Chapter 3

The problems facing the Coorong and Lower Lakes

3.1 The Coorong and Lower Lakes system are suffering from the effects of inadequate inflows of fresh water. The Murray-Darling Basin (the Basin) is currently experiencing the worst drought on record, water volumes in the entire Basin are very low and River Murray flows into the lakes are well below that required to exceed evaporation from the lakes' surface. This has led to the level of fresh water in the lakes falling below sea level and has halted the release of fresh water into the Coorong North Lagoon, in turn contributing to the closing of the Murray Mouth.

3.2 The committee notes the view of the MDBC that the general ecological decline in the Lower Lakes and Coorong has occurred over many decades and needs to be considered within the context of climate change and wider Basin reforms.[1]

The current drought

3.3 Submissions commented on the unprecedented nature of the current drought. The Wentworth Group stated that two years ago the Group warned that evidence was growing 'that this was more than just a drought' and since then conditions have worsened:

> We warned that our continent is getting hotter, that rainfall patterns have changed significantly and it is likely that southern Australia has experienced a steep change in its weather patterns, more reminiscent of the pre 1950s, than the high rainfall period we experienced since.[2]

3.4 The MDBC stated that for large parts of southern and eastern Australia, dry conditions have persisted since October 1996, but have been exacerbated in recent years. During the last seven years in particular, the Basin has experienced severe rainfall deficiencies. The period from September 2001 to August 2008 was the second driest seven-year period on record (the driest was from 1939 to 1946). This rainfall deficiency, particularly in the alpine areas, has been the main cause for the record low inflows to the Murray system.

3.5 The current dry period and low water availability can be put into perspective by comparisons with similar extended droughts in the early and mid-twentieth century. The average annual Murray inflow of 3800GL/yr during the current drought (2002 to 2008) is lower than that experienced in the previous worst two droughts on record – 4900GL/yr in 1897 to 1904, and 5600GL/yr in 1938 to 1946.

3.6 Rainfall during this drought has been comparable to previous dry periods. However, inflows and water availability have been considerably lower. The current drought has also recorded the lowest inflows for virtually all periods from one month

---

1 Murray-Darling Basin Commission (MDBC), *Submission*. 76, p. 2.

2 Wentworth Group, *Submission* 71, p. 7.

to ten years. In particular, for the two years ending August 2008, Murray system inflows were 3540GL which is almost half the previous two year minimum prior to this drought (of 6800GL in 1943-45).[3]

3.7 The MDBC has identified five factors that have contributed to the severity of the current drought:

- Over allocation – the second half of the 21st century was significantly wetter than the first half. Consistently wet weather, dam construction between the 1950s and 1990, and the accepted wisdom that only a percentage of new entitlements would be utilised, underpinned an expansion in irrigation entitlements. A larger number of irrigators dependent on the resource than previous droughts exacerbated the impact of the water shortage.
- Higher temperatures – three of the last five years, in the Basin, have been the hottest on record (of approximately 100 years of records). Higher temperatures increase evaporation and dry the catchment, resulting in less runoff. The impact of higher temperatures and a drier catchment have been clearly evident since September 2007 when a La Nina system bought above average rainfall to most of the River Murray catchment between September 2007 and March 2008, yet inflows remained very low.
- Changed rainfall patterns – Research indicates that a significant reduction in autumn rainfall has occurred over the MDB. Research points to a strengthening of a 'subtropical ridge' of high pressure over the Basin during the autumn months. Historically, the subtropical ridge is present in summer but weakens and moves rapidly north during autumn, allowing frontal systems to bring rain to the Basin (and south eastern Australia generally). Research links the persisting southerly subtropical ridge to climate change and the effect of diverting autumn storm systems to the south of the Basin.
- The lowest inflow year on record – total annual River Murray system inflow during 2006-07 was 1040GL, approximately 60% below the previous record minimum. Such an unprecedented dry year almost completely exhausted the River Murray's main drought storage, Dartmouth Dam. This has resulted in the current situation of allocations being almost entirely dependent on inflows.
- Two consecutive very dry years – following 2006-07, the driest year on record, 2007-08 has also been a very dry year. Never before, in the historical record, has an extreme dry year, been followed by another very dry year. Previously, the driest years on record 1902/03, 1914/15 and 1982/83 were followed by significantly wetter years.[4]

