

Water and the Western Australian minerals and energy industry

Certainty of supply for future growth



A Regional Minerals Program study sponsored by



The availability of sufficient water resources is critical to the wellbeing of all Western Australians and the future growth of the minerals and energy industry.



GOLD FIELDS AUSTRALIA

The aim of this study is to describe water use in the industry and its vital role in the development of water sources in Western Australia.

CME would like to thank Pilbara Iron for supplying the photographs that appear on the front cover.

Key findings



Competition for water

- Over 75% of the water used by the minerals and energy industry in Western Australia is remote from agriculture and populated areas.
- There is little competition for the water from other consumers in most areas due either to the remote location of the project or the poor quality of water used.
- The alumina/bauxite and heavy mineral sands sector face more competition than other sectors due to their location in agricultural areas, however this competition is limited to small areas of the State.
- The majority of the water used in some regions is from dewatering of mine sites to allow mining to proceed. When it is replaced in local aquifers with negligible environmental impact, it is questionable whether it should be regarded as used.
- Despite the arid nature of most of the State, few companies have faced technical difficulties in developing suitable water supplies for resource projects.

Discovery and development

- The minerals and energy industry plays a major role in the discovery, development and ongoing management of water resources.
- The minerals industry is almost totally dependent on groundwater which it

sources from its own borefields or dewatering of mine operations.

- The industry develops 95% of its own water supplies. A survey carried out for this study suggests that the cost of water discovery and development may have been in excess of \$700 million, while ongoing operating and management costs are estimated to exceed \$100 million per annum.

Water value

- The minerals and energy industry ranks second to agriculture in the total volume of water used in the State, but at least half of the water used is poor quality water and unsuited to other uses without treatment that would make it uneconomic. Were it not for the development of mineral processing technology capable of using such water, there would be no use for it.
- The minerals and energy industry values water because of the investment needed to discover, develop and manage the resource.
- The minerals and energy industry ranks highly in terms of the value of industry output per volume of water use. It ranks behind water for human survival, health and domestic food production but well above export based irrigated agriculture, which is the largest water use sector.

Allocation

- Mineral operations usually have a limited life and in most locations adequate groundwater exists to meet the short-term requirements. Shortage of water is not an impediment for most operations.
- The nature of mineral operations means that the industry seeks groundwater licences that are fixed in volume and duration rather than open ended rights to variable volumes.

Management

- The minerals and energy industry is aware of the value of water and the need to use it efficiently. In many situations, mineral operations are able to recycle large amounts of water.
- Resource companies are aware of water use efficiency objectives and the need to account for all water used, but could do more to adopt best practice water accounting principles.
- The resources sector publicly supports the sustainable use of all natural resources and a triple bottom line assessment for access to new resources. Some mining of water in remote and arid areas is warranted given the temporary nature of use, a lack of alternative demand and the regional development benefits that accrue.
- The State Government administers water allocation through a comprehensive licensing and environmental assessment process. Water allocations to the minerals industry are subject to more rigorous assessment than most other industries.
- Water abstraction by the minerals industry is closely monitored and comprehensively reported. Metering,

water level and water quality monitoring programs are intensive compared to other large users.

Knowledge

- While government regulation of the industry is rigorous, the hydrogeological support traditionally provided needs to be refocused, to assist industry locate and develop water resources. Annual reports provided to the Department of Environment should be electronically captured and made available through a comprehensive database.
- The emphasis in hydrogeological work in the State Government has shifted away from regional assessment and industry support towards environmental assessment. The important role played by hydrogeology in the development of water resources needs greater recognition.
- Management plans form the basis for water allocation and use in regional areas but only a limited number have been completed.
- The State Government Mining and Water Liaison Committee set up to liaise on water management issues has identified priorities for hydrogeological work. Consideration needs to be given as to how this work should be developed.



ALCOA WORLD ALUMINA AUSTRALIA

Recommendations



- 1** Industry bodies and governments should communicate the key findings and recommendations of this study to the community and key stakeholders to promote a better understanding of water use in the minerals and energy industry.
- 2** Groundwater information submitted to the State Government as part of water licence reporting is a valuable information source and should be actively managed. The current Department of Environment proposal for electronic data management and dissemination should be supported.
- 3** The hydrogeological expertise in the government is a valuable public resource. This expertise needs to be used to promote industry development and sound environmental management. The State Government should support a balanced approach to triple bottom line assessment.
- 4** The State and Australian governments should develop a more sophisticated approach to groundwater management that more explicitly recognises the value of water as a social and economic good in remote areas and the location and quality of water used.
- 5** The State Government should increase the rate at which Groundwater Management Plans are completed with a focus on areas that have surface environmental impacts or where competition is greatest.
- 6** A review of the process for preparation of groundwater management plans is recommended to ensure that the interests of the State and all stakeholders are reflected in their development.
- 7** Resource companies should be urged by minerals industry bodies and the State Government to develop water balance accounting at all projects.



