Senate enquiry into the management of the Southern Lakes and Coorong region of South Australia

A private response by ...

Dr. Peter Marsh
M.B., B.S.
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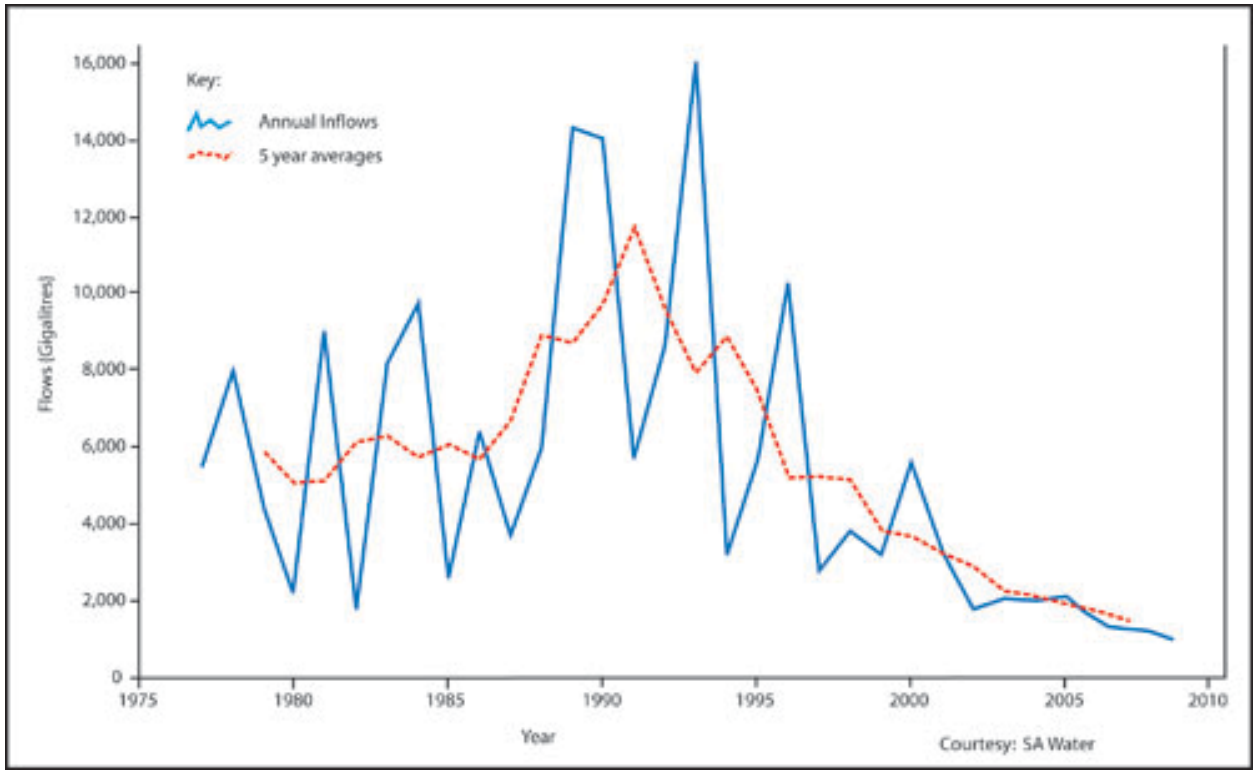
1. Introduction

There is much attention surrounding the demise of the Southern Lakes (SL) and the media is filled with articles on the inexorable decline in potable water from the shores of this once vast freshwater system. The Coorong is also painted as being under threat of total collapse. Much ignorance abounds in the various arguments from people who can be forgiven for responding to what must be a terrible tragedy unfolding in their lives. Pleas to our eastern states to release water to "save the lakes" have been made repeatedly and largely dismissed.

Agencies at all levels have been talking about this issue for many years but despite this, the trend is steady and continuing. Upstream agricultural users are being singled out as being the main culprits in what is shaping to be an event of national significance. Billions of dollars have been put on the table by the previous Federal Government and that process continues under the new administration. The chart of inflows into SA below tells the actual story.

The dry goes on and with poor rainfall this recent winter resulting in storages on the traditionally dominant Murray/Murrumbidgee section at all time lows. Cries are going out to release water held upstream in the Darling section in Queensland & NSW where agricultural holdings have been allowed to draw significant storages from the water courses over the years to the detriment of users downstream. That water is too little and too far away.

It is the purpose of this paper to balance the hysteria and mis-conceptions with some general facts and based on this present some forward thinking and rational plans to deliver a sustainable future for the region and for parts of South Australia.



2.Exposing the Hysteria and mis-information

The SL were never an exclusive freshwater system but rather an estuarine system that oscillated between fresh water in times of high flows and sea water in low flows. Sea water ebbed and flowed throughout the SL for millennia in response to the countering forces of fresh water from the Murray River and the ocean from the south. This produced an environment which vanished along with the construction of the barrages at Goolwa and Lake Alexandrina in early 1900's. Prior to this the sea sometimes extended almost as far inland as Mannum to a place called Pompoota, an aboriginal name which translated means "the place where the sea stops". What we have at the moment is an artificial freshwater system which is drying out due to decreased inflows and steady evaporation.

