BROKEN HILL & MENINDEE LAKES

"WE WANT ACTION " FACEBOOK GROUP

FOREWORD

The Darling River, slow, brown and majestic. It has sustained fish life, wildlife and humankind for many thousands of years, but I fear it may not be able to sustain us in years to come.

As a child and youth the best times of my life were spent with my family camped on the banks of the Darling River and Menindee Lakes, fishing and yabbying in their cool clear waters where you could fill the billy for a cup of tea out of the river and where you could almost see the river bottom. No computer games or plasma TV's then, just an old transistor radio and plenty of fresh air and exercise.

As a parent in later years I camped with my children on the river and lakes where they enjoyed the same wonderful experiences as I did.

But I wonder if my grandchildren will enjoy the same.

The point I am trying to make is the contrast between the Darling River in the 1970s , 1980s,1990s and the Darling River and Menindee Lakes now, in the 21st century. The water in the river is now not fit to drink or swim in, except when the occasional flush does trickle down. The magnificent old gum trees are long dead. Old campsites are overgrown by introduced noxious weeds. Native fish are close to extinction levels due to the introduction of European carp, poor water quality and quantity. Native birds and wild-life have also suffered drastically due to the destruction of their habitat. The mismanagement of the system by the Murray Darling Basin Authority since its inception

So where do we go from here?

What we don't need is more committees, studies or reports. What we do need is common sense and determination because hard decisions are going to have to be made to save the Darling River.

In this book, the Facebook group We Want Action has sought to present the facts, statistics and some possible solutions to the prob-lems facing the Darling River System so that you can make your own informed decisions.

Mark Hutton

Co Administrator

We Want Action Group.

"Environmental sustainability is not an optional extra to be sought only if it does not threaten short term economic productivity"

(Quote from 'Water Politics in the Murray-Darling Basin' by Daniel Connell)

Flood waters entering Lake Pamamaroo on the Menindee Lakes System (March 2010)

Quote from the Murray Darling Basin Commission website (www.mdbc.gov.au):

"Reduction in flows from the Darling is a particularly controversial issue and one that has been complicated by the droughts of recent years. It is a complex situation that has often been over-simplified and one that, at times, has become very emotional (Marshall 1993). However, the increased diversions are a fact. In 1960, diversions from the Barwon-Darling and the New South Wales and Queensland tributaries were 50,000 megalitres; in 1990-91, they were 1.4 million megalitres. The increase has been particularly marked over the last 20 years [from about 1978].

The increase in diversions has been primarily due to the expansion of the cotton industry and the use by growers of large on-farm water storage."

Another quote from the MDBC website:

"As one of the Murray-Darling Basin's former Commissioners has stated, the water audit's message is plain: the amount of water presently taken from the rivers is not ecologically sustainable and a new balance between the environmental requirements and the consumptive use will have to be struck. (Toyne 1995)

This is essential for the long term viability of not only the aquatic ecosystems and rivers, but also virtually all economic activity within the Basin."

CONTENTS

THE CURRENT STATE OF THE DARLING RIVER

The Darling River Basin covers 650,000 square kilometres of NSW and Queensland. As can be seen from the map below, almost all of the water in the Darling and its major tributary – the Barwon – comes from tributaries that feed into this system above Bourke. These tributaries contributed the following percentages into the Barwon Darling, prior to widespread irrigation diversions:

- Culgoa River: 15.1%
- Border Rivers: 20.9%
- Gwydir River: 12%
- Namoi River: 23.1%
- Macquarie/Bogan Rivers: 21.6%

Rare contributions come from the Warrego River and very occasionally from the Paroo River.

(Data from the 'State of the Darling' report by Webb, McKeown & Associates Pty Ltd, 2007, s*ee appendix 1 for more information)*

Figure 1: The Darling Basin and its streams

Since the late 1970s the contributions that the tributaries have made to the Darling River have greatly reduced. The Murray Darling Basin website states that in the 1960s diversions from the Barwon-Darling and its tributaries were 50 Gigalitres and by 1991 they were 1,400 Gigalitres. This increase in diversion and extraction has continued over the last 18 years, despite recent 'caps' that have been placed on most streams. Webb, McKeown & Associates Pty Ltd (State of the Darling report 2007, p 17) estimate that average annual runoff is about 7,000 Gigalitres, while total average annual surface water use in the Darling Basin is 3,200 Gigalitres.

The Murray Darling Basin Commission website (2007) further states that the diversions have been "primarily due to the expansion of the cotton industry and the use by growers of large on-farm water storage."

Communities and graziers that live along the Darling River have witnessed a severe ecological decline of the river system over the last 20-30 years. For several years, large tracts of the river were little more than stagnant pools. The river no longer receives the intermittent flooding that the river, associated wetlands and the floodplains depend on. Flooding that does occur is greatly reduced in duration. Some of the environmental impacts are:

Large numbers of river red gums (some hundreds of years old) and other perennial shrubs are dying. Quote from Mark Etheridge (Australian Floodplain Association): "We have large areas of perennial shrubs dying and on both the floodplain and the river banks there are large numbers of trees dying as well as the saddest part of this is that over the past 5 dry years, there has been enough water in the river system to maintain environmental health but it never got here because it disappeared upstream for irrigation." (Mark lives near Wilcannia.)

Migratory and non-migratory birds are losing breeding grounds vital to their continued existence. Two examples of this are the drying and destruction of the Macquarie Marshes and Gwydir Wetlands. (Professor Richard Kingsford University of New South Wales, Sunday Telegraph 19.6.2005). In 2007, a farmer cleared 850 hectares of the Gwydir Wetlands. He was fined over 400 thousand dollars and should have been made to remediate the wetland.

Murray Cod and other aquatic species are under threat not only from lack of water, but also due to blue green algae in the remaining pools. Toxic flows of water killed large numbers of fish in 2004.i

Bank slumping has occurred; this happens when the riverbanks are saturated by a high flow, and the water levels drop rapidly due to pumping for irrigation. Sections of the soggy banks slide into the river. This changes the profile of channels, leads to siltation and can cause diversion of channels.

A pipeline has replaced the Great Darling Anabranch, with enormous impacts on the riverine environment in that area.

The communities dependent on the river are also suffering.

Note: A megalitre is one million litres, about half the volume of a 50 m Olympic swimming pool. A gigalitre is 1000 megalitres (or a billion litres

Water Use

✦ In 2004-05, industries (including Agriculture) and households in the MDB used more than half (52%) of Australia's total water consumption.

✦ In 2004-05, 83% of water consumed in the MDB was consumed by the Agriculture industry.

✦ Other users of water in the MDB included the Water supply industry, which consumed 13% (predominantly through irrigation water supply losses), **and Households (2%).**

✦ In 2004-05, 3% of Australia's electricity and 33% of the nation's hydro-electricity was generated in the MDB.

✦ In 2005-06, 7,720 GL of water was consumed for agricultural production in the MDB, 66% of Australia's agricultural water consumption.

✦ In 2005-06, the majority of water consumed in the MDB originated from two main sources: surface water (6,499 GL or 84% of MDB agricultural water consumption) and groundwater (1,069 GL or 14%).

✦ In 2005-06, the majority of surface water consumed by Agriculture in the MDB was in New South Wales (57%) and Victoria (30%). Over 70% of the 1,069 GL of groundwater consumed in the MDB was in New South Wales.

✦ In 2005-06, the agricultural commodities that used the most water in the MDB were:

✦ cotton - 1,574 GL or 20% of water used for agricultural production in the MDB;

✦ dairy farming - 1,287 GL or 17%;

✦ pasture for other livestock - 1,284 GL or 17%; and

✦ rice - 1,252 GL or 16%.

✦ Between 2000-01 and 2005-06, water consumption by some agricultural commodities was more variable than others. For example:

✦ cotton water consumption - ranged from 1,186 to 2,599 GL; and

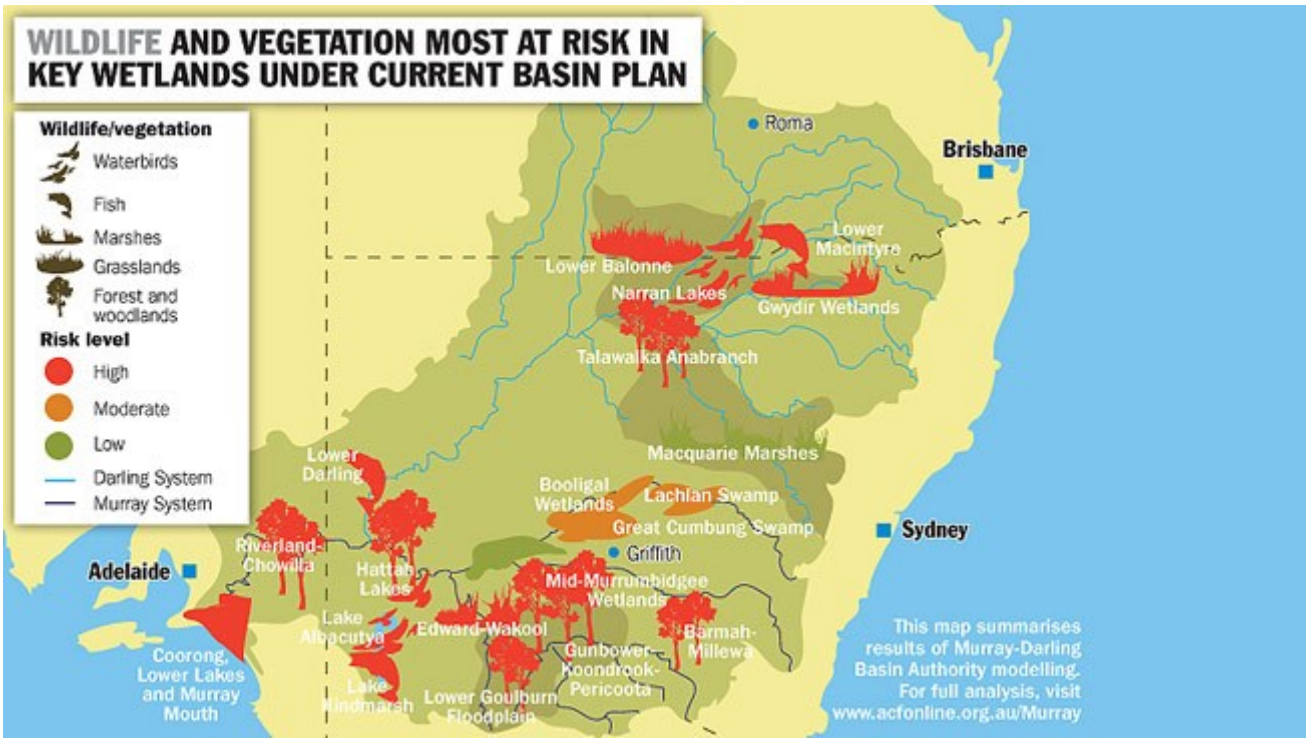
rice - ranged from 615 to 2,418 GL.

