

THE HYDROLOGICAL SOCIETY OF S.A. INC.  
C/- Water Resources Branch  
Box 1751, Adelaide, S.A. 5001

NEWSLETTER NO. 62

OCTOBER 1989

GUEST EDITORIAL : KEVIN TREVARTON, EWS

ARE OUR WATER RESOURCES SAFE FROM HAZARDOUS CHEMICALS ?

The vulnerability of our water resources to pollution by hazardous substances has certainly been in the news lately; with the Loxton oil spill, pesticides in Ral Ral Ck near Renmark, and concern over a proposed copper chrome arsenate mixing plant in Mt Gambier. How well can we protect our water resources from hazardous substances?

Hazardous materials may enter streams, lakes and groundwater deliberately (by waste disposal or acts of vandalism) or accidentally (by rupture of an unbanded storage container or as a result of loss during transport).

PREVENTION is definitely better than cure, or in this case, clean-up. There is little we can do to prevent deliberate dumping or acts of vandalism, except by enforcing heavy penalties to show that the government is serious about this problem. I wonder if we are doing enough on this front.

We can try to prevent accidental spillages. Unfortunately the Water Resources Act contains no powers to ensure that preventative measures are implemented. This is being corrected in the current review of the Act, however the ability to properly implement these powers will depend on adequate funding and staffing, which will mean upgrading the present level of operation.

#### RESPONSE TO INCIDENTS

If we haven't been able to prevent an incident how well do we respond to contain and minimize the damage? An effective hazardous incident procedure has been operating in SA for a number of years now. A 2nd edition of Emergency Response to Leakage/Spillage of a Dangerous Substance, known as the 'Blue Book' has been produced. These guidelines are to be followed by officers of the various organisations which participate in the response network. An incident should be reported directly to the police who will initiate the emergency response.

The once first reaction of hosing down all spills, regardless of the material concerned, to invariably discharge to the stormwater system, has at least been rectified. Containment is now the first reaction so that the nature of the substance can be determined and then appropriate action initiated. However in many areas of the state, particularly in sensitive groundwater areas, correct practices are taking longer to establish.

In conclusion, at present we are NOT protecting our water resources from accidental hazardous spills as well as is possible. At least we have a reasonable mechanism set up to partially recover the situation once a spill occurs. The challenge for everyone is to work towards minimising both the chance that hazardous chemicals will escape, and the harm done when an escape occurs.

HYDROLOGICAL SOCIETY OF S.A. INC.

1988/89 CHAIRMAN'S REPORT

In 1988/89 the Society continued its endeavour to promote interest in hydrology and water resources management through a variety of activities. The main program once again focused on general meetings and newsletters. Six meetings were held during the year, covering the following topics :-

- \* hydrology of the Great Artesian Basin
- \* wetland management in Denmark
- \* groundwater management at Woolpunda and Angas/Bremer
- \* the interface between hydrology and water quality
- \* urban stormwater management
- \* the cost of augmenting Adelaide's water supply from the River Murray

These meetings continue to be well attended by about 20% of members. It was particularly pleasing to see a good turnout, including several visitors, at our pre-Christmas meetings.

It is intended to again schedule a general interest topic at the corresponding meeting this year and with the added attraction of free refreshments it is hoped that this meeting will grow in popularity.

There were five issues of the newsletter produced. The high standard of these informative publications was maintained thanks to the many contributors and our editor John Argue, and in his absence, Peter Dillon. We are indebted to them.

The June issue focussing on the "big wet" in South Australia attracted many favourable comments. It is very gratifying to receive such positive feedback. The committee thrives on it.....keep it coming.

Please consider contributing to future issues. No matter how trivial or boring you may think your work will be seen by others, the opposite is invariably true. A paragraph or two doesn't take long to pen.

In addition to these regular activities the Society organised a workshop on the use of Australian Rainfall and Runoff to provide practitioners in South Australia an opportunity to get into this fundamental document. Sixty four people attended, which was very heartening and confirmed the need for such a workshop. The participants could not have asked for better course leaders than David Pilgrim and Ian Cordery and we thank them for their involvement.

