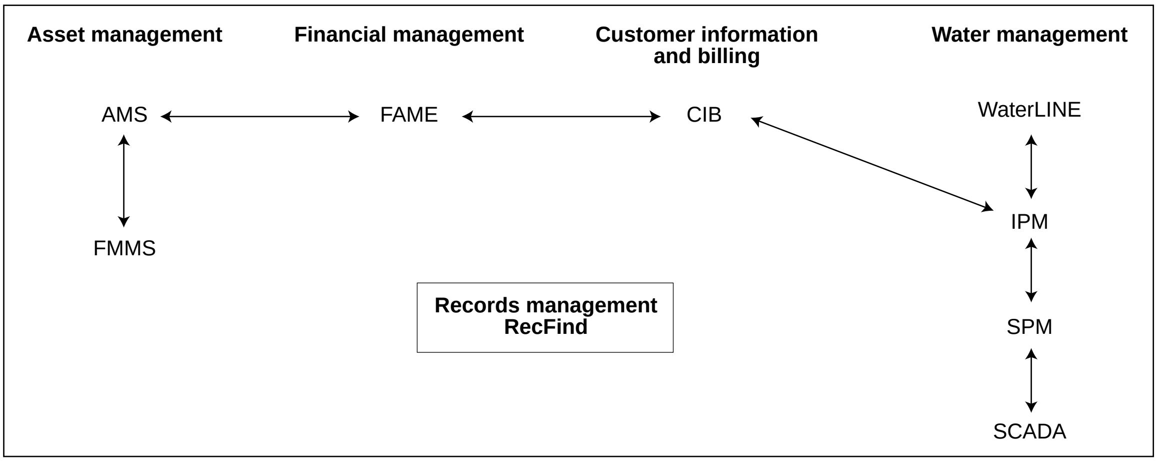
AMS contains complete descriptive detail and includes information on the condition of each asset and typical replacement and maintenance unit costs. It is a valuable business planning tool providing data on renewal annuities and future maintenance and replacement costs. AMS II is currently being developed by GMW's selected computer consulting company.

FMMS provides for the planning, initiating, monitoring, controlling, recording, analysing and diagnosing of all aspects of the maintenance of the water distribution assets.

*Financial management*. FAME is an integrated General Ledger, Purchasing, Accounts Payable, Job Costing, Fixed Assets and Workflow management system. An extensive range of reports is available to almost all GMW staff. Ad hoc queries and reports can be generated via end-user reporting tools.

*Customer management*. CIB provides for billing, debtor management and administration of land and water entitlements. Billing is based on customers and not areas of land, hence one bill can relate to several areas of land. A bi-directional interface to the Irrigation Planning Module provides entitlement data and collects usage data. Revenue collection via various agencies or directly to GMW is supported.

**Figure 38.** GMW management information system



*Water management*. Water Management includes the Irrigation Planning Module (IPM), System Planning Module (SPM), Waterline and SCADA. Water orders are received via Waterline, an interactive voice routing system, and then entered by irrigation planners into the IPM system where channel requirements are accumulated and managed. The SPM system provides a view of the total water system and is used for bulk water planning and modelling. SCADA (Supervisory Control And Data Acquisition) provides both monitoring and control capabilities for storage and distribution assets.

*Records management*. RecFind provides for file searching and tracking of all G-MW official files. A comprehensive electronic document management system (EDMS) is planned. This will control every aspect of document, image, plan, survey storage, retrieval and management.

*Best in class features of other providers*
MIL (GMW has a similar system)

GIS system uses GPS data input and generates maps in conjunction with CAD system and satellite imaging. GIS mapping is used for the following information:

- property boundaries;
- asset management and location, including location of expenditure which is a requirement of DLWC;
- rice areas;
- environmental factors, including
  - watertables
  - EM 31[1] surveys
  - crop intensity
  - water allocation maps of region
  - trend analysis (change detection);
- verification and auditing processes;
- linkages;
- asset management system; and
- environmental management plans and operations.