Source: Australian Bureau of Statistics

The Beauty of Lake Wetherall. We should not underestimate the Spiritual and Recreational value of our waterways! Water is not just a commodity

- **Nearly 1000 new cotton, rice farms upstream see precious water resources wasted**

2 years ago September 16, 2012



Source: adelaidenow

ALMOST 1000 new cotton and rice farms with a combined land area almost one-and-a-half times the size of Adelaide have sprung up interstate in a year.

And these new farms are draining precious water out of the already stressed Murray-Darling Basin.

The two most inefficient agricultural industries in the Basin were almost eliminated by the drought, but the latest figures from the Australian Bureau of Statistics show they have re-emerged throughout Queensland and NSW.

Cotton is now the biggest water user in the river system and both crops consume more than half of the Basin water used for irrigation.

The increase comes as the Australian Conservation Foundation today releases new mapping of the basin, showing nearly half of the key environmental outcomes, the MDBA's plan is meant to address, will not be met under the current proposal to return 2750 billion litres of water each year.

This week the authority is preparing to release new modelling to the states on the impact of returning 3200 billion litres a year.

The ABS figures show newly created farms or cropping areas meant 492 additional cotton businesses and 489 rice businesses were registered between July 2010 and June last year.

Irrigated cotton crops increased in area by 194,271ha to 331,826ha and rice by 74,498ha. The area of Adelaide and all its suburbs is 182,697ha.

The figures also show rice required 10.1 million litres/ha to irrigate, nearly five times the rate of grapevines, which needed 2.3 million litres/ha. Cotton required 5.4 million litres/ha.

Cotton and rice were the most significant contributors to an increase in Murray-Darling Basin irrigation of 942,973 million litres in 2010-11, the equivalent of almost twice the water in Sydney Harbour.

The 4.5 million litres extracted from the Basin in 2010-11 was an increase on the drought low point of 3.1 million litres in 2007-08.

Cotton crops more than doubled water consumption, from 763,924 million litres to 1.8 billion litres in 2010-11. The ACF map, based on the MDBA's modelling, identifies Chowilla Station, in the state's Riverland, as among the most at risk areas under the plan.

1. Water Allocation for Irrigation

Over-allocation of Licences

Water licences on the Barwon-Darling and its tributaries are vastly over-allocated. Approximately 500 Gigalitres of water licence have been allocated on the Barwon-Darling River, not including the tributaries. Until 2006-7 the only limit on extractions from the Barwon-Darling was the storage capacity of the farm dams. That capacity gradually rose, until in 2006 the farm dams could hold close to 300 Gigalitres. From a flow in January 2006, irrigators on the Barwon-Darling extracted a record 268 Gigalitres. If no limit had been placed on the irrigators, they might well have increased their storages to 500 Gigalitres, enabling them to extract that amount from a flow.

The Barwon-Darling gets all of its water from its tributaries. In all the major tributaries, irrigators extract large amounts of water. The irrigators on the Barwon-Darling take their water from what is left over.

Following are a few statistics from the Murray Darling Basin Commission:

Of the water that would have reached the sea from the Murray-Darling Basin, over two-thirds is now diverted from its rivers each year. Throughout the basin, rivers are now in a state of drought for more than 61 years in every 100, compared with 5 years per 100 (Murray Darling Basin Ministerial Council 1995).

Mean natural flows in the Darling system were 3,042 Gigalitres. Under 1993/94 conditions, this reduced to 2,272 Gigalitres – 75% of natural flows. But mean flow calculations are influenced too much by single large flows. The median flow is more informative.

Median natural flows in the Darling system used to be 1,746 gigalitres. Under 1993/94 conditions the median flow was 1053 – only 60% of natural flows.

Percentage increase in diversion from 1988-1994 (i.e. the increase in the amount of water being taken out of the rivers):

NSW Border Rivers	38.2%
Upper Darling	32.0%
QLD Border Rivers	187.2%
Condamine/Balonne	63.5%

Percentage change from natural flows at Wilcannia—29% Change from median flow - 73%

Increased storages, weirs and dams, have had only limited effect on very big floods, but have virtually eliminated small to medium sized floods on most rivers in the Murray-Darling Basin. Floodplain plants, animals, and floodplain graziers, are suffering as a result.

In the whole Murray-Darling Basin, over the 4 years between 1996/7 and 2000/2001, areas of irrigated cotton expanded by 108,000 hectares (36%), and the water requirements for cotton increased by 729 Gigalitres to 2,856 Gigalitres.

The 2007 State of the Darling report provides some updated statistics:

Average annual runoff into rivers of the Darling Basin is about 7,000 Gigalitres

The major government dams on the tributaries of the Darling can hold 5,129 Gigalitres, but they normally do not. A lot of the rainfall water enters the river below these dams.

Total on-farm storage in the upper Darling basin is now equivalent to 60% of the total volume of the government dams.

Volumes of Storages, Total Darling Basin (Gigalitres)

Major dams (incl Menindee Lakes)	7,179
Town water supply dams	138
Weirs	171
Ring tanks (mostly cotton farms)	3,150
Hillside dams	1,347

The Cap

In 2006 a Cap was introduced for extractions from the Barwon-Darling. A tentative figure of 173 Gigalitres was set. This looks like a limit, but is only a target yearly average. In some years extraction will exceed 173 Gigalitres. Each irrigator will have a water account. In order to make the new limit more palatable to the irrigators, they were given an extra one-off 170 Gigalitres, which they can use at any time. They also have the ability to carry over unused water**.** All of this means that irrigators can extract more than 173 Gigalitres in many future years, if sufficient flows occur.

The Cap figure was calculated based on hydrological modelling of past years, with no consideration of the future effects of global warming.

The Cap was introduced very late (2006) for the Barwon-Darling. The Murray-Darling Basin as a whole had a cap introduced in 1995. On the Barwon-Darling (not including tributaries), development continued after 1995 as follows:

On-farm storage increased from 173 Gigalitres to 300 Gigalitres,
Developed area increased from 25,000 hectares to 40,000 hectares,
Irrigated area increased from 19,000 hectares to 27,000 hectares or more. (Data from Murray Darling Basin Commission)

Inter Basin Transfer of Water Rights

Since water trading commenced, it has become possible to buy water from one valley, and use it in another valley, even though the water cannot flow between those valleys. For example the Tandou Company has bought up to 110 Gigalitres a year from the Murrumbidgee River to use on its farms on the Darling River. This may be difficult to understand. The actual 110 Gigalitres of Murrumbidgee water stays in the Murrumbidgee River, and Tandou extracts the extra 110 Gigalitres from the Darling River. The theory is that it all balances out by the time the Murrumbidgee water reaches the South Australian border. The reality is that it bleeds the lower Darling of water, and takes water that might have flowed down the Anabranch. Inter basin transfers can be environmentally disastrous. By allowing inter basin transfers, the authorities are treating the rivers as drains, with no regard for the environment.

Floodplain Harvesting of Water – Legal / Illegal?

A huge amount of water is being harvested off floodplains, depriving rivers of water.

Floodplain harvesting occurs when landholders capture water that is on the floodplain and use it to irrigate crops or pasture. It includes the taking of water that has overflowed from the main river channel as well as taking local runoff that has not yet reached the river channel. It can involve the digging of channels and banks to divert water to dams.

Until 2008 floodplain harvesting was not regulated and remained a major loophole within NSW water management, as it is almost always un-metered. In 2008 the NSW Government passed legislation making it illegal to build new diversion structures on floodplains without permission. The legislation did not correct the already excessive floodplain harvesting, and it is doubtful whether there are sufficient compliance officers to police the law.

Floodplain harvesting is making a mockery of the Cap. Water stolen from the floodplains is neither regulated, nor paid for, but it is a loss to the rivers. Cutting out floodplain harvesting is a major opportunity to return water to the rivers.

2. Cotton Farming

Irrigation of cotton has been blamed for lack of flow in the Darling and its tributaries. Many producers deny this, and Cubbie Station management bend statistics to show how little water they use. A statistic commonly quoted by Queensland irrigators is that Queensland only takes 5% (actually 7% for 2006-7) of the irrigation water in the Murray-Darling Basin. A more appropriate statistic is the proportion of irrigation water taken by Queensland from the Darling River Basin (i.e. the Darling River and its tributaries). Over the drought years 2002-2007 Queensland took between 20% and 47% of the Darling Basin irrigation extractions (figures from table below).

Quote from the Murray Darling Basin Commission website:

> "Reduction in flows from the Darling is a particularly controversial issue and one that has been complicated by the droughts of recent years. It is a complex situation that has often been over-simplified and one that, at times, has become very emotional (Marshall 1993). However, the increased diversions are a fact. In 1960, diversions from the Barwon-Darling and the New South Wales and Queensland tributaries were 50,000 megalitres; in 1990-91, they were 1.4 million megalitres. The increase has been particularly marked over the last 20 years [from about 1978].
>
> The increase in diversions has been primarily due to the expansion of the cotton industry and the use by growers of large on-farm water storage."

