CSIRO Submission 08/321

Inquiry into water management of the Lower Lakes and Coorong

Senate Standing Committee on Rural and Regional Affairs and Transport

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Enquiries should be addressed to:
Dr Kilian Perrem
Advisor
CSIRO Government and International
PO Box 225
Dickson ACT 2612
Ph: (02) 6276 6480
Email: kilian.perrem@csiro.au

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Summary:

- Full water balance accounting is needed to determine volumes which could be made available to the Lower Lakes, including the most recent information on inflows to the Murray system, flows from the Darling River and careful assessment of system losses.
- Knowledge of the water balance and biogeochemistry of the Lower Lakes is critical to prevent acidification of surface water. CSIRO is investigating the extent and severity of acid sulfate soils in the River Murray, including the Lower Lakes.
- Preliminary estimates of transmission losses between different parts of the basin have been provided by CSIRO to the Australian Government based on modelling long-term river behaviour. Additional modelling is required to provide more specific assessments for the current situation.
- The sharing of the impacts of the water reductions expected to occur with climate change will be critical for maintaining and/or restoring the ecological condition of Ramsar wetlands across the MDB.
- CSIRO's Murray-Darling Basin Sustainable Yields Project has provided detailed assessments of the likely impacts of climate change, farm dams and commercial plantation forestry by 2030 on surface water availability, and on surface water use under current water sharing arrangements.

Background:

CSIRO is undertaking a range of research to develop the knowledge needed to substantially improve the way Australia uses and manage water, some of which has particular relevance for the water management of the Lower lakes and Coorong.

Murray-Darling Basin Sustainable Yields Project

Through the Water for a Healthy Country Flagship, CSIRO is researching how the Murray-Darling Basin hydrological system works. The Murray-Darling Basin Sustainable Yields Project is providing a robust, Basin-wide estimate of long-term historic water availability and likely future availability in various catchments and aquifers taking into account climate change and other risks.

The research assesses the implications of various climate change scenarios and land use change for irrigation, the environment and the broader community across the Basin's 18 regions.

CSIRO has been contracted by the National Water Commission to undertake the project on behalf of the Australian Government and the Murray-Darling Basin (MDB) states.

The Sustainable Yields reports have been progressively released throughout 2007 and 2008, with the final Murray region report released in July 2008. They are publicly available: http://www.csiro.au/partnerships/MDBSY.html. A final Whole-of-Basin report will be provided to the Australian Government by mid-September.

Acid sulfate soils

CSIRO Land and Water, through its Centre for Environmental Contaminants Research, has also been contracted by a range of clients, including the Australian Government, Murray-Darling Basin Commission, South Australian Government and consultants, to investigate the extent and severity of acid sulfate soils (ASS) in river channels, lakes, wetlands and drained environments in the Lower Lakes region of South Australia, near the mouth of the Murray, as well as the entire River Murray. Acid sulfate soils are soil materials affected by iron sulfide minerals. These may either contain sulfuric acid, or have the potential to form sulfuric acid or cause deoxygenation or release contaminants (e.g. metals) when the sulfide minerals are exposed to oxygen.

Investigations of ASS have been undertaken by CSIRO as part of a number of projects from Lake Albert, Lake Alexandrina, Coorong and River Murray systems below Blanchetown (Lock 1) to determine ASS risks, distribution (ASS maps) and management options.

Despite decades of scientific investigation of the ecological, hydrological (salinity) and geological features of these wetland systems we have only in the past year advanced far enough to appreciate the wide spectrum of ASS subtypes and processes that are operating in the contemporary environmental settings, especially from continued lowering of water levels.

A report on 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 was released in February 2008 and is publicly available (CSIRO Land and Water Science Report 12/08). Brochures and Acid Sulfate Soil Information booklets have been produced for State Governments, the Murray-Darling Basin Commission and landholders.

Response to inquiry terms of reference

(Please note that responses have been made only to the terms of reference that CSIRO has the expertise to address)

Terms of reference 1

a. ***the volume of water which could be provided into the Murray-Darling system to replenish the Lower Lakes and Coorong;***

Water data

Data on water in storage is available from the Murray-Darling Basin Commission and state government agencies. This data includes assessments of the volumes required for meeting “critical human needs” in the year ahead. Definitions of “critical human needs” differ between states but seems to generally be considerably higher than simply basic domestic water requirements. There is currently no transparent definition for the term “critical human needs”.