SRWA and WML

Both of these organisations are overcoming diseconomies of scale by developing GIS by participating with Sunrise to be part of an all area GIS program.

1. Electromagnetic (EM) survey that measures soil conditions at a six metre depth.

### 11.3.3 Human resources management

**HR management**

*Best in class centralised system*
GMW

*Key features*
- Strong staff communication
- Human resources committees include:
  - regular meetings of a consultative committee;
  - OH&S committees in all irrigation areas;
  - EEO committee representative of all staff;
  - training needs are researched and implemented using competency based principles; and
  - performance appraisal for contracted managers.

*Description*
Goulburn–Murray Water has 618 employees of whom 47 are female and 571 are male. Sixty- five percent of the workforce are field based, water distribution or construction and maintenance employees.

A staff newsletter is circulated to all staff each fortnight. Group managers hold staff meetings with Unit Managers monthly. Unit Managers meet with their staff regularly.

A Consultative Committee operates, and meets monthly, consisting of union and management representatives from geographically dispersed work units. OH&S committees exist in all Irrigation Areas and an EEO committee operates with representatives of all employees.

An enterprise bargaining process was the tool for the last round of award negotiations. No work days were lost from industrial action in the last two years.

A questionnaire to ascertain training needs is sent to all Managers annually from which an annual training program/calendar is produced by the Training Services Business Unit. Employees are nominated for courses by their supervisor after consultation.

Formally trained Workplace Assessors are used throughout the organisation to assess the competencies of participants in the Water Resources Management Program, which is an accredited training program from which qualifications are issued.

OH&S modules form part of Training Services courses. OH&S committees are in each Irrigation Area. A consultant has conducted an audit of compliance with OH&S Act and Regulations and will further develop procedures and policies.

Contracted managers undergo performance appraisal and are eligible for performance bonuses.

*Best in class decentralised system*
MI and MIL

These organisations use a distributed system which places responsibility for human resources with line managers. This system is based on managers being responsible for their own staff and is favoured over a centralised system, because of the delineated relationship between managers and staff.

*Opportunities/Gaps*
The benchmarking program has reviewed HR in a structural sense but has not assessed performance. Further work should focus on performance.

**HR performance monitoring**

*Best in class*
MI

*Key features*
- OH&S management and monitoring
- Monitoring of human resources performance indicators

*Description*
MI has fully trained statutory safety committees in each business centre. A Personnel Officer is responsible for OH&S compliance, incident reporting and accident investigation at each centre. These activities are carried out in cooperation with team leaders, workers compensation requirements, and rehabilitation and safety training.

Personnel officers report to management on individual OH&S performance, team performance, OH&S incidences. Reports are also generated on associated costs and annual staff hour performance. The strategic performance indicator is attendance as a percentage of available time.

Workers Compensation premium is 5.1% of payroll. MI actively targets work processes that contribute to lost working hours and the cost of workers compensation.

*Gap/opportunity*
The efforts at induction and induction training by irrigation providers are relatively low. However, low levels of induction may be affecting areas of low performance, such as OH&S.

### 11.3.4 R&D and innovation

An innovation is defined as any new or substantially improved product or service which has been commercialised, or any new or substantially improved process or management practice used for the commercial production of products and services. 'New' means new to the business.

**Managerial (non-technical)**
This type of innovation refers to the way things are done in an organisation which do not involve technology, such as human resource management.

*Best in class*
SRWA

*Key features*
- Team-based working
  - staff meetings
  - staff get to provide feedback to strategic plans

*Description*
Staff are involved in the management decision making process and there is very little information which is not disclosed to them.

Enterprise bargaining is a powerful way for SRWA. Staff develop rules which are then discussed with management for approval.

*Best in class features of other providers*
MI

*Key features*
HR and OH&S performance monitoring system which includes:

- staff attendance measures, trends and targets; and
- matrix breakdown by regional office and whole of business for:
  - paid work
  - paid holidays, long service leave and public holidays
  - sick leave
  - accidents (journey and non journey)
  - other.

**Technical innovation – process**
Process based technical innovation refers to the way things are done for an organisation's benefit.