3.8 The Bureau of Meteorology (BoM) also commented on the current long drought across the Murray-Darling Basin noting that:

> The current drought event commenced in southern parts of the basin in late 1996 and more generally across the basin in around 2002. The El Niño years of 1997, 2002 and 2006 were each notably dry across the basin. Since 2001 each calendar year has seen below-average Murray-Darling Basin

3 MDBC, *Submission* 76, Part 2, pp 7-8.

4 MDBC, *Submission* 76, Part 2, pp 14-18.

> rainfall – a run of seven calendar years which is unprecedented in our records. During the last seven years, averaged across the whole basin, there has been a total of 2860mm rainfall (an average of 407mm a year) which makes this seven-year period the second-driest seven-year period since 1900, after the 1939-1946 drought event (with a total rainfall of 2757mm, and an average of 394mm a year). If the current drought event persists through 2009, it will likely overtake the 1930/1940s drought in terms of rainfall deficits.[5]

3.9 The BoM commented that an unusual feature about this drought is the repeated failure of the autumn rainfalls. There have been eight below-average autumn rainfalls in consecutive years, and 16 of the last 18 autumns have experienced below-average rainfall. This has major consequences for runoff, and in part explains why the runoff has been proportionally lower during this long drought event.[6]

3.10 The BoM also stated that perhaps the most notable feature of the current drought is the exceptionally high temperatures which have been experienced. The year 2007 was the Basin's warmest year on record (+1.13ºC above the 1961-1990 average); while 2005 was the second-warmest year on record, and 2006 the fourth-warmest year. As a whole, this long drought has been 1 to 1.5ºC warmer than the 1930-1940s drought. The BoM stated that this difference is the local reflection of the global warming trend, which is substantially driven by the enhanced greenhouse effect. Australia and the Murray-Darling Basin have warmed by about 1ºC since the 1950s.[7]

3.11 Mr Don Blackmore gave evidence of a low ratio of average run off to rainfall in the Basin and emphasised the relationship between rainfall and run off is not linear. His evidence suggested that runoff is likely to be reduced at a much faster rate than any concurrent reduction in rainfall. Furthermore:

> As we know, a 10 per cent reduction in runoff does not relate to a 10 per cent change in the flow to South Australia—it is a 20 or 30 per cent change because of the cumulative effect.[8]

The pace of water reform

3.12 As a result of a range of initiatives flowing from the COAG water reform framework, states and territories have made considerable progress towards more efficient and sustainable water management. Through the National Water Initiative (NWI) a range of planning, policies and legal and institutional frameworks have been developed, providing the platform for the on-ground delivery of reform.

---

5 Bureau of Meteorology (BoM), *Committee Hansard*, 26 September 2008, Written opening statement.

6 BoM, *Committee Hansard*, 26 September 2008, Written opening statement. See also *Submission* 71, p. 7.

7 BoM, *Committee Hansard*, 26 September 2008, Written opening statement.

8 Dr Don Blackmore, *Committee Hansard*, 9 September 2008, p. 91.

3.13 Significant action is still required to address overallocation, improve environmental management of water, and develop efficient water markets and trading mechanisms.[9]

3.14 In its March 2008 report to COAG, the Working Group on Climate Change and Water noted that:

> … while significant action is being taken by jurisdictions, in the face of a drying climate and rising demand, significant challenges remain. For example, current best estimates indicate the [Murray-Darling Basin] is expected to experience a fall in annual stream flow of 10-25% by 2050, with projections of up to 48 per cent by 2100. Moreover, in the absence of increased regulation, new estimates are that in the MDB alone, within 20 years a further 1200-3400 gigalitres of water will be intercepted annually by activities that currently do not require a water access entitlement, such as farm dams and bores and plantation forestry.[10]

3.15 COAG has since signed an Intergovernmental Agreement (IGA) on Murray-Darling Basin Reform. Under the IGA, governments commit to a new culture and practice of Basin-wide management and planning, through new structures and partnerships.[11] COAG has also initiated work to coordinate efforts in purchasing water for the environment, and enhance the effectiveness of water markets. COAG has also commissioned the development of a comprehensive new work program of water reform to address overallocation and improve environmental outcomes, including actions to address overallocation and improve environmental outcomes.[12]