A few million years ago the shoreline was much further inland compared to what it is today. A close inspection of the South East of the state reveals a series of parallel sand ridges which marked the stepwise progression of the last retreat of the ocean as it clawed its way south-westward with falling sea levels. If you look at the continental shelf there are submerged ridges that match today's Coorong, indicating that this oscillation has been a recurring theme.

If you have coffee and cake in the antiques store in Mannum in the excavated rear courtyard you can see embedded into the limestone the familiar shapes of cockle shells that you would dig from the sands of Goolwa but 150 km inland. The sea was very familiar with this place.

According to one author, about 2 billion years ago when the moon was much closer to Earth than it is today, giant tides several hundred metres high swept vast areas of the land twice daily with inundations that rushed over the land at staggering speeds, tearing away anything that was not firmly bolted down out to sea giving that "scraped clean" appearance of so much of our landscape. Only the hard layers of rock that existed would have held as the rest of the terrain was smoothed and washed away by this tremendous force.

Ice ages have created glaciers that eroded the land but in a more angular form but there are remnants of these events in our geological history with such places as "Glacier Rock" in Inman Valley and Hallet Cove moraine deposits on the northern shore of Fleurieu peninsula. As you drive along the "Main Range" between Cape Jervis and Victor Harbor you can see the deeply eroded valley of Yankalilla and Inman Valley which were once glacial valleys. The smoothed rounded tops have resulted from millions of years of erosion. The only permanent thing that the long history of the region ensures is that nothing is permanent.

The SL comprise an area of some 780+ square kilometres of waterways which when full has an average depth of only 2 metres. It is in an area that has an evaporation rate of around 1.4-1.6 metres per annum and so if full, the amount of water lost to evaporation from this enormous petri dish is around 1,300 Gigalitres. Balancing this with rainfall and local inflows results in a net evaporative loss of around 850-950 Gigalitres a year. That is over five times the total

consumption of Adelaide or similar to the domestic water consumption of every Australian to put it into perspective.

It is a large amount of water that is lost to evaporation and the author of this paper considers to be an unjustifiable waste. Contrary opinion would have it that the SL are an important natural environment which deserves preservation quoting a rich abundance of wildlife that is under threat should the dynamics of this area significantly change. This author would beg to differ.

The SL are home to several creatures and a modest collection of aquatic plants that are otherwise not unique to the area. Because of the persistent turgidity of the water due to years of clay deposits from the Murray Darling Basin (MDB), plant life is severely restricted to the shallower borders of the lake where plants can manage to receive sunlight through the muddy waters. In the deeper parts of the lake very little plant-life exists because of the effective lid the turgid water places on its potential. Now, with increasing salinity the aquatic plants are suffering because they are outside their normal range of conditions.

Creatures inhabiting the waters include freshwater turtles, fishes of various kinds and freshwater mussels. All of these species exist throughout the MDB and are not unique to this zone. European carp, an introduced species that thrives in the muddy water is also thankfully having a bad time as salinity levels rise during the drying out time of this waterway. Native fish such as the Murray Cod are also suffering as a consequence as will be countless numbers of creatures as decreasing flows throughout the MDB are putting pressure on their breeding and feeding grounds. What is largely absent are the creatures that once regularly migrated between the fresh waters of the river systems and the ocean. This proposal will give them a new home and allow them to return.

Picture 1: *Fresh water mussel on exposed sandy floor of Lake Alexandrina, September 2008*

Like it or not, global warming is upon us. Rainfall in the MDB has decreased sharply over the last 35 years {see figure on page 1 of inflows into SA} and is likely to continue to decline. The halcyon days of abundant water to waste are probably over and so as we move forward, we have to adopt an attitude of strict conservation and appropriate use of our limited and diminishing supplies. Along the way we also need to put a measure to environmental use to encourage the growth of

niche complex environments where nature has sway. The vast open waterways of the SL are no such niche environment.

The Coorong is often mixed into this debate as a precious waterway that is under threat from the diminished flows from the SL to the Murray Mouth near Goolwa. The popular logic goes that increasing the flow down the lakes to the Murray Mouth will help the Coorong is not true. The invalidity of this argument stems from the nature of the Coorong and it is pertinent to describe the Coorong system and then fit it into the overall scheme of things.

The Coorong is a complex ecosystem that stems from the South-East coastline north of Kingston SE and extends in an arc towards Goolwa in the west. It is a marine environment and currently its opening near Goolwa is under constant threat of closure due to declining outward flushing by virtue of the reduced flows down the Murray Darling system. Even to this point the vocal activists display their ignorance because for many, the assumption that the Coorong is a fresh water system is a sad sign of their lack of understanding.

2.1. The South-Eastern Coorong

As one moves south-easterly along the shores of the Coorong the nature of the waterway changes, as it becomes increasingly brackish and in some places the pungent smell of the hydrogen sulphide smell of anaerobic biological activity forces one to reach for the air conditioner to set recycle to on. This situation has allegedly become steadily worse over time but as a child, now some 40 years ago, I recall the same hydrogen sulphide smell coming from the Coorong every time we drove past Salt Creek. Salt concentrations are allegedly rising in this middle section with reports of mid-summer highs of nearly three times sea concentrations leading to the decline in marine creatures and a reduced feeding ground for the birds that make this area part of their migratory path.

