Submission

Competitiveness of the Agriculture Sector

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WaterLexicon
WaterKnowledge

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BACKGROUND

At the heart of agriculture in Australia is Water. In all circumstances water makes the present and future capacity of agriculture in Australia. This is true whether as moisture, rainfall, overland flow, retained soil moisture, in-stream flows, water from below the surface, stored water or water sourced from irrigation channels or streams regulated by infrastructure.

The value of agriculture and agricultural businesses in Australia is based on the perceived access and control of water. While the Australian water rights and water access regimes have advantages over the responses developed in the United States of America, they are well short of adapting to Australian requirements.

Much of the water infrastructure and planning in Australia was conducted during a period that experienced more wet times compared with the preceding 50 years. The ghosts of that planning and assessment continue through the existing models, the embedded water rights regime and water solutions developed in Australia today.

Although water is fundamental to the business of agriculture, the approach of government and the relevant disciplines is unhelpful for managing an agriculture business or operating a business heavily dependent on agriculture business.

There should be a fundamental review of the tools available to the agricultural sector as the work to date has been to support government infrastructure and planning decisions.

With a better range of tools all governments and businesses can make better decisions about allocation of resources and the management of risks around water.

SUMMARY

Government scientists, hydrologist and engineers continue to publish material that is reflecting on the Australian experience but of little assistance to the agricultural sector managing water issues. The list of water infrastructure and water planning completed in Australia is extensive. While the contribution of published material is important to enable the construction of assets and the allocation of government resources, their ongoing relevance to agriculture business is doubtful.

The white paper contains worthwhile areas for investigation, however the use of the word “drought” throughout the paper is a significant concern. As set out in this paper the use of historic terms to describe Australian conditions have passed their use by date. Drought is one of those terms.

Following the move from “drought relief” to “exceptional circumstances”, government and society needs to reconsider the way water availability is discussed. Excessive water flows and extended periods of little water may be cumbersome terms, however as set in this paper they are more reflective of the Australian condition and of water as a fundamental input to agricultural endeavours in Australia.

This response is divided into two parts, the first providing general commentary on water issues and the appendix providing specific observations about the key aspects of water in Australia.

RECOMMENDATIONS

1. Respond to the inherent uncertainty in water availability in Australia by reconsidering the models in use by governments and the tools developed based on those models.
2. Develop for the Agricultural Sector, forward looking models based on scenarios, rather than relying on “predictions” which are (implicitly or explicitly) based on historic performance. Accordingly the government should **move away from** current tools that are dependent on historical data as a guide to the future including using:
   - current hydrological modelling as an input to farm based and infrastructure decisions.
   - current climatic based modelling as an input to decisions on drought relief.
   - SOI as an indicator of rain.
   - use of the term “average” in the context of rainfall and water events
   - expression of events, such as 1 in 100.
   - models that have been incrementally adjusted, based on limited knowledge at the time of their development or are based on overseas experiences
3. Develop models that are relevant to participants in the agricultural for business planning as well as operational purposes, to ensure people involved in agricultural production have access to relevant information about water availability to maintain their short and long term viability.
4. Develop proper **adaptive tools** for understanding water:
   - as a fundamental input to agriculture,
   - to set the best suite of options for government involvement where there has or where there may be a failure in water availability,
   - consider more long term solutions capable of aligning to the varied and variable conditions where water may be unavailable.
5. Develop tools to assist a proper understanding of water as a right, so that the water markets operate better. The better water information would enable better decisions on water rights, water services, water service charges and better water markets. A corollary, is the reduction in the capital write off across the agricultural sector, particularly where capital has been invested based on incorrect water information.
6. Develop tools to assist viability assessments to be undertaken consistent with normal risk assessment tools, based on appropriate modelling tools. This would give agricultural enterprises appropriate water information, rather than relying on government water planning tools.
7. Consider in the government’s alternative water model development, the interaction between water and the agricultural markets that Australian producers participate in.
8. Review and align taxation, drought relief, income support and other market based solutions to properly reflect water availability and agricultural activity to give

agricultural businesses and the families on the land a better future and the ability to effectively manage their capital.

9. Provide effective guidance and oversight on the pricing of water infrastructure services to support water markets, including:
    - ensuring agriculture businesses are not lumbered with the risk of non-supply as well as a paying a premium to water service providers for that risk
    - better control of how hydrological modelling is used as an input into:
        - asset service assessments
        - asset costs
        - service costs
        - costs allocation between users in urban, industrial and rural sectors
        - charges for water services provided by assets
    - reviewing the water services “nominally” provided by water infrastructure (as scoped by hydrological reports) and ensuring that these services and their costs properly align with the needs of:
        - the sectorial users
        - agricultural production
        - the water markets
    - incorporating the learnings from the electricity industry and the regulation of distribution and transmission assets and entities
10. Provide effective tools for agricultural industry to understand and respond to water risks

OBSERVATIONS

These observations focus on the approaches taken in to modelling. It aims to demonstrate the pervasive nature of inappropriate modelling and the direct impact on participants in the economy and the availability and cost of capital.

There are many lessons to be learnt from other areas where modelling has either failed to assist in making good decisions or have totally misled people.

current modelling

The presence and availability of water throughout Australia is inherently uncertainty. While it is admirable for people to explain the future through modelling based on past events, the Australian reality is that these models have proved to be misleading for the agricultural sector.

The concerns of relying on the past to predict the future was identified in the early 1900s by a number of economists, however that has not stopped economic prediction based on past experience.

John Maynard Keynes considered reliance on the past to predict the future as unreliable, although Keynes conceded that in the absence of better options, this is invariably what happens. We rely on the past as the best guide for the future.

The question is why we have not developed better options.

Using an industry analogy, it's like driving down the road looking in the rear vision mirror, rather than through the front windscreen, and then being surprised when the road is not where It should be.

economic modelling example

The Black-Scholes Financial Model "discovered" by Fischer Black and Myron Scholes and published in 1973, "The Pricing of Options and Corporate Liabilities" provide a cautionary tale. This model was based on a historic stock market data going back many years. The Model provided a way of determining the value of derivatives and provided a methodology for managing risk of losses in the stock market. The model was representative of historical events and a very good fit to explain past stock market activities and actions taken by participants. The Model became the operating rule for many share market participants.

In the 1987 stock market crash, the Black-Scholes Financial Model failed or rather the market did not behave as predicted Black by the Model. The dynamics of the market were not consistent with the Model, the Model did not predict the outcome and those dependent on the effectiveness of the Model (investors, brokers, bankers, US Federal Treasury and the US Government) suffered serious losses. The 1987 crash wiped billions of dollars of asset values and was credited with causing the US recession.

