A NOTE FROM THE DIRECTOR

Professor Russell Mein

Inside...

COOPERATIVE RESEARCH CENTRE FOR
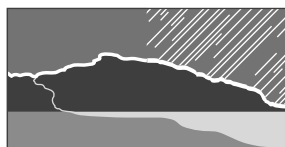
CATCHMENT HYDROLOGY

CRC SOFTWARE: OUTPUTS TO OUTCOMES

In current terminology, it is popular to distinguish between research outputs (reports, technical papers, PhD Theses, etc) and research outcomes. The latter term is applied to the adoption of the research in practice, and used to express the impact of that research. (Hence, an outcome of the CRC's research into sediment sourcing in the Tarago River was the implementation of a riparian land treatment program based on knowledge of the processes involved.)

An important type of 'output' from the CRC is computer software. The production of computer programs is of little value unless the software is applied to appropriate problems, and leads to productive 'outcomes'.

Need for an adaptive approach
A point to be made at the outset is that the CRC is not in a position to develop models to a commercial standard; our main aim in developing software is that the computational algorithms are working correctly.

The odds are against getting a computer program 'right' first time; most software is released in a series of versions, each one improving on the version(s) before. In many instances, the improvements are a result of users wanting to apply the program to situations unlike those used for the original research and development. Software produced by the CRC can be expected to fall into this category.

Hence, it is important that our software programs are trialed by a number of users, but equally important that these users realise the potential limitations of 'new' software. Although care is taken to produce error free programs, and to write guidelines for the use of the software, there can be no guarantee that the right answers will be produced when computer programs are applied to new situations. It is only the experiences of trial users, and their feedback to the program developers, that builds the body of knowledge needed to update to the next version, and to increase confidence in its use.

Thus, most of our models rely on people exercising their professional judgement in the model's use.

CRC software strategy
The CRC for Catchment Hydrology operates in the 'public good' area, and is not aiming to recover software development costs. We aim to have our software tested and used to produce beneficial 'outcomes' for land and water management. To this end, we are adopting a distribution and licensing strategy that is tailored for the type of program produced.

For some research modelling tools, like the TOPOG model (developed jointly with CSIRO), the approach is to register users before providing the code without charge. The reasons for registration are (i) so we can know who has the program [and which version], (ii) draw attention to the disclaimers [eg that the program is still being developed/tested], (iii) require that the program is not distributed to third Parties [we want to deal with users 'direct'], and (iv) generally further the development of the software [through an orderly feedback process].

The Aquacycle Program is a daily urban water balance model developed to assess the potential for urban stormwater and wastewater re-use. It is an example of a research output ready for further testing by users. The CRC website has details for those wanting to register, and obtain a copy. (Look under 'Models').

Visitors to the 'Products' page on the CRC's website will find details of a number of programs. Some of these can be downloaded directly; others require registration first. In many instances, a nominal postage/packing fee (similar to that applied to CRC reports) applies to cover the cost of manufacture and distribution.

Seeking user involvement
A key performance indicator for the CRC is the level of adoption of our research outputs by land and water managers. One of the 'outputs', with the potential to really make an impact on 'outcomes,' is computer software (especially from our 'toolkit' program over the next few years). We are keen that users try the software currently available from the CRC, and to interact with us to both apply and improve it. See our website, or call David Perry on 03 9905 9600 for details; we want your involvement.

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CRC PUBLICATIONS LIST

CRC reports, videos and software available from the Centre Office are listed in the Publications List included with this issue of Catchword.

Additional copies are available from the Centre Office or it can be downloaded from our website at www.catchment.crc.org.au

PROGRAM 1	Program Leader
PREDICTING CATCHMENT BEHAVIOUR	ROB VERTESSY

Report by Rob Vertessy

New Associate Projects

Program 1 has just commenced two new Associate Projects (Projects 1.3 and 1.4) funded by the South East Queensland Regional Water Quality Management Strategy (SEQRWQMS) and the CRC. Both relate to water quality management in the Brisbane River catchment, one of the CRC's five focus catchments, and adjacent areas. These new projects are strongly linked to the Modelling Toolkit (Project 1.1), led by Rob Argent, and the Urban Stormwater Management Decision Support System (Project 4.1), led by Tony Wong.

Project 1.3 is entitled 'Development of an Environmental Management Support System (EMSS) for catchments in south east Queensland' and is led by Rob Vertessy. Project 1.4 is entitled 'Modelling and estimating sediment and nutrient loads in south east Queensland catchments' and is led by Francis Chiew. Team members in these projects include Rob Argent, Fred Watson, Sue Cuddy, Joel Rahman and Phil Scanlon. Francis Chiew will describe Project 1.4 in the next issue of Catchword; right now I'd like to describe aspects of Project 1.3.