The 2007 State of the Darling report states that the total average annual surface water use in the Darling Basin is now approximately 3,200 Gigalitres (3.2 million Megalitres). The "drought" (i.e. climate change) has reduced that to 1,100-2,000 Gigalitres since 2002.

Irrigators claim haven't been able to grow any cotton in recent years, due to drought.

Apart from 2006 and 2007, this is a lie. Water allocation figures identify the lie. Some irrigators may have missed out occasionally, but for most it has been business as usual all through the pre-2006 drought years. Even in 2006, the worst drought year in history, the Namoi Valley grew a large cotton crop. Farmer Mike Carberry from Narrabri (Sunday Telegraph January 2007) bemoans the fact that the Namoi Valley's cotton crop will be less than half (presumably half of normal). Why was any water wasted on cotton in such a bleak year, with the Darling River running dry?

On 19th January 2007, Namoi Cotton announced a half-year profit of $24 million, obtained during a one in a thousand year drought.

On 23.4.2007 they announced a profit of $12.6 million for the year to 28.2.2007.

On 23.10.2007 a profit of $12.9 million was announced for the six months to 31.8.2007.

Their profit to 31.8.2008 was $18.6 million.

The amount of water extracted in the cotton-growing districts of northern NSW and southern Queensland, gives a good idea of the amount of cotton grown in those districts. Table 1 compiles data from the Australian Bureau of Statistics (Water Use on Australian Farms 2004-5, and following years):

Table 1: Water use on the upper Darling River and its main tributaries, 2002-2007. Notice how northwestern NSW diminishes as Queensland increases, until the "drought" began to bite in Queensland.

NSW Region	**2002-3**	**2003-4**	**2004-5**	**2005-6**	**2006-7**
	Megalitres	Megalitres	Megalitres	Megalitres	Megalitres
Northern (includes Moree, Narrabri)	891,364	639,808	759,277	883,615	583,120
Northwestern (includes Bourke)	650,617	321,529	309,087	377,327	256,467
Far West (includes Menindee)	Not available				9,605
QLD region					
Darling Downs	261,712	314,930	465,404	433,491	253,289
South West (includes Cubbie)	125,246	272,104	494,867	182,120	47,593

For 2005-6 and 2006-7 there is a further breakdown in the ABS statistics:

Region	**2005-6**	**2006-7**
Border Rivers-Gwydir NSW	526,254 ML	292,128
Namoi NSW	434,137 ML	296,223
Central West (presumably Macquarie R) NSW	209,274 ML	229,846
Western NSW	101,548 ML	33,298
Lower Murray Darling NSW	109,252 ML	85,379
Border Rivers QLD	251,382 ML	118,189

Condamine QLD	192,781 ML	130,543
Maranoa Balonne QLD	161,148 ML	47,239
South West QLD	6,515 ML	5,966

During 2005-6, a drought year, the three main irrigated crops in the Murray-Darling Basin were grass, cotton and rice. Much of the irrigated grass is in Victoria, much of the rice is in southern NSW, and most of the cotton is in the Darling Basin. Irrigation water figures for the whole Murray-Darling Basin, for 2005-6:

Pasture for grazing:	1,981 Gigalitres	26.9% of total irrigation extractions
Cotton:	1,574 Gigalitres	21.4%
Rice	1,252 Gigalitres	17.0%

Figure 7: Cotton farm near St George, Queensland in 2004, during our drought (the "Cotton Drought"). No shortage of water or cotton there, and plenty of evaporation.

Figure 9: The Culgoa River at St George, Queensland in 2004. Cubbie Station is downstream. How much of this water made it to the Darling River?

Irrigators claim they only take a small percentage of flows

Irrigator representatives try to pretend that irrigators only take a small percentage of flows. The following examples show that the percentage is not small.

By 1995 irrigation diversions had reduced the median annual flow of water to the Murray mouth to 27% of natural flow. The State of the Darling report (2007) puts it at 44%.

In January 2004, 268 Gigalitres were extracted from the NSW section of the Barwon-Darling. This was not a small percentage of the flow.

In the February 2004 flow, 110 Gigalitres were lost in the 90 km between Bourke and Louth, while only 23 Gigalitres were lost in the 200 km between Louth and Wilcannia (figures from NSW Department of Infrastructure, Planning and Natural Resources). The very large losses between Bourke and Louth may relate to the fact that Clyde Agriculture's cotton farms are between Bourke and Louth.

A very much needed flow occurred in early 2005 – 55% reached Menindee Lakes, 20% was used by the environment and evaporation, and 25% went to irrigators (figures from NSW Department of Infrastructure, Planning and Natural Resources).

Water from the December 2007 Castlereagh flood arrived at Menindee. What happened to the water from the January 2008 Queensland floods? Despite flooding rains in the Darling catchment over the summer, the Menindee Lakes only filled to 31% of capacity.

Figure 12: Lake Pamamaroo 2005.

3. The Great Evaporation Hoax

Over the last few years there has been an orchestrated campaign by cotton growers to focus attention on evaporation losses from Menindee Lakes. This resulted in yet another study, this time by Maunsell and Associates, (followed by Sinclair, Knight, Merz) on ways to engineer evaporation savings at the lakes. In the meantime, the State of The Darling report (2007) has estimated evaporation losses from various sources, and states: "Evaporation losses from Menindee Lakes (393 Gigalitres/annum) are much less than total evaporation from on farm water storages upstream of Menindee."

Compared to the 393 Gigalitres evaporated from Menindee Lakes, the report estimates that 727 Gigalitres evaporates from hillside farm dams and 650 Gigalitres evaporates from ring tanks. These ring tanks are the large farm dams that hold the irrigation water. They are generally constructed by building earth walls. The widespread development of huge ring tanks represents a transfer of water from the publicly owned Menindee Lakes to private lakes upstream. Water is generally pumped into these ring tanks from summer rains, and held until cotton planting in October, and later cotton watering. Evaporation rates are high.

We should closely examine the supposed 393 Gigalitres evaporation rate from Menindee Lakes. This is an "average", but over what period, and is it relevant to the present or the future? Since 2002 Lakes Menindee and Cawndilla have been dry, i.e. no evaporation losses are possible. Lakes Wetherell

Pamamaroo have varied from full to dry. When full, these lakes, combined, hold about 540 Gigalitres. Over the last 6 years evaporation would have been less than 100 Gigalitres per year.

With the huge increases in on farm storage upstream, and with climate change, it is likely that Lakes Menindee and Cawndilla will fill rarely, if ever. If huge amounts of money are spent to reduce evaporation there, it will be wasted.

What are the motives of the cotton growers who want changes to Menindee Lakes? First, it diverts attention from their own plundering of the Darling River Basin. Second, if water savings are made at Menindee Lakes, they figure that they won't have to let as much water go past their cotton farms. They will clamour to be given a share of the water savings. This will mean less water in the rivers, all the way from the cotton farms to Menindee Lakes.

Figure 13: Menindee Lake 2014 Looking from Sunset Strip. Not much evaporation here. Or sailing!

4. Water Quality

There are several issues with water quality, including blue-green algae, salinity, pesticides, herbicides, and turbidity. A major factor in water quality is flow rate. With increased extraction there is lower flow and problems such as blue-green algae and salinity increase.

Figure 15: Blue-green algae bloom in the Darling River in 1991/2, from The Independent Magazine (Crease across centre of picture).

In the 1991/2 summer, the Barwon-Darling achieved a world record – "the largest river bloom of blue-green algae recorded anywhere in the world emerged along the Darling River" (Murray Darling Basin Commission). This extended over 1,000 kilometres from Mungindi to Wilcannia. Growth of blue-green algae is promoted by warmth, low flows and run-off of phosphate and nitrate fertiliser.

In 2004 a flow of water, coming after a period of little or no flow, killed a large number of fish, including Murray cod. It was speculated that this occurred because the water at the front of the flow was de-oxygenated, from lying in stagnant puddles. The real problem was the extended lack of flow.

The pesticide endosulfan and the herbicide atrazine, both used in cotton farming, are bad news for aquatic ecosystems. Both were washed into the rivers. It has been suggested that endosulfan has been phased out, as a result of using GM cotton varieties. Endosulfan kills fish.

Aerial application of chemicals in farming means some drift is inevitable, and some of that drift will go into rivers.

Salinity

Salinity is a problem facing the whole Murray-Darling Basin. Modern research suggests that sea-salt continually blows into the basin, dissolved in the rain (e.g. research by Professor Allan Chivas, University of Wollongong). This is a process of continual addition, and the salt can only leave the basin by flowing out of the Murray mouth. When the rivers don't flow, no salt leaves the basin. With reasonable flow, the Murray River will take 20 million tonnes of salt out to sea per year. Over the last 10 years it has only transported 1 million tonnes (total) out to sea. The other 19 million tonnes, per annum, is still in the basin. Right now (February 2009) there is no Murray River water going out to sea, so no salt is escaping the system. The salt will destroy the river system from the bottom up.

The salinity audit of the Murray-Darling Basin (1999) showed high salinity levels in many tributaries. The Border Rivers, Bogan, Condamine-Balonne, Macquarie, Namoi and Warrego Rivers are expected to exceed World Health Organisation guidelines within 20 years. Also, salt stored in the ground is being mobilised as a result of land clearing and rising water tables contributing to the high salt load.

Salinity and the Murray River

To understand where all the salt comes from, first you need to know that the Murray-Darling Basin was submerged under a shallow sea; so on a map it looked like a group of islands rather than its present shape. At that time the whole land mass started to rise out of the sea (about 100 million years ago). Salt water flowed away from the emerging land back into the ocean, and a river was born which would eventually become the present-day Murray (see the beginnings).

Throughout southern Australia today we are experiencing a wide-ranging and fundamental readjustment in environment. The land changes caused by European settlement has created the major manifestation of salinity throughout the landscape. As a consequence, rising water tables are bringing salt previously stored undisturbed to the surface where it affects soils, streams and vegetation causing widespread salinization.

