The Impact of Mining On the Murray-Darling Basin

Table Of Contents

List of Figures

Introduction

The Murray-Darling basin is the source of life for a significant proportion of Australia, sustaining "10.94 percent of the nation's population" and "accounting for 41 percent of the nation's gross value agricultural production" (Murray-Darling Basin Commission, 2006)

The basin's unique geological history also makes the Murray-Darling rich in minerals rendering the area's environment and population increasingly subject to the impacts of mining, which is keenly encouraged and promoted by the NSW State Government.

However, the effect that mining activities have on a system that is already considered by the Federal Government to be threatened by "multiple stresses" (National Water Commission, 2005, p12) is under-studied and under-appreciated by those charged with managing the system in NSW.

This report seeks to identify the threats posed by the mining industry to the Murray-Darling basin and the communities it supports, and highlight the need for the NSW State Government to:

a) Facilitate the undertaking of comprehensive independent research into the environmental and social impacts of mining generally and the individual and cumulative effects of increased mining activity in the basin specifically

b) Give serious consideration to long-term environmental and social interests rather than just short-term economic gains and

c) Prioritise the development of a universal management plan in cooperation with federal and local government bodies.

How many mines use water from the Murray-Darling?

There are at least **fifty mines** in operation within the Murray-Darling Basin, according to the Australian Federal Government Department of the Environment, Water, Heritage and the Arts, which considers the Murray-Darling basin to encompass a far greater area than does the NSW Department of Mineral Resources.

According to a *Mineral Projects Map* (2003) provided by the NSW Department of Primary Industries, the number of operational mines in the 'Murray basin' is only seven, but, if using the Federal government boundaries, then there are at least fifty mines in operation within the Murray-Darling basin. There are, of course, more in exploration stages or pending government approval.

It is interesting to note that the NSW Department of Mineral Resources refers only to the 'Murray basin' as a "major structural geological unit" covering a greatly reduced area compared to the Federal government boundaries, which have been adopted for this report.

How much water is really used?

A figure of 1.5 percent of Murray (regulated) water used by the mining industry can be gained through a comparison of the total water use figure for the region from the National Water Commission *Australian Water Resources 2005* report and water use information for thirteen individual mines from the *2006-07 New South Wales Mineral Industry Annual*. However, the conflicting nature of the information available makes the task of accurately quantifying the amount of water used by the mining industry in the Murray-Darling basin difficult.

Whilst this figure does not suggest that a great percentage of water is used by the mining industry, the figure is illusory in that it offers no insight into (and indeed detracts from):

a) The way the water is used

b) The subsequent impact on the sustainable yield of the basin, and

c) The parties who are/will inevitably be denied water resources as a result of water being allocated to the mining industry.

As mentioned, the 1.5 percent figure is representative of the thirteen mines in the 'significant mines dossier' section of the *2006-07 New South Wales Mineral Industry Annual* for which water use data is provided (see figure 1).

These mines are all metallic and/or minerals mines and constitute a mere fraction of the mines in operation in the region. This is particularly significant given that there are in excess **of fifty operational mines in the Murray-Darling basin** (as outlined above).

Enquiries made to the NSW Department of Water and Energy about gaining information about the specifics of water allocations (as a means for determining a more representative picture of the amount of water used by mining) were met with claims to the privacy concerning such information.

Case Study: Cadia Valley Operations

The Newcrest Cadia Valley operation (Cadia), located near Orange in the New South Wales Central Tablelands, is the largest gold and copper producer in the State and one of Australia's largest gold producers. The operation comprises the low grade Cadia Hill open pit mine, the higher grade Ridgeway underground mine and shared ore treatment facility. (see ## below, pg 50)

Cadia is located on an *unregulated* * part of the Belubula River in the Lachlan River catchment. The Belubula River is a tributary of the Lachlan River, which is part of the Murray-Darling Basin. However, the part of the Belubula River from which Cadia extracts water is not covered by the Lachlan WSP (Water Sharing Plan). As such, any water reforms introduced as part of the water planning process in the Lachlan catchment do not apply to the Belubula River.

