Murray-Darling Basin Commission

# Options for Water Savings from the Lower Lakes for improved flows in the Coorong and through the Murray Mouth

Report prepared by the
**Environmental Flows and Water Quality Objectives for the River Murray Project Board**

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## MDBC Technical Report 2001/11

*For consideration at*
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## Executive Summary

In August 2001, the High Level Steering Group on the Lower Lakes requested that the Murray-Darling Basin Commission (MDBC) prepare this report on the options for water savings from the Lower Lakes.

The Lower Lakes are located on the River Murray in South Australia and are separated from the Murray Mouth and the Southern Ocean by a line of Barrages. They have a surface area of 81,500 ha and evaporate 745 GL per year on average.

This report analyses the benefits of four options for saving water in the lakes by reducing evaporation. The conclusions of this analysis are:

- A reduction in the target operating level of the Lower Lakes from 0.75 to 0.55 m AHD would save 30 GL/year by reducing the surface area of the lakes by 4% to 78,000 ha.

- Removal of the Barrages would reduce the average level in the Lower Lakes by approximately 0.5 metre. This would save 60 GL/year by reducing the average surface area by 9% to 74,000 ha.

- The construction of a bund within Lake Alexandrina to divide the lake into fresh and saline compartments would not reduce evaporation from the lakes since the inner lake would still evaporate. Because the water to replenish this evaporation would be drawn from inside the Mouth and because the water level in the fresh compartment would be more stable, the net flow out of the Mouth would be 10 GL/year less under this option.

- A weir at Wellington would maintain water levels in the River Murray between Wellington and Lock 1. It would not in itself save water but would be required if the Barrages were removed and may be desirable if the lake level is lowered.
- The ballpark cost of:
    - a Weir at Wellington is $100 million,
    - a bund in Lake Alexandrina is $270 million
    - Relocating the supply or compensating water uses around the lakes ranges between $10-$100 million.

- Lowering the level in the Lower Lakes would adversely affect navigation, marinas, boat ramps and jetties and would expose areas of mud flat. This would have a substantial impact on recreation, boating and tourism. However, it would have environmental benefits such as increased wader habitat.

- Lowering the lake level would reduce erosion and consequently decrease lake turbidity, improving water quality

- Both the Barrage removal and bund construction options would result in an increase in the tidal flows in and out of the Mouth. Whether this would result in an increase or decrease in the build up of sand inside the Murray Mouth would need to be examined using the morphological model being developed for the MDBC.

- Both the Barrage removal and bund construction options would result in substantial changes to the habitat in the Lower Lakes and substantial changes to the freshwater and estuarine fisheries.
- Any changes to the Coorong habitat would trigger Ramsar obligations and an international assessment of each modelling scenario may be necessary.

# 1. Introduction

## 1.1 This Report

This report explores a number of lake management options for reducing evaporation from the Lower Lakes, so that the resulting water savings are available to enhance the environment of the Murray Mouth and Coorong.

Lakes Alexandrina and Albert are located on the River Murray in South Australia just upstream of the Murray Mouth as shown in Figure 1. A line of Barrages, inside the mouth, separates the fresh water in the lakes from the saline water in the Coorong and the Murray estuary. The lakes have a surface area of 81,500 ha and currently evaporate an average of 745 GL/year.