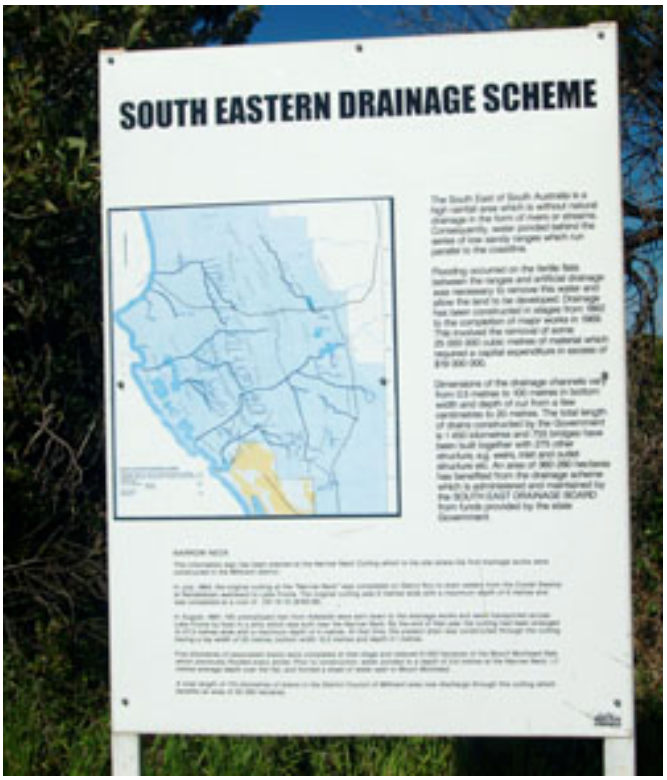
The major problem with the Coorong has its origins near Naracoorte and Mount Gambier in the south-east where a network of hundreds of kilometres of drainage channels diverts fresh water from the surface in winter and spring towards the sea to the west. In the past, vast sheets of water slowly percolated their way North-Westerly along the sand ridges of the south-east and some of this water eventually found its way into the southern and middle section of the Coorong.

In the past, these wetlands would have rivalled the current Kakadu wetlands and reports of flights of magpie geese blackening the skies for up to an hour as they flew past give a vivid image of what may have been but through mankind's activities, is no more.

The diversion of this surface fresh water directly into the drainage channels and out to sea is the primary cause of the decreased inflows into this section of the Coorong and has absolutely nothing to do with the River Murray and the SL. It is a separate problem and requires a separate solution.

A recent tour of the South-East revealed large drainage channels with significant flows of fresh water of varying quality today which could be turned back towards the Coorong with some significant engineering infrastructure but with the result of being able to replenish this section of the state and greatly assist the health and vitality of this section of the changing estuarine system. It may be possible to dovetail two purposes in the one project - by diverting this fresh water that is destined to be wasted at sea to parallel the lower and middle section of the Coorong.

This could re-invigorate the band paralleling the Coorong environmentally and at the same time offer a means of securing agriculture along this zone with the utilisation of ground water recharge during times of high flows and drawing during times of dry conditions. A key part of this proposal would be to greatly enhance the fresh water input into south-eastern and middle Coorong.



Pictures 2 and 3: *Photograph of billboard describing the South Eastern Drainage Scheme near Narrow Neck cutting which demonstrates healthy water flows with rich aquatic vegetation beneath the crystal clear waters.*

Whilst this cursory examination revealed exciting pockets of clean waterways with vibrant aquatic ecosystems the quantities that could be reasonably recovered from the system is one that requires serious investigation. Given that the South East Drainage scheme covers an area of land approximately 8,000 sq.km and has an overall average annual rainfall of 550 mm {source:

Bureau of Meteorology rainfall statistics} this represents a total rainfall of approximately 4,400 gigalitres. Given that the runoff may be between 500 and 2,000 gigalitres and that most of the runoff ends in drainages to the sea {meaning from an agricultural and an environmental point of view it is lost to the land} then by capturing some of this freely available resource and redirecting it north-westerly may be a worthwhile exercise.

2.2. The middle Coorong

The middle Coorong, west of Salt Creek has an interesting feature which functionally separates the western from the southern portion of the Coorong in a constriction called unimaginatively "The Narrows". This isthmus means that only a trickle flow can move in either direction. Tidal inflows from the western section will be hampered from moving into the southern section and vice versa.

Picture 4: *Image of middle Coorong showing "The Narrows". Source: Google Earth Pro 2008. This effectively means that the Coorong is functionally divided into two halves, a western and a south-eastern half. If both are crying out for attention, devoting time to the western section does little for the south-eastern section.*

This may mean that if an attempt to improve the health of the entire Coorong is the aim then it would seem that any attempt would need to involve doing something that directly benefits the southern section. That adds support to the argument for bringing fresh water from the SE Drainage Scheme to add to the salt water in this section to maintain an ideal level of salinity - but not to disturb it by making it fresh water. All this is doable in a controlled way.

3.What to do with the Southern Lakes {Lake Alexandrina and Lake Albert}.

