SUBMISSION

SENATE INQUIRY INTO
The Urgent Provision of Water to the Coorong and Lower Lakes

September 2008

Wentworth Group of Concerned Scientists

IN ASSOCIATION WITH
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Photo on front cover of exposed bed of Lake Alexandrina, by Peter Cosier, June 2008

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SUMMARY

There is an unfolding environmental disaster and human tragedy in the Murray Darling Basin, mirrored in the Coorong and Lower Lakes. In the Basin, and across much of southern and eastern Australia, dry conditions have persisted for a decade.

Salinity levels in the southern Coorong now exceed the maximum levels tolerated by the plants and animals that underpin the international status of these wetlands, and acid sulfate soils lie ready to be exposed and release acid into the water if lake levels were to continue to fall.

We are also facing an economic emergency, with many businesses and regional communities facing yet another season without water.

The science suggests that the weather patterns in southern Australia have shifted to a dry phase. While the precise role of cyclical changes versus the impact of greenhouse gases remains unclear, changes in the basin are consistent with CSIRO computer modelling of the impacts of increased concentrations of greenhouse gas in the atmosphere.

We must reduce our extractions to (1) correct our over-allocation during a period of plenty, (2) to be more sustainable under climate cycles we have experienced in the past and (3) to adjust to declining water availability under climate change.

The magnitude of the adjustment is massive - beyond anything that has been contemplated before in the Australian community. It will have profound implications for the future of the Coorong and Lower Lakes, for water resource management across the Murray Darling Basin, and the cities, towns and rural communities that rely on the rivers.

If we are to maintain healthy rivers and provide high quality water to produce food, our analysis suggests that the consumptive use of water across the Murray Darling Basin may have to be cut by between 42 and 53 percent below the current cap.

This will require a re-design of our irrigation industries to bring the demand for water into alignment with the greatly reduced supply capacity from the rivers and groundwater.

The Coorong and Lower Lakes

In their current condition, the barrages should not be opened to flood the Lower Lakes with sea water. This would cause irreversible damage. Instead, the Commonwealth should guarantee river flows into Lake Alexandrina and Lake Albert, to secure a sufficient reserve to maintain lake levels at no lower than -0.4 AHD[1], and thus avoid any significant release of acids this coming summer and autumn.

If it proves that such flows are not available, then as a last resort a 'shandy' process of allowing sea water into Lake Alexandrina should be undertaken. However, this should only occur once acid release is observed, and is not being buffered by existing lake waters, and other techniques of coping with acids are shown to be ineffective. Consideration should also be given to pumping out 50GL of hyper-marine water from the southern Coorong.

The Commonwealth should respond to the crisis in the Coorong and Lower Lakes by establishing a Commission of Inquiry to assess the scientific and engineering options for securing the long-term health of the Coorong and Lower Lakes, including engineering options to downsize the system upstream, and recognising the likely prospects for permanently reduced end of river flows.

An Interim Basin Plan

We can choose to do nothing or we can facilitate and expedite restructuring of our irrigation sector and the system that supplies it so that it continues to produce wealth by using water more efficiently without degrading the rivers upon which this wealth is based. However, in making this choice, we must recognise that there will be significant consequences for all who live and work in the Basin.

Moving quickly will provide water users with the capital they need to restructure their industry. If these reforms drag on for a decade or longer we risk the collapse of irrigated agriculture, causing social dysfunction across the Murray Darling Basin.

Our analysis shows that we need to recover over 4,000 GL of water to have a good chance of securing river health. The total cost sits between $8 billion and $9 billion.

The Federal Government has accelerated reforms with the $12.9 billion *Water for the Future* program[2] and has now started buying water on the market. This is a significant step forward.

It is apparent, however, that these reforms will not deliver the water savings that the science says is needed, nor will they deliver them quickly enough to avert an economic and environmental crisis, because most of the large scale water efficiency measures that were sensible have already been done. The majority of the infrastructure investment projects that were announced in July are therefore likely to fail a cost benefit analysis, in terms of the environmental benefit achieved from the investment[3].

All investments should be subjected to a common cost benefit test to ensure value for the money invested. The *Sustainable Rivers Audit*, released in June 2008[4], provides a mechanism for assessing value for money, whether it be the purchase of a water entitlement, or funding of infrastructure improvement.

While the water markets will facilitate much of this re-allocation, we will also need a structural adjustment and social process to expedite and foster the transformation.

The current $5.8 billion investment in infrastructure should be suspended and combined with the $3.1 billion water buyback program. The combined $8.9 billion is likely to produce significantly more water for the longer term health of the rivers.

If this program was then brought forward over the next 2 years, through an Interim Basin Plan, it will also provide another important dividend – a social benefit - by contributing a major incentive for structural adjustment.

This is the only way that we will achieve the volumes of water required to meet the needs of our rivers and underpin the long-term viability of our industries and communities who rely on a healthy working river.

A COMMISSION OF INQUIRY INTO THE COORONG AND LOWER LAKES

The people of South Australia, particularly those who live with these internationally significant wetlands, have a strong and natural passion to defend the health and future of the Coorong and Lower Lakes.

Many of those who live on the Murray Lakes are resigned to a future without irrigation water and are adjusting their businesses accordingly. They also recognise that there are no simple, silver-bullet solutions to restoring the short or long term health of the Coorong and Lower Lakes.

What they will not accept is inaction and the destruction of one of the world's great wetlands.