Project aims

The aim of Project 1.3 is to build a spatially-explicit Environmental Management Support System (EMSS) that can be used by catchment stakeholders to evaluate alternative management strategies to improve water quality, ultimately to improve the ecologic condition of Moreton Bay and adjacent estuaries. In the EMSS, we propose to embed a regional node-link type catchment runoff and water quality model, being developed by Francis's team in Project 1.4. This model will produce outputs that can be imported directly into the RMA10 bay hydrodynamics model run by Peter Bell at the University of Queensland. In collaboration with economists, we will also develop and embed an economics model that will permit costing of alternative catchment management strategies. This will permit a dollar-value to be attached to possible works and to the resources that stakeholders wish to manage. Prior to development of such a model we will consult with stakeholders to determine an appropriate list of works and resources, and their associated dollar-values.

Links to other models

The EMSS will be designed to permit easy integration of other models that may become available in the future (eg. climate and ecologic models). For instance, the EMSS should permit easy integration of the smaller-scale urban stormwater management decision-support-system (DSS) being developed by Tony Wong's group (Project 4.1). The DSS is being built to evaluate the efficacy of different treatment trains in improving stormwater quality in urban areas. The inputs it demands are similar to the outputs from the model being developed in Project 1.4.

Based on Tarsier

The EMSS will be based on the Tarsier modelling system developed by Dr Fred Watson (formerly of the CRC and now at California State University, Monterey Bay). Tarsier is a PC WINDOWS application that has been developed recently using Borland C++ Builder, a rapid application development environment. Tarsier was written to make model development easier and cheaper by providing a system that removed the need to repeat common tasks every time a model is developed, namely: input and output of data, and visualisation and control. It enables models to interact with each other and with visual components in a way that does not interfere with the speed of model operation. Tarsier has a very strong spatial dimension to it, containing most of the capabilities of a basic Geographic Information System (GIS). The advantages of Tarsier are that (i) quite sophisticated models can be developed within it quickly, (ii) the models themselves run fast using compiled C++, (iii) all models developed within Tarsier have a similer look and feel, and (iv) individual models can be linked easily with virtually no linking code required.

For further information

Joel Rahman and Fred Watson have already made considerable headway with adaptation of Tarsier for the EMSS we are building. We hope to meet with catchment stakeholders in late August to present an initial EMSS prototype as a means of gauging what they really need.

If any readers have an interest in knowing more about our development plans for the EMSS, they can ring me on 02 6246 5790 or email me at rob.vertessy@cbr.clw.csiro.au.

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| PROGRAM 2 **LAND-USE IMPACTS ON RIVERS** | Program Leader PETER HAIRSINE |

Report by Hamish Creswell

Project 2.3 Predicting the effects of land-use changes on catchment water yield and stream salinity

Project 2.3 is all about predicting the regional scale impacts of afforestation and other land use changes on mean annual and seasonal catchment water yield, groundwater recharge, and stream salinity. There is an emphasis on model development with a "top-down" approach considering only the most important hydrological processes and thus keeping the models simple and readily applicable.

Joint workshop

Lu Zhang (Project Leader) recently presented an overview of Project 2.3 and other projects in the CRC for Catchment Hydrology to a research workshop organised by Mark Cotter (Department of Natural Resources and Environment, Victoria) and the Goulburn-Broken Catchment Management Committee. The purpose of the workshop was to better coordinate various research activities undertaken or proposed for the Goulburn-Broken area. Other work presented at the workshop included the CSIRO/BRS Catchment Categorisation project (Mirko Stauffacher), the CSIRO Ecosystem Services project (Steve Cork), the CSIRO/MDBC Heartlands initiative (Hamish Creswell), the CRC for Freshwater Ecology (Paul Humphries), the Australian National University ICAM group (Bill Watson), and the Centre for Land Protection Research Land Capability group (Paul Rampant).

The workshop described the structure of the Goulburn-Broken Catchment Management Authority including their regional management plan, implementation committees, technical support groups and natural resource management strategy plans (eg. river health, water quality, native vegetation, salinity, groundwater management etc.) and the associated coordinators. Knowledge of the structures and people involved is very useful for planning and implementing successful project communication strategies.

Project outputs

Project 2.3 aims to make a significant contribution to the following outcomes:

- Increased understanding of hydrologic processes operating at catchment scales

- Enhanced capacity to predict the impacts of land use changes on catchment water yield

- Increased capacity to estimate groundwater recharge under different land use and climate conditions

- Enhanced capacity to parameterise landscape water storage and permeability using current and new forms of land resource data

- Improved confidence in the predicted responses of catchments under conditions of changed land use and/or climate.

Important linkages

These outcomes were clearly of great interest to a number of the other research project teams that will be operating in the Goulburn-Broken area. Workshops such as these help ensure there is adequate coordination between projects and with stakeholders. The direct collaborative contribution to Project 2.3 from Goulburn-Murray Water and the Department of Natural Resources and Environment, alongside CSIRO Land and Water and NSW Department of Land and Water Conservation will also be very important in coordination and communication in the Goulburn-Broken focus catchment.

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NEW CRC SOFTWARE

AQUACYCLE

Aquacycle is a daily urban water balance model which can be used to investigate the use of locally generated stormwater and wastewater as a substitute for imported water. Dr. Grace Mitchell developed Aquacycle during her postgraduate studies.

The Aquacycle includes the CD-ROM and a complimentary copy of the CRC Industry report 'The Reuse Potential of Urban Stormwater and Wastewater'.

