



## **Climate change and water from the sea**

Tuesday, 16 December 2008

By Brian Sadler

Forty years ago a change in atmospheric circulation occurred, un-noticed. Rain-bearing systems of the south-west of Western Australia moved pole-wards. This change would delay the start of winter rains, reduce the incidence of wet winters, increase the incidence of low-rainfall winters and reduce rainfall intensities.

Thirty years ago the change was causing drought, but this was not unusual for the recorded climate. Public water supplies, although designed for such eventualities, were stressed. Drought-response measures were introduced and water systems augmentation was brought forward.

Twenty years ago, the drought persisted. A good wet year to rejuvenate water systems had not occurred for two decades. Internationally, climate scientists gave the first warning of human-induced climate change and in 1987 national scientists forecast a rainfall decrease as likely for the region.

Controversially, water engineers responded by amending plans for the water systems of Perth and its hinterland. They assumed rainfall had undergone a small permanent decrease from global warming and that rainfall and water resources would follow a further slow decline amounting to 20 per cent and, by 2040, 40 per cent of historic averages.

Despite the controversy, these risk-management responses were far from extreme.

Twelve years ago (1996), in continued drought, a specially convened seminar at last recognised and concluded that a climate shift had occurred nearly 30 years before. In this change, rainfalls had decreased to the levels not expected until 2040 and caused a major reduction in sustainable water resources. A broad-based response to this water crisis was initiated. A regional climate research initiative began and South-West climate change became the most studied case in Australia.

Now, 40 years after the shift began, at least part of the observed change is confidently attributed to human-induced global warming. Decreases in river flows of about 50 per cent have occurred. River flow is only a small fraction of rainfall and is very sensitive to climate change. The issue has been further complicated by changes in river catchments, which include effects of climate stress as well as various human activities.

With hindsight, we ask why the conclusions of 1996 came as such a surprise. However, this is the insidious nature of climate change. Even today we are left to speculate on current and future climate. The observed change is greater than expected from climate modelling. Is some of this explained by natural variability? Are the models underestimating change? What is the next

surprise?

### **Not just the drying, but the uncertainty**

As a consequence of this history there has been a regional loss of confidence in the future reliability of surface water resources. Uncertainty, not just drying, has become a water issue in its own right. Water planners seek solutions that eliminate the climatic risk. They cannot allow serious, sustained failure in a major regional water system.

### **Diversity and declining robust options**

In living with these problems, the Perth region has some advantages enjoyed by few other regions of Australia. The coastal plain has deep, unconfined and accessible aquifers, which are a source of mid-term security and have helped manage through a severe climatic crisis. These aquifers extend under the Perth metropolis. They create opportunities for water harvesting, at domestic and community level, which no other Australian city enjoys. The aquifers also enhance the future opportunity for wastewater re-use.

Water managers make use of this diversity to pursue a full range of supply, re-use and use-efficiency measures with a community that has a relatively long history of awareness and commitment. This is a great strength of the Perth circumstance.

Nonetheless, some measures are decidedly 'softer' than others.

To be secure, the diverse system also needs growth in a robust supply core. Climate change has reduced the potential of many of the remaining, marginal, terrestrial options for supply augmentation, including low-quality options, which might be treated by desalination. Furthermore the established system capacity is at risk of further decline.

Water stress in natural water systems is growing insidiously, initiating automatic environmental change that no one likes to accept as the new reality. Such change has increased the conflict surrounding environmental water. Its mixture of inevitability and uncertainty is a public policy time-bomb.

In these circumstances the community has widening distaste for remaining terrestrial options, particularly from their own backyard.

### **Water from the sea**

Water planning of the 1990s and earlier looked at the seawater source as a post-2020 benchmark. However, events of the past decade, and loss of confidence in terrestrial water sources, have seen the 2020 options largely utilised or, in some instances, marginalised.

The sea, by contrast, is an unlimited source, unaffected by the regional climate uncertainties.

For major public water supplies, security is a more critical criterion than cost. The recent commissioning of a major seawater desalination unit for the Perth regional integrated water system was a development whose time had come.

The 'off-the-shelf' availability of seawater desalination and the limitless availability and 'climate independence' of seawater as a source have seen its rapid emergence as a planning mainstay.

This is an inevitable consequence of the growing demand and the diminishing terrestrial supplies of water in the WA's south-west.

The hydrological cycle is a natural solar-driven process that takes water from the sea, leaving its salt behind to be re-joined later. Seawater desalination might be simply viewed as a small human 'bolt-on' to this cycle, also taking water from the sea and leaving salt, but powered instead by engineered sources of energy. If such energy sources were truly carbon-emission-free, the

seawater solution would be truly 'climate independent'.

In the recent Perth development the desalination project has funded an equivalent component of renewable (wind) energy in the power system. Future planning anticipates trialling a wider set of renewable energy options, including wave power.

However, the critical test for widespread use of seawater is whether or not it is truly carbon-neutral and supported by renewable energy development, which would not have occurred otherwise. The extent to which this test has been satisfied, or will be satisfied for future proposals, appears to be an open question at present.

It would not be good if adaptive responses to human-induced climate change also become part of the problem. This challenge is well recognised by the region's water managers.

### **What are the lessons?**

- Even in a well-researched and long-predicted climate situation, climate change has been a major source of potential uncertainty and surprise.
- With change as the new climate norm, adaptation must be based on informed judgements – change cannot be confirmed before a repetition of potential impacts has occurred.
- Vulnerability to climate change has been a source of 'crisis' in a region enjoying a diversity of resources and the associated security. Other, more surface-water-dominated systems in southern Australia may prove more vulnerable.
- Uncertainty, in its own right, as well as attributable climate change, creates a demand for risk-avoiding options, which are independent of climate.
- Seawater use taps an unlimited resource that is not climate-dependent. Because of its plentitude and reliability, seawater is likely to be used increasingly as a source of security in vulnerable water systems. However, its energy use could have unwanted feedback to global warming.
- If seawater use can occur with a neutral impact on carbon emissions it is an excellent option for many vulnerable systems. This is a challenge.

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