These lakes and the associated waterways of the Goolwa arm are under threat as decreased flows expose the lake-bed and the accumulated sulphate chemicals laid down over many years of static water presence and algal blooms that break down under anaerobic conditions to result in sulphate chemical buildup. Once exposed by drying beds, a chemical reaction turns the sulphate compounds into sulphuric acid which may lead to some spectacular chemical effects for the time that the chemicals remain active.

Sulphate soils are turning out to the the bane of mining where any rocks with sulphate content are exposed to air. They result in an steady stream of sulphuric acid which will require constant remediation in order to maintain healthy waterways downstream from the exposed rock. The now disused pyrites mine at Brukunga is a source of sulphur pollution in the Bremer River which makes its way into Lake Alexandrina and were it not for the permanent counter-measures would lead to a dead section of the Bremer River for a significant part of its course.

Once exposed, the pyrite rock will produce a steady stream of sulphurous liquid forever, a permanent legacy from our mining ventures and in many places around the globe is damaging waterways. This is the surprise consequence of mining which in its outset would never deliberately try to leave lasting irreversible damage to a waterway system - but there we have it, a lasting legacy for a mine that only ran for a few decades.

The problem within the lakes and throughout the MDB is where fresh water has become stagnant, algal blooms occur. When this material dies and sinks to the bottom it is processed anaerobically, resulting in a deposition of gelatinous sludge rich in chemicals including sulphur compounds. The popular press reports the exposure of this sulphate to air as creating a source of sulphuric acid that will destroy the body forever.

I beg to differ. The source is finite, unlike the earlier described example of mining which is forever. In the case of sludge, once it has been agitated by high flows and dispersed, it is more than likely that the problem will not re-occur as long as the conditions that caused it in the

first place do not re-occur. This strengthens the argument for changing the SL to a tidal system.

I feel that argument used for flooding the SL is like the one used to dupe most of the western world into spending vast sums of money on a problem that never existed - the Milennium bug hoax of 2000. We were all convinced and all got sucked in - but things kept working despite the hysteria and irrational action. Let's learn from this and not rush headlong down a path that is not required.

3.1. Can they be maintained as fresh water systems?

Before we answer that question, it would be more important to ask "Why should we?". To many the answer is obvious that we should because it is only natural. However, as has been pointed out, the recent fresh water status of the SL has only been a brief artificial construct which nature never provided. I would question the wisdom of trying to maintain something that clearly is not natural and to do so would involve a cost that we probably cannot afford at this time.

Balancing the clamouring demands to release non-existent water from upstream to fill this vast evaporation basin this author considers that water, where available should be used for worthwhile purposes. In a situation of declining availability of fresh water situations that give little benefit and consume large amounts should perhaps be sacrificed in lieu of other more beneficial uses. I would prefer to see woody waterways receive a revitalising drink of water instead of the short term filling of a lake that is a poor place to use as a reservoir.

As we project into the future, maybe it is time for us to walk towards the future and not run away from it. It is clear that water from the MDB is in decline and we in SA have to find alternative sources of our water. We also need to come up with viable alternatives to producing energy at cheap costs to replace carbon based fuels. These are inescapable needs. Perhaps it may be possible to combine both needs in the one solution.

First of all some prejudices need to be exorcised and the first of them is that by filling the lakes with salt water will kill them. This is the emotive answer given by most of the voracious protesters at the moment. It is not true. Salt does not equal death.

If one were to calmly view what nature has on display for us by visiting the extensive coastline of our state we will see countless examples of beautiful natural micro environments and many of them involve salt or brackish water. Several of the healthy lakes and estuaries in the South-East and Eyre Peninsula are marine environments but the common thread amongst all of them is that their contents are open to the sea and are regularly discharged and exchanged with the contents of the sea. Almost exclusively, where a body of water is enclosed, salt accumulates

and eventually one is left with a salt pan. That is something to avoid and is probably behind the majority's phobia about allowing salt water into the SL. These environments are not dead.

However, it is my firm belief that with appropriate engineering a system of controllable gates could lead to a marine environment of the SL that will be regularly flushed and recharged with a steady cycle of fresh salt water from the Southern Ocean that will make this area more vibrant and more ecologically active than it is today. Basically, the proposed system includes the construction of the barrage on the southern end of the River Murray {whether near Wellington or further inland near Murray Bridge matters nought} but this is a key component to keep the salt water from percolating upstream.

Picture 5*: Salt pan complete with bordering heathland adjacent to Lake Alexandrina, 2007*

I would prefer instead of a solid barrier to have a construction that contains a central solid boat transiting station but within a wide "leaky" gravel and stone bed that slowed down but did not stop water from moving in either direction. Its level would be so constructed that with the new marine environment below the barrier which will have a water level lower than the River Murray, there will be a continual but small trickle of water through the barrier and into Lake Alexandrina.

Extensive plantings of vegetation that would choke the matrix of the wall would provide a vegetative glue that will fill the cracks to further reduce the free flow of water from the upside to the downside, with the exception of high flows in which case the excess water will simply flow over the top and into Lake Alexandrina.

A new channel and set of barrages would need to be dug into the southern end of the blind Lake Albert so that this body of water communicates with the mid western section of the Coorong. The existing barrages at Tauwitchere and Goolwa as well as the new barrage near Meningie would need to be re-designed so that their barriers can be regularly opened and closed along with normally occurring tidal changes.