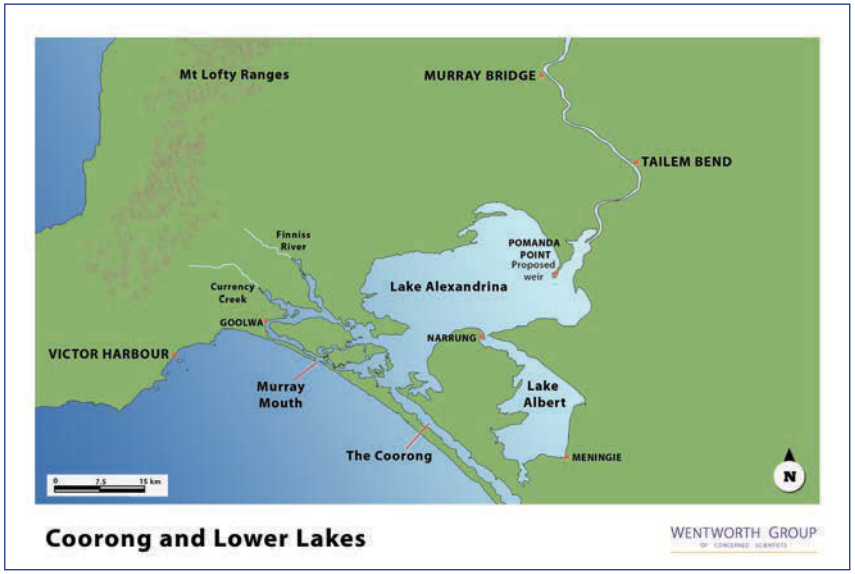
Do we need a functioning Murray estuary?

The Coorong and Lower Lakes are one of 15 wetlands in the Murray Darling Basin that are recognised internationally for their environmental significance. It provides habitat for more than 30% of the migratory waders summering in Australia. It achieved this international status because of the diversity of wetlands: fresh, estuarine and hyper-marine and because of the importance of the area to vast numbers of water birds: ducks, swans, pelicans, terns, grebes, and migratory sandpipers and endemic shorebirds (stilts, avocets)[5].

The ecological character of the Lower Lakes and Coorong depends upon the estuarine character of the environment. An efficient entrance allowing for tidal exchange combined with freshwater inflows is therefore fundamental to a functioning Murray estuary.

Half of the 60 fish species recorded from the Murray Darling Basin are marine or estuarine species that gain access to the river via the Murray Mouth. Some breed in fresh water but live in the sea for part of their lives others breed in the sea but live in fresh water.

Without the interchange between fresh- and salt-water, the Coorong and Lower Lakes would become hyper-marine lagoons over time.



Can we save the Coorong and Lower Lakes?

In the last 5 to 6 years, with no flows of freshwater over the barrages, salinity has risen to levels of 180-200ppt TDS (total dissolved solids) during summer.

Salinity in the southern Coorong exceeds the maximum levels that key fauna can tolerate. Small hardyhead fish and midge larvae abounded in the southern Coorong throughout the 20th century, when salinity did not exceed about 100ppt TDS.

The fish and midges have now gone from the southern Coorong and with them the waders and the fish-eaters, the pelicans, terns, and grebes. The lack of flows has led to water levels in the South Lagoon dropping in spring instead of late summer, preventing the key annual aquatic plant, *Ruppia tuberosa*, which is an important food source

for waterfowl, from completing its life cycle. After years of negligible reproduction this plant has disappeared from the entire South Lagoon and so has its seed bank.

A time bomb may be released if lake levels stay low for a sufficient period, exposing soils to air and allowing the oxidation of sulfides contained in these lakeshore and floor sediments. The capacity of present lake water to buffer persistent acid influx will decline with time, converting the remaining waters of Lakes Alexandrina and Albert into water like battery acid.

Mapping potential acid sulfate soils by CSIRO show the threat to a functioning estuary unless actions are taken. Mapping changes to the river entrance involving expansion of entrance shoals since the barrages were built highlights the additional threats to estuarine functioning due to reduction in tidal amplitude.[6]

What are the immediate options?

To have a healthy, functioning estuary you need both a regular exchange of water with the sea and an inflow of fresh water from the river. Simply building a weir or lowering the barrages does not provide this outcome.

Opening the barrages to the sea without an adequate flow of fresh water through the Murray Mouth will cause the Lower Lakes to become hyper-marine (saltier than seawater), and irrevocably so, unless engineering works are constructed to keep the entrance permanently open.

Even with the provision of additional environmental flows, the future health of the Coorong and Lower Lakes will almost certainly require on-going active human intervention.

Given the over-allocation of water across the Basin, prospects of drier conditions in the future, rising sea levels and reduced runoff as a consequence of climate change, it is unlikely that the Lakes can be maintained as a permanent freshwater system. Managed well, this is not necessarily a bad outcome.

With regard to the southern Coorong it is critical that action be taken now to reduce its hyper marine state. One option is to pump around 50GL of water from its southern lagoon.

In the Murray estuary, prior to barrage construction in 1939-40, the boundary between fresh and salt water moved up- and down-stream with changes in the balance of fresh- and salt-water inflows. Properties at the southern end of Lake Alexandrina had both fresh and salt-water at various times in nearly all years. By October or November the lake waters usually became too salty for cattle to drink, usually until the end of autumn, when fresh water started to flow back into the lake[7].

To halt the advance of salty water, a series of five barrages was constructed in 1939-40 across the seaward margins of Lake Alexandrina. The barrages have operated now for nearly 70 years, maintaining fresh water in Lake Alexandrina and Lake Albert, in the face of declining river flows.

Pre-European annual average discharge at the Murray Mouth is estimated to have been 12,000 GL. Over the last ten years, the annual average discharge has been reduced to 2,700 GL[8], or 23% of the natural figure. However, as the lake levels drop below mean sea level, there is no opportunity for fresh water to reach the sea and the entrance has to be continually dredged to stay open.

To secure the health of the Coorong and Lower Lakes in the long term is even more challenging. Sea levels are rising at an accelerating rate and may be as much as 0.5 to 1.0m higher later this century. The critical need to maintain lake levels near mean sea level with some freshwater input requires options that are more dramatic than needed for short term health of the Murray estuary system.

Given the prospects of declining river flows, we should look at all the options now.

Why not open the barrages?

Many claim that a simple solution is to open the barrages and allow the sea to flood the lakes.

This assumes that the Murray Mouth would remain open, which is unlikely along such a dynamic coastline where sand is constantly in motion. Entrance breakwaters would be very costly, although they may be necessary in the long term. The dredges that have kept the Mouth open in recent years are not adequate.