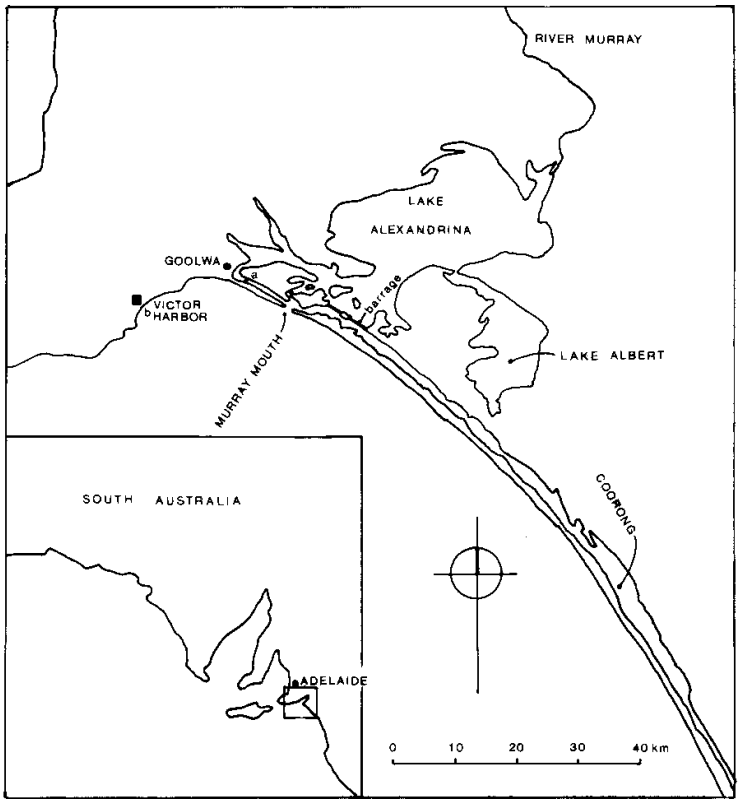


**Figure 1. Location of the Lower Lakes**

Flow into the lakes has been reduced by upstream development over the last 130 years. Currently the median annual flow over the Barrages is only 27% of the median natural flow as is shown in Table 1.

Reduced flows have resulted in the Mouth becoming increasingly constricted with a build-up of sand limiting tidal exchange in the estuary.

The primary concern regarding potential closure of the River Mouth is the impact that this would have on the ecology of the Coorong, a unique coastal estuarine lagoon system and part of a Ramsar registered wetland. Although the River Mouth has only

closed once in recorded history, it has been severely constricted for most of the past 4 years and there is evidence of a significant decline in the ecological health of the Coorong and the fish and bird populations that depend on it.

**Table 1. Comparison of natural and current flow conditions**

| | **Flow over Barrages (GL/yr)** | | |
|---|---|---|---|
| | Natural Conditions | Current Conditions | Current/ Natural % |
| Mean Annual Flow | 12896 | 5071 | 39% |
| Median Annual Flow | 11318 | 3092 | 27% |

It has long been suggested that changing the way the lakes are managed could generate significant savings from lake evaporation. The water savings could then be put either to increased consumptive diversions or to increased flows through the river Mouth potentially reducing the build-up of sand.

Currently the nominal operating level for the Lower Lakes is 0.75 m AHD although the actual operating level varies between 0.65 and 0.85 m AHD. Analysis using the Murray-Darling Basin Commission (MDBC) model indicates that the probability of there being no flow from the river into the lakes is very rare, occurring in only two months in the 109 year simulation during a period when South Australia's entitlement flow was restricted. However, there will be many months when the evaporation from the lakes will exceed the lake inflows. On these occasions the Barrages will be closed and the lake level will drop. In 1968 the lake level fell to 0.1 m AHD. The increase in South Australia's entitlement in 1979 reduced the size and frequency of lake drawdowns; however the lakes are still drawn below the target level about 30% of the time. The minimum expected lake level under current conditions is 0.25 m AHD. A sample of the simulated lake levels from the benchmark run which assumes that South Australia's diversions have increased up to the Cap level is plotted in Figure 2.