**Financial management**

*Best in class*
MIL

*Key features*
- Best practice modelling of the financial performance of each irrigation district
- Outsourcing of financial monitoring and asset assessments for renewals to ensure objectivity and due diligence in the board room

*Description*
Best practice modelling adjusts the performance of each irrigation district to a common base using 'modified megalitres'. Modified megalitres are derived from channel length, number of Dethridge

outlets and ML sold in previous year. An equal weighting is given to each. The lowest responsibility centre cost is then applied to the budgets of other centres, based on the modified megalitre formula. Managers of each centre then negotiate for budget allocation on the basis of their budgeted figures and best practice.

The final budget agreed sets targeted savings based on the best practice model and is reported using an activity/functional matrix. The budget is used for performance monitoring throughout the year using variance reporting and budget projections.

Consultants are used to review asset management and financial management and enable the board to demonstrate due diligence in these areas through the objectivity of external assessment.

**Hydraulic efficiency**

*Best in class*
MIL

*Key features*

- Investigation of applications for new technology in hydraulic efficiency
- Primary focus is channel water loss, being investigated using:
  – EM 31 soil surveying
  – Sentec sensors
- Satellite imagery employed to identify land use and, consequently, monitor and police land and wateruse.

*Description*
Sentec sensors are being used to measure water seepage from main irrigation channels over time. EM 31 soil surveying is being used to identify porous soils in and beside main irrigation channels. The information collected from both of these activities will be used to identify and prioritise channel sections for repair, or renewal, to minimise water losses.

EM 31 soil surveying is also being used to identify sites for on-farm soil sampling for filtration testing. As rice water usage is limited to 15.5 ML/Ha, the removal of porous soils from the rice cropping area on farm is a method used to optimise the area available for rice production.

Infrared satellite imagery is used to monitor individual farm cropping practices, particularly areas planted to rice. This system, used on a regular basis, is also used to monitor the frequency of watering.

*Best in class*
GMW

*Key features*

- Research to develop new services to maximise efficiency and optimise system capacity
- Modelling of irrigation demand to predict effects of changes
- Proposal to undertake further research to benchmark channel system efficiency and on-farm losses before product development and implementation.

*Description*
GMW is currently undertaking research aimed at maximising the distribution system efficiency through the development of new or improved water services. Possible new services would include maximising efficiency through outfall/escape sales, smoothing demand fluctuations through use of a off-peak tariff system, and allowing further water transfers by placing conditions on time of use.

Preliminary research has involved the study of a typical small open-channel system and serviced properties. An irrigation demand model has been developed to predict the effects of changed conditions. Improved methods for allocating capacity share on channel systems has been developed on the basis of modelling and the capture of culture information from remote sensing.

An improved understanding of the relative magnitude of the system losses, distribution systems and on-farm losses is required before the introduction of any new services aimed at improving overall system efficiency.

**Technical innovation—product/service**
Product based technical innovation refers to the way you do things for your customers.

*Best in class and key features*
GMW

- Customer linkages
- Paperless records system

MIL

- Developed and implemented its water ordering system in house for a total cost of approximately $20,000.

SRWA, RIT, WML

- Water supplied on a ‘first in first served’ basis which has dramatically reduced the number of complaints made on an equity basis.

SRWA and RIT

- Variable speed pumps installed to improve consistency of supply.

**Research and development**

*Best in class*
GMW

*Key features*

- Four key research areas are funded:
  - customer driven
  - projects related to the business plan
  - natural resources projects
  - funding to external organisations;
- Projects are the result of a planned program of R & D; and
- R&D is seen as integral part of the business plan.

*Description*
Research carried out by GMW is ‘Applied Research and Experimental Development’, as defined by the ABS. R&D is an integral part of the business programs and business plan development and approval process.

R&D funding is in four key areas: projects supported and funded by customer groups; key projects related to the business plan of GMW; natural resource management projects funded by government; and funds provided by the Authority to external organisations.

Where appropriate, R&D is conducted in collaboration with external organisations.