Even if an open channel could be maintained, it is likely that tidal action would be insufficient to drive water into and out of the lakes. In the absence of more infrastructure, Lakes Alexandrina and Albert would develop saline marshes around the shore and the Coorong would become a hyper-marine lake.

Once you let that volume of sea water in, without a major flood event, it would be nearly impossible to get it back out, because most of the water will be below sea level. We should not, therefore, allow sea water to enter the lakes until the lake levels have been restored with fresh water.

A weir at Pomanda Point?

Site preparations have commenced, although the government maintains that there is still only a 20-30 percent chance that the weir will be constructed.

The proposed new weir, at the point where the Murray empties into Lake Alexandrina, would cost at least $120 million to build. It would be a temporary structure, because it is expected to sink into the soft underlying sediments within 3 to 5 years. The main function for the proposed weir would be to maintain a potable water supply for Adelaide and some rural centres over the coming summers.

In environmental terms however, another weir is likely to exacerbate rather than solve the environmental problems along the river. There already are 10 weirs on the river below the Murray Darling junction, dominating the river over nearly 600 kilometres. They were built originally to support year-round navigation by riverboats, but their primary function now is to maintain stable water levels for irrigation offtakes.

The hydraulic effects of the weirs entrain large amounts of salt from underlying groundwater. Rather than being flushed to the sea, the salt is accumulating in the floodplain soil from where, eventually, it must be purged if the land is not to be laid waste.

The weirs also limit over-bank flows so that the river and its floodplain wetlands and woodlands are alienated for long periods. The effect of weir-pool construction has been to create lake-like environments in place of the former free-flowing river.

Can we 'shandy' lake waters?

The most recent information is that local rainfall and reduced evaporation over winter have seen Lake Alexandrina rise from a record low of 0.5 m below sea level (AHD) to its current level of -0.26 m AHD[9]. Should further rain fall before summer, it is possible that sufficient water will be in the lake system to avert the release of sulfuric acid in the current year.

Notwithstanding this, in the absence of an audit, the barrages should not be opened to flood the Lower Lakes with sea water. Instead, the Commonwealth should guarantee river flows into Lake Alexandrina and

Lake Albert, to secure a sufficient reserve to maintain lake levels at no lower than -0.4 AHD, and thus avoid any significant release of acids this coming summer and autumn.

If it proves that such flows are not available, then as a last resort a 'shandy' process of allowing sea water into Lake Alexandrina should be undertaken. This should occur only once acid release is observed, and is not being buffered by existing lake waters, and only if other techniques of coping with acid soils are shown to be ineffective.

The management as a sustainable estuarine environment will require very careful monitoring because it is not returning the Lakes and Coorong to their natural state – that has gone forever. We are proposing a new estuarine environment. As proposed below, a Commission of Inquiry would drive the creation of a new regime of marine and freshwater flows to create over time a new estuarine and coastal lake environment for the Murray River. A bold way forward, but one that we maintain is possible. It would require careful design based on science and engineering.

Let the river flow:

A more equitable and sustainable outcome is possible and requires that we make appropriate allocations to the environment.

For the Lower Lakes this would mean a commitment to provide at least 800 GL and periodically a pulse of more than 2,000 GL per year of fresh-water flows into Lake Alexandrina. The core of this inflow needs to be sourced from the River Murray, underpinned by flows from streams and groundwater in the Mount Lofty Ranges. Periodic flushes will need to come from both the Darling and the Murray systems.

With the help of the existing barrages it might be possible to maintain lake levels near mean sea level and periodically release flows of fresh water into the Coorong, depending on how the entrance is managed. Ideally, the inflow would drive the salt-water southward, and feed Lake Albert and the Coorong before its discharge into the ocean.

During seasons where there is a sufficient discharge into Lake Alexandrina, it might be possible to open the barrages more frequently, allowing the Murray Lakes to revert to something like their original character, as a reservoir feeding the estuary of the Murray.

Are there other options?

The current emergency has brought into the public domain a range of ideas for improving the health of the Coorong and Lower Lakes, both for the short and long term. Some involve engineering actions along the Coorong, river entrance works, a desalinisation plant at Goolwa, using wind and wave energy, and enhanced transfers of freshwater from the South Eastern Drainage Scheme into the southern Coorong.

One option is the suggestion of constructing a new regulator or weir between Clayton and Hindmarsh Island, to isolate and conserve the freshwater system at the headwaters of the Finniss River and Currency Creek[10]. This is an area that has the best habitat for the Murray hardyhead, an endangered freshwater fish.

Another option is to decommission Lake Albert as a permanent lake, converting it into an ephemeral wetland or swamp, perhaps with areas of paperbark ti-tree, reeds and/or samphire established within the lake's footprint. The freshwater saved from Lake Albert (which could be as much as 200 GL) might then be used to increase the volume of fresh water available to Lake Alexandrina, and the Coorong and Murray Mouth.

To help the southern Coorong, it may also be necessary to soon begin pumping 50GL of highly hyper-marine water from the lagoon into the ocean. The resultant inflow of waters into the Coorong will reduce salinity and give this ecosystem a chance of surviving until a management system for the entire estuary can be put in place.

How can we secure the long-term health of the Coorong and Lower Lakes?

We are not suggesting that these are the best or only options. What they show is that there is an abundance of ideas that, given a proper environmental assessment, make it highly likely that we can restore the long-term health of the Coorong and Lower Lakes.

The health of the Murray estuary has been the constitutional responsibility of the South Australian government, and it should have commissioned such an assessment some time ago when it became evident that the Coorong and Lower Lakes were in trouble.

With its listing under the Ramsar Convention, the Commonwealth government also now has a constitutional responsibility to protect the ecological character of these wetlands. It would be acting contrary to its own *Environment Protection and Biodiversity Conservation Act* if it did not do so.

The Commonwealth should take control of this crisis in the Coorong and Lower Lakes by establishing a *Commission of Inquiry* to assess the scientific and engineering options for securing the long-term health of the Coorong and Lower Lakes.

The task of the Inquiry would be to assess the scientific and engineering options for securing the long-term health of the Coorong and Lower Lakes, engineering options to downsize the system, and recognising the likely prospects for permanently reduced end of river flows.