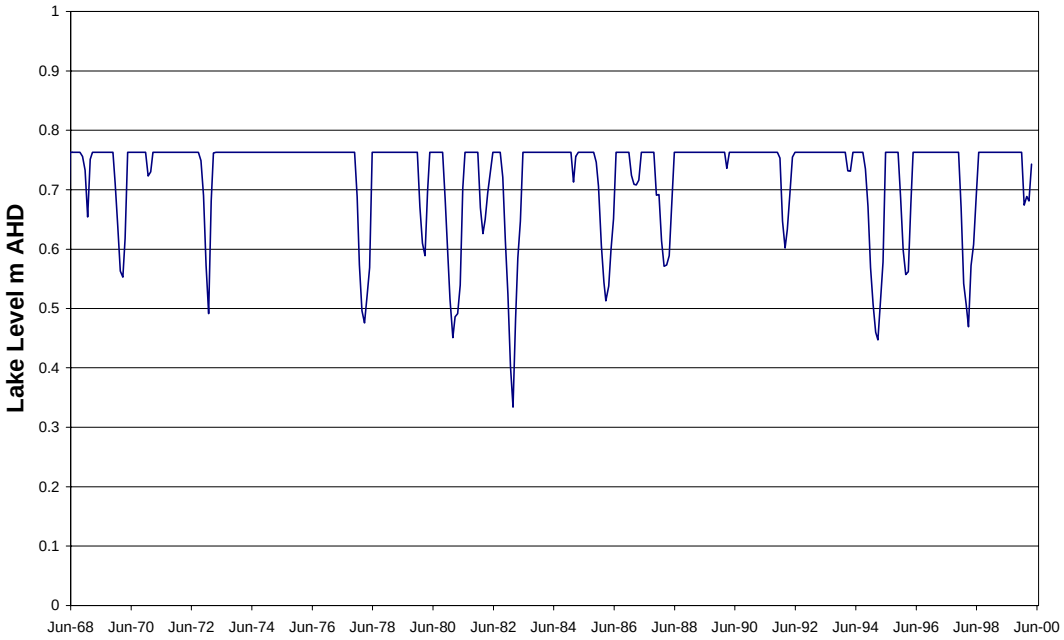


**Figure 2. Modelled Water Levels in Lake Alexandrina from the Benchmark Run**

## 1.2 Historic Lake and River Mouth Conditions

Under natural flow conditions, prior to the implementation of regulation and diversions throughout the Murray-Darling Basin, Lakes Alexandrina and Albert were predominantly fresh water lakes, only becoming brackish or saline at times of low river flow. It is evident from the original fringing vegetation, the ecology of the lakes and the fact that irrigation and domestic water supplies were being drawn from the lakes, that there were no substantial concerns about salinity in the lakes until upstream irrigation demands began to increase. Effectively the natural river flow negated the tidal influence throughout this area at most times.

It is also evident from photographs and historical accounts of the river and the lakes that the normal water level was dominated by freshwater flows and was substantially higher than would be expected if the level was dictated by tides alone. The higher natural flows would have been sufficient to back the water levels up to the current levels in many years. As a consequence the lake evaporation before the Barrages were built was not substantially less than that under current conditions.

## 1.3 External Constraints on Options

When assessing options for obtaining evaporation savings, the impacts on the following factors need to be considered:

1. Water levels in the Lower Lakes for:
   (a) social and recreational needs;
   (b) access to water supplies for current irrigation and stock and domestic users;
   (c) environmental needs/outcomes;

2. Water levels in the River Murray upstream of Wellington to allow:

(a) pumping for the major urban off-takes;
(b) gravity irrigation of the reclaimed swamps;

3. The risk of closure of the Murray Mouth;
4. The Ramsar values of the Lower Lakes, Coorong and Murray Mouth area;
5. Acceptable water quality in the Lower Lakes (eg salinity and algal numbers) for the intended use of the water;
6. The environmental and salinity benefits of the current flows through the South Australian section of the River Murray upstream of Wellington; and
7. The risk of flooding.

## 2. Modelling Scenarios

River Murray water can be saved by reducing the average surface area of freshwater in the Lower Lakes. Four options for reducing the evaporation from the Lower Lakes have been analysed for this paper and their impacts on water savings, lake levels, salinity and river flows at the Mouth have been assessed using the MDBC models.

### 2.1 Option 1 – Reduce the Lower Lake operating level to 0.55 m AHD

The current lake operating level averages 0.76 m AHD. This option lowers that level to 0.55 m AHD. The surface area of the Lower Lakes would reduce from approximately 81 500 ha to 78 000 ha (Lakes Alexandrina and Lake Albert combined) or a 4% reduction. The hydrologic impacts of the options are summarised in Table 2. The estimated water savings generated by reducing the lake surface area would be approximately 30 GL. Levels in the Lower Lakes and in the River Murray upstream of Wellington would fall by about 0.2 m. This change would not require any modification to the Barrages.