Of course such workshops don't just happen and particular thanks to Chris Purton, Fred Leaney, Bill Lipp and Chris Wright as well as Paul MacDonald (IE Aust.) for their efforts in organising a very smoothly run and professional workshop.

The Committee has foreshadowed a follow up seminar during the coming year to enable ARR users to discuss their experiences. This feedback will be much appreciated by the National Committee on Hydrology and will ultimately benefit all users.

As a footnote to the workshop, the response was such that the Society made a handsome, if totally unexpected, profit. This places the Society in an excellent position to expand its activities and support new initiatives in the coming year.

The Society also continued a number of routine activities.

It continued its involvement with the Scientific Expeditions Group's Gammon Ranges pluviometer project, by providing a further donation to help with costs.

As usual the Society offered the Ian Laing Prize at an increased value of \$300, to final year students studying in a relevant discipline. There was a special effort this year to attract a higher profile for the prize. Steve West, Graeme Dandy, Chris Purton, Bill Lipp and Paul Harvey are to be thanked for their efforts. They were well rewarded with a strong field of ten applicants.

This year's recipient is Mark Trenorden from the School of Earth Sciences at Flinders University. His enthusiasm for hydrology and his project, correlating sea temperatures with precipitation (EL Nino et al), was most encouraging.

Over the years the prize has attracted many high standard applicants. Last year's recipient, Alison Turnbull completed her work and was awarded a further university award for best thesis. Her work on light attenuation in reservoirs has much relevance to managing our water supplies. Alison was to present her work to our AGM this year but is now back home in Tasmania and was unable to do so.

The Committee also took some significant steps to reduce operating costs during the year, in particular postage costs associated with newsletters and notices of meetings.

It is very pleasing to report a 10% increase in membership to 170.

The Committee has worked hard to build on the foundation and direction set by its predecessors. I thank them for all their enthusiasm and support and would encourage all members to consider nominating for future committee membership. It is a rewarding and worthwhile endeavour.

C.B.Schonfeldt, Chairman Emeritus

#### NEW INITIATIVE TO COMBAT DRYLAND SALINITY IN SA [ ed ]

A State Dryland Salinity Committee has been officially sanctioned by the Land Resources Management Standing Committee to develop a state strategy addressing the problem of dryland salinity. About \$25M is being lost annually in farm revenue as a result of dryland salinity. The committee has already been deliberating a draft strategy which will incorporate hydrogeological research and investigation, off-site measures (recharge reduction), on-site measures (water and salt disposal), saline agriculture options, extension services, and community awareness and education programmes. The Committee is chaired by Roger Wickes, Chief, soil and Water Conservation Branch, SA Dept of Agric. Please contact Don McCarthy (085 621355) if you want to read and comment on the draft strategy.

The Committee is also planning a one-day Technical Forum in February 1990 on Dryland Salinity. This will be organised jointly by the Centre for Groundwater Studies and the Hydrological Society of SA. Details will be circulated later in the year.

#### SA ILSAX USERS GROUP

David Kernich, Highways Dept., ph 343 2094

The Highways Department has convened a "South Australian ILSAX Users Group", the inaugural meeting of which was held on 28 June, 1989. ILSAX is a

comprehensive computer model for urban hydrology, developed by Dr. Geoffrey O'Loughlin at the University of Technology, Sydney and is recommended in the 1987 edition of "Australian Rainfall and Runoff". The Users Group is an informal co-operative, with common aims based on the free exchange of information regarding

- . program application and calibration
- . program shortcomings discovered
- . program enhancements investigated.

Enquiries can be directed to the Group's convener, David Kernich.

#### BRUKUNGA REVISITED

Peter Smith, DME, ph 274 7691

The Engineering Geology Specialist Group (EGSG) of the Geological Society of Australia is organising a panel discussion of, and excursion to, the now defunct pyrite mine at Brukunga near Nairne in the Mount Lofty Ranges.

Thursday 16 November - Panel Discussion

DME and EWS personnel will discuss the geology, mine history and its impact on water quality, the waste water treatment plant and how some of the undesirable environmental impacts could have been avoided.