The impact of reliance on the past was a significant loss of value throughout the economy, a US recession and underperforming world economy. The wide acceptance of the (backward looking) Black-Scholes Financial Model by many investors, did not make the Model work or prevent investors being exposed to the very risk they were seeking to avoid.

Reliance on the Black-Scholes Model skewed investment and masked the real risks. The reliance on misinformation meant over investment, understatement of risks and the reduction of available capital.

toll road modelling example

In most cases, the gulf between the models and the reality is much the same as the disparity in toll road traffic volume predictions for the Cross City Tunnel Toll Road (CCT) in Sydney.

The approach in the CCT is the same approach adopted for a number of toll roads throughout Australia. The Sydney and Brisbane experience is that the CCT approach based on financial modelling is fatally flawed, with both toll projects being financially unviable.

In the case of the CCT both road user models used, proved to be irrelevant to the actual volume of vehicular traffic[1]. In particular:

- The EIS in 2000 was developed based on some assumptions about were optimistic, although was an attempt to model present human behaviour and to determine what the response would be to the change in traffic options.

- The Base Case Financial Model developed in 2002/3 development is described Dr John L Goldberg [2], in his submission to the NSW Parliamentary Committee in 2005, "Analysis of traffic projections and financial viability" as

1

Vehicles per Day	2005	2006	2009	2013	2016
Environmental Impact Statement **2000 Prediction**		52,720			59,472
Base Case Financial Model **2002/3 Prediction**		88,791	90,000		109,239
Actual	20,000		35,400	40,000	

Source: SMH http://www.drive.com.au/roads-and-traffic/road-to-nowhere-lenders-threaten-motorway-group-20130910-2ti8h.html

2 http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/ae685f47fb0e2884ca257100001bb60d/$FILE/051209%20Dr%20Goldberg%20Cross%20City%20Tunnel.pdf

> The general scheme of the algorithm is as follows. Having specified an internal rate of return (IRR) for equity investors, the traffic volumes and tolls necessary to produce sufficient revenue to pay these investors the promised dividends are obtained by a work back process.
>
> This approach enables the promoters of these toll road schemes to explain deficiencies in dividend payouts as due to "traffic risk", whereas the false traffic volumes had been created by the work back in the first place. In the case of the Hills Motorway M2 and Transurban City Link, dividend deficiencies are compensated simply by increasing the long-term debt of the projects.

The difference between actual and the two estimates was more than 200%.

The consequences for the toll roads are illustrative of the consequences in the agricultural community. Purchase decisions, investment decisions and finance decisions are doomed to be suboptimal or fail. Capital is written off, necessary investment cannot be undertaken and people lose the livelihood and become long term dependent on the government.

The significant shortfall in incomes, translates to an inability to service debt leading to receivership.

While it is acknowledged that agriculture is a price taker and by necessity carries the full risk of agricultural activity, it should be able to manage those risks based on appropriate and meaningful information.

environmental impact statement (EIS) example

Sydney Airport second runway is another example where the modelling for the EIS did not reflect the actual data or the subsequent experience. However in this case the land owners in the dominant flight path bore the consequences of the actual flight approaches to Sydney Airport, including reduced property values (or evacuation) and loss of utility.

Similarly the experience in Australian water infrastructure is that the viability of the water management regime and the associated infrastructure is based on a number of flawed premises and embedded historical practices.

Without a proper reassessment of the water rights and the services provided by water infrastructure there is considerable risk that the agricultural sector is paying more than its fair share and that it will be unable to properly identify and manage its water related risks.

energy distribution example

In response to rising end user energy prices increases based on transmission and distribution charges and their contribution to the cost of energy electricity prices to the end user, the Queensland Government instituted a freeze on the standard residential tariff for 2012/13 and established the Independent Review Panel on Network Costs (IRP) to develop options to address the impact of network costs on electricity prices in Queensland.

The observations and recommendations of the IRP are insightful in the energy sector and have just as much relevance to the water industry in Australia."

The commentary at Page v of the Executive Summary identifies those factors that increase the value of the energy entity through an increase in the asset base and through a reduction in responsibility. In an environment where the Regulator is unable to make decisions for the regulated entity, the energy entity assumptions, asset solutions and attributable costs remain unchallengeable, while the consumer still retains the exposure to risk.

> "Another factor contributing to the escalation in capital programs has been the consistent over-estimation of demand by the NSPs. The Panel also notes that the current revenue cap control mechanism places volume risk on customers. Where demand is over-estimated, capital programs will be excess to requirements and network tariffs to customers will increase during the regulatory control period to ensure the NSPs are able to recover the allowable revenue.
>
> Through consultations with stakeholders and discussions with Technical Reference Groups (established by the Panel and comprising representatives from the NSPs), it is further evident that these issues have been compounded by:
>
> - an industry engineering culture biased toward expanding the network infrastructure and enlarging the capital base of the NSPs;
> - a deficient commercial model in that there was no rigorous capital rationing by the Government, as shareholder and provider of capital, to guide investment decisions; and
> - a regulatory model that limits the ability of the AER to drive the NSPs towards the delivery of efficient capital and operating programs."

In many cases the underlying water management plan used as an input to planning by water entities also facilitates this approach.

At page vii of the Executive Summary, the IRP is quite explicit in the damage done by the past practices based on an inappropriate approach to regulation.

> **"Network Reliability Standards**
>
> On the basis of its analysis, including consultation with the NSPs and regulatory bodies, the Panel considers that network security standards:
>
> - …

- have resulted in over-engineering of the network and driven excessive capital and operating costs;

- have not sufficiently involved economic analysis of the benefit of network capital expenditure relative to outcomes that are acceptable to customers in terms of both reliability and cost; and

- have driven excessive increases in network tariffs that affect the affordability of electricity supply for households and business."

In the case of water planning, the issues arise in areas without water assets (and therefore directly exposed to departmental water management modelling) and those areas with water infrastructure (and exposed to assumptions in the water management modelling as interpreted and applied by decisions of the water asset owner).

The energy and water sectors in Australia are dominated by high technical skills, which regulators have been unable to effectively oversee due to the oversight framework or because the regulators have been unwilling to intervene in what are argued as being management or safety issues.

water modelling issues

This problem of historic data, associated models and experiential based decision making remains deeply embedded in the policy, decisions and conversations on water in Australia.

Rather than develop dynamic scenario based models, we have relied on past data with little relevance to making decision in agricultural industries, infused with European terms such as "drought", "reliability", "average" "1 in 100 event" taken out of context and maladapted to Australia.

