

## **Further material for the SA Royal Commission on the MDB climate and risk - Jason Alexandra**

Dear Commissioner Walker

Thankyou for the opportunity to present to the Commission yesterday, however there are a number of your questions for which I feel I could have responded to with greater clarity.

In particular, in this letter I am responding further to your questioning at yesterday's proceedings about:

1. Whether the findings of SEACI research had been widely distributed and how it had been used;
2. Risks, risks assessment and my views on the adequacy of Section 4 of the Basin Plan, and
3. Technical and scientific reports on the risks assessment undertaken.

To support these responses I also would like to present further evidence to your Commission, in the form of this letter and provide reference to various reports, presentations and papers, which I will forward as I locate them.

### **1. Findings and implications of SEACI phase1**

Firstly, I would like to respond, in more detail to your questions about whether the findings and implications of the SEACI research findings were well understood by senior decision makers in the Basin and specifically at the MDBA.

In the material below I will provide a clearer and more definite answer than I was able to yesterday.

The SEACI research program was integral to the work of CSIRO and the understanding of climate and climate change in the MDBA.

It played a value role in the CSIRO Sustainable Yields modelling (CSIRO 2008).

It was also influential in Victoria's approach to regional water planning, including in the Northern Victorian Sustainable Water Strategy (which I referred to).

SEACI research was also used to provide data to the MDB modellers and was used support the initial modelling and analysis in the early stages of the preparation of the Basin Plan. However, as I pointed out in my previous submission, in later modelling no provision was made for model runs that took account of observed or projected climate change.

The SEACI research was well communicated, with annual research forums held between 2008 and 2012, with wide ranging attendees.

SEACI research findings were also presented at countless seminars, both within the MDBA and in other forums, as well as specialist workshops and conferences. SEACI also had an excellent website and produced fact sheets and so on. Given the intensity of the drought there was much interest in this research and its findings.

I also wish to advise that in 2009 the SEACI 1 Synthesis Report was distributed with a covering agenda paper or formal briefing to the Commonwealth Minister, the MDB Ministerial Council, and to senior officials from all Basin Governments as part of the agenda for these meetings. The SEACI program and its results were also discussed at the Ministerial Council meeting in late 2008.

The papers for these meetings are signed off by (and also distributed) to the MDBA executives who attend these meetings. Therefore, it is reasonable to assume that they were also aware of the findings and implications of this work.

The covering paper was provided together with the SEACI 1 Synthesis Report (which has already been tendered as evidence to the MDB Royal Commission).

I prepared the covering paper and laid out very clearly the scope and findings of SEACI phase 1, in particular drawing attention to the implications of non-stationarity for water planning.

This paper outlined the key SEACI findings including those relevant to understanding water availability in the Basin under the predicted continuation of drying conditions.

In particular the paper clearly alerted readers to the policy implication of the fact that a **non-stationary climate raises fundamental issues about whether it makes sense to use the historic record to inform water resource planning** scenarios. It also brought attention to the need to develop water-planning approaches that are better suited to accommodating uncertainty based on the improved scientific understanding of the Basin under a non-stationary climate.

In addition to emphasising these implications, the paper summarised the key findings of SEACI report, drawing attention to specific sections.

The paper highlighted critical findings, such as:

1. rainfall decline is amplified up to 4 times in reduced runoff. The 13% rainfall reduction in the southern Basin between 1997-2006 led to a 44% decrease in stream-flow.
2. While reduced rainfall is the main reason for reduced stream flow, causal factors in the amplification of the reduction in stream flows include:

- a. Changes to plant water use, increased evaporation, transpiration and decreased soil moisture
- b. Timing, intensity and patterns of rainfall events that impact runoff generation.
- c. Autumn rainfall decline resulting in drier catchments before the critical winter spring runoff period.
- d. That rainfall-runoff relationship change with increasing temperatures and the 1 °C rise in maximum temperature in winter-spring over the last 50 years can be linked to a reduction in stream flow of about 15% of the total.
- e. Changes in dominant weather patterns include the intensification of the sub tropical ridge, which brings fine, dry conditions.

The paper emphasised that SEACI research compared projections from 15 global climate models finding that the majority of climate models:

- 1. Indicate an increasing risk of below average rainfall for the MDB in the coming decades.
- 2. Project a warmer and drier climate for the southern Basin, especially in winter.
- 3. Projected reductions in rainfall are comparable to the differences already observed between the climate of the past century and that of the last decade.

The paper and the report stated that SEACI research has identified that the rainfall decline is at least in part attributed to global warming, raising the concern that dry conditions may persist, and even intensify.

It warned that **climate projections, indicate an increasing trend of below average rainfall and runoff for south-eastern Australia in the coming decades.**

The paper explained SEACI's findings and their implications for water planning including that:

- 1. The severe drought and declines in streamflow appear to be partially linked to global warming;
- 2. Climatic conditions leading to reductions in streamflow are likely to be more frequent, severe and persistent across the southern Basin in the future; and
- 3. Intrinsic uncertainty about climate change challenge conventional approaches and assumptions to water planning that relies on historic information.