#### 2.1.1 Socio-economic impacts

The pump offtakes for the 199 private irrigation waters and for several small community water supplies around the lakes would need to be extended as a consequence of lowered lake levels. The cost for the extension of pipes will depend on the number, pipe diameter and how far into the lake the existing pipes would have to be extended. Further investigation into the irrigation cost of lowering lake levels is necessary, but these costs are likely to be relatively small. For many of the landholders adjacent to the lakeshore these costs could be offset by the reduced rate of land erosion.

Water levels from Wellington to Lock 1 (Blanchetown) are influenced by lake level variations. A lowered lake level would have implications on reclaimed swamp irrigators upstream of Wellington. The installation of pumps for gravity fed offtakes in this reach would be necessary whenever lake levels decrease below 0.55 m AHD.

The impacts of lake lowering on recreation and tourism would be significant. Boating, navigation and other activities would be significantly affected near Goolwa, some lakeshore areas or where existing channels are shallow. Information on the impact on existing marinas, boat ramps, jetties and access levels is needed if this option is to be pursued.

Small town (eg Narrung) water supply systems that are drawn from the lakes are still likely to be able to draw water effectively from the lakes but some additional pumping costs would be incurred.

Reductions in lake levels would result in a more stable lakeshore and increased environmental values. Therefore, a long-term improvement in tourism in the region could be expected. The fishing industry would be boosted by an improvement in water quality and ecosystem habitats.

### 2.1.2 Environmental Impacts

Adopting a lower lake level would reduce shoreline erosion. However, the variability of lake levels would have to be increased at this lower level to generate significant environmental benefits. Simply lowering the existing lake levels without introducing a degree of variability would provide very little environmental benefit. This may in turn reduce the volume of water savings over time. A reduction in erosion is achieved by promoting the dissipation of wave energy on lakeshore sands rather than terrestrial soils and to avoid the wave action and waterlogging of the highly dispersive Poltalloch soils. Detailed analysis is required to determine the optimum lake level for erosion control purposes but indications are only a modest reduction would deliver significant benefits. For example, a reduction in pool level of 0.25 m would most likely provide significant benefits in terms of reducing the exposure of the lakeshore to frequent, highly erosive forces. Smaller reductions of 0.15 m would benefit some areas but may still result in exposure of the Poltalloch soils to frequent wetting and wave action. The current management practice of surcharging the lake before summer to ensure lake levels can be maintained near pool level by the end of summer exacerbates the issue of an artificially high lake level.

A reduction in erosion would reduce the turbidity of the lakes and improve the water quality encouraging the growth of aquatic vegetation and supporting fish species. The samphire-Melaleuca swamp and edge communities inhabiting the lakeshores would be at less risk of inundation, thus increasing opportunities for lakeshore revegetation. Freshwater wetland habitat would increase providing drought and summer refuges for migratory birds and lakeshore waders. Any changes to the Coorong habitat would trigger Ramsar obligations and an international assessment of each modelling scenario may be necessary.

Salinity levels may rise due to increased saline groundwater inflows as lake levels are lowered. However, this requires further investigation.

This option would increase flow out of the Mouth by 30 GL/year which is a 0.6% increase over current outflows. By itself this is unlikely to reduce the risk of Mouth closure. However, combined with savings in other parts of the River, 30GL/year would contribute to a more comprehensive environmental flow program proving more beneficial to the Murray Mouth.