The Belubula River has been severely affected by drought. Currently, general security licence holders are unable to access any of their entitlement, while high security licence holders are only able to access 50 per cent of their entitlement.

Since Cadia commenced operation, water has been a key development issue and continues to be one of the great uncertainties for future development. It is important to note that the project was only able to commence due to work by NSW DNR in re-directing licences from the Lachlan River to the Belubula River. (see ## below, page 51)

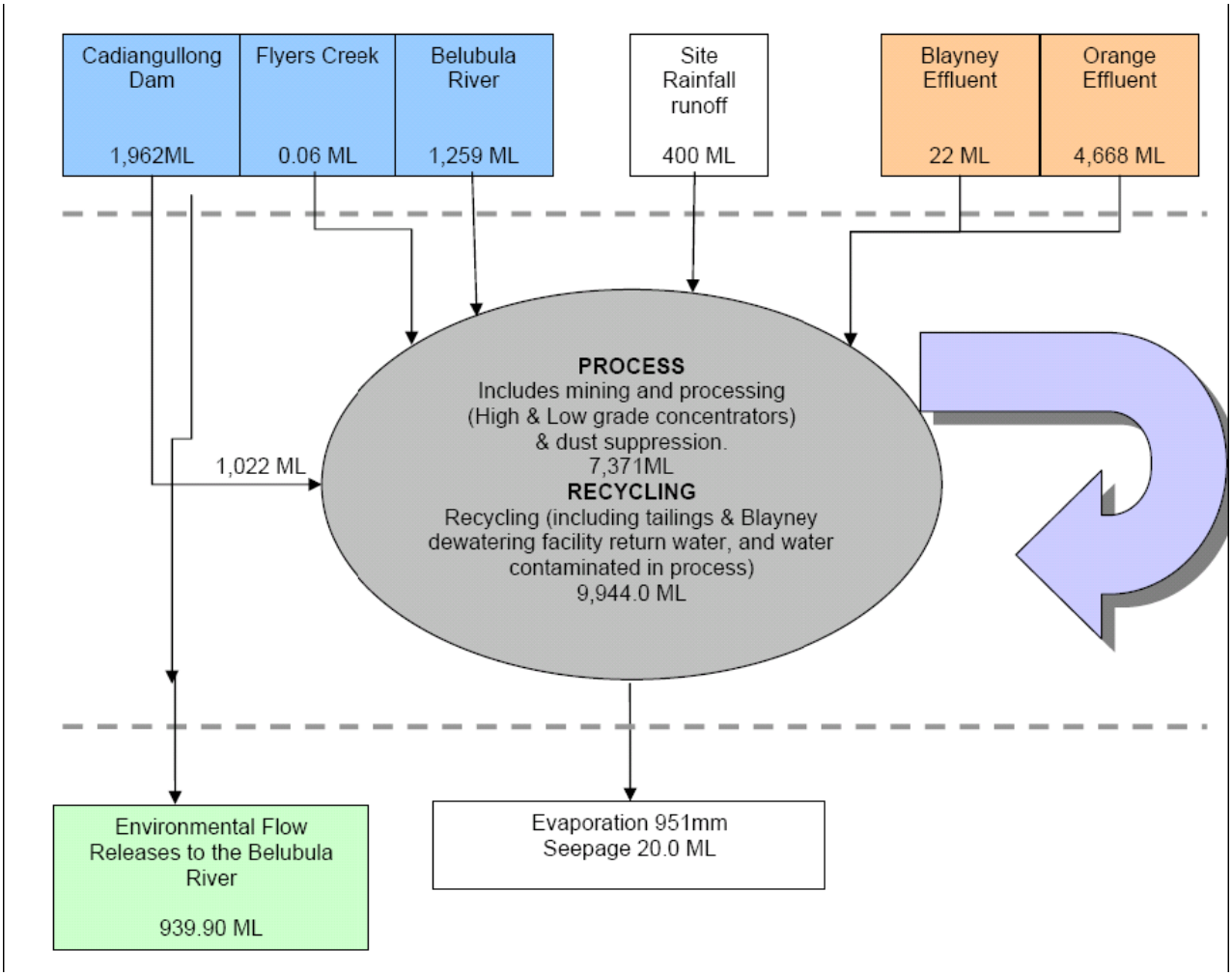
* According to NSW State of the Environment 2000, *regulated* rivers are those rivers proclaimed under the Water Act 1912 as having their flows controlled by the major Government rural dams; 'regulation' means that the flows along the length of the river are controlled or regulated by releases made from major dams to meet the needs of licensed water users up to hundreds of kilometres downstream.