3.16 As noted in chapter 2, under the *Water Act 2007* the new Murray-Darling Basin Authority is charged with preparing a Basin Plan for the integrated and sustainable management of water resources in the Basin. The Basin Plan is expected to play an important role in identifying responsibilities for managing risks associated with reductions in water availability and changes in reliability. A key element of that plan will be the introduction of sustainable and integrated diversion limits on groundwater and surface water extraction. The Basin Plan will be prepared in consultation with Basin states and communities and is expected to be in place in 2011.[13]

---

9 Working Group on Climate Change and Water, *Report to Council of Australian Governments*, March 2008, p. 2, http://www.coag.gov.au/coag_meeting_outcomes/2008-03-26/docs/CCWWG_water_report.doc (accessed on 29 September 2008).

10 Working Group on Climate Change and Water, *Report to Council of Australian Governments*, March 2008, p. 9, http://www.coag.gov.au/coag_meeting_outcomes/2008-03-26/docs/CCWWG_water_report.doc (accessed on 29 September 2008).

11 Council of Australian Governments Communiqué, 3 July 2008, http://www.coag.gov.au/coag_meeting_outcomes/2008-07-03/index.cfm#water (accessed 29 September 2008).

12 Council of Australian Governments Communiqué, 26 March 2008, http://www.coag.gov.au/coag_meeting_outcomes/2008-03-26/index.cfm#water (accessed 29 September 2008).

13 Mr Robert Freeman, MDBA, *Committee Hansard*, 26 September 2008, p. 75.

3.17 Notwithstanding these initiatives, concerns remain that the pace of water reform in the Basin in particular is not adequate to address issues such as those currently faced by the Lower Lakes and Coorong.

Impact on the Lower Lakes and Coorong

3.18 The overall impact of the current drought and water extraction for consumptive use has been a dramatic fall in the level of fresh water in the lakes. Lake Alexandrina is now at its lowest recorded level.