The data on water in storage also includes assessments of “carry over” water and announced allocations. Both of the latter two categories should be considered as water (not water entitlements) potentially available for purchase (short-term trade). These data primarily concern public water storages. Information on water in private on-farm storages is more difficult to obtain and probably less reliable. However, the majority of the water in private storage will be in the north of the Basin and would be logistically difficult to transfer to the Lower Lakes and subject to high transmission losses.

Water balance accounting

Full water balance accounting should be undertaken to determine volumes which could be made available to the Lower Lakes including the most recent information on inflows to the Murray system, flows from the Darling River and careful assessment of system losses. Current estimates of system losses are “unaccounted differences” in the river modelling and these estimates should be cross-checked against independent estimates of evaporation loss and leakage to groundwater.

Determining the fraction of any volumes of water released from any storage in the Basin that would reach the Lower Lakes or the Coorong could be robustly analysed using the modelling capability developed by the Murray-Darling Basin Sustainable Yields project.

Acidification

While a stated focus of this inquiry is about how much water could be provided in the near-term to the Lower Lakes and the Coorong, a critical question is how much water is needed for the Lower Lakes and the Coorong in the near-term and why.

On the issue of preventing acidification of the water of Lower Lakes, several aspects of the Lakes need to be well understood: the water balance of the lakes, the biogeochemistry of the lakes and transportation of acidity from the adjacent ASS soils which are prevalent in this region.

The water balance modelling is important since it determines what volumes of water would be required to maintain the lakes at any nominated level. The ability to predict lake acidification requires an understanding of ASS, their extent and responses to drying, the transport mechanisms for moving acid into the lakes and the pHs buffering capacity of the lakes.

ASS management options depend on the individual options, the ASS types and risks found there, as well as other factors such as wetland hydrology. For those areas that have been dried due to the drought conditions (below Lock 1 wetlands, and managed/temporary closure wetlands) the

ASS risks identified for each wetland in the above projects will then be used to determine the different management options required for each. Areas with a lower ASS risk and high soil pH may be reflooded and kept open to the river if the risk to river water quality is determined to be negligible.

Wetlands with a higher ASS risk that contain sulfuric materials (pH <4), acidic soils (pH <5.5) and monosulfidic black ooze (MBO) materials, causing deoxygenation, may require a range of management actions, including closing off wetlands, controlled reflooding or containment, liming of acidic soils or water bodies, bioremediation and pumping. There are risks and trade offs for each of these options.

Acid sulfate soil management options

Several management options for mitigating the effects of sulfuric and MBO materials in ASS, formed during the current drought conditions, are currently being implemented or considered.

The choice of management option will depend strongly on the nature of individual areas (e.g. depth of water, proximity to seawater and hydrology), ASS type and their position in the landscape. Improvements can generally be achieved by applying low-cost land management strategies. These include:

1. Avoidance of formation of sulfuric (oxidised) materials by slowing or stopping the rate and extent of pyrite oxidation. This can be achieved either by:

- Keeping sulfidic material anaerobic under saturated conditions. For example, water levels in Lake Albert have been maintained by pumping water from Lake Alexandrina at a rate of 400 ML/d, preventing the water level in Lake Albert dropping below -0.6 m AHD.
- Rapid drying of sulfidic material, to slow the biological processes controlling the rate of acid formation. However, rapid drying of sulfidic material in the Lower Lakes region will be difficult to achieve because of seiches (wind induced flow across the Lakes).

2. Neutralization of acid in ASS. This can be achieved either by:

- Liming to buffer the pH in the soil. The amount of lime required depends on acidity already produced, and potential for further production of acid. However, large amounts of lime can have a significant effect on biota, and the lime needs to be mixed into soil causing major soil disturbance. Surface application could effectively neutralize surface acidity, which is most prone to erosion or to which animals and humans may be directly exposed.

- Bioremediation – applying mulched organic matter on top of a wetland bed to encourage reducing conditions, which produces alkalinity to neutralise acidity. It is not yet known how effective this option will be for ASS in this area. CSIRO is currently assisting several State agencies in selecting sites and design/ASS monitoring of remediation experiments.
- Controlled reflooding by sea water – where feasible, sea water can be used to lessen risks due to acidity, dissolved metals, metalloids and non-metals. However, if constant connection and flushing with the sea is not possible, both salinity and the production of sulfide minerals will progressively accumulate in the lakes.