The water issues confronting Cadia currently, and into the future, pertain to accessing additional water for prospective mine developments. As mentioned above, a WSP (Water Sharing Plan) has been developed for the Lachlan River. However it does not include either the regulated or unregulated parts of the Belubula River.

The main use for water at Cadia is for minerals processing. Other water uses include:

- dust suppression;
- water for Ridgeway underground mine; and
- environmental flow releases from a dam purpose-built to supply water to the mines (Cadiangullong Dam).

Figure 1: Cadia Valley operations annualised water balance



Data source: *Minerals Council of Aust, Ministerial Council on Mineral and Petroleum Resources*

Graph Source: *Water Reform and Industry: Implications of recent water initiatives for the minerals, petroleum, energy, pulp and paper industries*, April 2007, page 54.
http://www.minerals.org.au/__data/assets/pdf_file/0013/20236/ACIL_Water_Reform_and_Industry_May07.pdf

Of interest to note in the above graph are the figures for "**seepage**" and "**environmental flow releases to the Belubula River**."

How the Aust Bureau of Statistics calculates water used in the mining sector

Total water use in the mining industry was 608,575 million litres in 2004-05, **a 34% increase from 2000-01**. In 2004-05 the **metal ore mining industry had the highest total water use within the mining industry** (364,998 ML), **followed by coal mining** (154,972 ML) (Graph 1.27). In Western Australia, there was **an 81% increase in total water use by the Mining industry** between 2000-01 and 2004-05, **primarily in the metal ore mining industry**.

Source: Aust Bureau of Statistics
http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4610.0Main+Features12004-05?OpenDocument

Calculating water use by industries is not straightforward. Water use can include self-extracted water, distributed water, or reuse water, and sometimes a combination of all three sources are used.

Calculating water use estimates for an industry or business is made more complicated when water is also supplied to other users, or when water is used *in-stream*. As such, simply adding self-extracted water, distributed water, and reuse water to derive a figure for total water use can be misleading.

In the Water Account, volumes of water used and supplied by each industry have been balanced to derive 'water consumption'. This figure takes into account the different characteristics of water supply and use of industries and is a way of standardising water use, allowing for comparisons between industries. As such, the following accounting identities have been used:

> Total water use is equal to the sum of Distributed water use, Self-extracted water use and Reuse water use;
>
> **Water consumption is equal to the *sum* of Distributed water use, Self-extracted water use *and* Reuse water use *less* water supplied to other users *less* In-stream use and *less* Distributed water use by the environment.**

For most industries, water use and water consumption are the same as most industries do not have any in-stream use or supply water to other users. **However water consumption will be considerably different for** some industries, specifically the water supply, sewerage and drainage services industry, electricity and gas supply industry, **mining industry, and manufacturing industry where in-stream water use and water supply volumes are significant**.

Source: Aust Bureau of Statistics
http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4610.0Main+Features12004-05?OpenDocument

Note 22: For mining and manufacturing

Distributed water use was the amount supplied to the mining and manufacturing industries by water providers.