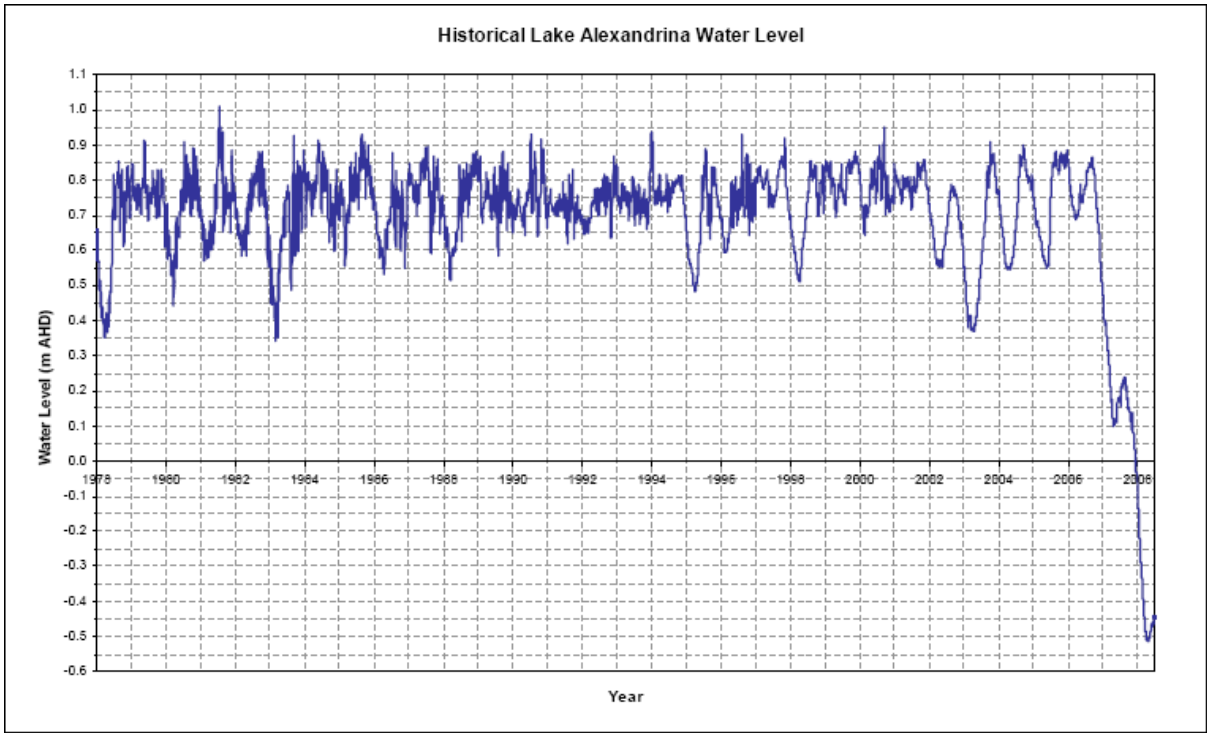

Fig. 3 Graph of Lake Alexandrina's levels since 1978[14]

3.19 In 2008-2009, the Murray-Darling Basin Commission estimates that 350GL of dilution flows for drinking water will flow into the lakes from the Murray. Some additional water will come from local rainfall and runoff from the Mt Lofty Ranges, but it is highly likely that water levels in the Lower Lakes will continue to fall and almost certain that there will be no release of lake water into the Coorong.

Lower Lakes

3.20 The low flows into the Lower Lakes have resulted in the drying of wetland habitat, steadily increasing levels of salinity and has exposed sulphur bearing sediments which have oxidised to form acid sulfate soils, releasing sulphuric acid into the lakes.

Acid sulfate soils

3.21 Acid sulfate soils are formed when anoxic waterlogged sulphur bearing sediments are allowed to dry out. Oxygen penetrates the soil, reacting with the sulphur

14 http://www.dwlbc.sa.gov.au/murray/drought/index.html (accessed 29 September 2008).

compounds, to form sulphuric acid. This acid is then washed out of the soil to form acid runoff. The acids also solubilise aluminium and heavy metals in the sediments.[15]

3.22 The Lower Lakes contain extensive areas of sulphur bearing sediments below 0.0 AHD. As the lakes' levels fall, the shallow bottom profile exposes extensive areas of lake bottom sediment, which oxidise to form acid sulfate soil. At the same time, the overall volume of water in the lakes available to dilute or 'buffer' the acid formed is reducing, resulting in a rapidly rising level of acidity in the lake. While small quantities of acid can be absorbed by the system, continued falls in lake levels have the potential to generate an exponential increase in acidity and consequent environmental collapse. [16] Dr Matt Hipsey described the problem:

> Our best understanding at the moment is that we have what we call a threshold event, where you would have a very large volume of acid sulfate soil which is increasing exponentially. We have a reducing volume of water to buffer that acidity. What happens is you have two exponential graphs superimposed on each other and you end up with a critical value where all of a sudden the lake can no longer withhold it. There is much uncertainty about when that threshold event occurs, but it does seem to occur as a threshold event. It is almost impossible to say what volume of water is going to be required. But if I were a risk averse manager, I would like to ensure that the water level was kept above negative one metre AHD.[17]

3.23 At the moment local rain and runoff from Mt Lofty Ranges has raised the level of water in Lake Alexandrina to approximately -0.26m AHD, but it has fallen as low as -0.55m in 2008. The critical level below which the impact of acid sulfate soils becomes catastrophic is uncertain, but general consensus places it at -0.5 AHD for Lake Albert and -1.0 to -1.2m AHD for Lake Alexandrina. Based on projections from September 2008, if there are no significant increases in inflows, these levels could be reached in mid to late 2009.

Salinity

3.24 Salinity levels in the lakes have been steadily rising. The Murray River deposits approximately 500 000 tons of salt in the lakes every year. With no outflow, this salt has been concentrated by evaporation. This has been exacerbated by seepage of saline groundwater. With the lake level substantially below sea level, sea water has been seeping through sandy sediment, particularly under the Goolwa Barrage. The net effect has been steadily increasing salinity levels. On 23 September, when Lake Alexandrina was at -0.29m AHD, salinity was measured as 4044EC[18] at Milang and

15 Rob Fitzpatrick, Steve Marvanek, Paul Shand, Richard Merry and Mark Thomas, *Acid Sulfate Soil Maps of the River Murray below Blanchetown (Lock 1) and Lakes Alexandrina and Albert when water levels were at pre- drought and current drought conditions,* CSIRO Land and Water Science Report 12/08, February 2008.