This Commission of Inquiry should have the powers of a Royal Commission. It should be chaired by a prominent Australian, preferably a South Australian, and should report to the Australian Parliament within 6 months.

Many people and many organisations have developed ideas and made proposals that have yet to be considered. It should therefore be a public inquiry where all innovative ideas are encouraged, and all evidence is made available for scrutiny and analysis.

AN INTERIM BASIN PLAN

The Coorong and Lower Lakes are just one of several significant wetlands across the Basin that are in trouble.

We are also facing an economic emergency, with many businesses and regional communities facing yet another season without water.

The crux of the problem, and the key to its solution, is that the current allocations of water in the Murray Darling Basin cannot be sustained.

The good news is that governments have agreed on how to manage water more sustainably (the 2004 COAG *National Water Initiative*), a means to implement the reforms (through a *Murray Darling Basin Plan* in 2011), and resources to fund the adjustment process (the $13billion *Water for the Future* program announced in April this year).

All that remains is the will to act.

We need to respond to the environmental and human crisis by accelerating the reforms. The Commonwealth can lead this through an Interim Basin Plan which sets long-term goals for the environmental health of the basin, establishes how much water is needed to achieve these goals, and puts in place a mechanism to accelerate the buyback of water by combining the water buyback with the irrigation efficiency program and then provide structural adjustment to support regions most affected by these reforms.

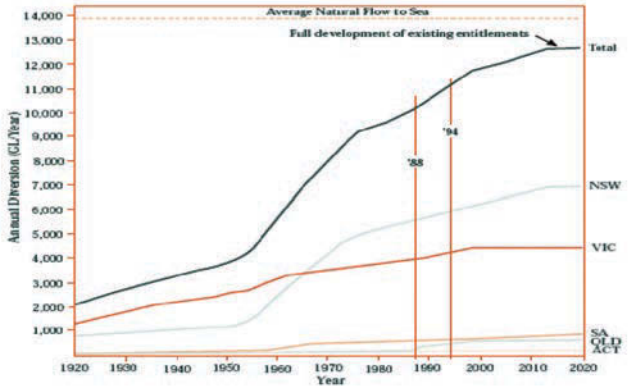
Our level of use of water is not sustainable.

Before Europeans arrived, the average flow to the Murray Mouth was around 12,000 GL a year - about the volume of 24 Sydney harbours[11]. By Australian standards this is a big river system: its catchment covers one seventh of the continent. But by world standards it is tiny.

Water is a precious resource in Australia and we are wasting it. In the process of developing the inland, we have degraded our river systems and this now puts at risk not only the environment, but also the viability of dependent industries and communities.

The fastest growth took place after 1955. By 1965 consumptive use had exceeded sustainable yields, yet it was not until 1997 that we placed a cap on further extractions.

Figure 1: Growth in Water Use in the Murray Darling Basin[11]



The first *Sustainable Rivers Audit*[12] of river health, released in June this year, shows that the vast majority of rivers in the Murray Darling system now show signs of long-term ecological degradation. Of the 23 river valleys in the Basin, only one, the Paroo, across the Queensland-NSW border, is in 'good' health. More than half (13 valleys) are in a 'very poor' condition.

Table 1: Health ratings of river valleys of the Murray Darling Basin

Health Rating	River Valley
Good	Paroo
Moderate	Border Rivers, Condamine
Poor	Namoi, Ovens, Warrego, Gwydir, Darling, Lower Murray, Murray Central
Very Poor	Murray Upper, Wimmera, Avoca, Broken, Macquarie, Capaspe, Castlereagh, Kiews, Lachlan, Loddon, Mitta Mitta, Murrumbidgee, Goulburn

Our weather is changing

Two years ago the Wentworth Group warned that the evidence was growing that this was more than just a drought[13]. We warned that our continent is getting hotter, that rainfall patterns have changed significantly and it is likely that southern Australia has experienced a step change in its weather patterns, more reminiscent of the pre 1950s, than the high rainfall period we experienced since. Since then conditions have worsened.

In the last 50 years of the 20th century (between 1951 and 2000), high rainfall resulted in average surface water availability of 16,500 GL per annum[15]. By comparison, in the first half of last century (the 50 year period between Federation and 1950) water availability was only 13,500 GL per annum.

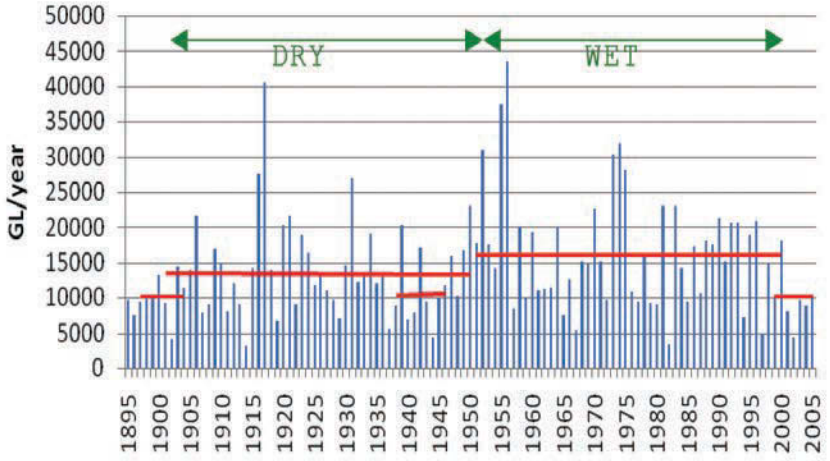
In the past decade we have seen the weather patterns shift, with a dramatic decline in runoff.

The average annual inflow between 1998 and 2005 of 10,500GL is similar to that experienced in the only two comparable previous major droughts (10,300GL in the Federation drought of 1897–1904, and 10,550GL in 1938–1945)[16]. With the benefit of hindsight, we can now see the mistake: we over-allocated water resources in a period of relatively high rainfall.