A copy of Aquacycle can be ordered through the Centre Office. Users are requested to sign a User Agreement and a manufacturing and distribution cost of $27.50 applies to orders.

For further information visit www.catchment.crc.org.au/ products

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PROGRAM 3
SUSTAINABLE WATER ALLOCATION

Program Leader
JOHN TISDELL

Report by John Ward and John Tisdell

Project 3.2 Enhancement of the water market reform process: A socio-economic analysis of existing and proposed guidelines and procedures for trading in immature water markets.

Survey of Farmers' Opinions on Water Allocation and Trading

A critical element of the initial phase of Project 3.2 is to develop and undertake a survey of water users and catchment communities for their opinions on water reform, allocation and water trading. Following meetings between the project researchers and industry staff from Goulburn-Murray Water and the Department of Natural Resources, Queensland over the last six weeks, a survey has been developed to elicit opinions and attitudes from randomly selected property owners and irrigators in the main sub-catchment areas. The questionnaire gives water users the opportunity to express their opinions and concerns on issues including:

- How water-users think water should be allocated
- Why farmers buy and sell water on both a temporary and a permanent basis
- As a corollary; why farmers do not buy or sell water
- Who should be allowed to enter the market and trade in water
- The perceived and actual costs associated with trading water
- The attitudes and constraints of respondents towards water trading.

Other data

Analysis of the collated data will increase the knowledge of the community's awareness in trade and trading issues and their concerns regarding the economic impact of water markets in the focus catchments. In concert with that primary goal, the survey results will also provide additional data, crucial for the future experimental phases of the project. These include:

- The identification of existing synergies, notably social welfare characteristics and the prevailing determinants of water trading, between respective catchments
- The determination of the appropriate preference sets of social, market and environmental attitudes to be used as hypothetical rules and procedures presented to

future "players" in the water trading experiments
- Identifying the full range of respondent attitudes to ensure an adequate and comprehensive "whole–of–catchment" representation in the experiments
- Ascertaining the prevailing set of market catalysts and drivers specific to water trading.

The extent of and access to available market information are seen as major factors inhibiting water markets from achieving the COAG objective of economic efficiency.

Timetable

Over the next month the survey will be conducted in the Fitzroy and Goulburn-Murray catchments. At the same time a survey of the community is being developed to explore the impact of water trading on the social capital of the whole–of–catchment communities. This will be administered concurrently with the irrigator/property owner questionnaires. If regions of a catchment are a net exporter or net importer of water over time, it will impact not only on the hydrological management of the system, but also potentially influence the economic and social well–being of the community. The magnitude of those social welfare repercussions is unknown. The identification and articulation of those factors is a significant outcome of the project.

Results and report

Indicators of socio–economic capital in a region include health and community services, levels of education, law and order, access to banking and public services. In essence, the survey will derive empirical data on the perceived concerns about the existing and future impact that water trading will have on regional communities. The results will also expand the current knowledge that exists on the hydrological consequences of major movements of water extraction within the catchments.

A report on the findings of this study will provide important background information to the water industry on which to develop market scenarios, trading rules and procedures for future mature water markets.

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PROGRAM 4
URBAN STORMWATER QUALITY

Program Leader
TONY WONG

Report by Tracey Walker and Rick Wootton

Workshop on Stormwater Quality Monitoring Protocols

Objectives of the workshop

The Urban Stormwater Quality Program has plans for extensive field monitoring activities to be carried out in Melbourne and Brisbane over the next three years in association with CRC industry Parties. A workshop to establish stormwater quality monitoring protocols and procedures was convened on the 8 May 2000 to coordinate the CRC's stormwater monitoring. The workshop dealt with issues of characterisation of urban stormwater pollutants to aid in the development of pollutant export relationships and pollutant speciation characteristics. The principle objective of the workshop was to derive a common basis for data collection of urban stormwater quality characteristics and the performance of stormwater quality improvement facilities. Thirty participants from industry, including state and local government departments, consultants, stormwater quality improvement device company representatives and researchers attended the workshop to address some of the inconsistencies commonly found in stormwater quality monitoring studies.

Why develop stormwater monitoring protocols?

Stormwater quality is being monitored throughout Australia by state agencies and local councils in an attempt to better understand the impact of urban stormwater pollutants on receiving water environments and to determine the effectiveness of stormwater quality improvement facilities. Field monitoring of urban stormwater quality is an expensive exercise and is often undertaken without adequate attention to the appropriate monitoring level or the relative costs of collecting and analysing data when compared with the usefulness of the data collected. Currently, no monitoring protocols exist in Australia for data collection on the characteristics of urban stormwater pollutants and for the evaluation of the effectiveness of stormwater quality improvement facilities.

Urban stormwater quality characteristics

The first session of the workshop was lead by Peter Breen (Melbourne Water and the CRC for Freshwater Ecology, Monash University). Peter presented an overview of the sampling techniques, sample preservation requirements and standard laboratory analytical techniques for a variety of water quality parameters. He then examined typical urban stormwater pollutant types, key constituents, speciation, and their effects on ecosystem health with additional inputs from participants.