The responsibility for setting R&D activity within G-MW is delegated to the Customer Services Committee of the Board, supported by a R&D Coordination Committee made up of senior technical and management staff.

The Authority approves an annual coordinated program of research and development, although R&D projects are an integral part of programs related to each of the Authority’s business segments. The development of the annual R&D program is an integral part of the Business Plan development and approval.

The results of R&D are communicated both internally and externally to customers and stakeholders.

Opportunities for commercialisation of R&D products are explored.

Current and planned spending are shown in Table 11.

### 11.3.5 Quality systems

TQM, quality management or continuous improvement have been discussed in the innovation section.

*Best in class*
MIL but this is at very early stages of development. The program is being driven by relationships to government since significant government audit savings are available if the organisation is QA.

*Key features*

- Program being championed by one manager
- Recognition of considerable training required
- Program to begin in one division
- Long-term goal to become QA accredited to ISO 9000

*Description*
MIL has a goal to implement QA which is championed by the technical services manager. Implementation will be undertaken for the precast facility of the Technical Services division first, over a two-year period, with a planned transfer to other departments to follow.

External consulting engineers will be used to undertake required training. Initial training will be to develop QA plans. MIL considers itself to be 5% towards QA.

*Gaps/opportunity*
The opportunities and benefits of QA are not fully recognised across the providers benchmarked. Even MIL, who are heading down the QA path, are only at the early stages.

QA is about adhering to the standards you set. Therefore, there is an opportunity for irrigation providers to work together to standardise QA specifications from the outset of its introduction to the industry. Over time, the standards would be expected to improve as a result of innovation and linking this

**Table 11.** Current and planned R&D spending

| Expenditure | 1995–96 | 1996–97 | 1997–98 (Budget) |
|---|---|---|---|
| LWRRDC | 172,000 | 172,000 | 172,000 |
| Other CRCs | 315,011 | 238,880 | 278,000 |
| G–MW Internally funded | 213,248 | 318,168 | 509,000 |
| G–MW Externally funded | 132,624 | 118,000 | 70,000 |

improvement with QA systems will enable the whole industry to improve together.

*Best in Class Features of Other Providers*
GMW—Auditable Environmental Management System accredited to ISO 14,001 (see Environmental Management 11.1).

## 11.4 Business performance summary

Key areas of best practice involve the management and integration of strategies, structures, systems, people and innovation. These can be detailed as follows.

*Strategies*

- Ongoing five-year strategic plans linked to customer and shareholder needs, with the use of performance indicators.

*Structures*

- Optimal choice of business units and cost centres;
- Board of directors with requisite skills and the motivation and authority to achieve best practice;
- Facilitation of R&D, innovation and quality management; and
- Utilisation of appropriate levels of outsourcing.

*Systems*

- Professionally developed user friendly software for asset management, financial management, water planning, customer information and billing and records management;
- Use of technology including GPS, GIS CAD systems; and
- The development of quality systems.

*People*

- Clearly defined HR management and responsibilities which include a participative approach to key areas of OH&S and EEO.

*Innovation*

- The use of dedicated teams to develop technical innovation.

# 12 Confidence Levels

The level of confidence that the consultants have in the accuracy of the data they have captured varies according to the nature of the information. This is either high, medium or low, as indicated below.

## 1. Hydraulic measures: *medium to high*

The majority of the data required are captured by each provider. A degree of inaccuracy does occur, because of the type of processes and mechanisms being used to measure water flows. For example Dethridge Wheels are notoriously inaccurate, because of their mechanical nature, and outfalls/escapes measurements can be inaccurate as they are taken at discrete intervals, rather than continuously. However, the level of inaccuracy is relatively consistent across differing providers.

## 2. Financial measures: *high*

These figures are taken from provider accounting records and published financial statements and are inherently accurate.

## 3. Business process information: *medium*

The level of accuracy of this information is only impaired by its subjective nature. Otherwise it is as accurate as possible.

## 4. Information up and down the value chain from providers

- **Water catchment and headwaters: *low***

Releases on behalf of irrigation providers are recorded but subsequent river flows and losses, before diversions taken by irrigation providers, are relatively unknown to benchmarking participants.