The additional 200-600 mm of imported irrigation water on top of the normal 300-500 mm of rainfall inevitably causes water table rises and widespread salinization. It affects virtually all major irrigation areas. For instance, in Northern Victoria, the Loddon Valley has 250,000 hectares with shallow saline water tables. In the Goulburn irrigation area there is now about 120,000 hectares with shallow water tables; this area is expected to double in the next 40 years if nothing is done.

Water Table Watch signs throughout South Australia

In the dryland areas, the effects are twofold, leading to both land and stream salinization. Virtually all streams in south western Victoria are brackish or saline due to groundwater out seepage, and this same process is now gradually affecting tributary systems feeding the major rivers of north western Victoria. The annual cost to Australia in lost production alone is close to $100 million; the environmental cost can only be conjectured. In Victoria, the annual loss of $50 million per year will be doubled in the next 40 years if no solutions are found.

In the Kerang Irrigation District,Victoria and the Wakool Irrigation District of New South Wales, saline water tables are within capillary reach of the surface and salinity is a major problem. Similarly, groundwater pressure rises are occurring in the dryland highland areas, in the plains and in the Mallee. In the Mallee, rises in saline water tables are evident by salinization of depressions, stock dams and some roads.In undulating settings in the Mallee and the highlands, the inevitable results of continuing water table rises is saline depressions or brackish to saline land and stream systems respectively. That is, under the present land-use techniques the trends in rising water will continue with the gradual expansion in land and stream salinization being inevitable and, in some cases, irreversible. The threats to agriculture where salinity is caused by rising groundwater pressures is a major issue for surface water supplies and agricultural land rendering the environment unusable.

Source: The Murray; Murray Darling Basin Authority

Salt Inception Schemes Picture a convoy of dump trucks carrying salt, pulling up and dropping their loads into the River Murray and you'll get an idea of how much salt enters the River every day. Historically the areas around Waikerie and Woolpunda in South Australia contribute close to 350 tonnes of salt a day between them. In South Australia the development of salt interception schemes has reduced this figure by more than 85%. That's over 300 tonnes of salt that is no longer going into the Murray every day. The inception schemes have lowered the average salinity at Morgan by 22 EC units.

How an inception scheme works? A system of bores and pumps take the highly saline groundwater from underground before it can enter the River. It is piped to the 400 hectare Stockyard Plain Disposal Basin 15 km south west of Waikerie. There the saline water is disposed of by evaporation and infiltration into the ground, and will not return to the River for thousands of years. The schemes are directly benefiting downstream of River Murray water. Irrigators in the immediate area are seeing the benefits of the lowered level of groundwater under their land, and healthy Murray flood-plain vegetation is beginning in some areas. Natural revegetation is also being encouraged around the basin near Waikerie - 135 species of birds now inhabit the area.

Source: SA Department of Water, Land and Biodiversity Conservation (pdf)

How do you test for Salinity?

Salinty is a measurement of the concentration of salts in water. Technically, salinity is measured in Electrical Conductivity Units (ECU's). The more salt in a solution, the more it conducts electricity.

Electrical Conductivity Units

<50	Rainwater
650	Salinity level can damage irrigated crops
800	World Health Organisation standards consider this the maximum desirable limit for water quality
>1500	Can't be used for many crops Likely to cause direct damage to natural ecosystems
>5000	No longer considered to be fresh water Most freshwater animals and fish won't survive
50,000	Seawater

Connection Between Surface Water and Groundwater on Cotton Farms

This subject might seem a little irrelevant here, but it is important to understand what happens when the country is flood-irrigated, where the water goes and how it interacts with fresh or saline groundwater. Recently research was carried out by the University of New South Wales on a research station on the Liverpool Plains, adjacent to the Mooki River, a tributary of the Namoi River.

Most of the irrigated crops in the vast flatlands of western New South Wales are grown on clayey-silty soils, and it is generally assumed that when water is applied as flood irrigation, it does not penetrate far down, but goes into the plants and into evaporation. Clay is generally assumed to be impermeable. But a lot of clays swell when they are wetted and crack when they dry out. The cracks can be quite deep.

The research station grows crops on typical clayey soil. Groundwater is pumped onto the crops from sands and gravels 50m or more below the surface. Instead of staying on or near the surface, some of the irrigation water was found to be leaking down cracks in the clay and mixing with groundwater in a saltier, shallow aquifer 16m below the surface.

With such an aquifer being recharged each time a crop is flood-irrigated, it must be discharging somewhere with its dissolved salts, and it is likely that occurs in a creek or river nearby.

5. Global Warming

Global warming is now accepted, not only by scientists and "greenies", but also by such archconservatives as George Bush, John Howard (R.I.P.) and Rupert Murdoch. However, there are still farmers and some Members of Parliament who don't accept it, and as a result, refuse to take appropriate action to respond to global warming.

The Annual Australian Climate Summary 2005 (Australian Bureau of Meteorology) notes that 2005 was the warmest year on record and a graph shows a significant rise in temperature from about 1960, but quite definitely from 1980.

It is doubtful whether global warming will be stopped, and that means that we have to adapt to it.

No allowance for global warming

Until 2007 all of the calculations done by water authorities for such purposes as setting Caps for water extraction are done on the basis of historical water flows. Global warming is predicted to cut rainfall in the Murray Darling Basin, and appears to be doing so already. This was not taken into account. The current CSIRO investigations into future water availability in each river valley, are based on climate predictions, and should lead to a change in attitude.

John Howard's February 2007 proposal to give 50% of his water savings to irrigators would have been disastrous. Irrigators would have increased the area of irrigation (already too large), and as rainfall diminishes, those denuded areas would become dustbowls.

6. Specific Places of Concern

Wetlands

The Murray Darling Basin Commission website states

"Despite their importance, wetlands have been one of the least valued and most abused of Australia's natural resources. Various assessments suggest that nationally, as much as 50 percent of the area of wetland that existed 200 years ago has been lost. Within the Murray-Darling Basin, many wetlands have been completely lost through drainage and filling. Most remaining wetlands have been altered or degraded through activities within them or within their catchments. These activities have profoundly changed the wetlands' water regimes and the quality, composition and distribution of vegetation communities and dependent animal species. Of particular concern is the degradation of wetlands on river floodplains – the most predominant type, in terms of numbers and area – within the basin.

"Examples of problems facing wetlands in the Murray Darling basin are:

University of New South Wales observers counted tens of thousands of water birds in the Macquarie Marshes 20 years ago, but less than 1000 in the year 2000, and less than 20 (yes 20, not a typo) birds in 2004. Professor Richard Kingsford said the decline was caused by diversion of water flows from the marshes into dams and irrigation, combined with the effects of the drought (Sunday Telegraph 19.6.2005). In 2007 the Australian Conservation Foundation released information showing where banks had been built to steal water allocated to the marshes.

The Gwydir Wetlands breeding failure in 2005: 6000 straw-necked ibis chicks didn't hatch. The birds had not bred since 1998. The cause of non-breeding was the release of too little environmental water by the NSW Department of Infrastructure, Planning and Natural Resources, even though the water was available and earmarked for the environment. The ibis eat locusts and grasshoppers, the scourge of crop farmers. Without assistance from birds, the authorities struggle to control locust plagues with pesticides (information from Arlene Buchan, Healthy Rivers campaigner for Australian Conservation Foundation, and from Professor Richard Kingsford of University of New South Wales.)

Effects of wetland degradation are:

- Deterioration of water quality
- Increased occurrence of algal blooms
- Reduced abundance and diversity of native plants and animals
- Sedimentation of storages and rivers
- Loss of floodplain uses, including grazing, forestry, fishing and cropping
- Loss of cultural and aesthetic values

Reduced recreational opportunities.

Figure 17: Ibis perched in background behind lignum breeding area, Lake Wetherell 1989. The lignum must be surrounded by water before the birds will breed.

Lake Wetherell, an artificially created lake in the Menindee Lakes system, has become one of the most important wetlands in the Darling Basin. For birds it offers tall, dead river red gums that line the old Darling River channel, live trees around the perimeter, and swamp-like areas with masses of reed-like plants, especially lignum. Lake Wetherell never dries completely, and when its waters extend into the back swamps, it provides breeding grounds for a number of bird species, including ibis.

Figure 19: Ibis perched on drowned river gum, Lake Wetherell 1989.

Menindee Lakes

The Menindee Lakes are incredibly rich and diverse ecosystems that sustain the wildlife and people of far western New South Wales. Indigenous peoples have been sustained and nurtured by the river and lakes for thousands of years.

Explorer Major Thomas Mitchell formerly named the lakes Laidley's Ponds in 1831. Except for Lake Wetherell, the Menindee Lakes are all naturally occurring lakes rimmed by large stands of river red gums, and filled from overflow of the Darling River. During times of high flow they acted as nature's flood mitigator by absorbing large volumes of water and gradually returning it to the lower Darling and Murray Rivers.

The lakes have been modified by the construction of levees and a system of regulators. These regulators allow water stored in the larger lakes to be released in controlled flow events so as to somewhat mimic small natural floods and to prevent flood damage to river banks and agricultural properties down river. All water stored in these lakes, except for residual pools, is returned to the lower Darling and Murray River system, and eventually through to South Australia and the Coorong. This is unlike up-river irrigation farms where water taken from the river system is never returned.

In February 2002 the lakes were virtually emptied after a legally legitimate demand from South Australia for water. Unfortunately a 40% error in the surveyed capacity of Lake Wetherell led too much more water being discharged than intended. Since 2002 the two largest lakes, Menindee and Cawndilla, have been dry, and the other lakes have varied from full to almost empty. The evaporation figures used by the irrigation lobby, for Menindee Lakes, and repeated by uninformed politicians, refer to a full lake system and are no longer relevant.

Figure 20: Lake Menindee from 2003 to the present. No evaporation losses here, no recreation, no fishing, no waterfront for Sunset Strip.