Joe Foti provided information on the capabilities of current field monitoring equipment from Ecotech, highlighting the advantages of automated sampling procedures and remote communication with monitoring equipment. Open discussion followed and the group worked towards setting priorities in selecting key stormwater pollutant characteristics. A minimum data set was formulated as a starting point for establishing protocols for the evaluation of stormwater quality, however it was agreed that this depended greatly on the desired outcomes of individual studies.

Protocols for monitoring urban stormwater quality

To facilitate the development of the protocols, the CRC offered a first draft of the protocols based on important constituents identified during previous monitoring of urban stormwater quality characteristics and the performance of stormwater quality facilities. Tony Wong facilitated discussion which identified stormwater quality constituents leading to the refinement of this first draft and categorisation of three levels of monitoring protocols. The lowest level (Level One) defined the water quality constituents and pollutant characteristics that should be analysed for all samples collected at stormwater monitoring sites. Water quality constituents and pollutant characteristics listed in the higher levels (Levels Two and Three) only require analysis for a smaller number of samples, and in the case of more specific studies focused on more detailed interpretations.

Evaluating the performance of gross pollutant traps

After formulating the three levels of protocols for monitoring stormwater quality, the participants heard talks from leading suppliers of stormwater quality improvement devices. Due to time constraints, the workshop only addressed the prioritisation of monitoring information for one type of stormwater quality improvement facility, the gross pollutant trap. The appropriate monitoring protocols for the evaluation of the remaining stormwater quality improvement facilities were to be developed "out-of session" by a smaller focus group.

Propriety gross pollutant traps suppliers, Baramy Engineering, CDS Technology, CSR Humes, Ecosol, and Rocla were invited to present information on the design and hydraulic operation of their products and recommendations on how their systems could be monitored for evaluation of their effectiveness in the field. Many of the suppliers demonstrated that they had already begun

NEW WORKING DOCUMENT

SCALING ISSUES IN HYDROLOGY:

Report of a Workshop held at the Bureau of Meteorology 28-29 June 1999

Edited by Alan Seed

Working Document 00/3

There is a high level of interest in the topic of scaling in hydrology and this workshop provided a forum for various issues to be discussed and debated.

The final session of the workshop attempted to summarise the current

state of knowledge of various aspects of scaling in hydrology and to identify what further research is needed.

The report is a valuable resource for researchers and others interested in the field.

To order your copy of this report ($22 - includes postage and GST), please contact Virginia Verrelli at the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

developing monitoring and testing methods for evaluation of their own gross pollutant traps both in laboratory and field conditions. However, it was apparent from the workshop that there are many different approaches taken and that different organisations have significantly different monitoring requirements, not all of which can provide a common basis for cross comparisons of the various traps. It was agreed, following lengthy discussion, that there is a need to specify the minimum set of information on the hydraulic operation and capture efficiency of gross pollutant traps and that their evaluation must incorporate life cycle costing, including both capital and maintenance expenditures. This latter point applies to the evaluation of all stormwater quality improvement facilities.

Protocols for monitoring gross pollutant traps

The last session of the workshop was led by Tony Wong and discussed the establishment of monitoring protocols needed to measure the effectiveness of gross pollutant traps. The participants raised a number of issues during this time; it was highlighted that water depths within the unit as well as upstream and downstream of the unit are needed to provide hydraulic performance data. The determination of gross pollutant weight trapped by a unit does not adequately measure the effectiveness of a unit, as the pollutant load bypassing the system must also be collected and analysed. It was decided after some lengthy debate that although the practice of trapping the bypassing load is important, it is also difficult and often not a practical or cost effective monitoring procedure; it was consequently left out of the monitoring protocols. The measurement of discharge bypassing the unit was settled on as a substitute measurement to provide at least some indication of the potential pollutant load avoiding the system.

Finally, all participants agreed to a set of monitoring protocols at three levels for assessing gross pollutant traps that displayed different categories of information. The lowest level (Level One) being the information on the hydrologic / hydraulic operation and water quality which should be collected for all gross pollutant traps to provide a minimum basis for their evaluation. Information listed in the higher levels (Levels Two and Three) are recommended only for a smaller number of selected stormwater quality improvement facilities.

Future monitoring of the performance of stormwater quality improvement facilities

It is hoped that the ideas and outcomes from the workshop relating to stormwater quality and gross pollutant trap monitoring protocols can be further extended in the future to incorporate protocols for other stormwater quality

improvement facilities. Monitoring protocols for stormwater quality improvement facilities such as swale drains, infiltration systems and constructed wetlands still require further development by the smaller focus group.

Working document

A working document has been prepared based on the workshop outcomes. The document displays the monitoring protocols agreed to by all participants attending the workshop for the monitoring of urban stormwater quality and the effectiveness of gross pollutant traps. The document also includes information on stormwater characteristics and background material provided by the five gross pollutant trap suppliers. It is hoped that these developed protocols will ultimately provide a foundation for the establishment of a national stormwater quality database.