Self extracted water use and water discharge was sourced from the 2004-05 Economic Activity Survey of Mining and Manufacturing industries, supplemented with information from company websites and annual/environmental reports.

Mine dewatering was assumed to be self-extraction by the mining industry in all States. The water is usually utilised on-site or subsequently discharged.

http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4610.0Explanatory%20Notes12004-05?OpenDocument

Water Use Per Annum

The National Water Commission in 2005, described the 'level of use', the 'consumptive flows as a proportion of inflows' and the 'consumptive use as a proportion of water resource' categories in the Murray-Basin as 'high' (see figure 2)

A 'high' ranking indicates that 'the sum of diversions and extractions is between 70 and 100 percent of sustainable yield' (National Water Commission, 2005, p84).

Mine	Water requirements per annum
Broken Hill	1500 ML
Endeavour	1200 ML
CSA	600 ML
Peak Mine	219 ML
Tritton	900 ML
Mineral Hill	75 ML
Mount Boppy	150 ML
Ridgeway Deeps	1460 ML
Cadia Hill	5840 -6205 ML
Northparkes	3200 ML
Attunga (Jackson's and Suclor Deposit)	50 ML
Gingko	680 ML
Snapper	630 ML
Total:	16, 504 ML/ 16.504 GL

Figure 2: *Department of Primary Industries, 2006.*

Level of water resource development for selected water management areas in 2004–05 based on allocation, use and inflows

No matter what the unknown percentage of water used by the mining industry in the basin, it is clear that the continual granting of water licences and allocations would only contribute to increasing the percentage of the basin's sustainable yield in use; a percentage that is already very high.

It should be noted that there is *'no uniform national approach to estimating the environmentally sustainable level of extraction (sustainable yield)*' (National Water Commission, 2005) This fact is described by the National Water Commission as a 'major problem', and further complicates the task of determining the effect that industrial water-use has on the Murray-Darling basin.

The NSW Department of Primary Industries (DPI), in it's *2006-07 New South Wales Mineral Industry Annual* publication, describes the Murray basin as 'one of the world's prime mineral sands provinces' (NSW Department of Primary Industries, 2007, p24) and considers the area to be a 'prime focus' for new minerals exploration (NSW Department of Primary Industries, 2007,p21)

Level of Water Resource Development

Water Management Area	Level of Water Resource Development		
	Level of use	Consumptive use as a proportion of inflows	Consumptive use as a proportion of water resource
Inter-jurisdictional Areas			
Border Rivers#	moderate	high	high
Coopers Creek	n/a	low	low
Great Artesian Basin	overused	high	high
Lake Eyre Basin~	high	moderate	moderate
Murray Darling Basin#	high	high	high
Ord River	low	low	low
Snowy River	high	low	low

Figure 3: (National Water Commission, 2005)

The DPI publication clearly shows that the NSW government strongly encourages mining, as indicated by the multi-million dollar programs and initiatives being used by the Government to attract mining companies and encourage exploration (NSW Department of Primary Industries, 2007, p25) The fact that the NSW Government actively seeks to attract mining companies to explore in the basin, shows that it is also prepared to allocate or grant the water licences needed for these operations.

Future water use

In 2007 it is anticipated that total water demand by the MPEPP (minerals, petroleum, energy, pulp and paper) industries will be 31,333 ML/annum, rising to 52,214 ML/annum by 2015 if these new power plants, mines and smelter upgrades are commissioned.

Water consumption is projected to rise to the level of the current extraction limit by 2013, and by 2015 annual consumption will exceed the extraction limit by 18,000 ML. (ACIL Tasman Pty Ltd, *Water Reform and Industry* p. 86.

If these projects were to proceed, **total additional annual water consumption** by MPEPP (minerals, petroleum, energy, pulp and paper) industries **could be around 430,000 ML/annum by 2015**.