Picture 6: *Possible site of new channel connecting Lake Albert with the Coorong near Meningie.*

3.2. A TIDAL SOUTHERN LAKES SYSTEM

The aim is to result in a SL system that is tidal, and with water that is being constantly charged, circulated and discharged. Because of this rapid turnover, its salinity level will remain near that of sea water. Water will remain within the system for a short period of time as it is regularly flushed out to sea and exchanged for fresh sea water from the Southern Ocean. The process will be handled entirely by nature and the height differential provided by normal tidal action will drive the process. The aim is for a tidal system which has an artificial high water level (AHWL) below that of the natural sea - approximately 150-250 mm.

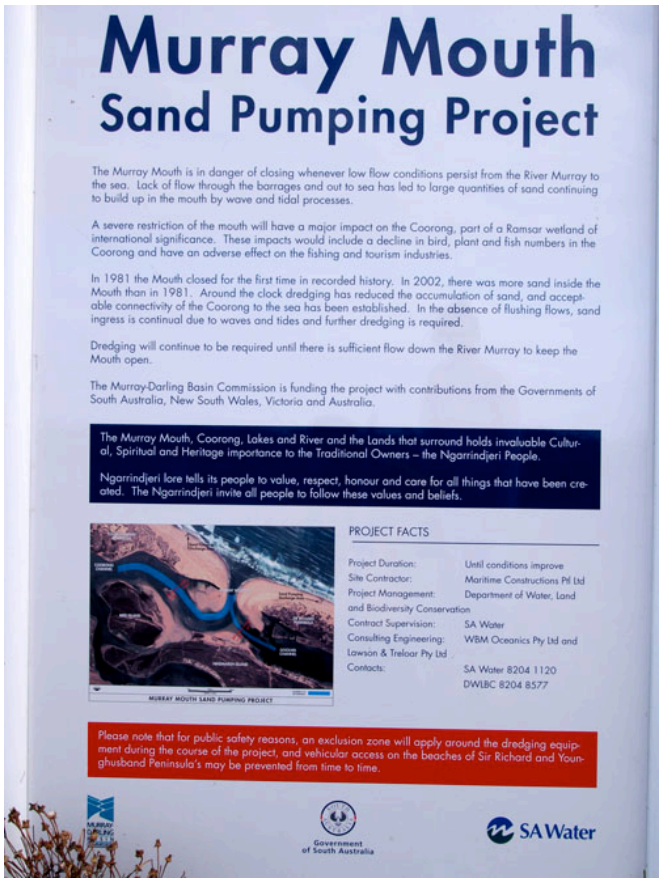
3.2.1. How it could work - the Inflow phase

As the incoming tide brings water through the entrance of the Murray Mouth, the gates along most of the length of the Tauwitchere barrages are opened. This would happen in mid flow as the tidal height exceeds the high water mark inside the SL {ie > 250 mm below AHWL}. Instead of being opened at the top or bottom, they are opened in the middle so that water can

flow freely into Lake Alexandrina. Water can continue to flow across this long expanse of barrage until it reaches the AHWL when the flow is stopped.

3.2.2. Outflow phase

As the outgoing tide is underway and the water level on the Coorong side is below the AHWL, one set of gates is opened either near Goolwa or Meningie. In this proposal, the entire set of gates are opened and would allow a vigourous outpouring of water that may be sufficient to lower the water level in the SL system by approximately 100 mm. This would therefore determine the general tidal fluctuation of the system - a twice daily rise and fall of only 100 mm, but sufficient to maintain the health and vitality of this marine environment.



Picture 7: *Photograph of the State Government's notice describing the sand dredging operations at the Murray mouth near Goolwa, 2006. Note the optimism in considering that this was going to be a short term exercise until nature behaves itself and conditions return to "normal". Nature has shown who is the real boss.*

The gates could be so designed that their base extends several metres below the AHWL so that a deep channel of flow can form that is contiguous with the central part of the Coorong. This will mean that instead of elevation, high net flows are achieved by rapid movement of water at depth.

As the outflow is oscillating between the Goolwa or the Meningie arms, both zones benefit from the daily flushing of significant volumes of water through the system. The flow through both these sections are constant: south-easterly in Lake Albert and westerly in the Goolwa arm. The volumes involved are staggering amounts and when compared to the flows of even the best of times via the Murray freshwater flows would glow red with significance. A tidal drop of 100 mm may seem a small amount but given the size of the SL at near 800 sq.km represents a volume of some 80 gigalitres. Given a twice daily ebb and flow of this amount means that in any 24 hour period, some 240 gigalitres of water will be flowing past the Murray Mouth.

That is an incredible amount of water and would result in a significant broadening of the opening of the channel to the sea and a deepening of this channel simply in order to cope with the huge amount of water involved. It may not be possible to move this amount of water in the limited time available but it must be borne in mind that elsewhere throughout the world similar quantities of water regularly make their way through narrow waterways with spectacular results {eg inside passage of Canada and Alaska}.