Thanks

On behalf of the CRC, thank you to all those who supported and participated in the workshop and helped in the development of the stormwater monitoring protocols. The working document is currently being circulated to the workshop participants for their comment. Final copies will be available later this year. Keep an eye on *Catchword* for further details.

Thanks.

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PROGRAM 5
CLIMATE VARIABILITY

Program Leader
TOM McMAHON

Report by Sri Srikanthan

Project: 5.2 National data bank of stochastic climate and streamflow models

Progress so far

This project will concentrate in the initial three-year period on the development of models for the generation of rainfall and other climate data. Streamflow data generation models will be dealt with during a second phase of the project.

As mentioned in the March 2000 issue of *Catchword*, a workshop of end users was held on 19 March 2000 at the Bureau of Meteorology in Melbourne to identify the climate variables needed by the end users. The workshop agreed on a set of monthly and daily climate variables for individual sites, and for multi-sites where the cross-correlation structure must be preserved.

As a starting point in the development of stochastic models, a literature review was carried out. This will be prepared shortly as a research report.

Review Panel meeting and issues

The first Review Panel meeting for the project was held on 26 June 2000, again at the Bureau of Meteorology in Melbourne, to assess the literature review and the recommendations therein. The members of the Review Panel are Associate Professor George Kuczera from Newcastle University, Dr Rory Nathan from Sinclair-Knight-Merz and Professor Russell Mein. One major issue raised at the meeting was the need to take into account year to year variations in the model parameters. In the past, the model parameters were assumed to be constant from year to year and only the variation of within-year seasonal parameters was taken into account.

Incorporating long cycles

Even though geographers and geomorphologists have observed long cycles or changes in the mean level of rainfall and streamflow, it was not considered by hydrologists in stochastic modelling work until the recent work of Thyer and Kuzcera (1999). Using 180 years of flood stage records at Windsor and 90 years of discharge data at Penrith, Warner (1987) defined alternating flood-dominated and drought-dominated regimes for the Hawkesbury-Nepean system. The drought-dominated regime periods are 1821 – 1863 and 1901 – 1948 and those of the flood-dominated regimes are 1799 – 1820, 1864 – 1900 and 1948 onwards. It is proposed to examine the hidden state Markov model developed for Sydney rainfall by Thyer and Kuzcera (1999) and autoregressive models of higher order, to see whether these models can adequately simulate the long cycles observed in the rainfall time-series in some parts of Australia. It is proposed to extend this modelling philosophy to the generation of monthly and daily climate data.

Next stage

The next stage of the project is to develop stochastic climate models for a number of representative sites throughout Australia so that the different climates are adequately covered.

Professor Geoff Pegram from the University of Natal, South Africa is visiting us as a joint collaborator for two weeks and has been very active in stimulating our thinking in this project and Project 5.1. He also participated in the review meeting

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Warner, R. F. (1987). The impacts of flood- and drought-dominated regimes on channel morphology at Penrith, New South Wales, Australia. IAHS Publ. No. 168: 327-338.

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DOWNLOAD SOFTWARE FROM OUR WEBSITE!

Continuous Simulation System for Design Flood Estimation

by
Dr Walter Boughton

The Design Flood Simulation Package is available as a FREE DOWNLOAD from the CRC website at http://www.catchment.crc.org.au/products/models/

The software is a simulation package, which generates rainfalls to route through a catchment model to estimate design floods. Dr Walter Boughton, Honorary Research Fellow (Griffith University and CRC for Catchment Hydrology) developed the package as part of his work in the (former) CRC project 'Holistic Flood Estimation'.

The aim in making the package available directly from our website is to encourage feedback and further applications of the novel technique.

Further information about the software is available on the CRC website.

RIVER MANAGEMENT MANUAL

A REHABILITATION MANUAL FOR AUSTRALIAN STREAMS VOLUMES 1 AND 2

by

Ian Rutherfurd
Kathryn Jerie
Nicholas Marsh

The two volume (550+pp) set costs $27.50 (inc. GST) plus $10 postage in Australia.

PROGRAM 6	Program Leader
RIVER RESTORATION	IAN RUTHERFURD

Report by Mandy Uys

Restoring rivers, notions and bilateral parties

Australia and South Africa links
This was how it all began. In 1994, a group of wild Australians met with a group of equally wild South Africans for a week - instant international chemistry! The event, entitled 'A Joint workshop on the Classification and Health Assessment of Rivers' will never be forgotten. It led to some unpronounceable Afrikaans words being incorporated into the Australian lexicon. It also led to significant scientific developments in both countries, one being the Index of Stream Condition, the ecological index of stream health currently used in Victoria. At the time, I was busy with my PhD on the ecology of temporary rivers in the Eastern Cape. My supervisor, Prof Jay O'Keeffe (Institute for Water Research, Grahamstown), who had initiated this workshop together with Prof Barry Hart (Centre for Stream Ecology and CRC Freshwater Ecology, Monash University), assigned me the questionable honour of editing the proceedings of this event.

Since then, there have been valuable exchanges between academics and agencies, and the growing recognition of what the two countries can offer to each other in terms of information, exchange and collaboration in the field of river research and management.