Lake Wetherell, the only man-made lake in the system, is a series of bends of the Darling River channel and shallow overflow lakebeds. The resulting masses of reed beds and snags developed over the last 50 years have turned the lake into an ideal wetland for a recorded 185 species of birds (Geoff Looney, Menindee resident), many of which are endangered. A breeding colony of thousands of ibis was seen a few years ago. Ibis eat insects in farmers' fields. Lake Wetherell is also, along with the residual pools left in the other lakes when the water levels drop, a hatchery and nursery for our native fish, frogs, yabbies and other aquatic species. It partly compensates for the destruction of other Darling system wetlands such as the Macquarie Marshes, Gwydir Wetlands and Narran Lake.

Recreation and tourism on the lakes also plays a vital part in the wellbeing and economy of the towns situated on and around the Menindee Lakes system.

Some politicians and irrigator groups have over the past few years singled out the Menindee Lakes as a scapegoat for the problems of the Darling River by describing them as " just big evaporation pans" and calling for their decommissioning (Malcolm Turnbull, The Bulletin, 05/12/06). They believe that concentrating their efforts and thereby media focus on evaporation rates in Menindee Lakes, will divert attention from the real problem of over-allocation of water licences and ill-conceived water sharing policies by state governments. Evaporation rates on the lakes are little different from those on shallow farm storages. Far more water is lost by evaporation from farm storages and by flood irrigation of thousands of hectares of denuded cotton fields.

The Menindee Lakes lie a few hundred kilometres from the bottom end of the Darling River, but the problem with lack of flows starts in the upper tributaries. Water flows down rivers, not up.

Figure: 21 Boat ramp to nowhere. Lake Speculation, adjacent to Lake Menindee

The Great Anabranch of the Darling River.

The Great Anabranch was an overflow stream from the Darling River below Menindee, receiving water at Menindee flow levels of 10,000 Megalitres per day, until the completion of the Menindee Lakes Scheme when water was delivered to the Anabranch via Lake Cawndilla. In 2006 a pipeline was installed with pumps on the Darling and Murray Rivers. This delivers up to 3 Megalitres of water to properties along the Anabranch. Before the pipeline there was a guaranteed flow of 50 Gigalitres per year down the Anabranch. Now there is no guaranteed flow; water will only flow down the Anabranch if the Darling River overflows, or if Lake Cawndilla fills. Irrigator's up-river will do their best to make sure this never happens. It has been claimed that the pipeline saves 47 Gigalitres per year, and that this is additional flow for the Darling River. We dispute this, and suggest that the savings have been used upstream of Menindee Lakes.

Figure 22: Homestead on the Great Anabranch before the drying out.

The Darling River (Great Anabranch) & Lake Tandou Water Supply Act 1960 approved construction "All for the purpose of providing an assured water supply to the Great Anabranch and making a supply available at Lake Tandou for irrigation by gravitation of about 25,000 acres in the bed of the lake". Reference to Tandou was removed in 1961 when the project did not go ahead.

Since filling the Menindee storage the Great Anabranch has only missed its annual supply once in 40 years. This was the case until 2003.

In 1981 Tandou Pty Ltd proposed to pipe water to properties on the Great Anabranch to save water. Extreme opposition by landholders and general public resulted in a report commissioned by the Water Resources Commission, and sent to the Minister for Land & Water Janice Crosio, who stopped the pipeline on environmental, social & economic grounds.

Because of mismanagement and over-commitment in our river systems, the Great Anabranch was again targeted as "wasteful, polluted, denigrated stream of saline water, infected with blue green algae, cumbungi and carp" when in actual fact it was a well recognised breeding ground for many species of birds, fish, green tree frogs and water rats, and highly valued by recreational visitors, anglers and apiarists.

The DAMP Management Plan to convert the Great Anabranch to a "Pipeline/Environmental Flow" situation has become a reality. The pipeline has gone ahead, but the "environmental flows" have not, due to highly reduced flows down the Darling River, the drought, and no water in Lakes Menindee and Cawndilla for over 5 years. Needless to say the Great Anabranch of the Darling River is now nothing more than a sandy tract lined by dying river red gums: an environmental disaster and a national disgrace.

Figure 23: Silver City Motor Cycle Club Camp 2000

Those living on the Great Anabranch opposed this pipeline/environmental flow proposal, but were slowly starved of water, and in the end did not have a choice but to accept the pipeline. In hindsight, it is unlikely the Anabranch residents are pleased with the outcome in 2007, as there is almost no probability of an environmental flow in the near future.

The Great Anabranch of the Darling River Water Trust, which represents landholders' interests, resolved in 2001 at its General Meeting:-

> "That the Great Anabranch of the Darling River Water Trust ensure that the Anabranch fulfill its role as a conduit between the Darling and Murray Rivers with a management plan under which the stock and domestic requirements are provided through the current regular flow regime, with some adaptations in the interest of water quality and the environment, until such time as Darling and Murray River plans are in place, when it will be reviewed."

The destruction of the Great Anabranch was not about saving water, but all about irrigation growth, and Marie Wecker (Treasurer of DRAG) wonders where the 47 Gigalitres that fed the Great Anabranch has gone, or is it still held in dams upstream. This is just a sample of a huge story yet to be told.

Great Ana Branch of the Darling River - Update

. Redgums hundreds of years old are dying, wildlife is suffering, and the river bed is being clogged with new growth, both native & introduced.

Originally 90% of those living on the Anabranch were opposed to the pipeline, but now most are happy only because it was the only way they would get access to water. In saying this, it is also recognised that a very serious environmental problem has occurred with very old river red gums dying, and flora and fauna seriously impacted on due to the failure of the NSW Government to make provision for the promised, vital Environmental Flows. Marie was told that the Great Anabranch is in a "very sad state".

Figure: 24 Native and introduced species now clog the main Anabranch Channel.

This was the recommendation from the Darling Anabranch Pipeline & Environmental Flows Environmental Impact Study: NSW Government.

Based on modelling and data environmental objectives, the following more natural flow was proposed for the Darling Anabranch:

60,000 to 75,000 Megalitres per release, with a two year frequency when averaged over ten years.

An "end of stream flow" is required for each event.

Periods between environmental flows should not exceed three years.

A natural flood event would be considered as an environmental flow where this flood is an "end of stream" flow.

Expected net water savings averaged over ten year periods were estimated to average 30,000 Megalitres per year.

Removal or Modification of Block Banks:

Seventeen block banks/regulators were previously constructed by landholders across the Darling Anabranch to provide weir pools for pumping stock & domestic water.

Evaluation was underway to determine which of the 17 block banks required either removal or modification to providee for free passage of flows and adequate fish passage. One might ask why this was not done before the pipeline was constructed.

Project outcomes:

To halt & reverse environmental damage.

Improve fish habitat.

Improve water quality for stock and domestic use and the environment.

Provide a more efficient stock & domestic supply.

Secure more natural environmental flows.

Provide variable end of stream flows.

Encourage the growth of a variety of native aquatic plants while reducing the growth of Cumbungi.

These were the recommendations before the pipeline was commenced. Now look at the result.

The Great Anabranch of the Darling River is a barren sandy tract, with dying river red gums, fish & yabby breeding grounds at risk, and a place of significance to campers and fishers now is a desolate state.

The Great Anabranch of the Darling River needs a drink urgently as do South Australia's lower lakes. Provision must be made for the environmental flows. Changes must be made to irrigation allocations to protect these precious once beautiful places.

Figure: 24 Native and introduced species now clog the main Anabranch Channel.

7. Indigenous Water Values and the Darling River

> 'River valleys have been the main focus of Indigenous life for tens of thousands of years and water maintains a significant symbolic part in Indigenous social life, including contemporary identity.' (Jackson and Morrison, 2007, page 23).

Indigenous water values throughout Australia have too often been ignored in water planning processes. The Darling is no exception. Similarly to other indigenous peoples, the indigenous people who live with and along the Darling are suffering the effects of poor governance over this vital system. Also, the impact on rivers of environmental degradation is amounting to what some claim is a second dispossession.

> 'The consequences of the over-extraction of water from the inland rivers are so serious that it is being experienced by the traditional Aboriginal land owners as a contemporary dispossession from their country. It is a second dispossession: the first occurred when European settlers did not recognise their rights to land, and gave the traditional country to others to further their own purposes. Despite this, continuing public and informal access to the inland rivers has provided important opportunities for the traditional owners to enjoy those connections with country that have persisted during the experience of colonisation.' (Weir, 2007, page 44)

Weir's comment on how traditional owners are maintaining connections with country, through interactions with inland rivers, is pertinent to the Darling. From Wilcannia to Menindee, indigenous people continue to swim in, fish from, and spend time alongside it. It is a crucial part of a living culture.

Indigenous people's conservation interests persist as well. For example, the Paroo wetlands have recently received Ramsar listing, in recognition of the valuable role this area has in maintaining vulnerable ecosystems. Ramsar sites are wetlands of international importance: they are valued for multiple reasons, including as homes for migratory bird species and nurseries for native fish. The help and support of local traditional owners who will continue to play an important part in its management enabled the listing. The Paroo remains unregulated – it is the last free flowing river in the northern Murray Darling Basin region. Its Ramsar listing identifies that 'the Paroo has significant cultural and spiritual values to the traditional Indigenous owners of the Paroo River country, the Baakandji and Budjiti people.' (Paroo River Wetlands Fact sheet)

The Paroo is just one part of the vast Darling system. More research is needed to underpin further recognition of Indigenous peoples' water values. Then, on the basis of this, participation of traditional owners in water management along the Darling's length could help save this vanishing river

Jackson, S. and Morrison, J., (2007). 'Indigenous perspectives in water management, reforms and implementation'. In: Hussey, K. and Dovers, S. (eds). *Managing Water for Australia: The Social and Institutional Challenges*. Collingwood: CSIRO, 23-42.

Weir, J., (2007). 'The traditional owner experience along the Murray River'. In: Potter, E., Mackinnon, A., McKenzie, S. and McKay, J. (eds). *Fresh Water: New Perspectives on Water in Australia*. Melbourne: Melbourne University Press, 44-58.

Flows into the Darling from tributaries.