By comparison, this is in the order of **69 per cent of total Sydney consumption**.

This would represent **an increase of around 50 per cent over the 2006 level of consumption by these industries.** (ACIL Tasman Pty Ltd, *Water Reform and Industry;* page 133.
http://www.minerals.org.au/__data/assets/pdf_file/0013/20236/ACIL_Water_Reform_and_Industry_May07.pdf

How is the water used?

Mines require water for most stages of their operations, including those of:

a) Exploration,

b) Ore extraction and processing,

c) Dust suppression,

d) Site amenities and for the

e) Irrigation of surrounding lands and rehabilitated areas

Source: (NSW Minerals Council, 2007).

Enquiries into the ways in which water is used by the mining industry exposed a distinct lack of specific information. The water-use data that is available from the *2006-07 New South Wales Mineral Industry Annual* provides no indication of the ways in which the water is used, indeed offering very little information about actual mining processes, preferring to emphasise the economic outcomes of mining rather than describe the means by which they are achieved.

In a fact sheet published by the NSW Minerals Council, a graph describing the relative water use for mines in the Hunter valley of NSW indicated that:

- 34 percent of water was used for 'dust mitigation'
- 23 percent in 'product processing'
- 14 percent in 'evaporation'
- 13 percent in 'tailings'
- 12 percent for 'in product coal' and
- 2 percent for 'other' (see figure 3)

Whilst these figures are area specific, they provide (in lieu of information specifically relating to the Murray-Darling basin) at least some indication of the ways in which water is used by mines, and can therefore provide some insight into the potential impacts of mining on the Murray-Darling basin and its water resources as outlined in the section below.

What are the effects of mining in the Murray-Darling Basin?

Whilst it is beyond the scope of this report to examine all of the potential impacts of mining in the Murray-Darling basin in depth, this section will outline some of the potential impacts of mining that are of particular concern to the Murray-Darling basin. Some negative impacts include:

a) Increased salinity levels as a result of mining processes

b) An increased percentage of sustainable yield being used and increasing competition for scarce water resources

c) Increases in sediment loads as a result of mining operations, and the

d) Increased potential for heavy-metal and toxin pollution as a result of mining processes

The lack of official literature that even acknowledges let alone considers the potential for these and other negative impacts from mining on the basin in either a singular or cumulative capacity immediately indicates the urgent need for further research to be undertaken and/or made available to the public.

a) ***Increased Salinity***

The National Water Commission in the *Australian Water Resources 2005* report described 'disturbances to the catchment and changes to nutrient and sediment loads' (National Water Commission, 2005, p67) as the greatest contributing factors to the degradation of the Murray-Darling Basin.

Whilst it appears that little study has been done into the actual effects that mining has on salinity levels in the basin, the potential of mining to increase salinity seems high when 'deep saline groundwater…can be used directly, such as for dust suppression' (NSW Minerals Council, 2007)

It is evident that operations that use highly saline groundwater for dust suppression not only disturb aquifiers, but are creating situations where salty runoff will inevitably enter waterways.

b) ***Impact on sustainable yield and water resource competition***

In addition to its mineral wealth, the Murray-Darling basin also sustains a significant population and is one of the nations' most important agricultural areas. Much depends on Murray-Darling water and as a result, management of the distribution of water resources must take competing interests into consideration.

As mentioned above, the percentage of the Murray-Darling Basin's sustainable yield in use is *already* between 70 and 100 percent (National Water Commission, 2005, p) and it follows that any new water allocations granted will either increase the percentage of sustainable yield in use or mean that levels of sustainable use are exceeded.

Use that exceeds sustainable levels not only brings various stakeholder interests into direct competition for scarce and vital resources, but also damages the system ensuring that less (if indeed any) water resources will be available for any purpose in the future.

c) ***Increased sediment loads***

Mining (particularly open-cut mining) requires large earth-moving operations, which disturb huge amounts of rock and earth. As the large percentage of water required for dust suppression purposes indicates, these large earth-moving operations stir up and disperse large amounts of dirt, mineral and metal deposits.