Similarly the human experience of recent events means that in many cases, our own personal experience frames our expectations for the future. It is clear that in many cases past data and past personal experiences had led to poor decisions. Techniques such as Stochastic Modelling while more sophisticated suffer the same problem in the Australian context and are merely better ways of perfecting a square wheel.

While the models currently in use may be "the best we have" they are not adequate for agricultural business purposes. The framework for existing models should be reviewed and commitment made to provide the agricultural sector with better information to manage their water activities, water risks and water operations.

modelling decisions

In South East Queensland "the best we had" led to:

- substantive delays in responding to declining water supplies

- flood modelling based on 1 in 100 year events
- subsequent over investment in water infrastructure in the region

Much of the new SEQ billion dollar water infrastructure remain idles and continues to be a debt burden for government with associated fiscal drag. The government is now contemplating significant investment with little certainty of effectiveness over flood events.

There is no discussion of investing to manage highly variable events (high rainfall or long periods of low/no inflow). In this context the losses in the risk and pricing of electricity distribution assets have not been learnt in the energy sector let alone incorporated into the water sector.

Particularly insightful was the Queensland Government[3] when it stated:

> Approximately 5 per cent of Queensland's multi-billion electricity network has been built to deliver energy for the extreme peak loads that occur for less than one per cent of the time (i.e. less than 88 hours per year). Hundreds of millions of dollars are spent each year to build and maintain this network, much of which is idle for all but the hottest summer days. Historically, the response to projected increases in peak demand has been to continually expand the network.

Similarly for water, investment is being made to:

- capture the "last 10 per cent" of events being the rare events. This not only has significant budget issues, but also provides false comfort against water availability and flood protection. Paradise Dam in Queensland continues this tradition and the future expansion of dams in Queensland supported by CSIRO and Qld Government modelling will continue this process in the foreseeable future.

- manage the largest historic rainfall event. The recent change in flood modelling is because the previous event assessed as 1 in 100 (historic experience) turned out to happen 3 time in a 100 year period, ie: the historic event relied on as 1 in 100 year event, turned out to be a 1 in 33 year event.

- build more assets, exposed to the same historic profile, changing how much water is available during good periods, but adding little to extending the period for which water supply is available.

Historically Queensland and New South Wales governments have invested substantial money in water infrastructure which has been matched or exceeded by private enterprise. Schemes have been built based on economic and community benefit principles, with agriculture mobilising capital accordingly. These schemes have now been converted to commercial return, fundamentally changing the scheme, agriculture enterprises and the local community.

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[3] Queensland Energy Management Plan May 2011 at page 2

This mobilised private capital, based on government water and economic models, cannot now be readily "moved". Despite this, water availability has been reduced by government decisions, modelling reviews and introduction of new infrastructure or new customers.

Similarly, the decision to invest money in urban or rural areas based on historic modelling creates:

- a false sense of security and lack of preparedness
- investment in permanent infrastructure, where this may not be warranted
- inappropriate configuration of public and private assets
- ongoing debt servicing and inflated cost base (for pricing) and costs for government, local government and agricultural businesses and communities.

current hydrological modelling

Current hydrological modelling is full of terms that are not appropriate for many agricultural enterprises dependent on instream flows (whether stored in stream or off stream or delivered through natural or artificial streams). Examples include "mean" or average" when discussing high variation in rainfall, whether expressed as annual or on a monthly basis. The particular issue with terminology is explained in the Appendix.

The modelling used by government has known significant limitations even for water planning purposes. It has no benefit for agricultural business planning or management purposes. In the absence of meaningful information, agricultural businesses have come to rely on government water planning, with adverse results for their business and for their participation in the water market.

modelling risks to agriculture from imported pest and disease

While not directly on water issues, there are other examples of how decisions about agricultural produce are implemented. In particular once of the most important issues in recent times has been the risk of pests being imported with imported produce under an FTA or WTO approved processes.

We have seen citrus canker in Emerald and concerns apples imported from New Zealand. Where the risk of co-importation of produce and pest and disease is assessed as being manageable, the exporting country, the exporter and the importer must commit to appropriate protocols to manage the particular hazards that have been identified.

At present where those protocols fail the Australian people and the farmers suffer financially through extra costs and eradication programs (eg: fire ants in Queensland).

It is usual in commercial dealings where a party commits to operate in a certain way, that the commitment:

- is documented
- verified (in some cases)

- backed by an indemnity
- backed up by a suitable insurance policy

With these elements in place the party receiving the commercial gain retains responsibility for the risk and the obligation to insure for that risk. It is not suitable for there to be an unfunded risk commitment or for there to be a risk transfer without compensation.

To prevent this occurring, the exporting countries, the relevant producers and/or the Australian importer should provide evidence of insurance for the potential liability for a failure in the pest/disease control measures in exporting the produce. The quantum of insurance can be reviewed to ensure that the insurance value is commensurate with the probable cost to government, producers and others involved in the agricultural sector, linked to the loss of profit and the cost of remediation. The insurance policy should:

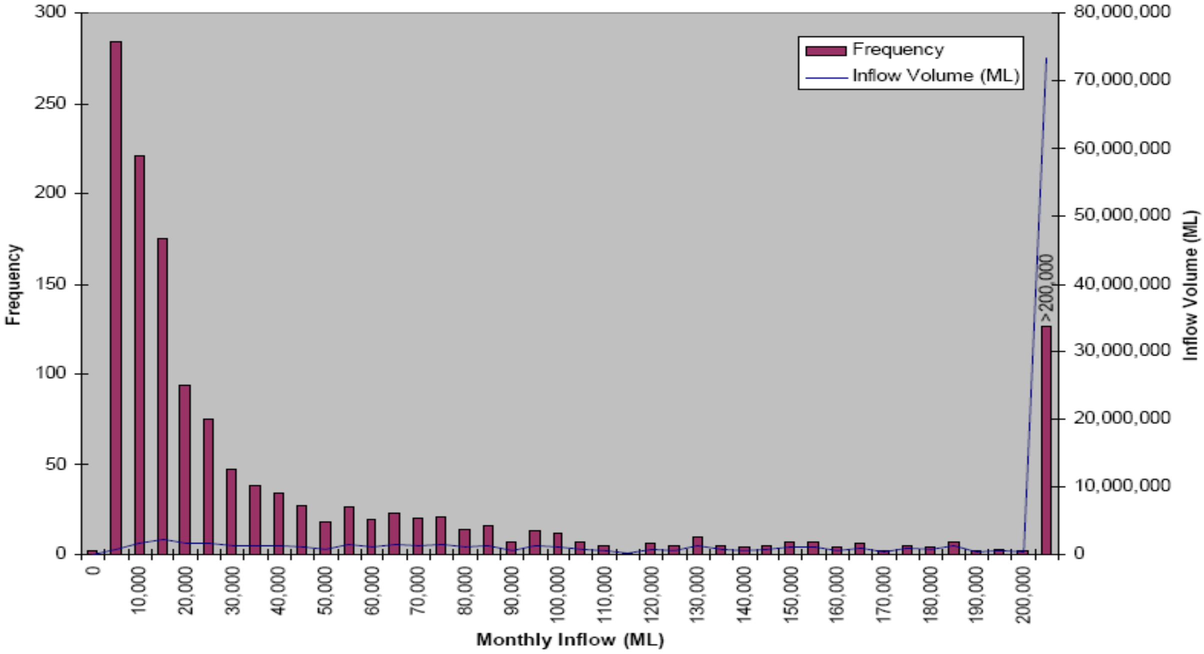
- cover the assessed quantum
- have the usual commercial terms and conditions
- name the Australian Government as an insured party and as a representative of all affected people
- enable unconditional access by the Australian Government

