



In the Pipe NCWE Chairman's Message

It is an interesting and challenging time for water engineers. The recent vote in Toowoomba over drinking recycled water, the Beattie Government announcing almost \$5 billion worth of new water infrastructure, the proposal to establish a Stormwater Management Authority in South Australia, and not forgetting the establishment of a National Water Commission, show that water management is at a critical point in Australia.

At this critical point it is essential that water engineers and Engineers Australia are part of the debate. Engineers Australia can clearly contribute at the policy level with submissions and meetings with peak bodies such as the National Water Commission. However more importantly water engineers need to be engaged at this point in time.

The old adage about what is an engineer - someone who can build something for a dollar where anyone could build it for two - is still true today. Water engineers need to be engaged in developing new approaches to water management. New ways that meet the challenge of climate change impacts on floodplain management, dam design, water allocation and environmental flow needs. New ways that meet the water re-use and water recycling needs of the future.

The challenge for all of us - NCWE and as water or water resource engineers is to be engaged and involved in the development of new solutions to the water resource issues facing Australia - by being involved in discussions on planning and policy, but just as importantly developing new approaches to plan, design and build the infrastructure and protect the environment.

By John Ruprecht

AR&R Update Progress with Derivation of New Areal Reduction Factors

The design rainfall (IFD) data in 'Australian Rainfall and Runoff' (ARR) are presented in the form of *point rainfall intensities* for any site in Australia. However, for flood estimation in catchments of significant size, designers are interested in the *areal average rainfall intensity* over the catchment. The *areal reduction factor (ARF)* represents the ratio between the design values of areal average and point rainfall; it allows for the fact that larger catchments are less likely than smaller catchments to experience high intensity storms over the whole of the catchment area. The areal reduction effect is also greater for short duration storms than for longer duration rainfall events.

The design ARF values recommended in the current version of ARR for all regions except the arid inland are based on values derived for the Chicago region in the USA, but a number of studies of Australian storm rainfall data have shown that these ARF values tend to overestimate design rainfalls for Australian catchments. The CRC for Catchment Hydrology (CRCCH) initiated a research project aimed at deriving ARF values based on analysis of Australian daily rainfall data and, after initial testing in Victoria, this methodology has been applied to derive design ARF values for all Australian states and territories (the derivation of ARFs for NSW is still in progress). These new ARF values cover a range of catchment sizes from 1 to 10,000 km² and storm durations from 18 to 120 hours.

The results of these studies have all been expressed in the form of a general equation which expresses the ARF as a function of catchment size, storm duration and storm frequency. However, different Australian regions are subject to different rainfall regimes, and it is therefore not surprising that the results for the different Australian states show significant regional differences in ARF values and their variation with catchment size, storm duration and storm frequency. The analysis of the Western Australian rainfall data also exposed a significant variation in ARFs between the winter and summer seasons. The new ARF values are consistently lower than the ones recommended in the current version of ARR.

For rainfall durations of 12 hours and less, the determination of ARF values has to be based on the analysis of data from pluviograph stations that are far less densely distributed than daily rainfall stations. Thus the CRCCH methodology has only limited applicability for determining short duration rainfall ARF values; it is restricted to areas of dense coverage of pluviograph stations. At this stage, preliminary ARF values for shorter durations have been defined, based on UK ARF values that showed similarities with the results of a limited number of Australian analyses of short duration rainfall data. Further research and regional analysis is desirable to refine these preliminary estimates.

Until the revised ARF recommendations are finalised, practitioners are advised to contact the relevant state water agencies for advice on currently available ARF data for their region.

ARQ Update A guide to Water Sensitive Urban Design

Chapter 7: Establishing Stormwater Management Targets to protect receiving waters

Given the complex nature of water quality processes in rivers, lakes and estuaries, the ANZECC/ARMCANZ *Guidelines for Fresh and Marine Water Quality 2000* adopted a risk assessment based approach for the determination of the permissible catchment discharge for a range of critical stressors (including flow). The *Guidelines* recognized that in many cases, water quality response processes within receiving waters are 'indirect pathway' based processes, and are multi-stressor related, such that application of simple ambient water quality criteria as design values for catchment management are no longer valid.

The *Guidelines* adopt a range of 'trigger levels' for critical water quality indicators, based on the reference ecosystems appropriate to the waters under assessment, the major threats to environmental and use values, and the management protection objectives. In the case of moderately to highly modified ecosystems, such as urban streams and drains, the 'trigger levels' are set at the 10th to 20th or 80th to 90th percentile values for the reference ecosystem, depending on whether the values relate to critical physical or chemical indicators that cause problems at low concentrations (DO, pH, SS) or high concentrations (nutrients, toxicants, pH).