A non-stationary climate raises the issue whether it makes sense to use the historic record to inform water resource planning scenarios, or develop other approaches better suited to accommodate uncertainty based on the improved understanding of the Basin hydro-climatic conditions.

## 2. Basin Plan Section 4 - risk assessment and management

With regard to your questions about risk assessment and management, I believe that I can give no adequate reason as to why the Basin Plan Section 4 is merely a restating of legislative requirements for risk assessment and a list of superficial statements of intent regarding the generation of improved knowledge on matters like climate risks.

This is especially concerning, when as we discussed, the risks to water quality and quantity are significant and that assessments and mitigation of them in the Basin Plan are a central mandated requirement of the Water Act.

Further, this does not in any way reflect the work that was undertaken on risk assessment and risk management in my Branch between 2008 and 2011.

I wish to make it clear that in order to meet these legislative requirements there was an intensive, well-organised and credible program of work undertaken to assess the risks, which my staff and I coordinated between 2009 and 2011.

This work consisted of many discrete projects with clear terms of reference, which were mostly undertaken by leading Australian scientists.

We also used leading researchers to help advise on the design and commissioning of this program of work that assessed a wide range of significant risks.

In addition to an expert advisory committee, consisting of prominent and experience research professionals, I contracted a leading water researcher, Dr Nick Schofield (now CEO of the Australian Water Partnership) to assist in scoping projects, overseeing their delivery, and analysing and synthesising their findings.

In the documents that I will tender electronically, following this letter, I will provide further detail on the scope and outcomes of this program and will endeavour to provide the Commission with copies of the reports or resulting publications (although it appears most of these have been removed from the MDBA website where they were published).

This work resulted in a substantial body of work. All technical reports were reviewed and then published on the MDBA website, (from memory in 2011), but these now appear to have been removed.

Many projects also resulted in peer-reviewed publications. For example, many of the R&D projects on climate change and risk assessment were published in peer review journals, including the first and only special edition of the journal Water Resources Research focused on the MDB.

Please see the full edition of Water Resources Research Volume 47, Issue 12 including for examples the articles such as:

***Introduction to special section on Water Resources in the Murray-Darling Basin: Past, present, and future*** Roderick M First published: 22 September 2011  
<https://doi.org/10.1029/2011WR010991>

***Steps toward “useful” hydroclimatic scenarios for water resource management in the Murray-Darling Basin*** Kiem A., & Verdon-Kidd

***The role of tropical modes of variability in recent rainfall deficits across the Murray-Darling Basin*** Timbal B & H. Hendon

Other results were published as the papers such as:

***Understanding hydroclimate processes in the Murray-Darling Basin for natural resources management***

J. E. Gallant, A. S. Kiem, D. C. Verdon-Kidd, R. C. Stone, and D. J. Karoly in Hydrology Earth Syst. Sci., 16, 2049–2068, 2012  
[www.hydrol-earth-syst-sci.net/16/2049/2012/](http://www.hydrol-earth-syst-sci.net/16/2049/2012/) doi:10.5194/hess-16-2049-2012

***Assessing the differences in sensitivities of runoff to changes in climatic conditions across a large basin.*** Donohue, RJ, ML Roderick and TR McVicar (2011). *Journal of Hydrology*. 406(3-4), 234-244.  
doi:10.1016/j.jhydrol.2011.07.003

There are many more reports and papers arising from this work, all of which provides a consistent message about the nature of the climate risks and the complex feedbacks involved.

It is my view that way these reviews were conducted represented best practice in terms of generating an approachable overview of the best available science.

Further, the number of projects that achieved peer review publications in recognised international journals supports this view. The same claim can be made for the SEACI research.

### **The Risk Assessment Program**

As I stated yesterday I managed the MDBA’s risk assessment program for most of the period between 2008 and 2012.

This was a systematic and comprehensive review of the risks to the waters of the MDB that started initially under the MDBC, but transitioned in provision of high quality analysis of the risks, that were needed for preparing the Basin Plan.

This program commissioned reviews of risks from bushfires, intensive forestry, increased farm dams, reduced return flows, and from climate change. It also investigated climate change impacts on water quality and quantity. From

memory the program would have designed, commissioned and published something like 25 projects.

The program also supported the bringing together of the researchers at workshops designed to stimulate exchanges and expose policy people to the findings of the work.

On the 24<sup>th</sup> of February 2011 the MDBA brought together many of the research groups that had been commissioned to work on advancing elements of the **Risk Assessment Program**.

DR Nick Schofield had been engaged to provide coordination, scientific advice and oversight of the projects. His PowerPoint entitled **Insights from Assessing Risks of Climate Change in the MDB** is provided in full, separately because it give a useful overview of the comprehensive nature of the program. This provides an insight into the nature of the risk assessments undertaken.