While some might consider such a step as extreme, it is wholly consistent with current practices, including the costs of clean up by BP for the Deepwater Horizon oil spill.

In reality it places responsibility and accountability for the risk with the party best able to manage the risk. As well this approach ensures that the party gaining the financial benefit, pays the full true cost and prevents the cross subsidy from Australian producers to overseas exporters.

SOUTH EAST QUEENSLAND DATA

The South East Queensland data is indicative of many parts of Queensland and New South Wales. The data clearly demonstrates that mean and median are not appropriate measures for interpreting the past let alone informing decisions on investing in the future.



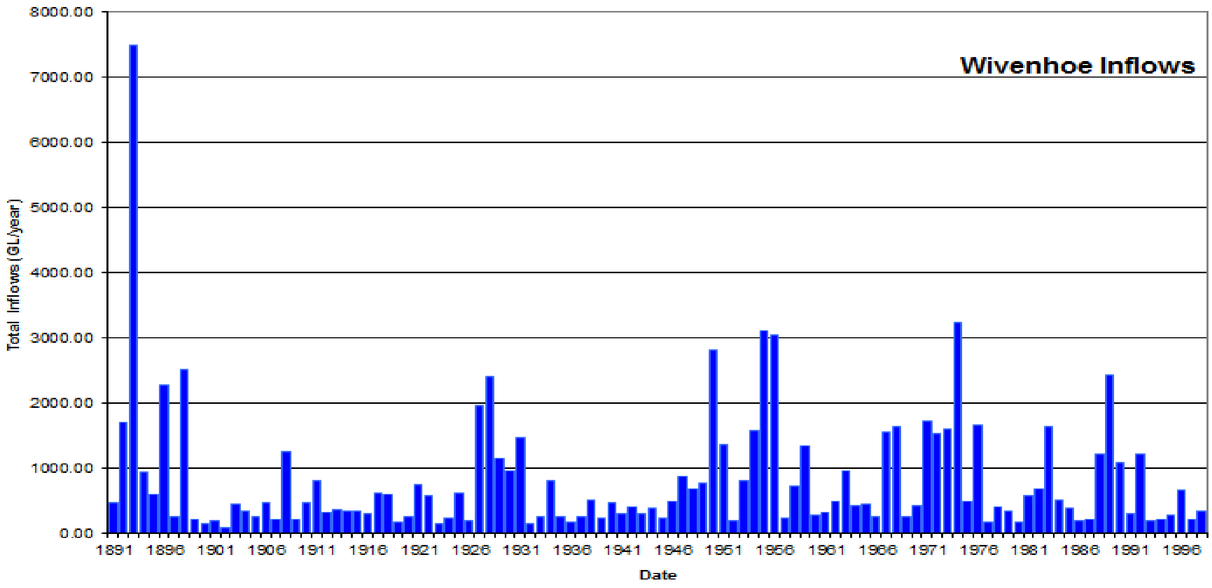
As the data is monthly inflow and given the prevailing weather patterns in South east Queensland, many of the high inflows on the RHS occur across January/February/March. The data also masks where multiple high inflows occurred across 30-90 day periods

With periods of high flows and periods of little or no rain, unregulated systems have limited opportunities to access water meaning they have extended periods dependent on in stream flows. For regulated systems the issue is complicated by both the mix of user demands and the water rights on issue.

The larger the dam and the lower the volume of water allocated, means the water infrastructure can operate over a longer period of no/low inflows. This approach, however:

- does not optimise agricultural enterprises
- gives a false impression of the ability of the water infrastructure
- embeds a "community" based about resource allocation, without a proper understanding of the consequences

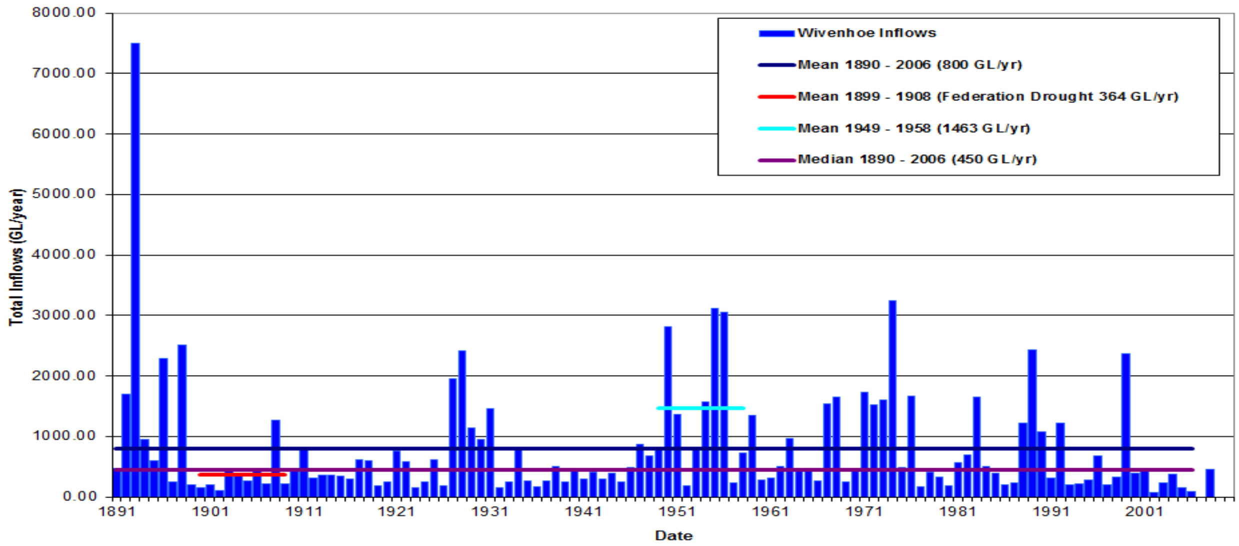
The data in the following graph shows that that there is no discernible drought-flood cycle.



the measurements

This submission argues that men, median and other current modes of analysing data, are inappropriate. In the South East Queensland example, the graph below shows the mean across different time periods. Give the high variability in the inflows, it is clear that mean is not representative of the experience. The system is more off or on.