Water reform in South Africa
The African National Congress (ANC) was voted into power in 1994. Kader Asmal became Minister of Water Affairs and Forestry. Asmal, a professor of law, charged into battle, promising a thirsty population a reliable, potable water supply within years. As a result, dramatic changes were made: river frontage was taken out of private ownership and became public property; and the river was named as a resource, rather than a user of water. This second alteration entrenched the environmental 'right' of the river to exist in a sustainable state. Under the new law, before any more water could be allocated for use from any river, two things had to be determined: the 'Human Reserve' (the amount of water required by people living in the catchment, based on the UN standard of 25 litres per person per day) and the 'Ecological Reserve' (environmental flow). A complex and highly pressurised process followed to formulate and refine methodologies to determine the Human and Ecological Reserve (quality and quantity) for all the country's rivers.

Consequences for river restoration
The methods used for rapid, intermediate or comprehensive determinations of the Ecological Reserve (quantity) are largely based on the Building Block Methodology (BBM) for determining instream flow requirements (IFR). It is documented at www.wrc.org.za. With human and economic resources directed towards new legislation, determination of Reserves, new licencing procedures and providing a secure supply of clean drinking water to 42 million people, there were little extra resources available to pay attention to the growing international field of river rehabilitation. Consequently this issue attracted little attention from government agencies and funders. Rehabilitation efforts were largely problem-solving exercises undertaken by researchers or private consultants, and evidence of the work or the results seldom appeared in the literature. However, as the stepwise Reserve Setting procedure was developed, it became apparent that this procedure could contribute enormously to developing a process for river rehabilitation.

I completed my PhD in 1997, with a lot of e-support and scientific help from Dr Andrew Boulton who was working on similar arid-zone river systems. I later set up 'Laughing Waters' (Aquatic Research, Consultancy and Media). In January 1998, the South African Water Research Commission (SAWRC) circulated a document of Strategic Research Directions to all South African water scientists and managers for comment and input. The words 'river rehabilitation' were alarmingly absent. Dr Chris Gippel (The University of Melbourne) who had been working on rehabilitation of the Snowy River, assisted me with a submission to SAWRC which included a set of recommendations for the development of the SA river rehabilitation field.

Looking overseas for answers
I became involved in the planning of an urban river rehabilitation project in East London, following principles derived largely from the international literature. In June 1999 I delivered a paper at the Society of Aquatic Scientists conference in Namibia to southern African scientists who were all exhausted with IFRs and Reserves and hungry for new directions. There was a lot of support for the idea of developing the field further – perfect! The time was right to take my 'research' division on a little trip. Laughing Waters kindly sponsored a twelve stop air ticket, and I set off in September 1999 to travel a bit of the world, find out something about river rehabilitation, and how best to adapt international models to South African conditions.

Australia is the final leg of the trip and was preceded by Europe, UK, west coast US, Canada, Hawaii, Fiji and New Zealand. I have been fortunate to meet, work, and establish links with many individuals and organisations involved in furthering the field of river rehabilitation.

Current work

I arrived in Melbourne in March this year. Although plans had not been formalised, I had discussed with Chris Gippel my intention to spend a few months studying the Australian approach to river rehabilitation, and at least try to establish bilateral links in this discipline. Chris introduced me to Dr Ian Rutherfurd (The University of Melbourne) at the CRC for Catchment Hydrology. Within weeks, Ian had promoted me from United Nations Refugee to Honorary Research Fellow, and recommended that I become involved with Program 6.2 - Stream Restoration Planning and Execution in the Yarra Catchment.

The project team recognises the need to plan river rehabilitation with clear goals, measurable objectives and temporally and spatially scaled processes. Outcomes need to be evaluated against objectives, in accordance with the principles of Adaptive Management. The associated question is how best to incorporate science into river rehabilitation to ensure that the development of the river rehabilitation field is an informed process. This has led me to review the extent that current Australian federal and state government and corporate policies provide directives for linking priorities, objectives and processes to river rehabilitation. I am using Melbourne Water's Waterway Activity Plans, which include management activities directed towards rehabilitation, as a case study.

It is great to be here, and I hope to interact with and learn from as many of you as possible, and to come back often.

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COMMUNICATION AND ADOPTION PROGRAM
Program Leader DAVID PERRY

Report by David Perry

The Flow on Effect – July 2000

Knowledge seeking workshop

Early last month I was fortunate enough to attend a workshop on 'Knowledge seeking strategies for natural resource professionals' organised by Professor Peter Cullen, Director of the CRC for Freshwater Ecology. The workshop allowed participants to reflect on the ways and means which individuals and organisations use to disseminate and seek knowledge.

It follows that if you are able to understand when, how and why natural resource management professionals obtain knowledge they require, then organisations such as CRCs could position a communication strategy to be more effective and relevant. In conjunction with some sound marketing principles to ensure that the information is in a form suitable for the user, this should be the basis of a successful strategy. Unfortunately, it's not quite that easy. Think for a moment about the way you seek information at work.