Place : Charles Hawker Conference Centre, Waite Ag Research Institute, Waite Rd, Urrbrae  
Time : 5.30 - 6.30 refreshments (\$2 donation)  
6.30 - 8.00 (nominally) discussion  
8.00 coffee

Sunday 19 November - Excursion

Dependent on response, a bus will depart Adelaide at 9 am arriving onsite approx 10 am. A two hour inspection of the mine site, treatment facility and tailings dam is planned to be followed by a family picnic in the vicinity ie. take the spouse and children.

Details will be circulated in mid October - please mark the dates in your diary NOW. For further information contact Peter Smith.

#### CGS SHORT COURSES (Adelaide)

Peter Dillon, CSIRO, ph 274 9311

- 13-17 Nov 1989 Geostatistics in Water Resources Including Monitoring Network Design  
Drs P. Brooker, S. Ahmed, P. Dillon  
(still a few vacancies)
- ? Mar 1990 Applied Groundwater Hydrochemistry  
Prof E. Mazor (yet to be finalised)
- ? Nov 1990 Evaporation measurements using micro-meteorological measurements (ground-based and airborne); Dr J. Hacker and Prof P. Schwerdtfeger

#### WELCOME : TREVOR DANIELL

The Hydrological Society warmly welcomes Trevor Daniell who was recently appointed Senior Lecturer in the Department of Civil Engineering at University of Adelaide. He was formerly Principal Engineer, Hydrology and Water Resources with ACT Electricity and Water. He has interests in many facets of hydrology, town water supply, water resource investigations and management of people. He has worked for 15 years in this field for UNESCO, AIDAB, State Governments and the Commonwealth in Australia, Indonesia, the Philippines and the Pacific Region. He has been chairman of the Canberra Hydrological Society.

AN INTERESTING FLOW AND QUALITY MEASURING PROBLEM

John Rolls, EWS

The River Murray downstream of Mannum is a popular section of the river for recreation and water sports, and the source of water supply for many towns.

The bacteriological quality of the river in this locality is of some concern. The figure shows a substantial increase in this section. Bacteriological levels exceed the level recommended for waters which are to be used for direct contact recreation in from 9 to 19% of samples taken.

The principal source of the contamination is the drainage return from reclaimed swamp pastures which are irrigated to provide fodder for dairy cattle.

Measurement of the loads will require sampling and measurement of flows onto and from the irrigation bays. The flow measurement will present unfamiliar problems because of the low heads involved.

It is hoped that following the investigations it will be possible to devise irrigation and pasture management strategies which will result in minimised impact on the quality in the lower Murray.

PORT WAKEFIELD ROAD - RIVER LIGHT FLOODPLAINS

Philip Blake, Highways Dept

The Highways Department is currently preparing the design of the duplication of Port Wakefield Road across the River Light Floodplains. There are twelve banks of box culverts on the existing road (five south of the river and seven North) in addition to the bridge over the perched river channel. These culverts largely coped with the flooding of March 1983, however overflows from the river spread into a flood channel further to the north than had been previously anticipated. Floodwaters from this channel flowed over the road approximately 3 km north of Lower Light.

With the benefit of the March 1983 experience, and as the standard for this section of National Highway has been raised to 100 years ARI, the total waterway requirement for this section of road was reviewed. Aerial photography taken shortly after the March 1983 event was the major source of design information utilised. An assessment of the attenuation of the peak flow over the floodplains between Redbanks Bridge and Port Wakefield Road was made using a simple linear storage/discharge relationship derived from an estimate of the volume stored on the floodplains as depicted in the aerial photographs. This analysis enabled a reduction in the total design flow from that calculated at Redbanks Bridge, without the need to undertake a detailed analysis of the flooding behaviour of the floodplains.

The waterway provided by the existing banks of culverts will be duplicated on the new carriageway. Additional banks of culverts have been specified just north of Two Wells, as well as at 2 km, 3 km, and 4.5 km north of Lower Light.