Picture 8*: Image of Westernport Bay in Gippsland Victoria demonstrating a tidal estuary that is maintained by a dentritic collection of drainage channels that help the tidal flow of some 210 gigalitres passing through a narrow entrance measuring 1.7 km from an area approximately 350 sq.km.*

In Australia there are a couple of examples of open waterways and a cursory examination of their dynamics would put this concept into credibility. Firstly, the WesternPort Bay area mentioned earlier is a tidal estuary that has a basic fan shape. The bay which has a surface area of approximately 350 sq.km has an opening which is only 1.7 km wide. With a tidal variation of approximately 600 mm means that on a four times daily basis 0.6 x 350 = 210 Gigalitres flows into and out of the opening. This means a daily estimated total flow of 840 gigalitres. This is around four times the anticipated flows from the revamped SL under this proposal.

Another example is Port Phillip Bay on whose shores are home to Melbourne, Geelong and many other settlements along its extensive coastline. It has a surface area of approximately 1,850 sq.km and using tidal figures available from the official tide estimates for Australia, an average tidal variation for the entire bay of 500 mm means that an average tide moves approximately 1,100 gigalitres of water. Four times a day means an average flow across the 2.7 km opening near Queenscliff of a staggering 4,400 gigalitres a day.

From the preceeding two examples, what is being proposed on the SL is not outside the realms of possibility and it is certainly based on what nature has been capable of for milennia.

By scouring the Coorong alternatively from both ends would maintain this waterway in pristine condition and because of the high flows possible on the revitalised central portion, water to the east of this area will improve in quality as its stagnation experienced currently gives way to regular recycling. Marine life will improve and along with that the visiting marine bird-life for whom this are was once famous and hopefully will become again.

3.3. Rehabilitating the Ecology of the Southern Lakes

Assuming that the process of engineering the SL to become a marine environment has occurred then what of the ecological consequences of this action? These will be many but some topics to be discussed in this paper include:

a. Removal of accumulated clays and clearing of the turgid water

b. Revegetation of the coastal strip

c. Vegetation of the lake bed

d. Artificial environments for sea birds

With the opportunity afforded of the exposed lake bed one can see a variety of materials that form the base of this shrinking lake. Being an estuarine environment, sand makes up a significant part of the shoreline and base of the lake. Over the years, a slow build-up of clays that are included with the inflows from the MDB deposit themselves on top of the sands and mud-stones but as is obvious during normal times, the regular agitation of water through the system keeps the clays from settling and they remain in suspension.

If an alternative action dominated the SL that included regular flushing out to sea, the top scum of clays would be eventually carried out to sea and would leave a cleaned sandy bottom and where present, clean sandy shores. This would eventually lead to the situation where the body of the lake became clear water, allowing the establishment of an extensive bed of sea grasses and macro algae that will thrive in this new environment.

Where the beds are of clayey materials, the wind and wave action will continue to stir the microscopic clays into suspension and would continue the process of maintaining the brown muddy waters seen through most of the MDB. However, if in those sections, aided by the new regime of a low tide and repeated oscillation between gentle inundations and exposure to air, the controlled planting of mangrove forests will eventually stabilise the ground and prevent wave action from agitating the clays into suspension.

Mangrove swamps occur within this latitude and require specific conditions in order to thrive. It is believed that those conditions of warmer waters {large expanse of shallow water exposed to sunlight}, continual cycling to avoid stagnant hypoxic water and the absence of significant deep water currents will tend to enhance the chance of mangroves in colonising this area. Mangroves are an important feeding and breeding ground for marine creatures as well as birds who nest and feed in its waterways. By creating this micro-environment in locations where otherwise open water previously existed would enhance the biodiversity of the area.

Pictures 9, 10, 11: *Photographs of vegetation growing on a beach where daily inundation by sea water occurs. This is similar vegetation to that which occurs adjacent to salt pans, indicating that the plants can survive high levels of salinity. The waters are calm here with few storms to erode the delicate beds. This is what may develop should the Southern Lakes be made a marine environment with a modest tidal regime.*

Another form of vegetation that could be established on the shores of the now stable but low tidal variation environment could mirror the mysterious mud mounds seen on the northern coast of Yorke Peninsula {see pictures 9-11}. Here, with the low tidal variation, mud stacks measuring only 250mm high survive with plants that look like they could survive happily in any garden with one major exception - that they grow in sea water. With careful engineering, mounds similar to the examples could be produced artificially but made to look as if they had been created naturally. By engineering in a new home for a variety of plants that otherwise would not exist in this area goes to enhance the "natural" biodiversity of the area.

Once the instability of the edges have been controlled the overall water turgidity may improve to the stage where sunlight will penetrate to the bottom of the lake. Then, sea grasses and macro algae will colonise the area, bringing with it the myriad marine creatures that take advantage of this new environment.

One of the niche environments that exist already dotted around our coastline are protected places where predatory animals cannot reach. These are havens for sea birds who come to recognise the benefit of a secure nesting site away from mainland predators and with a local food supply from the sea, make these areas either their permanent home or an important stopover location on their global migration paths.

By cleverly building nesting islands off-shore that direct all of the droppings from the birds into centralised collection points, there is an opportunity to take advantage of the waste produced by thousands of sea birds in the potent guano that their high phosphate manure contains. Given large quantities, this could become a significant additive to the other sources of fertilizer on which much of our agriculture is based. The key difference with this approach compared to mining phosphate rock from historical sites is that this process is self-renewing and can be harvested continually into the future. Give a few million birds a new home and they will reward us with a generous supply of fertilizer, free of charge.