The median is also inappropriate given the nature of the system and the high variability of inflow volumes across the period of record



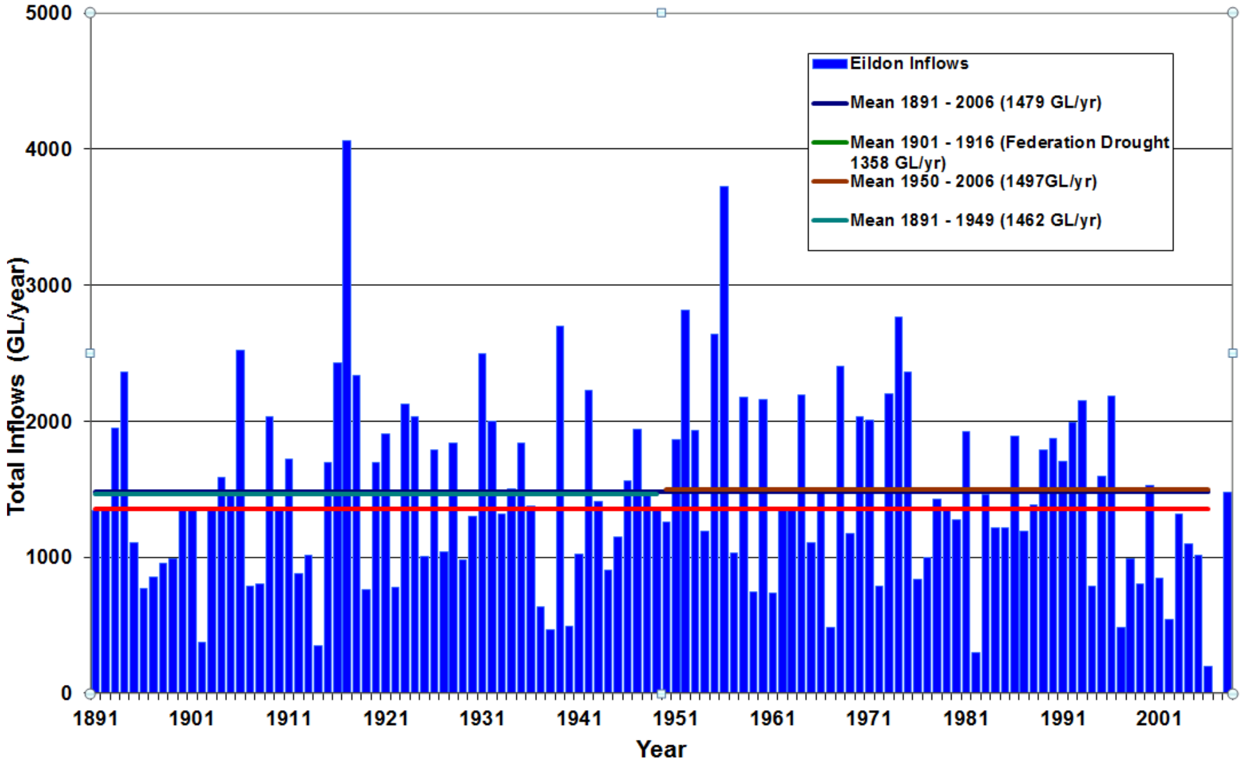
The present alternative to mean and median is to "re do" the model based on excluding the high flow events, ie: to treat the high flow events as anomalies. While interesting, the approach is more about "tidying up " the data than it is about finding a way of presenting water information in way that is useful for the agricultural (and urban) communities.

comparison with victoria

The individual experience and the historic record in Victoria's Lake Eildon is a near perfect example of an historic record where mean and median are sufficiently representative to form a proxy for understanding the system.

Here the assumption that that future can be informed by the past will be stronger, because experience, past predictions and the historic record are highly correlated. This was true up until recent years (2001 – 2009) when the inflows into Lake Eildon were dramatically reduced and did not correlate with the historic record.

The concerns about variability may have touched lake Eildon, however the Lake and the region having recovered now obscures the long term risk inherent in the Australian experience



the future

Australia is a continent of extremes and with that comes extremely variable rainfall. The current water modelling, water planning and water management decisions were developed using measurement and tools that were not appropriate.

THE CURRENT FUTURE

The deficiencies in those tools were not evident at the time, because of the apparent abundant availability of water.

current planning

The tools used are all pervasive with the recent report by the CSIRO "The Flinders and Gilbert Agricultural Resource Assessment" (2013) (the Assessment Summary) continuing this tradition at page 8 where after using phrases such as "Rainfall is unreliable"; "Rainfall is highly variable" and "1.3 times more variable year-on-year than in comparable parts of the world"[4].

The Report specifically state at Page 5 "The historical (1890 to 2011) climate record provides the best available information to support short- to medium-term planning.", and goes on to state:

- …"
- Dagworth dam could potentially store 498 GL and yield 326 GL at the dam wall with 85% reliability. Approximately half the volume released would be lost as water was transmitted to the most promising delivery point 70 km from the dam wall.
- Water delivered to the dam wall at Dagworth (excluding delivery to farm) is likely to cost approximately $1,450/ML in 85% of years.
- If used to its full extent, the Dagworth dam would reduce flow near the mouth of the Gilbert River by 498 GL, or approximately 19% of median streamflow.".