Benefits of ignorance

David Johnson, a social psychologist and a Dean at the University of Kentucky, was an invited guest to the workshop and raised some very interesting points in his presentations. In his introduction, he outlined a number of valid reasons why people don't seek information or ignore their need to do so. One reason was that maintaining ignorance can avoid action or change (often an additional workload when you're already busy); it avoids admitting one's inadequacies and can avoid conflict. Organisations, David proposed, may also have a vested interest in 'maintaining ignorance' for these reasons, as well as reducing communication costs and management input.

Ease and Accessibility

'Mooer's Law' states that an information source or system will tend not to be used whenever it is more painful and troublesome to have the information than it is not to have it. In short, what effort is needed to obtain this information, and is it worth it? We answer these questions every day in our lives. If we accept that ease and accessibility is a critical factor in determining how we seek information then we have a good rationale for the rapid growth of the internet and email communication. Accessibility is only one influence, however. There are many factors that shape our information-seeking behaviour.

WATER SENSITIVE URBAN DESIGN WORKSHOP

A JOINT PROJECT WITH THE AUSTRALIAN WATER ASSOCIATION

Hilton on the Park Melbourne, Victoria

30-31 August 2000

This first national workshop brings together some of the leading proponents and practitioners of this rapidly evolving field to present the learnings from applications around Australia. It will also provide a focussed workshop environment to explore the developing technologies and the structural and administrative impediments to their wider introduction.

For further information please see brochure with this Catchword or contact Clare Porter on (02) 9413 1288.

Trusted sources

David presented some research which investigated how people seek information about cancer related illnesses when they, or a close family member or friend, have cancer. His research showed that people are most likely to seek information from friends or other trusted personal sources regardless of their informant's qualifications or experience in the area. Often we accept advice or answers from those we have regard for, or an understanding of our personal interests. Their familiarity, and our trust in them, is often more important than seeking advice from a fully qualified professional such as a doctor. Might this apply to organisations as well?

Searching skills

Many information seekers can be described as lazy or as having poor searching skills. People will regularly stop seeking information when two or more sources, perceived as trusted, provide a similar answer. Often there is no further evaluation of the information. David described this phenomenon as the 'Law of Least Effort' - people stop seeking information when they think they have a plausible answer. When you combine this with Mooer's Law, it describes a scenario that ensures that information communication to an audience is a complex task.

Case study

A key factor is the way we like to receive information: generally people prefer face-to-face. In seeking information we balance a number of factors. A case study was given as an example where researchers studied the information seeking behaviour of professional staff in offices. They found that the employees were unlikely to walk more than about fifteen metres or so to obtain information they required. (The workshop group supported this idea by giving similar examples from their own experience where sections of organisations were on different floors resulting in a barrier to effective communication.)

Relying on users

The CRC, like many other organisations, is charged with a responsibility to communicate information to potential users. We currently rely on a diversity of approaches to our information delivery to meet the diverse needs of audiences who can use it. We also rely heavily on the information-seeking-skills of land and water managers.

I have written this article from my own interpretation of the workshop and the presentations given. Peter Cullen recommends David Johnson's book 'Information Seeking. An Organisational Dilemma' as an excellent read if you are interested. I need to get a copy myself to better understand the issues and their relevance to the CRC's communication and adoption strategy. Now, where to get a copy? I'll ask Peter Cullen next time I see him!

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CRC PROFILE

Chris Carroll

The earliest songs I recall are:
'How Much is that Doggy in the Window'
'The Pub With No Beer' by Slim Dusty
'Que Sera Sera' by Doris Day

That probably polarised my readers into "I remember those songs", and those who ask, "who is Doris Day?"

The song 'Doggy in the Window' reminds me of the time I lost my teddy, only to get back to the shops to find it sitting in the post office window staring out at me with its one eye and missing leg. I was 21 at the time, and it was a relief to get it back I can tell you!

The 'pub with no beer' was probably my father's favourite song when it was released, and his greatest fear, to come across a pub in such a state. Although he was part of a crowd who drank his local pub dry on the last night of opening before it was demolished to make room for a motorway.

The lyrics Doris Day sang in 'Que Sera Sera' sum up how I felt when I left school, the lyrics went something like:

"I asked my mother what will I be,
Will I be handsome will I be rich, and here's what she said to me
Que sera sera, what ever will be will be.'

Well I'm neither handsome nor rich, and when I left school I had a vague idea that I wanted to work with the environment. However my first love and ambition was to become a professional soccer player, and I tried to achieve this while undertaking a graphics art course in England. For all my efforts I still ended up as a member of the 'I could've been a champion club', and now content myself with pointing out to my son premier league coaches I used to play with, and against in the old days.

My interest in the environment was revealed at art college where for a final year project I produced a colour slide and tape presentation following a beck (creek) from near its source to where it joined a major industrial river. It went from a beautiful country stream to almost an open sewer, and I followed it through industrial areas and under factories and roads. It was this very same beck that I explored as a child with my elder brother and friends during our long summer holidays. I could not have imagined that 30 years later I would be following the path of much bigger rivers in the Fitzroy in Central Queensland.