3.4. Can we do other things on the Southern Lakes?

The SL are windy places, as the air whips across the surface of the water. Travel only a short distance inland and the air at ground level stops moving because friction with the land slows wind movement. If a wind turbine system was designed to take advantage of this natural resource, we could take this abundant and inexhaustible supply to drive many possible outputs. We could produce electricity, electrolyse sea water to produce hydrogen {which could form the basis of our replacement transport fuel or simply burn it to produce base load electricity, something that current wind generators do not do} and if the device was sited directly on top of the water, could provide the mechanical energy needed to drive the process to desalinate sea water.

This means that theoretically the energy going to waste on the surface of Lake Alexandrina alone could not only provide a large proportion of electricity for SA, but also produce a slice of our future transport fuel and in the short term, drive sufficient desalination plants at a cheap price to not only meet domestic needs but agricultural needs as well. This means that every property within a short distance of the shore would have an inexhaustible supply of fresh water for the cost of the apparatus and a few replacement materials. As fuel is provided for “free” the running cost of this apparatus would be a minimum.

One issue that is causing some concern with the alternative proposal for a reverse osmosis plant near Port Stanvac is the release of a concentrated stream of brine into the gulf St. Vincent. Instead of this happening, a diffuse trickle of brine would be returned to Lake Alexandrina by the wind turbine driven desalination plants. As the water is regularly recycled out to sea, the net effect will be negligible.

A marine SL could also be an inexhaustible supply of water for Adelaide and because of its position at the in-feed end of the existing reticulation system could easily dovetail into the current network. It would also provide a much needed alternative source for water for this entire region to the River Murray which projecting into the future is truly sustainable.

It may be an ironic twist that this approach is so successful that excess fresh water is allowed to flow into the lower River Murray section to travel as far inland as the barrages at Blanchetown, some 250 km upstream. Farmers along the way will be able to draw from this new resource as well as properties along the entire shoreline of the SL region.

This alternative design wind turbine could also be put to work in our South-East to pump some of the water that goes out to sea to be redirected along one of the lines of sand dunes that parallel the Coorong. The vision is to create an artificial waterway that travels all the way from near South End to north of Meningie, but with several "leaks" along the way that let some of the water south into the Coorong.

Farmers along this route will benefit by being able to draw from this new artificial waterway and either directly use it or store underground in their sandy soils for later use at drier times. Along the way, we will have made a beautiful waterway, filled with aquatic plants, trees, fish, amphibians and birds which will also hopefully be a pleasant canoeing route through this country. It may be that sufficient water will make it as far as the north eastern corner of Lake Alexandrina near Coomandook where it can be discharged into this northern point in the lakes. There it will mix with the salt water that is whizzing past daily to make this more like it has been for millennia - a rich soup of brackish water that supports the transition from marine to fresh water throughout the system.

3.5. What if conditions improve with higher inflows?

If what we are experiencing is a cyclical phenomenon and flows down the MDB increase to their long term average exceeding 1,850 gigalitres into South Australia, then the prospect of returning the SL to a fresh water environment will be a new question. If the process of turning the SL into a marine tidal system and the quantities of daily flow indicated eventuate, then the daily outflow across the Murray Mouth will be approximately 160 gigalitres.

During the highest recorded flow into South Australia in 1993 of 16,000 gigalitres then compared to the revised pattern such an inflow would result in an extra 30% of flow for the year overall. During those times the barriers will be kept closed on the incoming tide. Because the system will be flushing large amounts of water out daily, the suspended silt that is carried with this flow will cause some problems with the system but it is anticipated that it will be cleared in a short space in time to preserve the marine nature of the overall system.

By then, a new system of agricultural practice based on the sustainable production of salt free water will have taken over from the unsustainable one of using salt laden water provided by the MDB and nobody in their right mind would wish to go back to the uncertainty and pain that the current regime induces. If there is an excess of fresh water in the MDB then more suitable sites can be activated {such as the Burra Lakes depressions which are a potential storage for 2,000 gigalitres of fresh water with a very low evaporation potential} which because of their deeper structures and smaller surface areas are far wiser places to store water for a dry period.

If we were to consider the environment and allocate a portion of future flows exclusively to what has become popularly termed "environmental flows" then a scene that is not valid is the spectre of the vast emptiness of Lake Alexandrina stretching from horizon to horizon as a barren evaporation basin. It is the wonder of complex ecosystems such as the one captured by the late 18th century painter H J Johnstone who painted a scene of the Murray River in 1880 titled "Evening shadows, backwater of the Murray, South Australia", the original of which is proudly handing in the South Australia art gallery. You can view this on the Art Gallery's web site via http://collection.artgallery.sa.gov.au/agsa/home/CollectionOnline Each night before I go to sleep I pass this print and wonder if as a consequence of our actions there will be more places of magic like this one instead of less. We can only hope.

3.6. A COMPARISON WITH OTHER PROPOSALS

This proposal is big, expensive and sustaiable. Compared to the other proposals that are coming forward it is based on sound logic, a keen understanding of the dynamics of the current system and an appreciation of what can be done with some imagination, sweat and funding. It is also inspired by nature and most of the key components are based on what nature already does, enhancing those forces to the benefit of the environment and mankind in partnership.