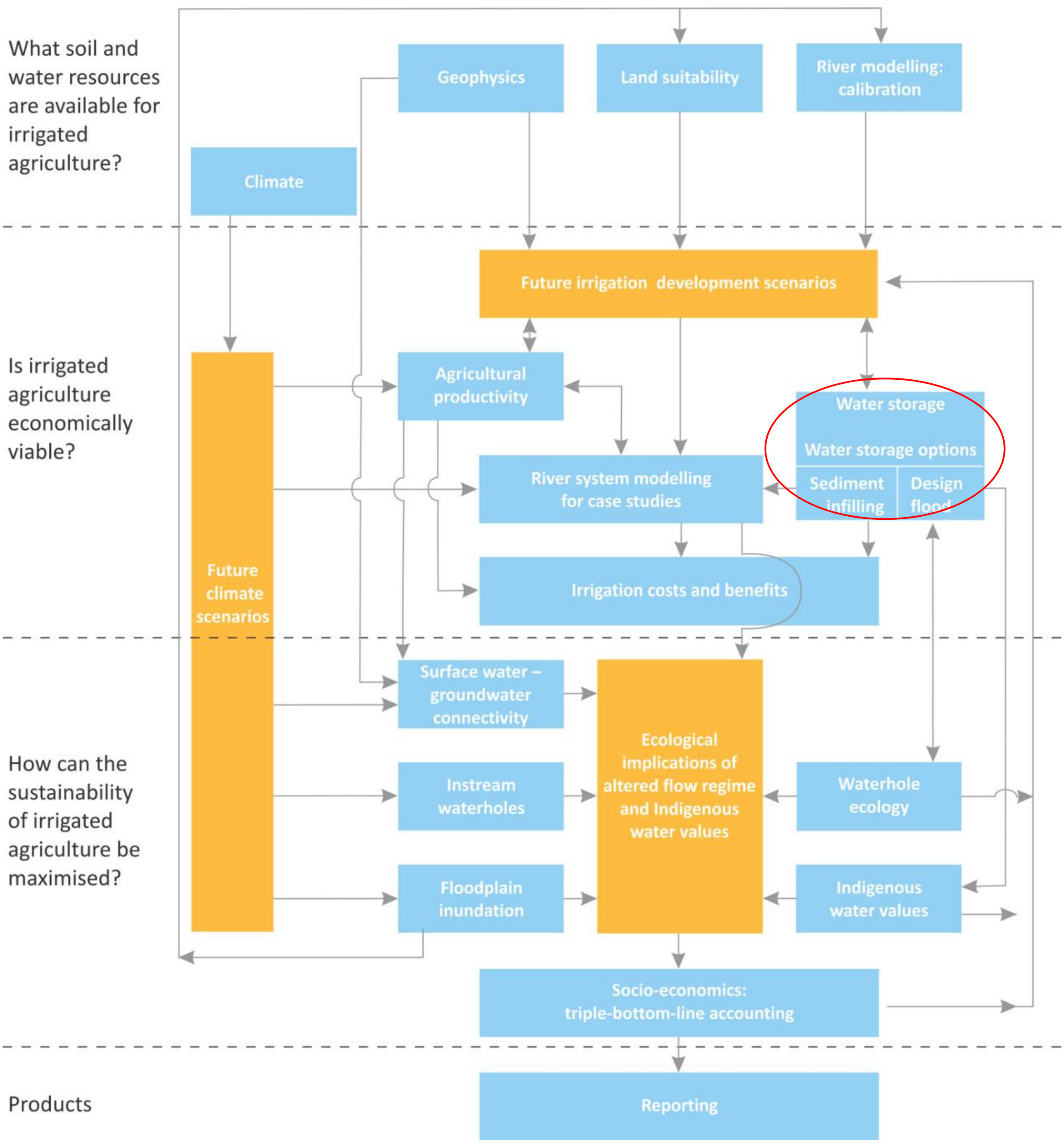
Unfortunately the construction of a dam and private investment are long term planning issues not "*short or medium term*".

It is beyond the scope of this submission to deal with all of the implications of reliance on the CSIRO Assessment Summary and the elements that contribute to that summary.

The CSIRO Report contains a very important diagram that points to the centrality of water planning in the development of water resources, the sizing dam infrastructure, the options available to agriculture and the scheme potential correlated to the water availability.

A copy of the CSIRO mapping appears on the next page.

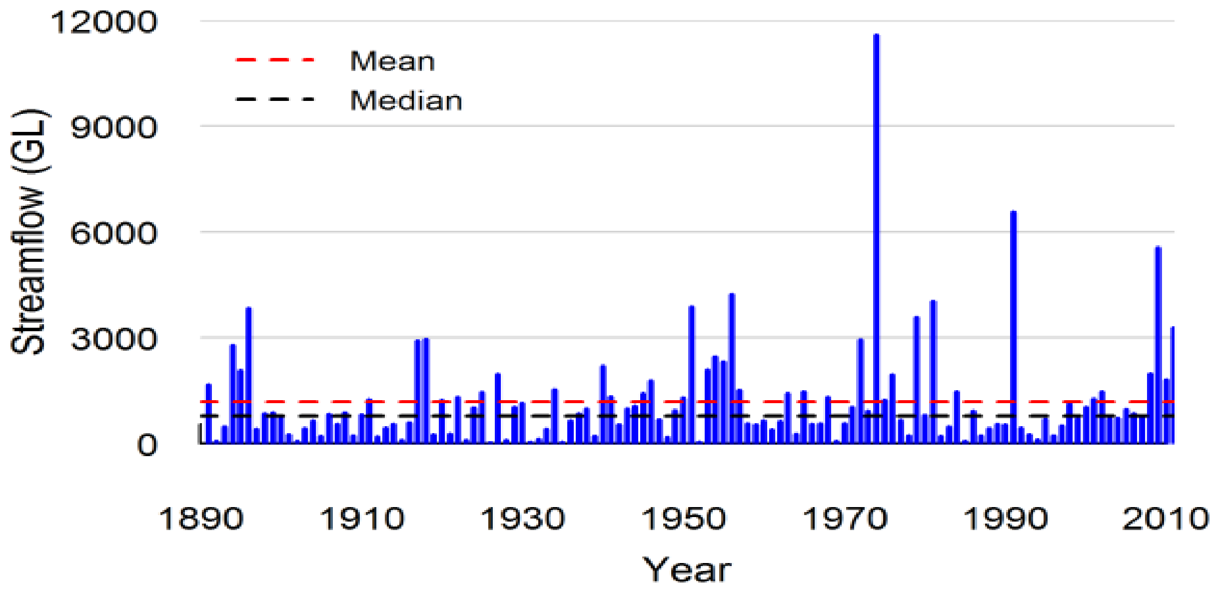
4 Although this masks that this is variability on variability, which has its own concerns.