16 Dr Matt Hipsey, *Committee Hansard,* 19 September 2008, p. 54.

17 Dr Matt Hipsey, *Committee Hansard,* 19 September 2008, p. 54.

18 EC – Electrical Conductivity, a quick and easy, but not completely accurate measure of salinity.

16 915 at Goolwa, although several witnesses referred to measurements as high as 25 000. [19]

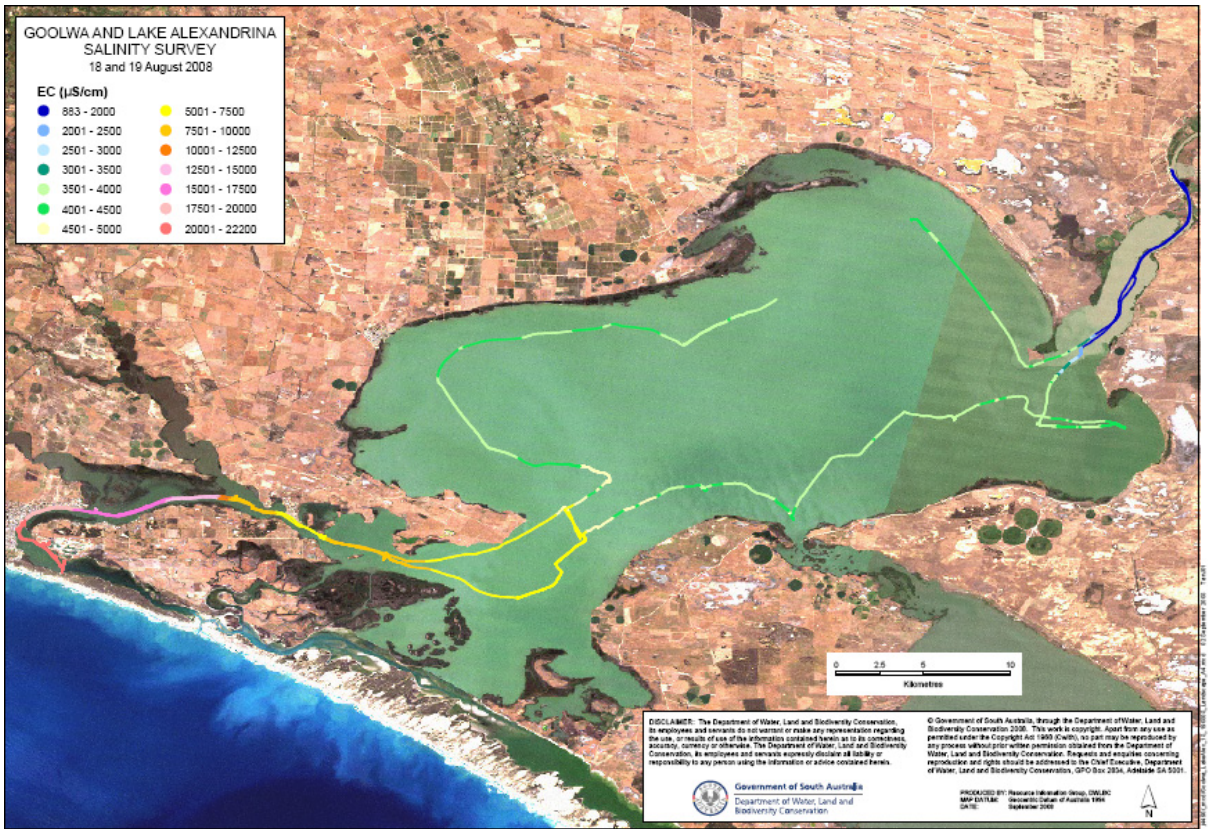

Fig 4 Plot of salinity levels measured in Lake Alexandrina.[20]

3.25 These rising salinity levels are affecting the fresh water ecosystem of the lakes. Fresh water plant and marine life are suffering from the increasing salinity and more estuarine and marine species are appearing in the lakes.[21]

3.26 Increased salinity has also rendered the lake water unsuitable for human consumption for irrigation or watering stock.