## Table 2. Summary of the Analysis of the Options for Water Savings in the Lower Lakes

| | B57550 | B57540 | B57530 | B58530 | B57650 | B57580 | B58400 |
|---|---|---|---|---|---|---|---|
| | Natural Conditions Run for Lower Lakes Study 25/9/01 | 1993/94 Reference Run for Lower Lakes Study 25/9/01 | Benchmark Run for Lower Lakes Study 25/9/01 | Barrages held at 0.55 m AHD | Wellington Weir - Barrages held at 0.55 m AHD | Wellington Weir - Barrages Removed | 50000 ha Bund in Lake Alexandrina |
| | Absolute | Absolute | Absolute | Difference from Benchmark Run | | | |
| **Wellington** | | | | | | | |
| **Flow into Lower Lakes (mean GL/year)** | 13581 | 5898 | 5857 | 0 | 0 | -41 | 0 |
| **% of months with Flow Reversal at Wellington** | 0.38 | 0.08 | 0.15 | 0.00 | 0.00 | 0.00 | -0.08 |
| **% of months Wellington Level < 0.75 m AHD** | 100.0 | 27.2 | 30.7 | 68.7 | -30.6 | -30.6 | -27.4 |
| **Wellington Level (mean m AHD)** | 0.20 | 0.73 | 0.72 | -0.21 | 0.05 | 0.05 | 0.04 |
| **Lower Lakes** | | | | | | | |
| **Lower Lakes Level** (mean m AHD) | 0.20 | 0.73 | 0.72 | -0.21 | -0.21 | -0.51 | 0.04 |
| **Lower Lakes Level** (minimum m AHD) | 0.06 | 0.09 | 0.25 | -0.20 | -0.23 | -0.19 | 0.04 |
| **Lower Lakes Level, % months < 0.6 m** (all months) | 100.0 | 7.2 | 12.5 | 87.0 | 87.0 | 87.5 | -12.3 |
| **Flow over barrages** (median GL/year) | 11318 | 3041 | 3092 | 35 | 36 | 123 | 550 |
| **Flow over barrages** (mean GL/year) | 12896 | 5115 | 5071 | 30 | 31 | 60 | 447 |
| **Net Flow out of Mouth** (mean GL/year) | 12684 | 4903 | 4859 | 30 | 30 | 60 | -9 |
| **Flow over barrages** % years (& longest gap in years) | | | | | | | |
| - **> 7,000 ML/d 2 consec. mths Sep-Dec** (fish recruitment) | 98 (1) | 61 (4) | 61 (4) | 0 (0) | 0 (0) | 1 (0) | 3 (0) |
| - **> 10,000 ML/d 3 consec. mths Sep-Dec** (fish recruitment) | 96 (1) | 39 (11) | 39 (11) | 0 (0) | 0 (0) | 3 (0) | 3 (0) |
| **Water Quality** | | | | | | | |
| **Wellington Salinity** (ave level in EC) | | 633 | 631 | 1 | 0 | 21 | 1 |
| **Lake Alexandrina Salinity** (ave level in EC) | | 861 | 854 | 3 | 3 | 2191 | 81 |
| **Lake Albert Salinity** (ave level in EC) | | 1834 | 1808 | -30 | -30 | 4028 | 213 |

## 2.2 Option 2 – Reduce the Lower Lake operating level to 0.55 m AHD and construct a weir at Wellington to maintain river levels

This option is similar to Option 1 except that a weir is constructed at Wellington to maintain the river upstream of Wellington to Lock 1 at the current or higher pool level. As with Option 1, the area of the lakes would be reduced from approximately 81 500 ha to 78 000 ha (4%) and the estimated savings in evaporation would be 30 GL/ year. The ballpark estimate of the cost for the construction of a weir at Wellington is $100 million, however this is an approximate figure that is greatly dependent on further investigations..

### 2.2.1 Socio-economic and Environmental Impacts

These impacts would be similar to those discussed under Option 1. The difference would be that no further action would be required to maintain the supplies to the gravity irrigators or to the major urban pump offtakes on the River between Wellington and Lock 1.

## 2.3 Option 3 – Remove Barrages and construct a weir at Wellington

This scenario proposes that the existing Barrages would either be removed or simply left open (ie, gates/stop logs removed) with causeways left intact. A weir would be required at Wellington to maintain the supply of fresh water upstream to Lock 1 (Blanchetown) for irrigators and major urban water supply offtakes. The 199 irrigators around the lakes with an annual diversion between 45 and 52GL/year are supplied from this weir pool.