The predicted impact of climate change on water resources in the Basin prescribes an even bleaker future. CSIRO estimate that global warming could cause a decline in rainfall in the southern Murray Darling Basin by up to 10 percent[17] within the next 25 years, with a consequential fall in runoff into our river systems of up to 40 percent[18].

Australia has a problem: impose 2008 levels of water consumption on pre-1950s weather patterns, and factor in the prospects of less water because of climate change, we will be struggling to maintain the health of our rivers and provide water for our cities and farms.

Figure 2: Murray Darling Basin surface water availability



Modelled using historic climate and current development.[14]

What is required to achieve sustainable levels of extraction?

Whatever the future, it is critical we provide enough water to the river to ensure it continues to function, because without a functioning river, we will not have viable communities.

The environment has not been given the priority it should.
If we want healthy communities, we have got to have a healthy river.
That is commonsense[19].

In 2004, all Australian governments signed an agreement to achieve just that. The Commonwealth and all State and Territory governments committed to return overallocated water systems to sustainable levels of extraction[20]. This commitment is now entrenched in Commonwealth legislation[21].

A first and fundamental step towards achieving this reform is to define what 'sustainable levels of extraction' means.

We argue strongly that a modern 21st century Australia is entitled to expect that any plan for the Murray Darling Basin should aim to achieve three things:

1. To restore and maintain all major rivers and floodplains in the Murray Darling Basin in a healthy condition;
2. To manage the Coorong and Lower Lakes as a healthy functioning river estuary; and
3. To improve or maintain the health of wetlands of national and international significance.

What is healthy? The Sustainable Rivers Audit describes healthy rivers as ensuring "the long-term integrity of the system is preserved while meeting human needs"[22]. It does not seek, as some believe, to return rivers to a so-called 'natural' pre-European states.[23]

How much water do we need?

History tells us that if we remove more than two thirds of the natural flow we will cause significant damage to river health and that flow regimes of less than half natural flow will mean that it is highly unlikely that a river will be capable of remaining healthy in the long-term.[24]

The most recent science estimates that to have a moderate to high probability of having a healthy southern connected river system in the Murray, will require between 1,630GL and 3,350GL of new environmental flows[25]. If these estimates are extrapolated across the whole of the Murray Darling Basin[26], we will need to recover between 2,116GL and 4,350GL of additional environmental flows if we are to achieve our stated goals. If this is added to the existing environmental flow component of available surface water the environmental flow will be between 4,609GL and 6,843GL[27].

These are the best estimates that science can provide at this time. While further research should be commissioned, we judge these estimates to be reasonable if not conservative estimates of what our rivers need to maintain their functionality and thus support long-term availability of quality water.

Having calculated these volumes, we now have the basis for estimating how much water for the environment the science says is needed.

Table 2 shows the percentage of available surface water required for the environment for three scenarios:

- no added impact from climate change or any other future losses in runoff;
- a 2030 'best estimate' of climate change and losses from unregulated future developments such as commercial forestry and farm dams[28]; and
- the 'worst case' climate change impacts and other losses.

Table 2: Environmental flows needed for a healthy Murray Darling Basin[29]

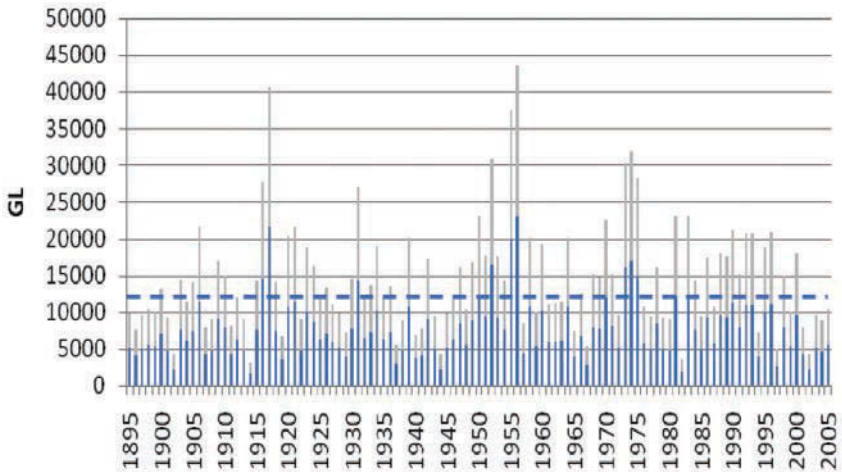
Volume of environmental flows to give a moderate to high probability of a healthy river	Average available surface water	Percentage of available surface water for environmental flows
With no added climate change impacts		
Moderate probability (4,609 GL/year)	14,493 GL/year	32%
High probability (6,843 GL/year)	14,493 GL/year	47%
2030 best estimate of climate change and development (11% reduction in surface water availability)		
Moderate probability (4,609 GL/year)	12,899 GL/year	36%
High probability (6,843 GL/year)	12,899 GL/year	53%
2030 dry extreme of climate change and development (38% reduction in surface water availability)		
Moderate probability (4,609 GL/year)	8,986 GL/year	51%
High probability (6,843 GL/year)	8,986 GL/year	76%

These percentages show a long term allocation of available surface water for the environment, some of which could be traded in any given year depending on the needs of the environment at the time.

The following graph illustrates the likely impact on historical flows with a 47% environmental flow allocation to restore river health, but no other impacts such as climate change or new development.

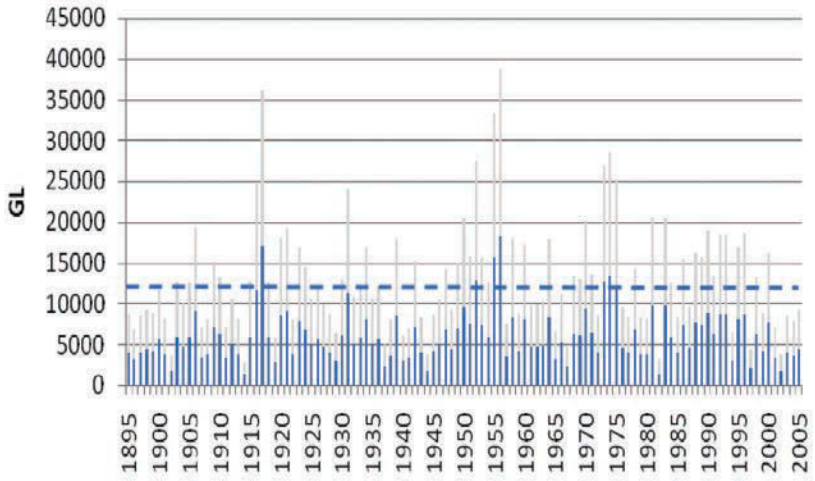
The grey indicates environmental flow proportion of total surface water availability for each year and the blue indicates the water that would have been available for consumption with an environmental flow allocation of 47%. The dashed line is the current cap.