The "Assessment of surface water storage options in the Flinders and Gilbert catchments" prepared by CSIOR at page 129 which is a part of the Water Storage (Blue Box), contains the following graph. The graph is remarkable for a number of reasons, including:

- confirmation of the high variability in rainfall in this catchment, consistent with the high variation in South East Queensland (not the Murray-Darling basin)
- the use of mean and median given the high variability acknowledged by the authors
- the conclusion expressed as "reliability", (read "historic reliability") is a concern given the observations expressed in this paper
- that large volume of water would be lost to the storage, during the high inflow events or multiple events in the same year, (which appear to correlate with

cyclonic activity), yet these inflows are added into the system through use of median and mean.



converting yield at the dam to available water

The 85% historic reliability is also dependent on full draw down of the storage in each year. Implicit in this statement is the model does not provide water for "drought proofing", carrying water into the next season or provision for urban or industrial demand for a more certain supply.

The reliability of 85% is interesting given the statement at Figure 5.67 that "(i)t does not account for storage operation and delivery losses however **so the results are an overestimate**." (my emphasis). This is without dealing with the issues of reliability based on a mean or median that is inappropriate.

The model then moves to "average". having assumed a yield of 326 ML(sic) the model moves to an "average supply" of 134,944 ML and then considers the impact of climate moving towards drier and a reduction of the average volume by 8% to 124,148 ML.

We already know that average is not relevant. As indicated investment decisions based on this approach is a significant risk for government as a direct funder of the project or as the entity required to provide support where the project fails to meet the expectations created by these reports.

converting yield at the dam to a price per megalitre

Based on the dot points from the Report, the "costs" issues are better described as:

- a 163ML "yield" at "promising delivery point" (first dot above)
- converted to a price of $3,900.00/ML at "promising delivery point". This price excludes the development of any extraction and off stream distribution infrastructure. (first and second dot point above).

NB the CSIRO report states a yield of 326GL which based on the price of $1,450/ML, should be corrected to 326ML.

The “price of landed water” is significantly under calculated and therefore is under estimated. It also assumes that this amount will be payable by users. Assuming a direct pricing approach with risk falling as stated, this would result in users paying, $0.636 million per annum per annum. For government to better manage its risk, the price would have to be a take or pay price.

This summary does not include and analysis of the NVP, however given the issues raised here are inputs to the NPV, it is doubtful the NPV is appropriate. Reliance on the assumptions, data and assessments report will have a number of implications, including:

- the required capital investment is understated for the water that can be made available
- the system performance not being amenable to mean and median, creating unrealistic expectations of water availability, leading to over investment in capital

converting NPV to true price

The NPV calculation is a very simple but acceptable way of determining the value of an investment. Adopting NPV as the assessment tool requires only a limited number of variables. NPV can be expressed as:

$$\mathrm{NPV}(i) = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t}$$

R_t, is the Net Cash Flow.

The Net Cash Flow =

Project Cost (construction/operation) – Project Revenue (price/ML x ML Available).

Given the concerns about volume, the price/ML must be adjusted up to maintain Project Revenue.

As indicated the ML sold is based on a doubtful method of assessment given the underlying data and the material contained in this submission. In this sense the pre-development work has already started down the path of the Toll Road Example, by having an elevated volume sold. With a project cost blow out, the price per ML will rise. It is not clear from the CSIRO material who bears these risks and the proposed response.

APPENDIX

Many parts of Australia have highly variable climate, rainfall and agricultural activity. The high variability of rainfall means that current tools and models are unlikely to effectively predict future water availability in a way that is useful for agricultural enterprises.

There are many terms used in the water industry and applied in the agricultural sector. Although they have a long history and are used endemically throughout Australia, they are inappropriate as a bias for managing agricultural businesses or for the government to make decisions about policy, infrastructure or support.

The discussion below identifies some of those terms and provides some explanation of why they are inappropriate.

appropriate measures

Current measures rely on a sequence to classify events as either:

- average (mean)
- number of occurrences
- median

The Australian experience in many areas is better characterised according to the table below. The table in a simple form expresses a country of extremes, intensive rainfall over a short period of time and extended periods of no rain. The table also ignores rainfall events that occur at the wrong time for the agricultural activity (eg: late rain).

Example 1

Event	1	100	
Frequency	1	1	
Mean (average)			55

Neither of the actual events is reflected in the Mean as shown in Figure 1.

Building the model one step further we get.

Example 2

Event	1	100	
Frequency	90	10	100%
Mean (average)			11

Neither of the actual events is reflected in the Mean as shown in Figure 2. The actual experience is almost always no/low rainfall events, with some extensive rains, that could be beneficial, may not be useful or may be damaging.

Building the model one step further we get.

Example 3

Event	0-1	2-99	100	
Frequency	70	20	10	100%
Mean (average) (using 50 as the mean for the range 2-99)				**21**

The Mean sits at 21. This provides no insight into the actual experience of the agricultural sector and is not the basis for planning. The mean is representative of one event. The use of median is not appropriate in this context.

water planning, water management and water rights

Using the Example 2, while an average of 11 might suggest sustainable agricultural business, the reality is that under the model a business could not survive the 90 events of no/little rain. A business might survive four consecutive years or three years out of six years, but not five consecutive years.

Cubbie Station exemplifies this approach, although Cubbie Station had difficulties sustaining its operations during an extended period of reduced inflows to the Condamine River.

Many of the SEQ catchments (and other NSW and Queensland catchments) conform to the dynamic of high number of no/low flow events and a few large events, with isolated events in between.

Much of Queensland and New South Wales manage agricultural enterprises within these boundaries, yet the material published uses mean as a defining term.

Accordingly "mean" is not apt to define water rights, be used in water planning or be the basis for agricultural decisions around water. In a modified environment, where dams and weirs have been constructed, the use of these terms also skews the water market.

For the better functioning of water, water markets and farming there should be a review of how information about water is published.

"drought" and the use of "average" rainfall

The use of the terms "drought" and "average (mean)" are endemic phrases used throughout media, scientific and engineering discussions about weather, rainfall and water availability. The use of these terms is embedded in many government reports, technical reports and society.

In many cases the reports and models are framed by historic data but do not explicitly state these limits. Australia has many diverse climatic conditions and influences.

When we discuss drought and average we are inherently speaking about the past. Drawing upon past records and making a calculation about the past data. When we talk about present or the future using average or drought we are talking about the experience or the future anchored to the past.

There are there fundamental issues with:

- conviction that the past is a reference point to the future
- measures used to describe past events are relevant to the future
- past measurements can shed light on future experience

The word “drought” in South East Queensland was used describe a situation where there were low inflows into one dam – Wivenhoe. The real driver for a declining water volume for urban use was unchecked rising water demand and/or lacked of planned augmentation.