- **On-farm wateruse: *very low***

There are few records on this information and it is rarely measured. Hence, crop use, waste and soil losses cannot be assessed.

- **Agricultural production: *very low***

Only low levels of information on agricultural production and value are available. Assessment of agricultural production is usually undertaken using the latest ABS statistics survey and generic gross margins from agricultural departments, to arrive at gross values. Data on the incremental benefits of irrigation to the relevant regions are not available.

# 13 Next Steps

## 13.1 Continue and Refine the Process

### Annual benchmarking

The benchmarking program carried out in 1997 is designed to be the beginning of an ongoing and improving process. The process should be continued and improved on an annual basis. Three key benefits will occur:

- the measures will identify improvements made by each participant over time;
- the measures will be refined over time to better reflect the key performance areas, resulting from an increased understanding of the key performance drivers and as more relevant information is captured; and
- the information available to support ongoing performance improvement will be provided by continuing the benchmarking process.

### Implement improvements identified

The benchmarking study was conducted to enable each participant to learn from the others, especially the best in class for each process, and improve performance. The opportunities identified during the study will allow each organisation to implement changes leading to improved performance. Some motivation may be required to focus management attention away from pressing day to day activities, or working in the business, to working on the business.

### Pursue key issues in greater depth

The benchmarking program has identified a number of factors which would benefit from further research. These include:

*Hydraulic loss*

The significant volumes of water lost within the system provide an opportunity to better identify the main areas of loss and to reduce it. The two primary areas for investigation are within the supply system and on-farm. GMW and MI have submitted proposals to undertake further research on hydraulic losses. Additional focus is suggested as approximately one million megalitres per annum are lost within the systems of the six participating providers. These losses do not account for any on-farm wastage.

*Environmental performance*

Environmental performance is becoming increasingly important for all aspects of agricultural management including the irrigation process. Significant effort has been devoted to monitoring and managing changes in the environment. However, it appears that environmental management is undertaken in a fragmented manner. Each of the participating providers undertakes different activities in environmental management. This study has highlighted the opportunity to improve the coordination between different environmental stakeholders to improve the overall environmental management and performance.

*Linkage of water supply to farm productivity*

The true measure of irrigation effectiveness is the incremental benefit to agricultural production and value. At present there is a lack of accurate and coordinated information on farm production as a result of irrigation. The effective management of the scarce water resource requires an understanding of the ultimate economic benefits because of the supply of water, which in turn requires a whole of system approach. The current water management system does not reflect a whole-of-system approach.

Improved measures may be developed as the information of irrigation provider and on-farm is further integrated. ML per ha measures are non-transferable because of differences in crop, rainfall, season, etc. Better measures include ML per unit of produce and ML per production value (although this measure is altered by moving market values).

*Drivers of irrigation provider productivity*

The introduction and better use of information systems and technology will provide an opportunity to continually improve performance. All aspects of water delivery may be able to be improved including operations, maintenance, capital works and administration. Opportunities exist to learn from the more advanced organisations in the industry as well as to leverage from similar industries such as the urban water suppliers and other large utilities (gas and electricity).

*Innovation*

A continued focus on innovation including commercially focused R&D will ensure further improvement to systems, service, processes and performance. Opportunities exist for improved asset management and better data and process management using geographical information systems.

*Asset management*
Systems to manage long-life assets are being developed with considerable potential for future gains. The coordinated development of effective asset management techniques should be a key priority.

*The use of geographic information systems*
The use of Geographic Information Systems (GIS), linked to modern data and process management, will facilitate better management of the overall system including irrigation provider and on-farm performance. A coordinated approach by the irrigation industry to the development of these systems will benefit the industry as a whole.

*Best in class criteria*
The development of criteria and weighting for measuring best in class allows a more objective assessment. One potential method is to lay out the criteria and rate each organisation on each contributing aspect. This was not done during this study in an effort to create impetus for change rather than provide performance comparisons.