MULTI-PURPOSE HOLES IN THE MURRAY BASIN

Steve Barnett, DME

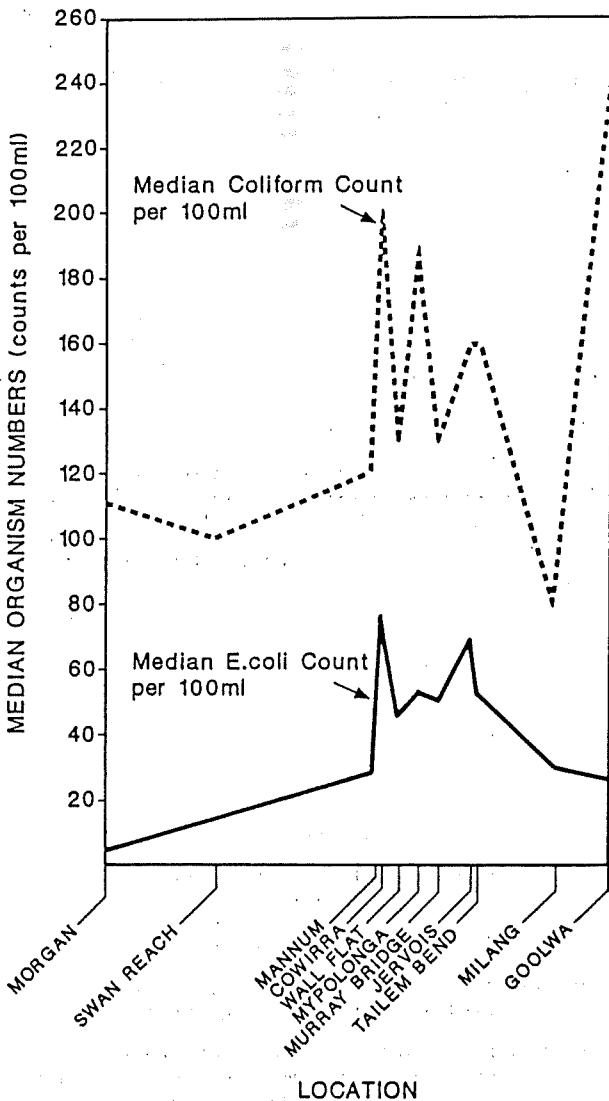
A drilling program in the low-lying Coastal Plain area of the southwest Murray Basin has commenced with multi-disciplinary objectives. The eight holes to be drilled in the Lake Alexandrina-Coorong area will complete the regional investigation of the Murray Basin in SA and will also provide cores of fresh bedrock for petrological analysis and also cores of the overlying Tertiary sediments for palaeontological investigation to determine their age.

Observation wells will be completed in the confined Renmark Group aquifer. Several shallow observation wells will be drilled and private wells selected to monitor the water table aquifer where water levels have been rising over the last decade in response to land clearing. Consequently, dryland salinisation problems have been increasing.

"QUITE EXTRAORDINARY MEASURES" - WATER REOURCES MANAGEMENT AND THE HIGH COURT

Paul Harvey, EWS

It is not often that water resources management issues are decided in the High Court but this was the case recently when the state government asked the High Court in Canberra to rule on the validity of some regulations under the Waterworks Act.



Existing pasture and irrigation management practices are generally inefficient. It is anticipated that improvements can be effected to both increase farm productivity and reduce drainage loads.

Inter-related Department of Agriculture and Engineering and Water Supply investigations are underway.

From a water resources point of view it is intended to determine the relationships between irrigation and pasture management practices on one hand and the loads of micro-organisms and nutrients lost from irrigation bays, on the other, using the landholdings participating in the Department of Agriculture study.

The case stemmed from a Planning Appeal Tribunal ruling that they could not make a determination in the case of a proposed shop/office/aviary complex at Hahndorf because a regulation under the Waterworks Act appeared to prohibit portion of the proposed development and it was unclear whether the Planning Act or the Waterworks Act took precedence.