The increasing annual demand was directly related to increased population coupled with increasing per annum usage per person. In short it was a man made “drought”.

In many places the water shortages have been and will continue to be created, where in many cases they could be avoided or better managed or in some cases provided with better responses from government.

defining “drought conditions”

In Example 2, history plays its part. As more events occur, the events crowd the space in the range, making it harder to rank each event. Where each event has less rainfall than the previous event, the time at which exceptional circumstances support might apply, reduces over time. So after 10 years, the same sequence of low rainfall will mean that:

- the first sequence will be ineligible
- but the second will be eligible

  because the base line will have shifted downwards.

The Bureau of Meteorology (BOM), states:

> drought is "a prolonged, abnormally dry period when the amount of available water is insufficient to meet our normal use".
>
> Using rainfall as a measure, drought is defined by a period of serious or severe rain deficiency. The Bureau of Meteorology examines rainfall periods of three or more months to see whether an area falls in the lowest 10 per cent of records. That determines the severity of a drought.

Serious rainfall deficiency is when rainfall measures above the lowest 5 per cent of ever recorded in that area but below the lowest 10 per cent for the period in question. Severe rainfall deficiency is when rainfall is in the lowest 5 per cent for that area over the period in question.

It is quite clear that the BOM approach is anchored in the past data. The approach has a number of issues including:

- With a highly variable rainfall, the concentration of events is likely to be at either end of the spectrum. Accordingly over time the lowest 5 per cent will shift. The on farm conditions will remain the same, with the same need for assistance.
- The on farm conditions remain the same, irrespective of how the rainfall events might align compared to past events.

SOI and ENSO

The analysis provided by BOM of SOI an ENSO is highly retrospective in attempting to fit the past pattern of observed values in the Pacific Ocean with observed events in Australia. The BOM at http://www.bom.gov.au/climate/enso/ provides:

> "El Niño is ***often, but not always***, associated with below normal rainfall across large parts of southern and inland eastern Australia during the second half of the year. The strength of an El Niño ***does not alway***s indicate how much it will influence Australian rainfall. ***Historically*** there are examples where weak events have resulted in widespread drought across large parts of Australia, while at other times strong events have resulted in relatively modest impacts."
>
> ***(my emphasis added)***

So SOI and ENSO according to BOM has some correlation to events experienced in .Australia but is not certain

chief scientist discussing "flood"

The Queensland Chief Scientist provides a number of views about how to discuss flooding[5]. While the discussion is focussed on planning (town planning in particular) it retains the principle that the historic view is a worthwhile guide to:

- flood height levels
- flood duration
- flood chance
- flood frequency
- flood experience

The Chief Scientist highlights:

- "Australia's flood records do not extend far into the past"
- "flood events are highly variable"

[5] http://www.chiefscientist.qld.gov.au/publications/understanding-floods/chance-of-a-flood.aspx

- a similar flood event occurring in Kempsey twice in two years, but not consistent with the published 1% Annual Exceedance probability

Although the commentary is focussed more on town planning, the Chief Scientist still goes on to talk about “odds” of experiencing at least one flood event in a lifetime.

The Chief Scientist acknowledges the deficiencies of the each approach, but continues to promote this way of thinking. The consequences are the same, modelling and results based on the past proving to be unsuited for:

- the use to which they are put
- the expectations of the community
- explaining the real risk, compared to the planning or assessment theory

In the “flood Quiz”[6] despite all the reservations stated by the Chief Scientist, the following question and answer appears, although the fundamental issue remains unaddressed. How does the one arrive at the 1 in 100 event assessment?

The 1974 flood in Brisbane was considered the 1 in 100 year event. Based on the current logic, the 1974 event was a 1 in 33 year event.

13. If you experienced a 1-in-100 year flood this year, what is the chance you will experience one next year?

a. none

b. 1 in 10,000 odds (0.01%)

c. 1 in 1000 odds (0.1%)

d. 1 in 100 odds (1%).

View the answer

d. The chance of experiencing a 1-in-100 year flood in any given year is 1% (or 1 in 100), regardless of when the last 1-in-100 year flood was experienced.

Under this approach, when an area goes through a long period dominated by reduced inflows and small floods events, the historic flood event frequency drops. The converse applies, where flood events occur over a short period of time.

The explanation of the Chief Scientist at times confuses issue of hazard, risk, likelihood and chance.

The Chief Scientist goes on to perpetuate a view that there is some “flood-drought cycle” operating in Australia. The best that can be said is that at some stage the extended period of low rainfall will be followed by rain. This is not a “cycle”. The system in many parts of Australia is more an “on or off”.

6 http://www.chiefscientist.qld.gov.au/publications/understanding-floods/floods-quiz.aspx

Similar suggestions that a “drought” will break, suggests the problems about understanding high rainfall events (leading to floods) are just as relevant for understanding long periods of low rainfall.

reliability and probability of supply

Irrespective of where climatic information is sourced it is clear that most areas have broad, geographic, marine and land factors that contributes to the volume, time and timing of water and influences the heat, time and timing of periods of no or limited water.

In many areas the factors can lead to an historic record that can be considered a “pattern” and operates within a “range” of measurements. This record of the reliability of experience has a number of implications. Embedded in much of the material is historical data and historical performance.

From time to time other solutions are offered, however they as a rule start with historical data and attempt to produce a “future pattern and commentary such as “probability”.

In water discussions, this manifests ultimately in the phrase of “reliability”, which really means “historic reliability”, which depends on the future looking like the past. While this position is often defended, based on “this is the only data we have”, it is not defendable.

The past is not a good guide to the future in many parts of Australia. Unlike any other continent, Australia:

- by and large does not have a snow season that can provide and indicator of summer flows
- has large areas that receive rain and/or water on an infrequent basis against a background of low or no rain
- have a consistent weather pattern, where we deal with variation within that pattern
- can have four or five weather systems operating independently, in combination , on integrated basis and together to create different conditions over the short, medium and long term
- in many areas the defining boundary between land that is considered dry, wet and subject to rain is highly arbitrary in climatic terms

About Andrew Watt

Andrew has worked in the Water Sector for over 20 years in roles in government, government business entities and the private sector.

Throughout this period of time, Andrew has led and reviewed infrastructure projects, hydrological and hydrology assessment as well provided policy, legislative and environmental advice.

Andrew delivered business cases and financial models for water infrastructure and guided pricing reviews for water services

Through effective strategy, structures, risk identification and control documents Andrew has documented:

- water auctions, water sale, lease and volume transfer arrangements
- water release, supply, relocation and availability contracts
- water infrastructure BOO, BOOT and capacity agreements

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