Figure 3: Water available for consumption with no climate change impact and a high probability of a healthy working river[30]



This next graph shows, in a general sense, the likely impact on the availability of water for consumptive use with climate change and new development (-11%) and an environmental flow allocation of 53%.

Figure 4: Water available for consumption with climate change and development and 53% allocation for the environment[31]



The grey indicates environmental flow proportion of total surface water availability for each year and the blue indicates the water that would have been available for consumption with an environmental flow allocation of 53%. The dashed line is the current cap.

How much water can we take from the rivers?

Having established the environmental needs of the river system, it is now possible to estimate the percentage reduction in allocation to irrigators and other consumptive users if we are to achieve sustainable levels of use.

The scale of the impact will depend on what happens to our weather systems in the coming years.

There are three possibilities:

- things will get better: we might enter another period of high rainfall and floods such as we experienced in the 1950s; or
- there has been a climate shift: part of the normal pattern of Australia, similar to a pre-1950s low rainfall pattern; or
- we cop a double whammy: where there has been a tipping point in the climate system in southern Australia to a far lower rainfall pattern that is then exacerbated by higher evaporation and less runoff caused by climate change.

Table 3: Implications of river health flows on water allocation by 2030[32]

Period	Average surface water availability for diversion (GL/year)	Cap volume (GL/year)	Percent of cap available for diversion	Percent below the current cap
High probability of a healthy working river with no climate change impact				
1901 – 1950	7181	12,000	60%	40%
1951 – 2000	8796	12,000	73%	27%
High probability of a healthy working river with 'best estimate' reduction in runoff from climate change and development (11%)				
1901 – 1950	5667	12,000	47%	53%
1951 – 2000	6942	12,000	58%	42%
High probability of a healthy working river with 'worst case' reduction in runoff from climate change and development (38%)				
1901 – 1950	2016	12,000	17%	83%
1951 – 2000	2470	12,000	21%	79%

If things get better:

The Sustainable Rivers Audit shows that even in a time of plenty we have been taking too much water out of our rivers.

If the current weather patterns suddenly change back to patterns similar to that experienced in the post 1950s wet cycle and climate change does not reduce river runoff, we should be able to achieve our goals with a fall in consumptive use across the basin by 27%.

If the weather systems have moved into a dry sequence:

If we have returned to a pre-1950 dry sequence, our goal of "returning rivers to sustainable levels of extraction"[33], becomes more difficult. We will need to reduce water consumption by town, cities and irrigation across the Basin by up to 40 percent.

If we cop the double whammy:

The most recent modelling by CSIRO suggests that higher temperatures, increased evaporation and changed weather patterns as a result of climate change combined with the continued development of groundwater extraction, forestry and farm dams will decrease surface water availability by 11% by 2030. This work is conservative in its assessment of groundwater impacts and does not account for tree planting accessing carbon credits.

If we have to manage the double whammy of a return to a dry pre-1950s sequence coupled with our best estimate climate change, then water available for consumption use will fall by up to 53%.

If the 'worst case' climate modelling is correct, water consumption will reduce by 79% to 83%: irrigated agriculture as we have come to know it will no longer be possible in the Murray Darling Basin and Adelaide will almost certainly need to cut reliance on the River Murray for fresh water.

It will also mean almost no chance of restoring the rivers, wetlands and estuaries in the Basin to good health.

We must plan for a future with less water

The cause of these changes can only be known retrospectively, once sufficient time has passed for any possible effects from climate cycles to have occurred. We cannot know which of these is to be our future. We cannot know if it's a short phase drought, whether we've returned to a pre 1950s dry weather pattern or whether climate change has permanently changed Australia.

Whatever the cause, the drought has exposed what we have known for many years: that current levels of extraction from our rivers and groundwater systems are unsustainable.

The science suggests that the most likely outcome is that our weather patterns have shifted to a dry sequence and that over the next 20 years, this dry sequence will be increasingly exacerbated by the effects of climate change.

The consequences of the most likely future weather patterns in the Murray Darling Basin is that our consumptive use of water will need to be cut by between 42 and 53 percent.

This has profound implications for the future of water resource management and the towns and cities and rural communities that have relied on the rivers.

It may require a complete restructuring of irrigated agriculture in the Basin, requiring us to put in place structural adjustment programs in some regions, in the same way government mobilised to address the closure of BHP in Newcastle in the 1990s and more recently the closure of the Mitsubishi car manufacturing plant in Adelaide.

Doing better with less water

If the science is anywhere near right and if we have to halve the amount of water taken out of the rivers to ensure that irrigated agriculture survives what will that agriculture look like?

The answer is, that we don't yet know because we have collectively (government, research, industry) failed to develop the technologies and farming systems required in a modern 21st century economy. Market failure in irrigated agriculture research and development must be redressed as a matter of urgency.

Irrigation landscapes will change as the amount of water available for irrigation reduces. New crops will be grown and old ones grown differently as the current security of supply decreases and the capital value of water increases. There is likely to be a reduction in the area of permanent plantings and pasture and perhaps more emphasis on annual crops that can be planted once water availability for the season is known. This trend is evident in the current data (Figure 5 and 6)[34].

We need an irrigation industry which is resilient and therefore able to adapt to even more highly variable climatic conditions. Irrigation properties are likely to become larger and farmers will develop more sophisticated approaches to deciding which commodities to grow based on water availability and market price.