The Coorong

3.27 Under natural conditions, the Coorong received significant fresh water inputs from the Murray, the water courses of the southeast of South Australia and the regional groundwater. As a result the Coorong was regularly flushed with fresh water inputs from both the north and the south which would have reset the estuarine

19 http://data.rivermurray.sa.gov.au/ (accessed 23 September 2008). For the higher figure see Minister Maywald, *Committee Hansard,* 19 September 2008, p. ****. Water above 2500EC is not regarded as suitable for human consumption or irrigation except for salt tolerant plants. Pigs, poultry and dairy cattle can tolerate water up to 10 000EC. Sea water is approximately 50 000EC.

20 http://www.dwlbc.sa.gov.au/murray/drought/index.html (accessed 29 September 2008).

21 A much publicised example has been the appearance of a bristle worm which attaches to the shells of freshwater turtles, weighing them down and eventually killing them.

conditions and replenished its nutrient and organic matter. Under current conditions, flows from the Murray have been the major fresh water inputs to the Coorong because of extensive drainage of the southeast and alterations to the regional groundwater system.[22]

3.28 Salinity distribution in the Coorong is determined by evaporation, mixing of water both within and between lagoons, fresh water inputs via barrage releases and ground water. In the Coorong, the silting up of the mouth has resulted in reduced tidal exchange, particularly into the South Lagoon. When coupled with a reduction of fresh groundwater seepage and a reduction in runoff from the upper southeast drainage scheme area, steady evaporation has resulted in worsening hypersaline conditions which are exceeding the levels that even the specialised ecosystems in this area are able to cope with.

3.29 In 2005-06 it was noted that more than 75 per cent of the Coorong has salinities greater than double that of sea water (>110 000EC) with salinities reaching up to seven times sea water (>380 000EC) in the South Lagoon. Salinities of 100 000EC are a critical threshold for many ecological components and processes. The length of time that salinities of this magnitude persist determine the extent of the damage caused as most species can tolerate only short periods of less than 30 days exposure to high salinities.[23]

Economic and social impact

3.30 The Lower Lakes and the Coorong form the basis of the local economy and contribute significantly to the South Australian economy. The area surrounding the Coorong and Lower Lakes supports extensive economic industries including irrigated and dryland agriculture, commercial fishing and cockle harvesting, tourism, and some urban developments. Each of these activities is in some way dependent upon, and at the same time has an impact on, the ecological health of the system.[24]

3.31 The committee received a range of evidence that stressed the significance of the Lower Lakes and the Coorong to local industries:

> Until recently, the Lower Lakes and the Coorong supported a thriving dairy industry, irrigated horticulture, fodder production and beef cattle production. [25]

---

22 MDBC, *Lower Lakes, Coorong and Murray Mouth Icon Site Environmental Management Plan 2006-07*, p. 25, http://www.thelivingmurray.mdbc.gov.au/publications#pub_icon (accessed 29 September 2008).

23 MDBC, *Lower Lakes, Coorong and Murray Mouth Icon Site Environmental Management Plan 2006-07*, p. 2, http://www.thelivingmurray.mdbc.gov.au/publications#pub_icon (accessed 29 September 2008).

24 MDBC, *Lower Lakes, Coorong and Murray Mouth Icon Site Environmental Management Plan 2006-07*, p. 21, http://www.thelivingmurray.mdbc.gov.au/publications#pub_icon (accessed 29 September 2008).

25 Cr Strother, Mayor of Coorong, *Committee Hansard,* 19 September 2008, p. 47.

> Between Goolwa and Wellington, there is a $100 million a year boating-tourism industry. We have within our council area some 8,000 hectares of vines, which on average is about an $800 million a year industry.[26]

3.32 The Lower Lakes, and Coorong region is also of high cultural, economic, spiritual and social value to the Ngarrindjeri people. The Ngarrindjeri are the traditional owners of the region and maintain a continuous, strong relationship with their land and waters.[27]

3.33 However, the exposure of acid sulfate soil threatens an environmental collapse in the Lower Lakes. The Ramsar listed wetlands could be irreparably damaged. Local communities which rely on tourism, fishing and the dairy industry are already suffering and would be further damaged.

3.34 In the Coorong, increasing hypersalinity will reduce biodiversity, accentuating the damage to the area's natural value and the commercial fishing industry.

3.35 The town of Goolwa is particularly dependent on boating and the current low levels in the Lake Alexandrina have already rendered the majority of its dock facilities useless.