Figures from the report: State of the Darling, interim hydrology report, by Webb, McKeown & Associates Pty Ltd, released by the Murray Darling Basin Commission in 2007.

Darling Tributary	Average Natural Inflow into Darling (Gigs per	Percentage of total natural inflows from Darling Trib-	Current average inflow (Gigs per year)	Percent reduction in inflow into the Dar-
Border Rivers	862	20.9 %	574	33 %
Gwydir River	493	12 %	196	60 %
Namoi River	949	23.1 %	779	18 %
Condamine/Balonne/Culgoa	621	15.1 %	293	53 %
Macquarie/Bogan Rivers	888	21.6 %	634	29 %

Their “current” data are probably 3 years out of date.

Figure: 31 The Darling River. A legacy for our children?

It is important to note that the new lengths are still only approximations, because they have been measured from a cartographic representation of the rivers, rather than the actual rivers.
These are the revised top rivers in rank order:

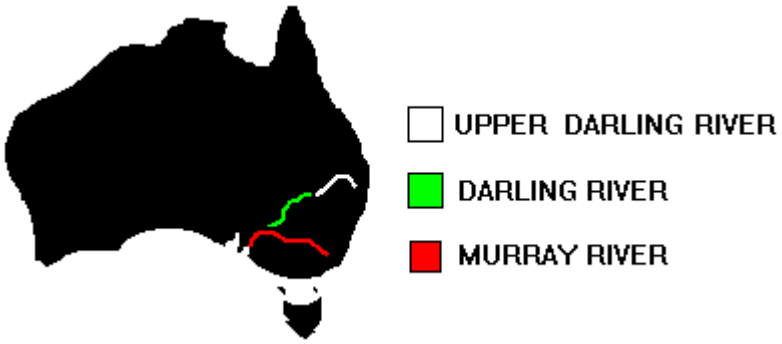
NAME	STATE	LENGTH (km) approximate
River Murray	New South Wales/South Australia	2508
Murrumbidgee River	New South Wales/Australian Capital Territory	1485
Darling River (from the River Murray to Culgoa River)	New South Wales	1545
Lachlan River	New South Wales	1339
Cooper Creek	Queensland/South Australia	1113
Flinders River	Queensland	1004
Diamantina River	Queensland/South Australia	941

Longest river by State and Territory

Although the River Murray forms much of the border separating New South Wales and Victoria, it is not Victoria's longest river because the New South Wales border is delineated by the river's southern bank rather than by the middle of the river. The only section of the river considered within Victoria is a stretch of approximately 11 kilometres where it separates Victoria and South Australia. At this point, the middle of the river forms the border.

NAME	STATE/TERRITORY	LENGTH (km) approximate
River Murray	New South Wales	1808
Flinders River	Queensland	1004
Gascoyne River	Western Australia	834
River Murray	South Australia	700
Goulburn River	Victoria	654
Victoria	Northern Territory	510
South Esk River	Tasmania	245
Murrumbidgee River	Australian Capital Territory	59

Longest continuous river system



The River Murray and its tributary, the Darling River, are the main rivers in the Murray-Darling River Basin. This drainage basin comprises the major part of the interior lowlands of Australia, covering more than one million square kilometres, or about 14 per cent of Australia.
The Murray-Darling catchment also contains Australia's longest continuous river system. This is established by measuring downstream from the confluence of the River Murray and the Darling River, plus the Darling itself, together with some of the Darling's tributaries to create an overall length of 3672 kilometres. With connected flow through Queensland, New South Wales and South Australia, this system drains a major portion of the interior lowlands of eastern Australia. Its total length is just over half that of the Nile River in continental Africa, which at 6695 kilometres is considered to be the world's

From its headwaters in Queensland down to the River Murray mouth near Goolwa in South Australia, the Murray-Darling system has been measured using the following rivers to establish its approximate overall length:

NAME	STATE	LENGTH (km)
Condamine/Balonne/Culgoa Rivers	Queensland/New South Wales	1195
Darling River (between the Culgoa River and River Murray)	New South Wales	1545
River Murray (downstream from the Darling River junction)	New South Wales/Victoria/South Australia	828
Total length of system	Queensland/New South Wales/ Victoria/South Australia	3672

Largest lakes by State/Territory

These lakes are the largest waterbodies, whether natural or constructed

Gordon Dam, Tasmania.
Photo courtesy Cam Botherway

Australia is not well endowed with natural lakes containing plentiful supplies of water. Both rainfall and runoff can be highly variable across the continent and many rivers have dams containing large reservoirs constructed on them to meet water and power supply needs.
The most significant water management project undertaken in Australia is the Snowy Mountains scheme which includes 16 large dams. The scheme diverts water from the Snowy and Eucumbene Rivers on the east of the Great Dividing Range through the Snowy Mountains to the Murray and Murrumbidgee River systems on the western side of the range. The water is used to generate electricity and for irrigation farming in New South Wales, Victoria and South Australia. The project, which took 25 years to complete, was undertaken by the Snowy Mountains Hydro-Electric Authority.
Another significant irrigation scheme dam is Lake Argyle on the Ord River in Western Australia.
.

Largest lakes by State/Territory

These lakes are the largest waterbodies, whether natural or constructed.

STATE/TERRITORY	LAKE NAME	AREA (km2)
Australian Capital Territory	Lake Burley Griffin	7.2
New South Wales	Lake Garnpung	542
Northern Territory	Lake Amadeus (salt)	1032
Queensland	Lake Dalrymple	220
South Australia	Lake Eyre (salt)	9690
Tasmania	Lake Gordon	272
Victoria	Lake Corangamite	209
Western Australia	Lake Mackay	3494

Largest constructed reservoirs by State/Territory

These lakes, held back by dams, are the largest waterbodies serving water and power supply needs.

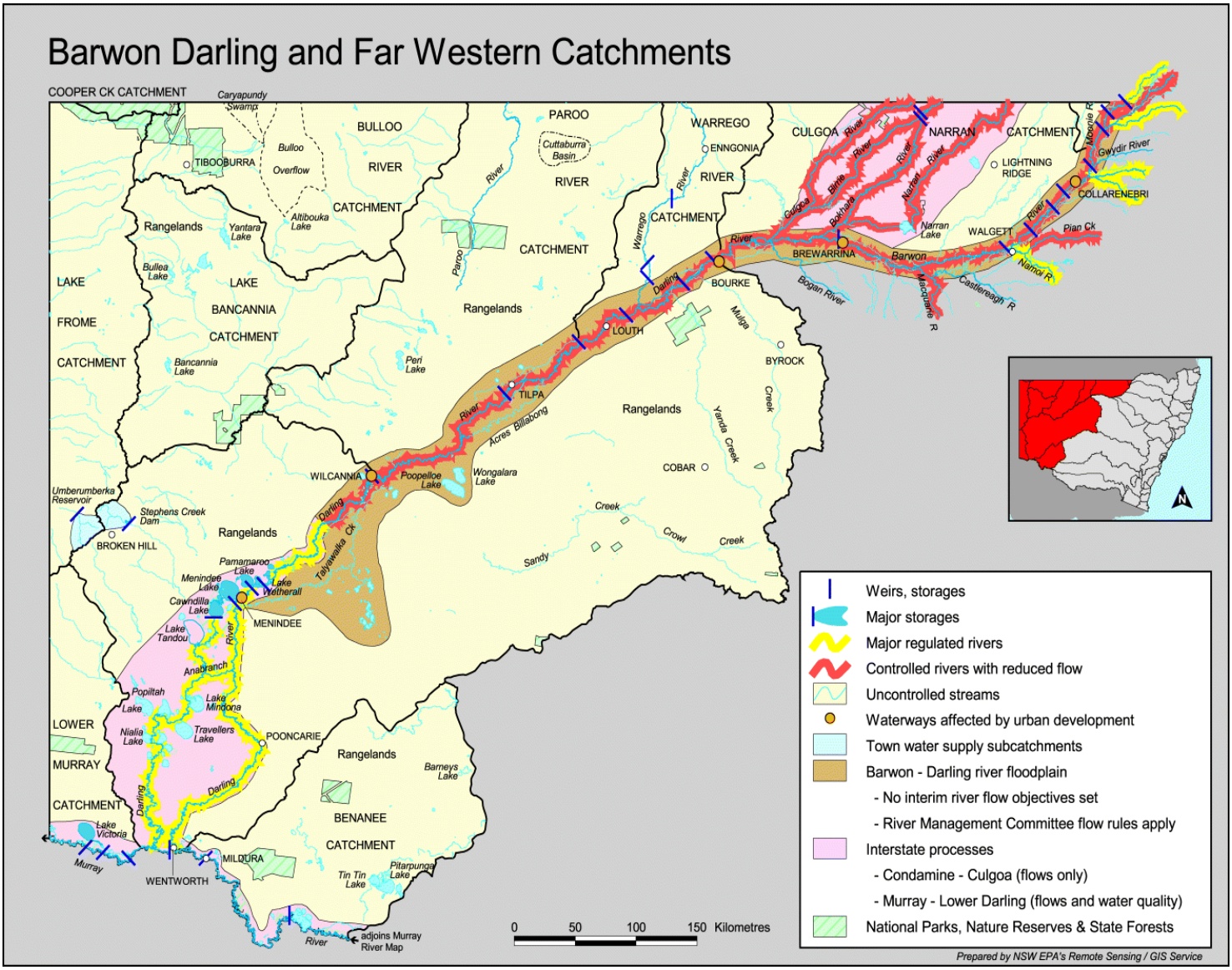
STATE/TERRITORY	DAM NAME	RESERVOIR	CAPACITY (million m3)
Australian Capital Territory	Corin	-	70.9
New South Wales	Eucumbene	Lake Eucumbene	4798
Northern Territory	Darwin River	-	259
Queensland	Burdekin Falls	Lake Dalrymple	1860
South Australia	Mount Bold	Mount Bold	45.9
Tasmania	Gordon	Lake Gordon	12 450
Victoria	Dartmouth	-	4000
Western Australia	Ord River	Lake Argyle	10 760