PILBARA IRON

The Western Australian minerals and energy industry

The resources sector underpins the economy of Western Australia. It is the largest single economic sector, provides a fifth of direct and indirect employment and approximately three-quarters of total exports. It makes substantial payments to government and contributions to the communities in which it operates. The industry is highly diversified and geographically dispersed with almost 500 projects and some 50 different minerals in production.

This study was commissioned by the Chamber of Minerals and Energy of Western Australia under the Australian Government Regional Minerals Program (RMP) and was administered in conjunction with the Australian Government Department of

Industry, Tourism and Resources and the Western Australian Government through the Department of Industry and Resources and Department of Environment (incorporating the former Water and Rivers Commission).

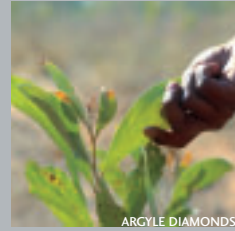
The RMP was established by the Australian Government in 1996 as a cooperative and coordinated approach by industry and governments to facilitate regional development of mining and processing activities and to promote regional employment opportunities.

The aim of this study is to describe water use in the resources sector and the role of the industry in the development of water sources in Western Australia.



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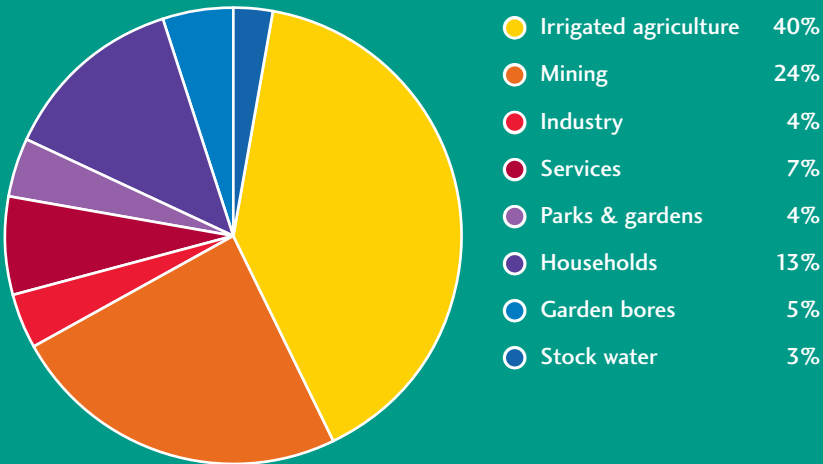


Mineral and petroleum extraction and processing activities are major water users in Western Australia. However, the water use statistics overemphasise the scale of such use as they do not take into account the location of use, the quality of the water used, the self-supply role of most of the industry and the company effort that goes into water management.

Proportion of total water use

Total water use in Western Australia is estimated at 1,795 GL per annum of water¹. The minerals industry is ranked as the second largest water use sector behind irrigated agriculture. Mining use was put at 430GL per annum or 23% compared with irrigated agriculture at 40% and household use at 13%.

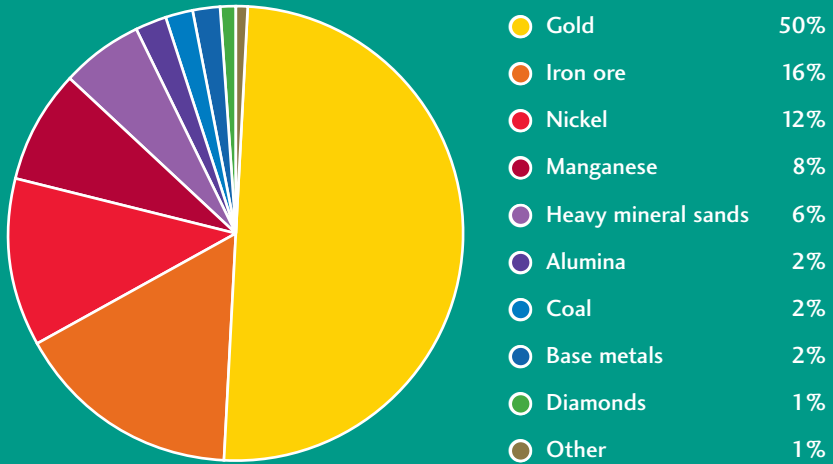
Figure 1: total water use in Western Australia (1999-2000)



Source: Water and Rivers Commission, March 2004

¹National Land and Water Audit, 1999-2000.

Figure 2: water licence allocations by mineral



Source: Water and Rivers Commission, March 2004

Use by commodity sector

The gold sector dominates water allocations with half of the licensed volume (Figure 2). Iron ore and manganese take up 24% followed by nickel projects at 12%. These three commodity groups account for 86% of the total water allocation.