Current management of the Lower Lakes and Coorong

The Living Murray Initiative

3.36 As mentioned in the previous chapter, the Lower Lakes and Coorong, together with the Murray Mouth, has been identified as one of six Icon Sites under the Living Murray Initiative. The Living Murray Initiative includes a water recovery target of an average of 500GL of new environmental water per year by 2009. This is being achieved through a coordinated effort by the state and federal governments and the MDBC using a combination of infrastructure, regulatory, urban and market based water recovery projects.[28]

3.37 To date 133GL of water entitlements has been recovered under the Living Murray Initiative; however, the actual volume of water available at any time is dependent on the allocations. At present there is only 1.218GL of water available to the environment in 2008-09 although this may increase modestly if higher allocations are announced against entitlements this water year. These low allocation figures affect both irrigation and environmental entitlements equally.

3.38 Environmental watering of Icon Sites has been managed under the Living Murray Environmental Watering Plan since 2005-06. This plan provides for coordinated watering at Icon Sites, regardless of the type of environmental entitlement

---

26 Mayor McHugh, Mayor of Alexandria Council, *Committee Hansard,* 10 September 2008, p.100.

27 MDBC, *Lower Lakes, Coorong and Murray Mouth Icon Site Environmental Management Plan 2006-07*, p. 10, http://www.thelivingmurray.mdbc.gov.au/publications#pub_icon)accessed 29 September 2008).

28 MDBC, *Submission* 76, Part 2, p. 11.

or source of water. A limited amount of watering has been undertaken during 2006-07 and 2007-08 but the MDBC considers that this has 'demonstrated that excellent, though localised, environmental outcomes can be achieved where water is actively provided and managed for environmental outcomes.'[29]

MDBC Ministerial Council Initiatives

3.39 In March 2008 the MDBC Ministerial Council (the Ministerial Council) approved the Lake Albert Water Level Management project at a budget of $6 million. A temporary structure has been built to separate the lakes and pumping from Lake Alexandrina to Lake Albert commenced on 2 May 2008.

3.40 The Ministerial Council also directed the MDBC to develop risk management strategies and future management options for the Coorong and Lower Lakes and to report to Council in October 2008. The Ministerial Council has agreed to the following short term management objectives (defined as the next 6-24 months):

- Avoid irreversible damage, especially acidification of the Lakes system;
- Actions taken must not adversely impact on water quality for major water supply offtakes.
- Use treatments that as far as possible do not compromise long-term options.

3.41 To achieve these management objectives, South Australian agencies have developed critical acidification thresholds and water level management triggers. The modelling for these thresholds and triggers is being regularly reviewed against actual data to improve its predictive capacity.

3.42 A draft real time management strategy for 2008-09 is currently being considered by Ministerial Council. This strategy is being supported by a number of ongoing activities including regular review of lake levels, water quality and acidification data and forecasting of the projected date to reach the water level management trigger. Field trials are also being undertaken in relation to the potential for bioremediation to manage localised acid affected areas.

3.43 The MDBC also advised the committee that longer term options have been identified in relation to three scenarios:

- a fresh water Lakes system;
- a variable Lakes system (fresh with times of estuarine at low flow); and,
- a marine/estuarine Lakes system.

3.44 The MDBC told the committee that these scenarios will be developed in the light of long term water availability, climate change, and sea level rise forecasts. The identification of the potential risks of each scenarios will be identified and assessed including the impact of sea water on environmental, economic and social values should an estuarine/marine system be seen as a possible future. The first report on the development of these longer term options is expected to be provided to the MDBC and the Ministerial Council in early 2009.[30]

29 *Submission* 76, Part 2, p. 11.

30 *Submission* 76, Part 2, p. 13.

Commonwealth Government Initiatives

3.45 Under the Water for the Future initiative the Australian Government recently announced $320 million in Commonwealth funding. This includes:

- $120 million towards the piping of fresh water supplies to take to dependant communities and
- $200 million towards the development of a long term plan to address the environmental issues facing the Lower Lakes and Coorong.

3.46 The Water for the Future program has also allocated $3.1 billion for the purchase of water entitlements to be held by the Commonwealth Environment Water Holder, together with other initiatives which will also see the water efficiencies return to the rivers.