The lakes would return to an estuarine condition. Lake levels would be determined by a combination of sea level/tidal and River flow influences. The average surface area of the lakes would reduce from 81 500 ha to 74 000 ha (9%). This option would reduce evaporation from the Lower Lakes by 60 GL/year.

Salinity across the lakes would vary from freshwater during flood flows to seawater during extended periods of low flow.

As stated (with qualifications) the ballpark estimated cost for construction of the weir at Wellington is $100 million. The cost of relocating the water supply to the current irrigators around the lakes would be in the range of $10 to $100 million. If this option is to be pursued, more work is required to clarify the estimated costs.

### 2.3.1 Socio-economic Impacts

With a return to estuarine conditions, lakeshore irrigation would have to either cease (presumably with purchase or compensation) or irrigators would have to be given access to the weir pool above Wellington weir (again, with compensation). The costs incurred with these options require further investigation to provide an accurate estimate. In addition, the same options apply to small town offtakes from the Lower Lakes due to the decreasing water quality of the lakes for consumptive use. It is

estimated that the compensation or resupply of all lake water users would be in the range of $10 to $100 million.

Removal of the Barrages would subject the lakes to tidal influence and would reduce the average lake level by around 0.5 m. Boating navigation and other activities would be significantly affected near Goolwa, some lakeshore areas or where existing channels are shallow. There would also be considerable impact on existing marinas, boat ramps and jetties and the area of mud flats would increase. The impacts of lake lowering on recreation and tourism would be substantial.

A change to the fishing industry would occur with a reduction in freshwater. However, further investigation would be required to determine whether this would be a negative or positive impact due to the increase in estuarine conditions favouring particular fish species.

### 2.3.2 Environmental Impacts

Lake salinity levels would rise due to the ingress of seawater with the tides and to replace evaporation in the lakes during periods of low inflow from the River. There may also be increased saline groundwater inflows as lake levels are lowered. However, this requires further investigation.

The Lower Lakes would return to more estuarine conditions with removal of the Barrages and installation of a weir at Wellington. A change to fish, bird and fauna habitat would be a consequence of a return to estuarine conditions. Lower Lake levels would reduce erosion around the lakeshores and this, in conjunction with the increased salinity, is likely to reduce lake turbidity. This may encourage aquatic vegetation.

Removing the Barrages would increase net flow out of the Mouth by 60 GL/year which is a 1.2% increase over current outflows. This increase in the net flow out of the Mouth will result in a slightly reduced risk of Mouth closure although, by itself, it is unlikely to make a major impact. Combined with savings in other parts of the River, however, 60GL/year would contribute to a more comprehensive environmental flow program proving beneficial to the Murray Mouth.

The removal of the Barrages would increase the tidal prism and hence the volume of water flowing in and out of the Mouth during the tidal cycle. In addition, evaporation from the lakes during those months when evaporation exceeds inflow from the River would draw an average of 60 GL/year of water into the lakes from the sea. This volume would be flushed out again once the inflows from the river increased. The impact of these changes on the risk of Mouth closure is not well understood. The MDBC has engaged a consultant to develop a morphological model of the Murray Mouth which is expected to shed light on this question. However, there is a belief that increasing the inflows from the sea may increase the volume of sand deposited inside the Mouth.

## 2.4 Option 4 – Construction of a bund in Lake Alexandrina to isolate a freshwater annulus from a 50 000 ha saline inner lake

This option aims to physically divide the lakes into freshwater and saline water compartments. There are several possible variations on the theme, including bunds or embankments in Lake Alexandrina, Lake Albert or both. The bund could either be a continuous structure leaving an annulus of freshwater around the perimeter of the lake(s) or a structure which isolates a portion of the lake by joining with the land at two points. The bund could be constructed of a variety of materials and would have an estimated total construction cost of $270 million.

The option examined for this report was the construction of an embankment in Lake Alexandrina running parallel to the shore. This embankment separates the fresh river water from a saline inner lake contained within the bund. The fresh water flows around the outside of the lake before eventually entering the Murray estuary and the Coorong through the existing Goolwa, Mundoo, Boundary Creek and Tauwitcherie Barrages. The inner lake is connected to the Murray Estuary and the Coorong through a separate channel between these Barrages. This connection is inside the Mouth. As modelled, the inner lake has a surface area of 50 000 ha compared to the existing surface area of Lake Alexandrina of 63 500 ha. The surface area and volume of the lake upstream of the Barrages is reduced and this enables the level in the outer lakes and the river to be regulated more closely to pool level. It also increases the flow over the Barrages into the Murray estuary by 447 GL/year on average.