The developer had proposed a shop and office complex associated with a heritage building in the main street of Hahndorf and a large walk-through aviary to house about 600 birds to be located immediately adjacent to Hahndorf Creek.

The Waterworks Act regulation in question prohibits the establishment of zoos, piggeries and feedlots in the Mount Lofty Ranges Watershed. The aviary as proposed fell within the definition of a zoo because it was primarily for the purpose of display and would be open to the public.

The developer, in an attempt to resolve the matter, sought a ruling from the South Australian Supreme Court on the validity of the Waterworks Act regulation and whether the provisions of the Development Plan over-rode the Waterworks Act.

The Supreme Court in what many saw as a surprise ruling determined that the provisions of the Development Plan take precedence over legislation in relation to land use matters.

This decision implied supremacy of the Planning Act which could be used to negate the powers of other Acts controlling land use, such as the Licencing, Health, Meat Hygiene and Local Government Acts. This had serious implications for a wide range of government activities and for this reason the state government decided to challenge the Supreme Court decision in the High Court.

The High Court, in a 4 to 1 decision, reversed the Supreme Court ruling and stated that "quite extraordinary measures were justified to reduce or prevent pollution" because the watershed is unique and particularly vulnerable to pollution compared to catchments in other states.

#### HYDROGEOLOGICAL ACE

Andrew Proudman, DME

Earlier this year DME received a complaint from a retired gentleman about a new spring which had formed in his Murtle Bank back yard, making a mess of the lawn and killing his prized camellias. Groundwater levels had historically been at 2-3m below the surface. Investigation found water flowed into a 30 cm deep hole dug in the lawn. When bailed the hole would refill within minutes.

A plumber had inspected the mains and sewerage and claimed that there were no leaks from the house. The eastern neighbour on the uphill side had recently completed extensions but the plumbing there also seemed to be intact. It appeared that a legitimate groundwater-induced problem existed. Gone was the owners concern for the camellias, replaced by visions of marketing this spring water profitably.

After reexamining the spring and the bailing hole it was evident that water was entering from a specific direction. Digging was carried out by hand, to trace the water source, which stopped at an unusually long cylindrical rock - a pipe. The pipe belonged to the western neighbour. The retired gentleman's land was originally a tennis court for this neighbour. The irrigation pipe for the court had been plugged and not removed, and had finally corroded through. "The neighbour, who was at fault, courted disaster, but the Mines and Energy service, being on the ball, proved to be more than a match for the problem, with a winning net result."

#### SPECIAL FEATURE :

##### HONOURS AND POSTGRADUATE HYDROLOGY RESEARCH IN SA

Postgraduate hydrologic research is alive in SA and with new hydrology lecturers at Adelaide and Flinders Universities and the increasing involvement of CSIRO scientists as student supervisors, the research nucleus is approaching a critical mass which will attract graduate students in hydrology to SA. A number of current projects are briefly described.

##### HEAD BUILD-UP IN STORMWATER JUNCTION PITS UNDER PART-FULL AND SLUICE CONDITIONS.

T.P. Thiel & M.D Jones (4th year BE. students); supervisor J. Argue, S.A. Institute of Technology

This paper describes the determination of head build up in stormwater junction pits operating under part-full and sluice conditions. Two cases have been modelled (half full-size hydraulic model): gutter flow only and gutter flow combined with straight through flow. Design curves based on the well-known "Missouri Charts" have been developed to determine head build-up. These design curves relate two dimensionless values involving junction pit water depth,  $d$ , discharge,  $Q$ , and a factor,  $F$ , to be applied to the Missouri Chart coefficient  $K_w$ .

Bannigan and Morgan (1981) suggested that in cases where part-full outflow occurs in junction pits the Hydraulic Grade Line be set at pipe obvert level and the build-up in the pit above H.G.L. be set equal to  $hw = K_w(Vo^2/2g)$ , where  $K_w$  is the appropriate constant found from the "Missouri Charts". This approach was found to underestimate the head build up by Argue (1986) who recommended that the Bannigan and Morgan (1981) approach be used with a factor,  $F$ , of 1.5 applied. This method has been found in the current study to be conservative. The authors found that for gutter flow only the average factor  $F$  was 1.2 and for gutter flow to total flow ratios of 0.2 and 0.4,  $F$  was 1.0 and 1.1 respectively. Hence the recommended factor of 1.5 was found to be conservative in all cases tested. A maximum value of 1.2 is recommended.