It was my time spent on holidays on my mother's farm in the west of Ireland that captured my interest in agriculture. It was a small subsistence farm where forage was grown for dairy cows and cattle. At the bottom of the farm was a beautiful shallow lake where trout and perch could be caught, and where we collected water from a spring and carried it back to the house. It seemed like miles, but now in adult years it's no more than 200 to 300 yards. Alas, the lake was drained in the late 1960s when there was money to be made with agricultural expansion through EEC subsidies.

In 1975, I was offered a contract by Eastern Suburbs in Brisbane to play and coach soccer. At the end of a 30 hour flight I was picked up from the airport by the club president and secretary and bought my first XXXX heavy (nothing else was sold in Queensland pubs in those days) at the Red Brick pub at Woolloongabba, with its white tiles and a faded picture of the Queen.

In 1983 I joined the Queensland Department of Primary Industries (DPI) after completing my undergraduate degree at Griffith University. It was at Griffith University that I was first exposed to erosion modelling with Prof. Calvin Rose, and it's wonderful to re-establish old linkages with the University and other graduates through the CRC's. After a series of restructures in the late 1990s the research, development and extension staff involved in resource management in DPI were incorporated into the Department of Natural Resources (DNR).

I have worked in the Fitzroy Catchment since 1983, initially in Biloela and then for thirteen years in Emerald. For the past eighteen months I have worked in Rockhampton at the bottom of the Fitzroy Catchment. The Fitzroy is part of DNR's Central West Region which covers approximately one third of Queensland. Other catchments that straddle the region are the Burdekin, Cooper, Georgina and Diamentina.

Over the past seventeen years I have undertaken research on the four major land uses in the Fitzroy: dryland cropping, grazing, irrigation and mining. The objective of the research projects was to study the impact of various land management practices on erosion and water quality. This was conducted at a paddock scale (10ha), or smaller (0.01ha). Now we are also interested in how land-use and management impact at a larger catchment scale, and on first and second order streams that make up approximately 80% of the Fitzroy Catchment. It is difficult to generate ownership and change when dealing at a sub-catchment scale, it is for these reasons we are now studying the impact of land management at a small 'Neighbourhood Catchment' scale. A 'Neighbourhood Catchment' consists of a group of farms, or part of a farm located in a common catchment (approximately 300km²). This scale is used as a building block to create ownership in land and water management issues, and hopefully improve resource management at the sub-catchment scale and larger.

The CRC for Catchment Hydrology brings with it a diverse range of skills that can help achieve change and a better understanding of large semi-arid tropical catchments, such as the Fitzroy.

So where to from here? In my best Doris Day voice, 'Que Sera Sera.'

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RECENT INDUSTRY REPORT

THE REUSE POTENTIAL OF URBAN STORMWATER AND WASTEWATER

by
   Grace Mitchell
   Russell Mein
   Tom McMahon

Report No. 99/14

This report deals with the feasibility of reusing storm-water and wastewater to reduce the demand on the potable water supplies in Australian cities. It also describes 'Aquacycle' - a model developed by the CRC to assist in this process.

Copies available for $27.50 (inc. GST) from the Centre Office.

Please contact Virginia Verrelli on tel 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au.

WHERE ARE THEY NOW?

Report by Frank Winston

Where is Frank Winston now?...

…. still at Monash University. I completed my Masters by Research degree entirely part-time, and worked in the hydraulics laboratory at the same time. This took a huge toll on my personal and family life but I have managed to get most of that back together since submitting in September 1998. The highlight of last year was taking the family to Disneyland. On this study trip, I gained useful insights into the effects of sharp vertical accelerations on the adult human body, (the juvenile human body appears unaffected). Later I studied the erosional impact of the Colorado River on a hitherto flat landscape and discovered a grand canyon had been formed. We almost discovered first-hand the reason behind the choice of name for Death Valley as we motored across in a small Chevy with inadequate air conditioning.

I continued to work in the laboratory on various consulting and research projects. One of the research projects was related to another CRC for Catchment Hydrology research area of "Hydraulic Derivation of Stream Rating Curves". The aim was to quantify the effect of uneven velocity distributions on the energy losses and friction factors in the channel. I set up a computer system for comparing a large quantity of laboratory data from the UK, on velocity distributions in compound channels with predictions from an existing computer model called "Monflo". The result was that the computer model, developed a number of years ago at Monash, can be regarded as validated. Others are now using this model as an aid to predicting the effect of physically measured floodplain roughness parameters on Manning's n values.

Most of my time these days is taken up with physical model studies and I find these projects both interesting and challenging. Despite advances in computer modelling techniques, there are still a myriad problems that are easiest to investigate using a physical model of the proposed structure. A big drawback is that the clients who commission these types of projects invariably do not have the luxury of time: they want answers quickly. The inquisitive researcher inside me wants to investigate all the interesting side issues and theoretical implications of the phenomena observed, but these are rarely relevant to the problems facing the client. Despite this, some interesting undergraduate projects can flow from this type of work, leading to a real advance in knowledge.

My MEngSc research topic concerned Minimum Energy Loss Structures and it is still my dream to see this design system used in nearly all new small to medium sized culverts and bridges. I really believe there are many advantages to be had, not the least of which is reduced cost.

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