However, the water inside the inner lake will continue to evaporate and water will be drawn from the Murray Estuary which is inside the Murray Mouth. All of the additional flow over the Barrages is used to balance evaporation in the inner lake. The analysis of this proposal suggests that, although the flow over the Barrages increases by 447 GL, the net outflow from the Mouth reduces by 10 GL.

The maintenance of the Murray Mouth has been recognised as a key objective for environmental management in the Murray-Darling Basin. The bund proposal, although nominally saving evaporation of fresh water, does not reduce overall evaporation from the Lower Lakes and does not increase flow out of the Mouth. Therefore, from the viewpoint of Mouth closure, no savings have been achieved and no water has been generated. . If further irrigation development occurred along the River as a consequence of this option, net outflows from the Mouth would reduce, breaching the Murray-Darling Basin Ministerial Council's Cap on diversions.

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### 2.4.1 Socio-economic Impacts

A bund in the Lower Lakes has socio-economic impacts in the Lower Lakes, Coorong and Murray Mouth region due to extensive alterations to the lake environment.

The construction of a rock-lined embankment visible from all locations on Lake Alexandrina would be an unnatural intrusion into a unique landscape and this may affect tourism and recreation in the region.

The presence of a bund would hinder movement around the Lower Lakes, thereby impacting on recreational activities ie. boat navigation, fishing, and water skiing. Consequently, the economically significant tourism/ecotourism industry in the region could be affected.

Freshwater fish habitat would decrease with a reduction in lake area damaging a significant South Australian industry. Currently, the freshwater fishing industry in the Lower Lakes generates approximately $1.1 million per year (770 tonnes for 1999/2000 financial year) for the economy, and any impact on this industry must be viewed with extreme caution. This may be balanced to a degree by an increase in the estuarine fishery.

The presence of indigenous cultural artefacts requires consideration. Aboriginal historic sites, burial grounds and relics may be impacted with the implementation of this option.

### 2.4.2 Environmental Impacts

The construction of a bund in Lake Alexandrina would reduce the net flow out of the Mouth by 10 GL/year or 0.2%. This reduction is unlikely to have a significant impact on the risk of Mouth closure, however, given the impact that the reduction in flows has already made to the silting of the Mouth, it is a move in the wrong direction.

The connection of the inner lake to the Murray Estuary will increase the tidal prism and hence the volume of water flowing in and out of the Mouth during the tidal cycle. The impact of this change on the risk of Mouth closure is not well understood. However, there is a belief that increasing the inflows from the sea may increase the volume of sand deposited inside the Mouth. If this is the case, siltation would also cause problems for the maintenance of the inlet channel to the inner lake.

The greater degree of lake level regulation that is possible with the bund option could result in more stable and, on average, higher lake levels. As a consequence, lakeshore scouring and erosion is likely to increase leading to greater water turbidity and a decline in aquatic vegetation.

Evaporation from the inner lake would result in a net inflow into that lake. Since the lake would no longer be flushed during high River flows, the exchange of water with the tides and winds is unlikely to be sufficient to prevent the salinity of the inner lake rising steadily over time. This process may also lead to the concentration of other undesirable water quality parameters with consequential impacts on the environment.

A reduction in the freshwater area of the lake would impact on fish habitat decreasing freshwater fish species. The compensating increase in the area of estuarine habitat may depend on how saline the inner lake eventually becomes.

A reduced area of either Lake Alexandrina or Albert would restrict the mixing of water between the two lakes via wind. Lake Albert is naturally more saline than Lake Alexandrina. Wind generated water mixing ensures that Lake Albert is occasionally

freshened with less saline Lake Alexandrina water, especially when flood flows are present. The possible impact of reduced wind mixing of the lakes has not been included in the modelling of Lake Albert salinity.