If adopted, it could springboard this region from one of environmental decline and human depression to perhaps the finest example of forward thinking with a view to result in a truly sustainable environment where nature and mankind are mutual beneficiaries. It may just give the local city of Adelaide the long term water supply for which it is searching and also play a part in our transition from inflicting a net negative impact to a positive impact on our world.

There are other proposals of grand engineering which deserve to be criticised and a brief discussion of those alternatives and this author's comments follows.

3.6.1. Diverting water in the current system to "save" the Southern Lakes.

This proposal is so ridiculous that it is sad that people would seriously believe that this is the right approach to take. A full response to this proposition would make this document many

more pages long, but to summarise the key reasons why this proposal is more than likely to fail follows...

a. The availability of sufficient water to enable the preservation of the Southern Lakes in the form to which we have become accustomed does not exist. Upstream systems are at such low capacities that by sacrificing them would most unlikely result in a significant change in the status in the SL.

b. During transit, any water released from storages upstream will face evaporative losses, ground seepage and other forms which would diminish the percentage of water that actually arrives compared to how much is sent to a small proportion.

c. Evaporative losses would quickly remove the short term benefit from the release of water from upstream resolving in a short term improvement with no long term sustainable outlook for being able to maintain this system in its artificial form.

d. Because of the perilous state of storages throughout the MDB a higher priority use for this water should be preserved because of inadequate alternatives for those people dependent for the flow for their everyday functions, outside of agriculture.

e. Allowing the continued evaporative losses for a huge amount of water that the SL system loses is not sensible. Far better uses can be made of this precious resource.

f. This situation is not likely to improve but as the effects of global warming excalate, this situation is likely to repeat itself throughout the world. We need to act sensibly and with forward thinking to not compound the mistakes of the past and walk towards a sustainable future.

1. The Scheme to pipe fresh water around the edges of the Southern Lakes

Our state Government has announced a bold plan to ensure the water supply of communities lining the lakes which once drew water directly from the lake but not is not able to because of low levels and high salinity. A series of pipelines ringing the lakes is planned to consume several hundred million dollars of public moneys to "guarantee" the supply to those communities. Unfortunately, this plan is unlikely to succeed on two counts.

a. Firstly, it is predicated on the availability of fresh potable water in quantity near its intake near Wellington. This cannot be guaranteed as with rising salinity and declining flows this end point in the system may not have the reserve required to meet this demand.

b. Secondly, the regions involved are agricultural ones whose livelihoods are based on broad-scale irrigation practices. In the absence of abundant water for agriculture those pursuits will cease and along with them so will the communities that have come to depend upon them.

This skewed thinking highlights the schism that exists in Government that fails to recognise the intricate link between nature and our ability to maintain sophisticated aggregations of people. Cities survive by virtue of the grace of the land that supports them. Let the land die, and so too do the cities. When people talk freely of shutting down agriculture in lieu of urban water use, they are signing their own ultimate eviction notices, unwittingly of course.

1. Lake within a Lake Scheme

One alternative proposal is to build a lake within a lake by constructing an earth wall that runs parallel to the existing shoreline. The logic is that any fresh water that enters the system will travel down this pathway to the Goolwa arm and keep this area "fresh" and allow the central portion of the Lake Alexandrina system marine. Realtors are the proponents of this scheme as they can see a future where a new opportunity will emerge to provide a continuous belt of holiday homes by the sea. Can't you hear the cash registers ringing!

There are several problems with this system that need to be exposed. Firstly, the concept is not based on sustainable principles. The tidal flow across the central portion of Lake Alexandrina is not likely to be sufficient to prevent the build-up of sand and the continual blockage of this area. Only by amplifying the effect of outgoing water, by accelerating it and taking advantage of the cube relationship between velocity and erosive power can a small

amount of water do a lot of scouring.

Lake Albert is not included in the lake within the lake scheme and along its shoreline are significant agricultural holdings whose water supply will be made potentially available under this current proposal. They deserve a chance but the Lake within a lake scheme ignores them.

Long term, as a consequence of global warming, sea levels are set to rise. Councils throughout Australia are drawing up demarcations below which no further development should be allowed because of the anticipated rise in sea levels. The SL are not immune to that process and the Lake within a Lake project will fall foul of this process.

Should high flows occur again, it is likely that significant damage to the walls will occur necessitating costly repair works which the state Government will need to make good. Without being of solid construction, the steady action of wind and water will erode any bank made of earth and it will need constant maintenance.

Apart from anything else, a clay mound wall would be incredibly ugly. It will add to the turgidity of the water which under this proposal will become clear. Let's not condemn this piece of engineering onto our children and please, do not let developers fool the people into thinking that they are doing it for the good of the environment and or mankind.

They are only proposing it for the good of their bank balances and as usual we will be left to pick up the mess once their profits are spent. After all, this problem is the result of the profligate actions of the collective human experience. Any solution should not involve more of the same. It is time to think long term and embrace truly sustainable processes.

Best wishes,

Peter Marsh
Sampler Pty Ltd

Contact: marshhome@internode.on.net
Ph: (08) 8398 2141
Fx: (08) 8398 2199
Mob: 0412 847 257

Destination: rrat.sen@aph.gov.au