The *Guidelines* recommend that the median values for the critical indicators be maintained within the 'trigger level'. Exceedance of a 'trigger level' triggers a requirement for more detailed analysis of the risk to agreed environmental and use values for the receiving waters.

The ARQ approach to setting permissible discharges for receiving waters builds on the ARMCANZ/ANZECC *National Water Quality Management Strategy 1998* framework, comprising the identification of the receiving waters environmental and use values to be protected or restored, and the catchment land use and management strategies providing for the protection or restoration of the agreed environmental and use values.

The ARQ approach recognizes that in view of the variable nature of stormwater discharges and pollutant exports, the adoption of a probability-based assessment of management measures is critical. The simulation of catchment daily discharges and pollutant exports as the basis for assessment of a range of management strategies, enables their application to receiving water models, providing daily simulation of daily water quality and ecological responses of the receiving waters. Chapter 7 outlines a series of simple physical, chemical & biological process based receiving water (ecosystem specific) models for undertaking this assessment. The models are in process of incorporation into the eWater CRC 'toolkit' framework, for use by engineers and resource managers and agencies.

The Permissible Average Annual Export Load, determined on the basis of the daily loads maintaining the receiving water median value within the trigger levels, is adopted as a target guiding the design of catchment management measures.

By Ian Lawrence

ICE WaRM 2006 / 2007 International Visits and Exchanges Programme

The International Centre of Excellence in Water Resources Management (ICE WaRM) provides a national focus and international gateway to Australia's education, training and research expertise in water resources management.

ICE WaRM's International Visits and Exchanges Programme provides an opportunity to persons from industry, education, training and research sectors for increased engagement at an international level in the sharing of skills, knowledge and experience in water resources management.

Applications are now open for inbound (to Australia) and outbound (from Australia) visits by individuals and exchanges between two candidates.

Individual candidates will be eligible for funds to the maximum of AUD\$10,000 for visits or exchanges ranging in duration from 4 to 13 weeks. The proposed visit or exchange must commence no later than 27 April 2007.

Further information regarding the International Visits and Exchanges Programme and how to apply is available in the International Liaison section under Programmes at www.icewarm.com.au

Applications close **6 October 2006**

Water Engineering Hall of Fame

The Water Engineering Hall of Fame honours individuals who have made outstanding and lasting contributions to the water engineering profession in Australia. These individuals have shaped the theory and practice of water engineering. The Hall of Fame not only seeks to acknowledge their contributions but also seeks to document their legacy to develop a sense of tradition and appreciation of the history of the profession.



John R. Burton (1930 – 2000)

After graduating from the University of Sydney as a Civil Engineer in 1951, John Burton began his outstanding career in water engineering with the NSW Public Works Department (1951-1954) where he worked on Eucumbene Dam and Chifley Dam. In 1954 he joined the staff of the School of Civil Engineering of the University of New South Wales as Lecturer, and became Senior Lecturer in 1962. He was closely involved with the development of the Water Research Foundation of Australia, and was the first Research Fellow of the Foundation in 1957. He was a Fulbright Research Fellow in 1960-61.

In 1965, John Burton was appointed Professor of Agricultural Engineering, and Head of the Department of Agricultural Engineering, and Director of the New Zealand Agricultural Engineering Institute at Lincoln College of the University of Canterbury in New Zealand. In 1971 he was appointed Foundation Professor of Natural Resources and first Head of the School of Natural Resources at the University of New England.

He was made an Officer of the Order of Australia (AO) in 1990. After his retirement in December 1994, he remained active as an environmental and engineering consultant.

John Burton's major professional achievements

Natural resource Engineering

In 1971-77, John Burton was responsible for the establishment, staffing, equipping and development of curriculum for the School of Natural Resources at the University of New England, offering degree, diploma and post graduate courses in resource and environmental management. In 1990-93, he was responsible for establishing a new degree programme in resource engineering, and subsequently in 1993 the establishment of a new School of Engineering. His award of an AO in 1990 was mainly because of his work in educational development in natural resource engineering. In 1995, he was honoured with an Honorary Doctorate in Resource Management from the University of New England.

Catchment Management

John Burton was active in the practical implementation of catchment management in many areas. He was a consultant to the NSW Government in 1987-88 on procedures and practices for Total Catchment Management Policy. He was Chairman of the Murray-Darling Basin Community Advisory Committee in 1986-89, responsible for advice to Federal Ministers regarding management of the Murray-Darling Basin. In 1998, he was a consultant to the United Nations (ESCAP) and involved in the preparation of a manual and guidelines on land use planning, watershed management and disaster reduction.