Location of use

Most mineral operations in Western Australia are found in remote areas and some distance from each other. Water supplies are generally obtained from groundwater sources with some from dewatering operations. The study estimates that 75% of water used is from groundwater sources and 25% from surface water sources.

While the industry is a large water user, it ranks well behind agricultural water in the State as a whole. Resources sector use is more significant in the remote areas of the State including the Pilbara, Goldfields, Murchison and the Mid West. There is limited demand from other water users in these regions and therefore little competition.

Only a few areas of Western Australia face potential water supply limitations that could restrict mineral operations. The South West corner of the State with its rapidly rising population is facing longer term water supply challenges. However, the resources sector is not a large water user in this part of the State although the industry is well aware of potential future access constraints.

An important consideration in the mining industry is that mines usually have limited lives, rarely exceeding 25 years and often less than 10 years. Groundwater resources are generally robust and can be managed to meet these fairly short-term requirements.

Self supply

The minerals industry provides the overwhelming proportion of its own water needs. It locates suitable sources, develops supply facilities (borefields, dams), and builds supply pipelines and holding tanks. The industry manages most water disposal on site minimizing any need for off-site drainage.

Most mineral operations, with some effort, have located acceptable groundwater supplies. Some water is obtained from other licensed water providers but it is estimated that the industry supplies nearly 95% of its own water needs. However, some has to be pumped from distant sources or obtained by desalination.

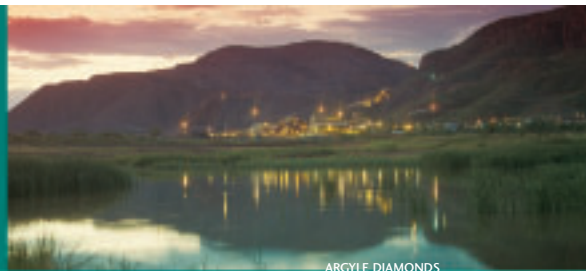
Water quality

Water quality varies widely across the State. Brackish and saline groundwater is common in the Goldfields and Murchison regions. Indeed, it was the development of gold ore processing technology using saline water that enabled much of the gold sector to develop in the arid areas of Western Australia. Without the ability to utilise poor quality water that would not be used in other economic sectors, the minerals industry would be much smaller than it is.

The survey conducted for this study suggested that around 60% of the water used in the industry is of poor quality and not well suited to other uses without expensive treatment.



PILBARA IRON



ARGYLE DIAMONDS

The industry supplies nearly 95% of its own water needs.

Dewatering

Despite the arid climate, some resource projects have a water surplus problem with water pumped from working areas to allow mining to proceed. Much of this water is placed back in local watercourses and ends up in the aquifer system from which it was pumped. In the Pilbara, that same water may be pumped from other projects down stream from the dewatering project.

Water infrastructure

Much of the State's economic development can be traced to the minerals industry and resource companies have made substantial investment in water infrastructure. A survey carried out for this study suggests an investment in water supply development by the companies in excess of \$700 million. Annual operating and management costs almost certainly exceed \$100 million.

Water value

Mineral operations are managed to limit groundwater contamination and effects on wetlands and water dependent ecosystems. The industry is aware that it must value water resources and use them in an efficient manner if continued access to water is to be provided.

The industry is conscious of conservation efforts and the study suggests that as much as 30% of water on mine sites is recycled at least once and sometimes many times before disposal. The industry has become a "best practice manager" in water use and management. Water balance tables have been developed by some companies and others are moving to improve such water accounting practices.

The industry supports policies for the sustainable use of natural resources including water. While some definition and assessment issues are being developed, the industry supports a triple bottom line assessment of sustainability in which economic, environmental and social impacts are all assessed.

Mining of water in remote and arid areas is warranted by such an approach. The abstraction of water in excess of the recharge amount is permitted on the grounds that there is exceptionally little alternative water demand and that the regional development benefits outweigh any environmental impact. Furthermore, mineral operations usually have a limited life and in most locations adequate groundwater exists to meet the short-term requirements.



PILBARA IRON

Much of the State's economic development can be traced to the minerals industry and resource companies have made substantial investment in water infrastructure.

State governance



The State Government manages water use by the minerals industry through a comprehensive licensing and environmental management process. The industry is subject to more rigorous assessment than many other water users.

Licences are issued for groundwater abstraction, surface collection, dewatering and water disposal. Major resource projects are issued with an Operating Strategy requiring water use measurement, quantity and quality monitoring, environmental impact reporting and aquifer review processes.

Groundwater licences

At 30 March 2004, there were 641 licences held by the resources sector with a total licensed allocation of 629 GL. The licences describe water use in mineral operations, mineral exploration, for mining camps, as process water, dewatering and for dust suppression. The State Government has assessed actual groundwater use at 410 GL, or around two thirds of the total allocation.