The above management strategies still contain a degree of risk, and some may not be suitable to a particular site. Management strategies other than those listed may be considered, provided that sufficient information regarding their successful implementation, environmental impacts and scientific merit is provided.

There is a need for monitoring of ASS and adopting an adaptive management approach in order to achieve the best possible outcomes, including for the short-term emergency management of the Lower Lakes.

Other issues for consideration regarding short-term management options include:

- The long-term objectives for management of the Lower Lakes and the Coorong and their appropriateness given climate change projections including sea level rise
- Trade-offs for other wetland environments (including the Menindee Lakes) in the Basin implied by the short-term management options for the Lower Lakes, and
- Assessments, in the context of longer-term management objectives, of the value of the benefits of additional water to the Lower Lakes; costs of not providing additional water to the Lower Lakes and costs and benefits of other short term management options

b. options for sourcing and delivering this water, including:

(i) possible incentive and compensation schemes for current water holders who participate in a once-off voluntary contribution of water to this national emergency

(ii) alternative options for the acquisition of sufficient water

(iii) likely transmission losses and the most efficient and effective strategies to manage the delivery of this water

Preliminary estimates of transmission losses between different parts of the basin have been provided by CSIRO to the Australian Government, but additional modelling is required to provide more reliable assessments.

An important issue is that under current water sharing arrangements, release of water from storage might be subject to abstractive use along rivers unless special provisions were put in place to prevent consumptive use of these environmental releases.

Terms of reference 2

The implications for the long-term sustainable management of the Murray Darling Basin system for inquiry and report by 4 December 2008, with particular reference to:

c. long-term prospects for the management of Ramsar wetlands including the supply of adequate environmental flows;

The sharing of the impacts of the water availability reductions expected under climate change will be critical for maintaining and/or restoring the ecological condition of Ramsar wetlands across the MDB.

The consequences of water resource development for Ramsar wetland hydrology differs greatly across the Murray-Darling Basin, as does the likely affect of climate change on Ramsar wetland hydrology. In particular, the Murray-Darling Basin Sustainable Yields Project has shown that current water sharing arrangements protect consumptive users from much of the change in water availability expected under climate change and transfer much of this impact to the environment. This is especially true in the southern regions of the Basin.

d. the risks to the basin posed by unregulated water interception activities and water theft;

CSIRO's Murray-Darling Basin Sustainable Yields Project has assessed the likely impacts of likely projections of farm dams and commercial plantation forestry across the Basin by 2030, and has assessed the streamflow impacts of the possible increase in groundwater extraction by 2030 under current water sharing arrangements. Advice has recently been provided on the findings of these analyses to the COAG Climate Change and Water Working Group.

In summary, these are considered to be relatively small risks relative to the risk of climate change, but these risks can be managed under existing or revised regional/basin scale policy.

g. the impacts of climate change on the likely future availability of water

The Murray-Darling Basin Sustainable Yields Project has provided the Australian Government with detailed assessments of the likely impacts of climate change by 2030 on surface water availability. These assessments are detailed in 18 comprehensive and carefully reviewed reports, all of which are now public documents. A report for the entire Murray-Darling Basin synthesising the findings of this work is expected to be released in the near future.

A series of comprehensive technical reports documenting the methods and models using the study have been produced and are either now public, complete but under embargo, or in the final stages of completion.

This work shows:

- Median reduction in water availability across the Murray-Darling Basin by 2030 is 11 per cent or around 2500 GL/yr on average.
- Under current water sharing arrangements, more of the impact of any reduction in water availability would be borne by the environment (particularly at the lower end of the Basin – i.e. the Lower Lakes and the Coorong) and less would be borne by consumptive water users. Under current water sharing arrangements an 11 per cent reduction in water availability would lead to a 4 per cent reduction in surface use, but a 24 per cent reduction in flow at the end of the Murray River.
- Under current water sharing arrangements, the sharing of any water availability reduction between consumptive use and the environment varies between regions. In the high water availability and high water use regions of the Murray, Murrumbidgee and Goulburn-Broken regions, the water availability reductions would be high and the share of this reduction borne by consumptive users would be small.