## 3. Conclusions

Four Options for saving water from the lower lakes to increase flow out of the Murray Mouth have been examined. The conclusions reached for these four options are summarised below and in Table 3.

### 3.1 Option 1. - Lower Lake Level to 0.55 m AHD

- Evaporation reduced by 30 GL/year;
- Works required to lower water offtake infrastructure around the Lower Lakes and the River Murray between Wellington and Lock 1;
- Lake and River levels drop by 0.2 metres on average;
- Significant impact on recreation, boating and tourism expected; and
- Reduced erosion around lakes and subsequent environmental benefits.

### 3.2 Option 2 - Lower Lake Level to 0.55 m AHD and Build Wellington Weir

- Same as Option 1 except that water levels in the River between Wellington and Lock 1 are stabilised at the pool level
- Estimated $100 million cost for new weir

### 3.3 Option 3 – Remove Barrages and Build Wellington Weir

- Evaporation reduced by 60 GL/year;
- Works required to relocate water supply for existing water users around lakes at cost of $10 - $100 million;
- Estimated $100 million cost for new weir;
- Reduced operation and maintenance costs for Barrages;
- Lake levels drop by 0.5 metres on average
- Substantial impact on recreation, boating and tourism expected;
- Reduced erosion around lakes and subsequent environmental benefits;
- Increased tidal prism may or may not increase siltation at the Murray Mouth;
- Salinity in the lakes would vary from freshwater during flood flows to seawater during extended periods of low flow;
- Substantial changes to the habitat in the Lower Lakes; and
- Substantial changes to the freshwater and estuarine fisheries.

### 3.4 Option 4 – Construction of a bund in Lake Alexandrina to isolate a fresh annulus from a 50 000 ha saline inner lake

- 10 GL increase in evaporation from lakes;
- Estimated $270 million construction cost

- More stable water levels in the outer lake and in the River Murray between Wellington and Lock 1;
- Increased tidal prism may or may not increase siltation at the Murray Mouth;
- Slightly increased erosion around lakes and subsequent adverse environmental impacts;
- Without flushing, the salinity of the inner lake would increase over time;
- The bund would be an unnatural intrusion in a unique landscape;
- The bund would hinder boat movement around the Lower Lakes,
- The freshwater fish habitat would decrease but, provided that the inner lake does not become too saline, this may be balanced by an increase in the estuarine fishery; and
- Increased salinity in Lakes Alexandrina and Albert.

**Table 3 – Summary of Options**

| **Scenario** | **Construction Cost** | **Generated water Savings** Net flow out of Mouth (mean GL/year) | Operation & maintenance expenses | **Salinity Impacts** Lake Alexandrina (ave level in EC) | **Salinity Impacts** Lake Albert (ave level in EC) | **Lower Lake Levels** (mean m AHD**)** | **Net flow out of Mouth** (GL/year) |
|---|---|---|---|---|---|---|---|
| Current Operation (Benchmark) | 0 | 0 | $850 000 / year (current) | 854 | 1808 | 0.72 | 4859 |
| Lowered Lake levels (0.55m AHD) | Cost of lowering offtakes around lake and lower River | 30 GL | $850 000 / year (current) | 857 | 1778 | 0.51 | 4889 |
| Lowered Lake levels (0.55m AHD) **with** Wellington Weir | $100 million Plus cost of lowering pump offtakes around lake | 30 GL | $850 000/ year (as above) plus operation and maintenance on Wellington Weir $320 000/year. | 857 | 1778 | 0.51 | 4889 |
| Barrages Removed **with** Wellington Weir | $100 million plus $10-$100 Million to move supply to lakes | 60 GL | $320 000/ year Plus reduced operating costs of Barrages and supply to existing lakes irrigators | 3045$^{+}$ | 5836$^{+}$ | 0.21 | 4919 |
| Bund Option | $270 million | -10 GL | $850 000 / year (current) plus bund and lake operation and maintenance | 935 | 2021$^{+}$ | 0.76 | 4850 |

## 4. References


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