Water service providers

Some water for mining and mineral processing and oil and gas processing is supplied to resource companies by other licensed water service providers. The Water Corporation of Western Australia and Harvey Water supply water to companies primarily for mineral processing activities. Specific details are confidential and hence only regional scale information can be provided. Total sales in 2003 were 27 GL. This includes sales for oil and gas processing activities, nickel refining, titanium production, ship loading and port operations, hot briquette iron manufacture and alumina refining. While it is not possible to break down these sales, it is suggested that approximately 18 GL is used in mining and mineral transport activities as distinct from mineral processing.

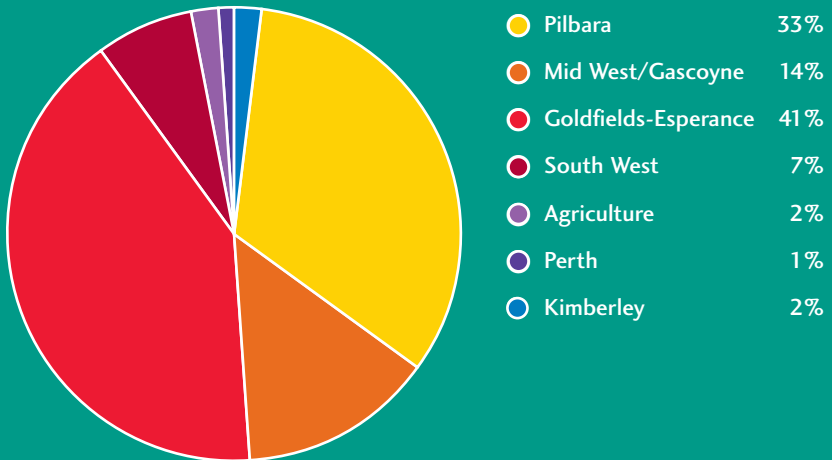


Resource sector water use by region

The majority of water use (92%) by the minerals industry is concentrated in four key regions in Western Australia, the Goldfields-Esperance, the Pilbara, the Midwest Gascoyne and the South West. Remote regional water use away from any population pressures accounts for nearly three-quarters of water use in the resources sector.



Figure 3: mining water allocation by region



Source: Water and Rivers Commission, March 2004

The Goldfields-Esperance

Value of mineral and oil production in 2003:	\$4,215 million
Minerals industry water use:	
Water Corporation sales:	5.5 GL
Water licence allocations by commodity:	
Gold	187.4 GL
Nickel	60.9 GL
Other	2.2 GL
Total licence allocation:	250.5 GL

The Pilbara

Value of mineral and oil production in 2003:	\$14,900 million
Minerals industry water use:	
Water Corporation sales:	13.5 GL
Water licence allocations by commodity:	
Iron ore	120.9 GL
Manganese	64.8 GL
Gold	17.8 GL
Tantalite	3.5 GL
Copper	3.0 GL
Other	0.1 GL
Total licence allocation:	210.1 GL

The Mid West-Gascoyne

Value of mineral and oil production in 2003:	\$2,215 million
Minerals industry water use:	
Water Corporation sales:	1.5 GL
Water licence allocations by commodity:	
Gold	54.4 GL
Heavy mineral sands	21.0 GL
Base metals	7.0 GL
Vanadium	3.5 GL
Other	2.7 GL
Total licence allocation:	88.6 GL

The South West

Value of mineral and oil production in 2003:	\$5,000 million
Minerals industry water use:	
Water Corporation sales:	3.4 GL
Water licence allocations by commodity:	
Coal	16.1 GL
Alumina	14.26 GL
Heavy mineral sands	14.1 GL
Other	0.4 GL
Total licence allocation:	44.86 GL

Agricultural areas

Value of mineral and oil production in 2003:	\$508 million
Minerals industry water use:	
Water Corporation sales:	0 GL
Water licence allocations by commodity:	
Heavy mineral sands	8.8 GL
Nickel	5.1 GL
Gold	1.4 GL
Total licence allocation:	15.4 GL

The Kimberley

Value of mineral and oil production in 2003:	\$808 million
Minerals industry water use:	
Water Corporation sales:	0 GL
Water licence allocations by commodity:	
Diamonds	6.7 GL
Base metals	5.4 GL
Nickel	1.5 GL
Other	0.1 GL
Total water allocation:	13.7 GL



PILBARA IRON

Further information

Water and the Western Australian minerals and energy industry: Certainty of supply for future growth was authored by Murray Meaton of Economics Consulting Services. For a full copy of the report or to find out more about water use and policy issues in the minerals and energy industry and the CME Water Issues Group, please visit the CME website at www.cmewa.com or contact us on (08) 9325 2955.

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