##### OPTIMIZATION OF WATER DISTRIBUTION PIPE NETWORKS

Dr.A.R.Simpson (228 5874), Dr.G.C.Dandy (228 5872), University of Adelaide.

Currently 4 honours Civil Engineering fourth year students are investigating the application of linear programming and non-linear optimization techniques to the optimal expansion of a water distribution network. A typical network provided by the E&WS is being considered to attempt to minimize the cost of expansion of the supply system.

##### OPERATING POLICIES FOR ADELAIDE'S WATER SUPPLY HEADWORKS SYSTEM

Dr.G.C.Dandy, University of Adelaide, 228 5472.

This recently completed research project was aimed at using mathematical optimisation techniques to aid in the formulation of operating policies for Adelaide's water supply headworks. The research officer on the project was Philip Crawley. During the project, a computer model of the Adelaide system was developed. It was shown that use of the model would reduce pumping costs by 5 to 10%, or an average of \$250,000 to \$500,000 per year. Salinity damage costs can also be included in the model. When these are considered significantly different pumping policies result. The model will now be installed on an E&WS computer to assist the pumping engineer.

USE OF MULTISITE TIME SERIES MODELS FOR FLOW FORECASTING

Dr.G.C.Dandy, University of Adelaide, 228 5472.

This project is associated with the previous one. It has been shown that by improving the forecasts of runoff from the various catchments in the Adelaide Hills, it is possible to save up to 20% of pumping costs for the Adelaide system. This project is aimed at developing multisite time series models for forecasting monthly runoff values. Tim Baker is the research officer on the project. To date a series of single site models have been developed. These relate the runoff in one month at a site to the runoff in previous months. The models give improved runoff forecasts for 2 to 3 months ahead. Work is currently underway to extend the models by including rainfall and runoff in adjacent catchments to improve the forecasts.

ISOTOPE GEOCHEMISTRY OF ACID- SALINE GROUNDWATERS IN THE DUTTON RIVER AREA, EYRE PENINSULA.

Robbie Lennard supervised by Dr Herb Veeh (School of Earth Sciences, Flinders Uni.) ; and Dr Andrew Herczeg (Centre for Groundwater Studies/CSIRO Div Water Resources)

This project investigates processes controlling elemental and radionuclide distributions in shallow, acid-saline groundwaters and associated sediments in the Dutton River area, Eyre Peninsular. It has important parallels with potential mobilisation of uranium decay series members from uranium mine tailings dams and nuclear waste repositories. Safe exploitation of uranium and safe disposal of nuclear waste relies on an understanding of radionuclide behaviour in different environments.

A key result of this study will be the delineation of the sources of radionuclides (and other elements), how they are mobilised, transported, and deposited. The depositional processes are of particular interest. Nuclear track and other techniques will be employed to determine which minerals sequester particular radionuclides and in what redox and pH conditions.

DIFFUSE DISCHARGE OF THE GREAT ARTESIAN BASIN NEAR LAKE EYRE

Peter Woods, Centre for Groundwater Studies (CGS) PhD. project supervised by Drs. Graham Allison, Glen Walker (CSIRO Div Water Resources) and Herb Veeh (Flinders Univ. School of Earth Sciences)

Leakage to the water table and evaporation into the atmosphere is an important natural discharge mechanism of the Great Artesian Basin, particularly near its margin. In the Olympic Dam Project borefield area near Lake Eyre, evaporation from the shallow, saline water table is being estimated from vertical profiles of the concentration of chloride and stable isotopes obtained from holes drilled from 0.5 to 15m deep in gibber and flood plains. The evaporation rates are closely related to the supply of water by leakage from the artesian aquifer below.