*Improve measures*
Some of the measures in the study are affected by external changes including rainfall, market prices and crop differences. As the whole system is better understood, the measures used will be further refined to better reflect the performance of the irrigation process on the production of sustainable produce.

## 13.2 Extend the Focus

**Value chain (whole-of-system) management**
Historically the irrigation system has been viewed as a collection of separate activities, with differing purposes and differing stakeholders. Consequently, research has focused on the individual components of the system. Future research and management should be focused on a whole-of-system approach. This will better achieve improved overall water management performance, thus meeting LWRRDC's objectives of resource sustainability, ecological performance, wateruse efficiency and economic performance.

**National extension**
Significant benefits have already been demonstrated as a result of this benchmarking project. Extending the focus to include all Australian providers is expected to provide two benefits. The first is a larger database of best practice management which will enable each provider to have greater opportunity to improve. The second is that more irrigation providers will be able to make improvements from shared information and coordinated improvement activities.

A coordinated irrigation industry has the added benefit of being in a position to become more proactive in managing the development of the irrigation industry and its regulation.

## 13.3 Making it Happen—Championing the Cause

Recognising the benefits of the opportunities is only the first step. Achieving them will require significant enthusiasm, effort and resources. Some person or entity must accept responsibility for continuing and developing the process. A champion or champions will be required to make it happen.

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# 15 Appendix

## Financial Input Data: 1995–96

### Balance Sheet

| | Current assets | Non-current assets | Current liabilities | Non-current liabilities |
|---|---|---|---|---|
| WML | 8,738 | 38,154 | 1,459 | 7,523 |
| SRWA | 12,829 | 24,086 | 572 | 2,263 |
| RIT | 417 | 9,933 | 308 | 2,948 |
| MIL | 21,309 | 170,012 | 6,332 | 1,556 |
| MI | 28,200 | 27,461 | 4,134 | 2,662 |
| GMW | 34,452 | 909,527 | 11,969 | 5,815 |

### Profit and Loss

*Operating revenue*

| | Gross Revenue | Irrigation revenue |
|---|---|---|
| WML | 1,817 | 1,817 |
| SRWA | 6,971 | 6,808 |
| RIT | 1,721 | 1,721 |
| MIL | 20,870 | 16,033 |
| MI | 17,072 | 13,637 |
| GMW | 67,942 | 49,817 |

*Operating expenses*

| | Bulk water charge | Energy expenses | OM & A |
|---|---|---|---|
| WML | 140 | 364 | 1,599 |
| SRWA | | 955 | 5,695 |
| RIT | | 248 | 1,212 |
| MIL | 3,220 | | 15,966 |
| MI | 1,006 | | 13,723 |
| GMW | 12,622 | | 49,563 |

*Non-operating expenses*

| | Net interest | Capital expenditure | Capital revaluation | Depreciation |
|---|---|---|---|---|
| WML | (513) | 4,949 | | 261 |
| SRWA | (21) | 1,115 | | 811 |
| RIT | (18) | 338 | | 261 |
| MIL | (957) | 9,043 | 15,000 | 3,889 |
| MI | 1,027 | 7,880 | (76,397) | 5,798 |
| GMW | 2,574 | 16,354 | | 21,134 |

| | Total expenses | Adj. EBIT pre exceptionals |
|---|---|---|
| WML | 1,086 | 206 |
| SRWA | 5,674 | 1,599 |
| RIT | 1,194 | 509 |
| MIL | 15,072 | 67 |
| MI | 14,750 | 941 |
| GMW | 52,137 | 11,831 |

## Non Financial

| | No. of employees | km of system | Water delivered (ML/year) | No. of properties |
|---|---|---|---|---|
| WML | 10 | 121 | 43,923 | 542 |
| SRWA | 52 | 792 | 95,933 | 1,552 |
| RIT | 24 | 140 | 35,584 | 696 |
| MIL | 155 | 3,800 | 1,291,181 | 2,288 |
| MI | 263 | 2,533 | 876,400 | 3024 |
| GMW | 539 | 5,650 | 2,212,083 | 17,263 |