Figure 5: Net water consumption

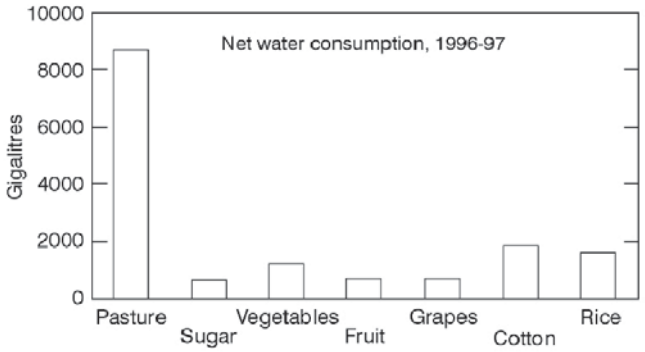
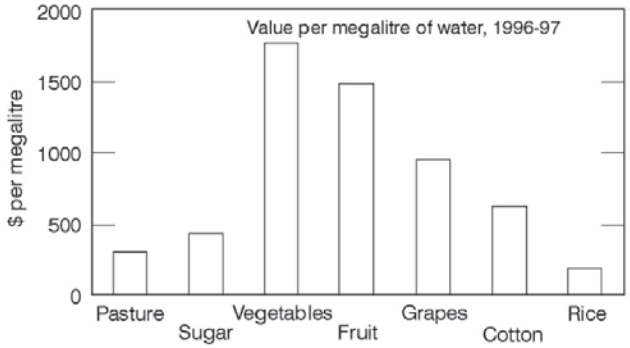


Figure 6: Gross return per unit of water



Australians need vibrant irrigation industries which can produce the high quality, clean food and fibre and which are able to create wealth to underpin the economic performance of the regions in which they are established.

Water trading is a key way for new or expanding enterprises to gain access to water. On the other hand selling some water can fund investment in water efficiency or other inputs that build resilience into dryland farming, or allow entitlement holders with degraded land to realise a return on their assets and change their business.

A well crafted structural adjustment process will be crucial in facilitating and building the capacity that regional communities dependent on irrigated agriculture require to be transformed to a new future.

Fast track the acquisition of environmental water

In April 2008, the Commonwealth announced a $12.9 billion, 10 year *Water for the Future* program, designed to secure the long-term health of water resources in Australia. It includes $3.1 billion to purchase water entitlements and $5.8 billion to improve water efficiency in the Murray Darling Basin[35].

The Federal Government has begun to buy water on the market and has recently agreed to accelerate these reforms. This is a significant step forward. However, these reforms will not deliver the water savings that the science says is needed, nor will they deliver them quickly enough to avert an economic and environmental crisis.

Without a dramatic downsizing of the supply system and abandonment of agreed environmental objectives, our analysis shows that we need to recover over 4,000 GL[36] of cap equivalent water to have a good chance of securing river health. The average cost would likely be between $2 million per GL and $2.25 million per GL, which translates into a total cost of between $8 billion and $9 billion.

We have two choices: we can dip further into the budget surplus or we can target our investments more effectively.

Buy water before upgrading infrastructure

In July this year, the Commonwealth agreed in principle to fund $3.7 billion of "significant water projects" in South Australia, New South Wales, Victoria, Queensland and the ACT, "subject to a due diligence assessment of the social, economic, environmental, financial and technical aspects of the projects".

Whilst the list of projects might seem impressive, a cursory assessment suggests that the vast majority are likely to fail any cost benefit analysis, in terms of the environmental benefit achieved from the investment[37]. Most of the large scale water efficiency measures that were sensible have already been done.

In 2006, an analysis of similar projects[38] announced under the former 'Water Smart Australia Projects' found similar outcomes. For a Commonwealth investment of $400 million, only 155GL of savings was being promised, at an average cost of over $6 million per gigalitre. Tax payers were paying over 4 times the market price for water.

Governments should not be spending money upgrading unviable irrigation infrastructure. The current investment in infrastructure should therefore be suspended, combined with the water buyback program and all investments subjected to a common cost benefit test to ensure value for the money invested.

This is the only way that we will achieve the volumes of water required to meet the needs of our rivers and underpin the long-term viability of our industries and communities who rely on a healthy working river.

The combined $8.9 billion is likely to produce significantly more water for the longer term health of the rivers. If this program was then brought forward over the next 2 years, through an Interim Basin Plan, it

would also provide an important social benefit by contributing a major stimulant to structural adjustment of the industry throughout the basin.

Target investments to maximize benefits

The *Sustainable Rivers Audit* released in June 2008[39] allows us to provide, for the first time, a mechanism for transparently assessing value for money, whether it be the purchase of a water entitlement, or funding of infrastructure improvement.

The accounting framework that underpins this Audit allows the development of an environmental benefits index that can be used to assess 'value for money' for water purchased. It allows us to compare the improvements likely to be achieved in the flows and subsequent improvements in river health in different valleys, for the dollars invested.

Direct purchase of water entitlements, water efficiency improvements, the purchase of land and water, and other options, should all be evaluated by the same metric. Water entitlements offered at a higher price may still be preferred to entitlements at lower offer prices provided they generated a proportionately larger environmental score. If projects do not generate a sufficiently high enough environmental score, then the money should not be invested.

River health must have equal status

In 2004, COAG set the rules for the future sustainable management of Australia's water resources. One important principle of the National Water Initiative is that: "*water that is provided … to meet agreed environmental … outcomes … be given statutory recognition and have at least the same degree of security as … consumptive use*."

Despite this agreement, water buybacks for the environment are unlikely to achieve the environmental benefits that we need, because the environment still continues to 'play second fiddle' to water diversions in times of water stress.[40]

This is because the existing allocation rules in many parts of the Basin still accord priority to consumptive uses, despite the fact this runs counter to the National Water Initiative and the Commonwealth's 2007 Water Act[41]. For example, in the past ten years, Victoria's water share of the Murray River inflows has declined by about a third relative to the long-term average. Although this has resulted in a 10% decline in diversions for consumptive use, environmental flows have fallen by over 40 percent (Table 4).