Largest salt lakes

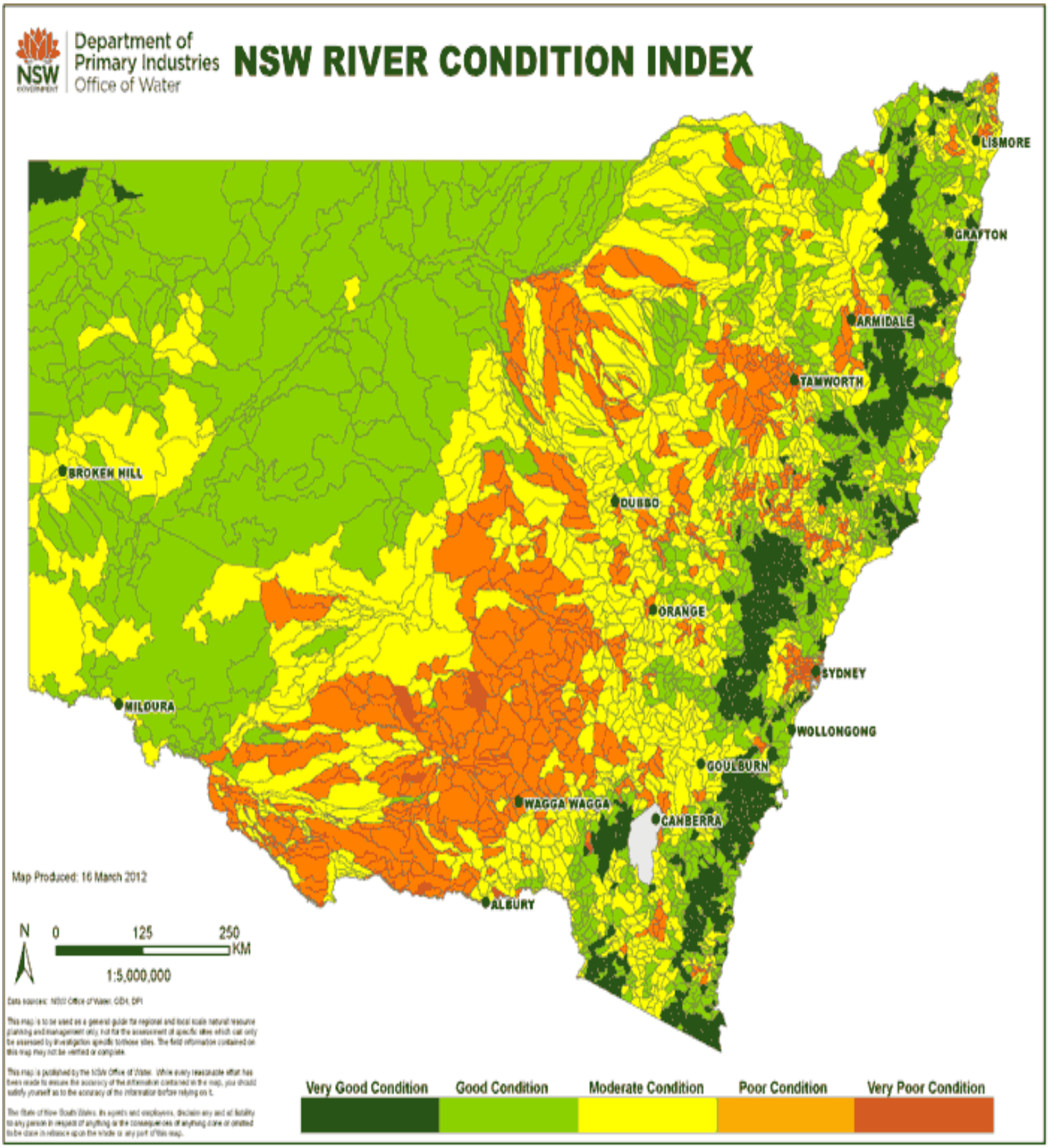
Salt lakes are normally dry, appearing as glittering sheets of salt that stretch to the horizon. Lake Eyre filled only three times last century, and Lake Torrens only once.

NAME	STATE	SIZE (km2)
Lake Eyre	South Australia	9690
Lake Torrens	South Australia	5745
Lake Gairdner	South Australia	4351

The sizes of the water bodies listed have been determined using 1:2.5 million scale data.


Barwon Darling and Far Western Catchments
COOPER CK CATCHMENT
Caryapundy Swamp
TIBOOBURRA
Bulloo Overflow
BULLOO RIVER CATCHMENT
Altibouka Lake
Rangelands
Yantara Lake
Bullea Lake
LAKE BANCANNIA CATCHMENT
Bancannia Lake
FROME CATCHMENT
LAKE
PAROO
Cuttaburra Basin
RIVER CATCHMENT
Paroo River
WARREGO
ENNGONIA
RIVER CATCHMENT
Warrego River
CULGOA
NARRAN CATCHMENT
Culgoa River
Birrie River
Bokhara River
Narran River
LIGHTNING RIDGE
COLLARENEBRI
Gwydir River
Tibooie R
Narran Lake
WALGETT
Pian Ck
Namoi R
Castlereagh R
Macquarie R
BREWARRINA
Barwon River
Darling River
BOURKE
Bogan River
LOUTH
Mulga
BYROCK
Perl Lake
TILPA
Darling River
Acres Billabong
Rangelands
Yanda Creek
Creek
COBAR
WILCANNIA
Poopelloe Lake
Wongalara Lake
Umberumberka Reservoir
Stephens Creek Dam
BROKEN HILL
Rangelands
Darling
Tolarwalka Ck
Pamamaroo Lake
Menindee Lake
Lake Wetherall
Cawndilla Lake
MENINDEE
Lake Tandou
River
Anabranch
Popiltah Lake
Lake Mindona
LOWER MURRAY CATCHMENT
Nialia Lake
Travellers Lake
POONCARIE
Rangelands
Barneys Lake
Darling
Lake Victoria
Murray
WENTWORTH
MILDURA
BENANEE CATCHMENT
Tin Tin Lake
Pitarpunga Lake
adjoins Murray River Map
0 50 100 150 Kilometres
Weirs, storages
Major storages
Major regulated rivers
Controlled rivers with reduced flow
Uncontrolled streams
Waterways affected by urban development
Town water supply subcatchments
Barwon - Darling river floodplain
- No interim river flow objectives set
- River Management Committee flow rules apply
Interstate processes
- Condamine - Culgoa (flows only)
- Murray - Lower Darling (flows and water quality)
National Parks, Nature Reserves & State Forests
Prepared by NSW EPA's Remote Sensing / GIS Service