In this presentation he outlined that the MDBA climate investigations included:

- The SEACI Phase 1: 2006-2009 (CSIRO/BOM)
- Phase 1 Climate Syntheses and preliminary policy analysis & gaps June 2009 (SKM)
- 9 Climate science reviews completed Aug 2009
- SEACI Phase 2 commenced July 2009 (CSIRO/BOM)
- MDBA/NCCARF Climate science workshop March 2010
- 4 climate risk projects (Oct 2010).

It is important to note that we did not rely entirely on the work of SEACI but commissioned a comprehensive suite of climate science reviews that included

1. Evans, J. & Pitman, A. Scientific review of the atmospheric and land surface dynamics of the Murray-Darling Basin
2. Gell, P. et al Palaeo-climate Studies relevant to NRM in the Murray-Darling Basin
3. Helman, P. Drought periods in the Murray-Darling Basin since European settlement
4. Karoly, D. et al Climate variations and causal processes
5. Kiem, A. et al Review of current understanding into MDB climate patterns and causal processes
6. Low, T. Scoping Study - significant ferals and weeds, risks, options and implications for the MDB
7. Procter, W. et al Scoping adaptation strategies and research applicable to natural resource management in the Murray-Darling Basin – literature review
8. Roderick, M. et al Evapotranspiration Trends and Water Availability: the Murray-Darling Basin now and into the future
9. Stone, R.C. et al Comprehensive review into the core climate patterns, droughts, rainfall systems and associated causal processes relevant to the Murray-Darling Basin at a range of associated time scales.

As part of a suite of risk assessment projects the MDBA had commissioned additional work:

1. Dr Bonnie Atkinson et al Impacts of Climate Change on the Murray-Darling Basin's Water Quality
2. Greg Holland et al Risk of Climate Change Impacts on Salinity Dynamics and Mobilisation Processes in the Murray-Darling Basin
3. Dr Fran Sheldon et al Impacts of Climate Change on the Aquatic Ecosystems of the MDB
4. Prof Quentin Grafton et al Impacts of Climate Change on the People, Communities and Industries of the MDB

Some of the key issues identified by these projects are referred to in Dr. Schofield's powerpoint presentation (sent separately).

Dr Schofield also referred to an earlier climate science workshop held in March 2010 in which the MDBA had brought together many of those working on the climate research and climate reviews. He outlined the key presentations:

1. Jason Alexandra overview of the MDB and challenges faced in the context of climate change
2. Graeme Pearman South-East Australia Climate Initiative (SEACI): Phase 1 synthesis
3. Prof. David Karoly and Dr. Ailie Gallant Climate patterns and causal processes of wet and dry sequences in the Murray-Darling Basin
4. Anthony Kiem and Danielle Verdon-Kidd Current understanding into Murray-Darling Basin climate patterns and causal processes
5. Lu Zhang Assessing the Impact of Climate Change on Water Availability
6. Michael L. Roderick, Fubao Sun, Wee-Ho Lim, Graham D. Farquhar
7. Water availability in the Murray Darling Basin
8. Dr Peter Helman Droughts in the Murray-darling Basin since European settlement
9. Peter Gell Paleoclimate Studies relevant to NRM in the MDB
10. Jason Evans & Andy Pitman Coupled atmospheric and land surface dynamics over South East Australia
11. Tim Low Weeds & Pests & Climate Change in the Murray-Darling Basin
12. Mark Howden, Mark Stafford Smith, Wendy Proctor, Karen Hosking and Trevor Booth Future research needs for climate adaptation in the MDB.

Given the range of studies of relevant studies Dr Schofield had been commissioned to provide a synthesis of recent research. His report to the MDBA was structured in the following way:

1. Implications of Climate Change for Natural Resource Management in the Murray-Darling Basin - Part 1: Collation of Recent Research
2. Implications of Climate Change for Natural Resource Management in the Murray-Darling Basin - Part 2: Policy Analysis of SEACI and Climate Science Reviews

3. Implications of Climate Change for Natural Resource Management in the Murray-Darling Basin - Part 3: Preliminary Policy Synthesis
4. Key gaps.

These reports were delivered to the MDB and after review were published on the MDB website.

As far as I am aware, the staff and executives responsible for preparing relevant sections of the Basin Plan were well aware of these projects and their outputs.

This view is supported by my recall that earlier, draft versions of the Basin Plan had more detail with respect to risks and risk assessment. However, I do not know why the final version of section 4 of the Basin Plan was so simplified.

I will endeavour to have the published reports located and provided to the Commission.

As a matter of principle, it is my view that publicly funded research reports should be made publicly available, in order to inform decision and support further analysis.

Please let me know if you seek any further information.

Yours sincerely

Jason Alexandra