Advisor to Government

In 1972-74, John Burton was Chairman of the Australian Government Inquiry into the Flooding of Lake Pedder, Tasmania. In 1986-89, he was Chairman of the National Soil Conservation Advisory Committee. In 1988, he was Chairman of the NSW Government Review of Reforms in the Water Industry. In 1993-95, he was Chairman of the NSW Floodplain Management Advisory Committee. His CV lists 27 such activities undertaken during his career.

Hydrological Games

In May 1975, the 8th Hydrology & Water Resources Symposium was held at the University of New England. As one of the principal organizers of the Symposium, John Burton devised and introduced the inaugural Hydrological Games, and constructed the "Cumece Trophy" to be presented to the winning team. In 2000, shortly after his death, the National Committee on Water Engineering renamed the trophy as the "John Burton Cumece Trophy" to honor the role he played in devising and introducing the Games.

Position Paper Water Resources Data Collection

A draft has been prepared for an updated version of this position paper. Although the paper is still undertaking development, here is a peek at what is to come:

Water accounting is an important component in addressing a wide range of water issues, such as assessing the best approaches for use, development and protection of the resource in an environmentally, economically and socially sustainable manner. It is understood here that water accounting is field monitoring, storage, management and analysis of data and leads to procedures for analysing the uses, depletion and productivity of water. This is why water accounting is vital to the realisation of specific National Water Initiative objectives such as water trading and the integrated management of water for the environment and other public benefit outcomes. In any change process in which there will be winners and losers, there needs to be an accepted degree of precision in quantifying the redistribution of the water. Water accounting is intended to provide the necessary reassurance. However, without meaningful and constantly improving monitoring networks, with associated field measurement and archiving, the intent of water accounting is undermined and may become an impediment to reform, rather than assist progress.

Appropriate and accurate data are fundamental for the effective assessment, planning and management of resources and assets in all manner of industries. Water is no different. The ABS is the only National Agency that has attempted to construct Water Accounts for Australia. In the explanatory notes to these accounts the ABS notes that the reliability of the data is dependent on the collection arrangements of the numerous contributing agencies. In particular, the ABS indicates that for data received for Victoria, Queensland and Tasmania, only 22% of responses are from sources based mainly on reliable recorded and surveyed data. A further 8% of responses come from approximate hydrological analysis and limited surveys. Even in cases where mainly sound data were provided, some components depend on significantly less reliable data. Expert hydrologists suggest most of this data is of a general nature and does not contain some of the detail needed as a basis for good infrastructure and resource planning, design, and management. However, the ABS proceeds with its accounts on the basis that the data it has are the best available in Australia.

Water data can be collected in a variety of forms. Consideration of the following factors is required to develop water data collection programs:

- Sampling interval – resolution, time between data records can vary from seconds to years (eg. Discrete samples versus continuous monitoring);
- Response time – real time (e.g. for flood forecasting), or archived historical (e.g. for water supply assessment, planning and infrastructure design);
- Duration e.g. short term project specific, or long term for base-line and trend analysis;
- Spatial distribution – point measurements such as rainfall and river flow or a network of these to give areal indicators, or spatially diverse, such as land use and vegetation;
- Quality and accuracy – units of measurement and their tolerances, for example most high flows are estimated with error tolerances of at least $\pm 50\%$;
- Range of measurement to allow definition of calibration curves for a wide range of conditions; and
- Magnitude – large events or concentrations only, or continuous monitoring?

These issues each have a bearing on the extent and quality of water data. The Position Paper reviews what has gone wrong in general, and considers some specific examples where problems have arisen and how they may be resolved. A copy of the draft paper can be obtained from Alex Loy at Alex.Loy@nrm.qld.gov.au. Comments on the draft are welcome.

By *Alex Loy*

The Honourable Jack G. Beale AO

Jack Beale, an eminent engineer in Australia's water resource field passed away recently, at the age of 89. His contribution to the Australian community was profound. He was one of the youngest members elected to the NSW legislative assembly, and was the Minister for Conservation from 1965-71 and the Minister for the Environment from 1971-73 including Minister assisting the Premier and Treasurer at that time.



Jack Beale's innovative work was not limited to Australia. As a consulting engineer, Jack worked in over 60 different countries. His work in India from 1952-59 has been recognised as saving millions of people from famine through the concept of 'drought proofing'. This was also applied in Australia resulting in expansion of our irrigation industry.