Australias's Artesian Basins


Department of Primary Industries
Office of Water
NSW RIVER CONDITION INDEX
LISMORE
GRAFTON
ARMIDALE
TAMWORTH
BROKEN HILL
DUBBO
ORANGE
SYDNEY
MILDURA
WOLLONGONG
GOULBURN
WAGGA WAGGA
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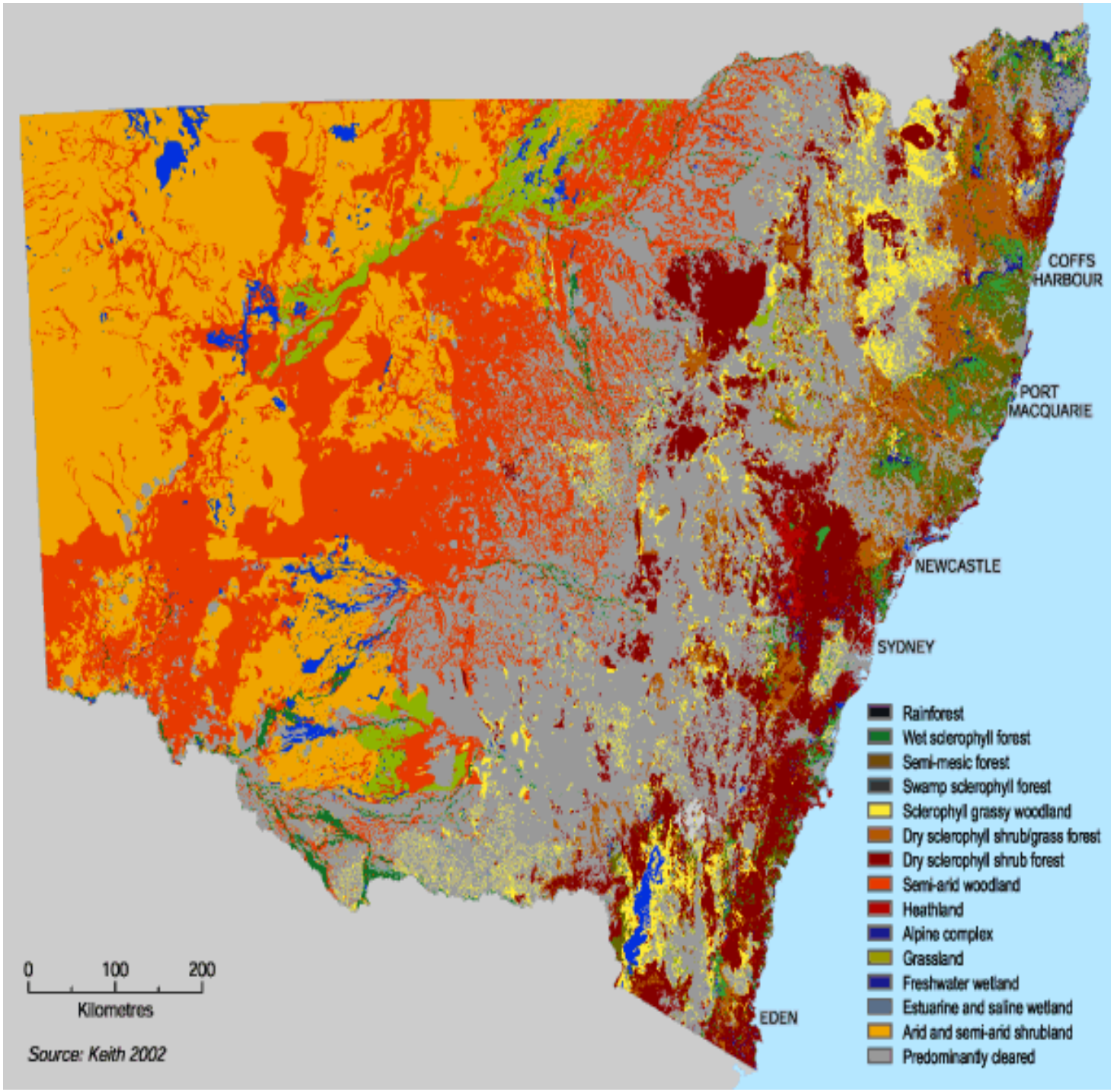
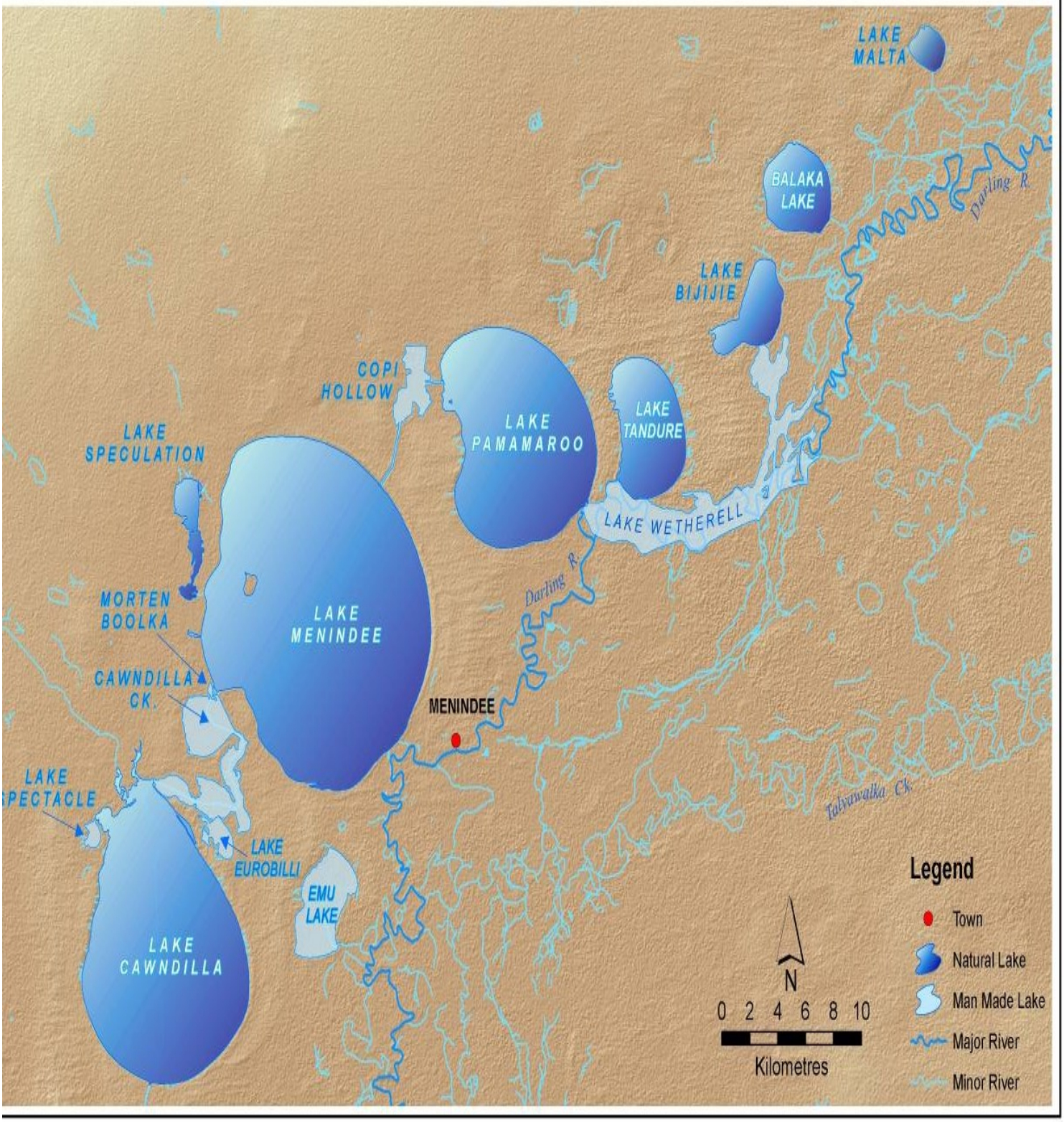
Very Good Condition
Good Condition
Moderate Condition
Poor Condition
Very Poor Condition

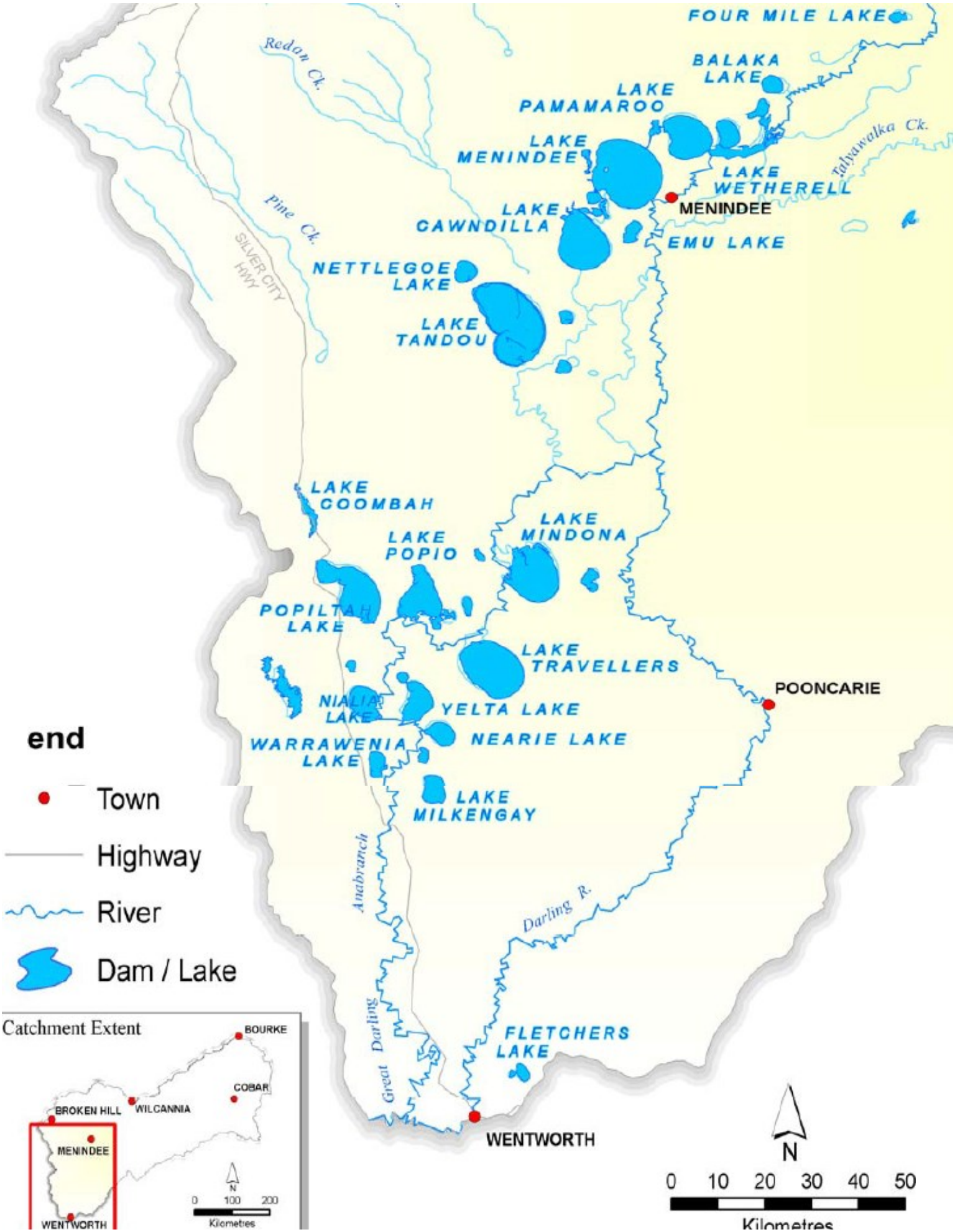

COFFS HARBOUR
PORT MACQUARIE
NEWCASTLE
SYDNEY
EDEN
Rainforest
Wet sclerophyll forest
Semi-mesic forest
Swamp sclerophyll forest
Sclerophyll grassy woodland
Dry sclerophyll shrub/grass forest
Dry sclerophyll shrub forest
Semi-arid woodland
Heathland
Alpine complex
Grassland
Freshwater wetland
Estuarine and saline wetland
Arid and semi-arid shrubland
Predominantly cleared
0
100
200
Kilometres
Source: Keith 2002

Lower Darling Catchment

Menindee Lakes



Menindee and Anabranch Lakes



Let's do it as a Nation

Bill Riley

As I sit here tonight thinking,
How our country's drying out,
I fully know the reason being,
This ten year man made drought.

They've dammed our upper tributaries,
To make it right for cotton,
While smaller farmers further down,
are totally forgotten.

Inland rivers have stopped flowing,
With our livestock being bogged,
We curse the upstate irrigators,
Where our water's being hogged.

But just look at what it's doing,
To our fauna and our flora,
We're heading down the poor road,
And getting even poorer.

They've killed our lakes and wetlands,
that used to feed the Murray.
So if we're going to fix this problem,
SAY let's do it in a hurry.

But to overcome our problems,
We must bypass our politicians,
And take it to World Heritage,
And force a Royal Commission.

But to get things really moving,
And stop further degradation,
We must all rise get off our butts,
And do it as a Nation.

YES LET'S DO IT AS A NATION