Table 4: Inflows, Diversions and Environmental Flows for Victoria's Share of Murray River Water

Health Rating	Total Inflows	Diversions	Environmental Flows
Long-term mean	7,062 GL	1,698 GL	3,946 GL
10 year mean	4,746 GL	1,533 GL	2,221 GL
% Change	- 33%	- 10%	- 44%

source: Craik, 2008[42]

The solution is to modify the water title system in the 2011 Basin Plan, to ensure the environment is given a formal entitlement to all allocations of water to the shared water pool. In order to manage risk, the environment should be given a formal share of every type of water entitlement in the Basin and allowed to carry forward or sell any unused water allocations with adjustment for evaporative losses.

Government will need to strike a balance between the purchase of high security and general security water to ensure that the buyback is able to satisfy these requirements in the final Basin Plan. In the southern connected River Murray system we should aim to secure 10% of each type of water entitlement in this system for the environment. This would require the purchase of at least 1,100 GL of cap equivalents.

Options for accelerating water buyback

There are a number of mechanisms that the Australian Government could pursue to accelerate the buy back of water:

- buy water offered for sale by entitlement holders, such as with the recent Commonwealth purchases;
- an off-market buy-back, as often takes place in private sector companies;
- negotiating bulk purchases with water supply companies; or
- negotiating a conditional access arrangement, such as the River Reach proposal.

In practice, a mix of approaches may be necessary. Whatever mechanisms are used, the Australian government should clearly signal that the budget for water buy-backs is limited and time-bound, that it will be "a prudent purchaser", and will only make purchases that satisfy the Commonwealth's "good value for money" test.

As an interim arrangement, we suggest that a combination of accelerated water purchases and policy reforms should seek to put in place a regime that gives first priority to the provision of water needed for essential system maintenance and conveyance needs coupled with that needed to meet critical human needs.

Facilitating structural adjustment of the irrigation sector

The impact of this prolonged drought makes it inevitable that there will be structural adjustment in the Murray Darling Basin, whether or not inflows return to what has been regarded as a "normal" pattern. Many small businesses in irrigation districts are reconsidering their future, some are taking the plunge, but many will move slowly out of fear of change.

History suggests that most attempts to impede autonomous adjustment backfire, with the most significant adverse impacts often on the capacity of the most talented in a district or an industry to innovate[43]. Structural adjustment can be done well or very badly. Small dollops of taxpayers funds skilfully applied to target areas can greatly speed up adjustment process, especially if there are substantial public benefits at stake.

It is not the role of government to bail out businesses for making investment decisions. It is however, the responsibility of government to assist communities adjust to new economic circumstances imposed on them, particularly when the cause of the economic problems is a consequence of flawed policies of previous governments.

There is a case for government assistance through structural adjustment as part of the acceleration of water reform in the Murray Darling Basin. Firstly, the economic difficulties in many of the irrigation centres are a direct result of bad public policy. People made decisions and built businesses based on these government policies and government, therefore, has to take some responsibility for the consequences.

Secondly, timely adjustment is usually more economically efficient and leads to better long-term structures. Facilitating rapid adjustment and reinvestment minimises transactional losses and creates greater certainty for communities to move forward.

The alternative is to do nothing, with the consequences that the adjustment risks becoming a genteel decline into poverty with long run financial and social costs for governments.

The Australian Government should implement a structural adjustment program, funded separately to the water buyback, targeted to those districts where the buyback of water will cause significant social and economic disruption to the regional economy.

CONCLUSION

The inaction of COAG in response to the crisis in the Murray Darling Basin exposes a policy paradox. In her 1984 book "The March of Folly", the American historian Barbara Tuchman examined the tendency, over a long period of history, for governments (and the societies they represent) to act stubbornly and perversely against their own best interests.[44]

Tuchman's definition of folly requires that a reasonable alternative course of action was available and that different people pursued the misguided policy over time.

The current state of the Murray Darling Basin satisfies the conditions to become another chapter in the March of Folly because over a long period a lot of people have acted against their own long-term interest and alternative policies have been available. However, the situation is more serious than the mere folly of acting against our own best interest.

Almost every person is rightly concerned about climate change and the need to urgently deal with it, but somehow we think we can afford to take three years to develop a Basin Plan and several years after that to reduce entitlements to water allocations.

This exposes an underlying issue that haunts the COAG agreements. Whilst we have understood that our overuse of the Basin for irrigation has been misguided and unsustainable for decades, as a nation we have done little to manage the problem.[45]

Whilst in the medium term we need a well-researched Basin Plan, we have at hand adequate a *priori* information in the Murray Darling Basin Commission, the state and federal departments and CSIRO of the urgent need to prepare an Interim Basin Plan.

An Interim Basin Plan could be prepared in a matter of weeks and would give important signals to the market and all users of the Basin on which to begin to plan for the future that confronts us all. We need to treat the matter with greater urgency.

The current indications are this rainfall year may be below average and in any case it will take several years of better than average rainfall to return the system to a water-rich condition.

Under climate change such conditions are not expected to persist. Irrigators are likely to get low allocations for some time and that will bring about painful structural adjustment and hardship. As a nation we can afford to facilitate this change to reduce the hardship and in the process reduce the demand for water.

Dealing with the hardship of structural adjustment and the public interest in the recovery of water for sustainability can begin now.

There are plenty of actions we as a society can take to be more efficient users of water in the Basin and to delay confronting these issues is to continue the delusion.

It is an issue for us all to consider not just governments. We collectively shape the demands on the politicians and we need to be realistic in our expectations of water usage and understand that politicians cannot make it rain.

We all own this issue.

REFERENCES AND NOTES

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30. By applying the environmental flow percentage contained in Table 2 to the historical flow estimates provided by CSIRO this graph shows environmental water and available surface water for consumption with a high probability of a healthy river and no climate change or development effects.

31. By applying the environmental flow percentage contained in Table 2 for a combined impact of climate change and development of 11% to the historical flow estimates provided by CSIRO this graph shows environmental water and available surface water for consumption with a high probability of a healthy river and climate change and development effects.

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