These sedimentary deposits inevitably end up in waterways as they are washed by runoff into nearby creeks and rivers. Large-scale earthworks also often require the removal of trees. This can lead to the destabilisation of banks and increases the potential for erosion, which can only contribute to increasing sediment loads in waterways.

This is of particular concern for the Murray-Darling basin considering that the National Water Commission lists 'changes to sediment loads' as a major factor contributing to the basin's degradation.

d) ***Increased potential for heavy metal and toxic pollution***

Mining operations often require the use of dangerous chemicals to extract metals/minerals from unwanted waste products. Gold mining for instance uses the toxic chemical cyanide to separate the gold from other sulphide minerals (National Mining Association 2002)

The use of such chemicals increases the potential for toxic pollution in a number of ways.

Firstly, these chemicals are often stored in tailings ponds, from which they can leach into groundwater and/or evaporate thus entering the water cycle. As the Murray-Darling basin is an agricultural region, the presence of toxic chemicals in the water cycle would inevitably mean the subsequent presence of toxic chemicals in the food chain.

The Murray-Darling basin is also home to over 10 percent of Australia's population, who source their drinking water from the system.

Secondly, chemicals must be transported to and from mine-sites. No transport system is infallible and the potential for contamination from spills is thus ever-present. A toxic chemical spill would have devastating and far-reaching effects for both the basin's environment and the many people who are sustained physically, economically and spiritually by it.

Conclusions

It is evident from this study that more research needs to be sanctioned (or made available) by the NSW Government if a full and accurate quantitative and qualitative assessment of the impacts of the mining industry on the Murray-Darling basin and its water resources is to be made.

Assessment of official documents overwhelmingly indicates that the NSW Government has, and continues to make decisions that impact upon the health of the basin with an inadequate understanding and/or care for the consequences of such decisions.

The Government's management agenda appears to reflect the pursuit of short-term economic gains ahead of the pursuit for environmental, social and economic sustainability. Federal, State and local governments must make a universal approach to the sustainable management of the basin a priority, instead of multiple departmental bodies merely producing conflicting or incomprehensive accounts.

The differences in official accounts belie any claim that the NSW government might make that the decision-making process with regard to the management of the Murray-Darling basin system is motivated by anything other than profit.

The mining industry lends nothing to the sustainable development of the Murray-Darling basin, and the NSW Government must recognise this and *act* on this recognition if the Basin is to survive.

References

Department of Mineral Resources, 2003. *Mineral Projects, New South Wales, Australia,* (map) NSW Government, Sydney.

Department of Primary Industries, 2007. *2005-06 NSW Minerals Industry Annual,* NSW Government, Sydney.

Australian Bureau of Statistics http://www.abs.gov.au

Murray-Darling Basin Commission, 2006. *Basin Statistics.* Available via: http://www.mdbc.gov.au/about/basin_statistics. Last updated: 29 October, 2006

National Mining Association, *How Gold Is Produced.* Available via: http://www.nma.org/publications/gold/gold_production.asp. Last updated: 2008

National Water Commission, 2005. *Australian Water Resources 2005.* Available via: http://www.water.gov.au/. Last updated: 2 September, 2007

NSW Minerals Council, *Water Use in the NSW Minerals Industry.* Available via: http://www.nswmin.com.au/__data/assets/pdf_file/0005/8609/Water_fact_sheet_FINAL_June2007Update.pdf Last updated: June, 2007

ACIL Tasman *Water Reform and Industry: Implications of recent water initiatives for the minerals, petroleum, energy, pulp and paper industries*, April 2007.
http://www.minerals.org.au/__data/assets/pdf_file/0013/20236/ACIL_Water_Reform_and_Industry_May07.pdf