For more information of his achievements visit: http://www.unsw.edu.au/news/pad/articles/2006/jun/Jack_Beale.html

Call for Papers AJWR

The Australian Journal of Water Resources provides a forum for Australian & International researchers and practitioners to publish high quality articles on issues related to and affecting the hydrology & water resources in Australia. Topics covered range from rainfall & runoff modelling, climatic variability & change, assessment & management of water resources, catchment hydrology, environmental flows and hydraulics, open channel flow and hydraulic structures. Instructions for prospective authors can be found at: http://www.engaustralia.com.au/transactions/pub_info1.asp

Upcoming Papers in the Australian Journal of Water Resources

Technical Papers –

Can the GRACE satellite mission help in the Murray-Darling Basin?

KM Ellett, JP Walker, AW Western, RB Grayson, AB Smith and M Rodell

Use of radar rainfall data to improve calibration of rainfall-runoff routing model parameters

PW Jordan and P Hill

Quantifying uncertainty in environmental flow assessments

M Stewardson and I Rutherford

A robust procedure for transposing gauged streamflows to ungauged catchments

L Lowe and R Nathan

River-groundwater interaction: a practical management approach

R Evans, M Dudding and G Holland

Impacts of the 2003 bushfires on water supplies in the Australian Capital Territory

I White, D Givinnage-Wijesekera, M Worthy, A Wade, R Wasson and N Mueller

Forging ahead: incorporating seasonality into extreme rainfall estimation for Western Australia

JM Durrant, N Nandakumar and PE Weinmann

Conference Papers -

Remote sensing estimates of actual evapotranspiration in an irrigation district

CL Savige, AN French, AW Western, JP Walker, M Abuzar, JM Hacker and JD Kalma

Sydney Division Water Panel:

<http://www.sydneywaterpanel.org.au/>

Queensland Division Water Panel:

<http://qld.engineersaustralia.org.au/jetspeed/?group=water>

West Australian Division Water Panel:

<http://www.wa.engineersaustralia.org.au/404.shtml>

Victorian Water Engineering Branch:

<http://www.vic.engineersaustralia.org.au/groups/branches08.html>

Hydrological Society of South Australia:

<http://www.hydsoc.org/>

Links

Upcoming Events

Water Sustainability and Innovation Forum

This one day forum for professionals in the engineering and water industry is intended to provide an understanding of the status of water resources in South East Queensland, to give examples of innovations which have been implemented locally and internationally, and to provide a forum for discussion of how engineers are responding and can assist in improving the sustainable use of water.

The forum has been scheduled to correspond with the release of Engineers Australia **National Policy on Water and Sustainability**, which will be launched by Engineers Australia CEO Peter Taylor at the event. The forum will be held at the Brisbane Convention Centre on the **4th October 2006**, and sponsored by the Environmental Protection Agency.

For more information, contact:
Engineers Australia Queensland Division
447 Upper Edward Street
Brisbane, Tel: (07) 3832 3749

30th Hydrology and Water Resources Symposium

The 30th Hydrology and Water Resources Symposium will be held in Launceston at the Hotel Grand Chancellor from **4th-7th December 2006**. The theme of the symposium is 'Past, Present and Future', and we have been fortunate in attracting four high profile speakers to address these themes. The City of Launceston will be celebrating its 200th anniversary, appropriately with the conference theme of past, present and future.

For more information visit:

<http://www.cdesign.com.au/hydrology2006/>

For the following events see the Sydney Division Water Panel web site:

http://www.sydneywaterpanel.org.au/other_events.php

30th August – 1st September: 2nd Groundwater Model Calibration – QLD *Parameter Estimation & Uncertainty Analysis using Modflow & PEST*

25th - 30th September: 32nd Australian Groundwater School – QLD *Fundamentals of Groundwater Science, Technology and Management*

14th – 17th November: 5th Australian Groundwater Modelling School – WA *Concepts, Application (Visual Modflow), Calibration and Predictive Uncertainty Analysis (PEST)*

15th – 17th November: 1st New Zealand Getting to Know Groundwater & Surfacewater – Christchurch *Practical training in hydrogeology for non-specialists who work with groundwater*

21st – 24th November: 6th Australian Groundwater Modelling School – NSW *Concepts, Application (Visual Modflow), Calibration and Predictive Uncertainty Analysis (PEST)*

28th November – 1st December: 1st New Zealand Groundwater Modelling School – Auckland *Concepts, Application (Visual Modflow), Calibration and Predictive Uncertainty Analysis (PEST)*