Estimated evaporation rates between 0.5 and 10 mm/yr are consistent with possible leakage rates calculated by Darcy's law, and consume the same order of water as is drawn by ODP's borefield, in the strip of aquifer south of Lake Eyre. It is important not to reverse this upward leakage of water by overpumping in the borefield, otherwise saline to hypersaline shallow groundwater (30 000 to 200 000 mg/l) will begin to leak back into the useful 2-3 000 mg/l water in the aquifer below.

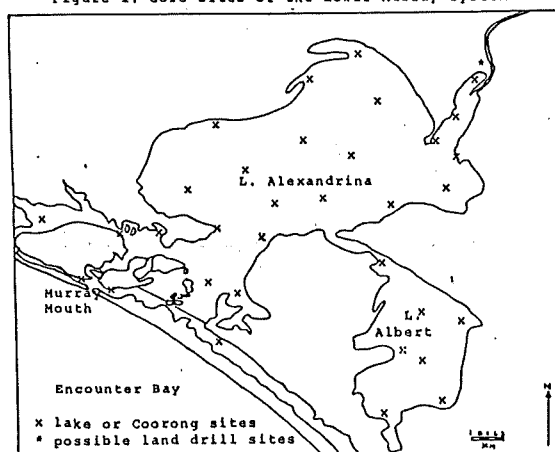
The work is nearly completed and is being written up at the moment, and summary results are available in draft form from Peter Woods at CSIRO Div Water Resources, PMB 2 Glen Osmond, SA 5064 ph(08)2749395.

RECENT GEOLOGICAL HISTORY OF THE LOWER MURRAY RIVER SYSTEM

Elizabeth Barnett, CGS ; supervisor Prof C. Von der Borch, Flinders University

The lower Murray River Region has evolved over the last 10,000 years as a response to Holocene sea level rise and periods of increased or decreased pluvial activity. To interpret the environmental changes that have occurred, a series of cores and seismic profiles are being collected within Lakes Alexandrina and Albert, the Coorong and the present Murray River Mouth. A number of sediment lithologies have been encountered, ranging in depositional environment from subaerial to shallow lacustrine, estuarine or marine as well as sections of the ancient river channel itself. Analyses of the mineralogy, trace elements, organic carbon content and micro-organisms in the cores in conjunction with <sup>14</sup>C and <sup>210</sup>Pb dates should provide detailed information on previous sedimentation rates and palaeoenvironments and outline possible palaeoclimates. Once this has been established it will provide a necessary reference with which the hydrologic impacts of European settlement can be assessed. This is particularly significant in that the region is the major sink area for the Murray Darling Basin.

Figure 1: Core Sites of the Lower Murray System



GROUNDWATER RECHARGE IN THE MURRAY BASIN

Peter Cook (CGS) ; supervisor Glen Walker (CSIRO)

Natural tracer techniques provide the most reliable means for estimating rates of groundwater recharge in semi-arid regions. However they provide only point estimates, and considerable difficulties are encountered in attempting to scale-up these point estimates to provide recharge estimates over a larger two dimensional space. Also tracer techniques involve costly drilling, so that it is not always possible to obtain a sample size sufficiently large to accurately define the spatial variability.

In order to overcome these problems, remote sensing techniques for estimating groundwater recharge are being investigated. To date, work has concentrated on electrical methods, in particular continuous wave and transient electromagnetic techniques. Multi-spectral scanning techniques (esp. thermal and infra-red bands) are also to be studied.

Publications to date :  
 Cook, P.G., Hughes, M.W., Walker, G.R. & Allison, G.B. (1989) The calibration of frequency-domain electromagnetic induction meters and their possible use in recharge studies. *J. Hydrol.*, 107:251-265.  
 Cook, P.G., Walker, G.R. & Jolly, I.D. (in press) Spatial variability of groundwater recharge in a semi-arid region. *J. Hydrol.*

CONTAMINATION OF GROUNDWATER BY CHEESE FACTORY AND ABATTOIR WASTES

Stuart Richardson (CGS) ; supervised by Peter Dillon & Santo Ragusa (CSIRO) and Gordon Stanger (Flinders Univ)

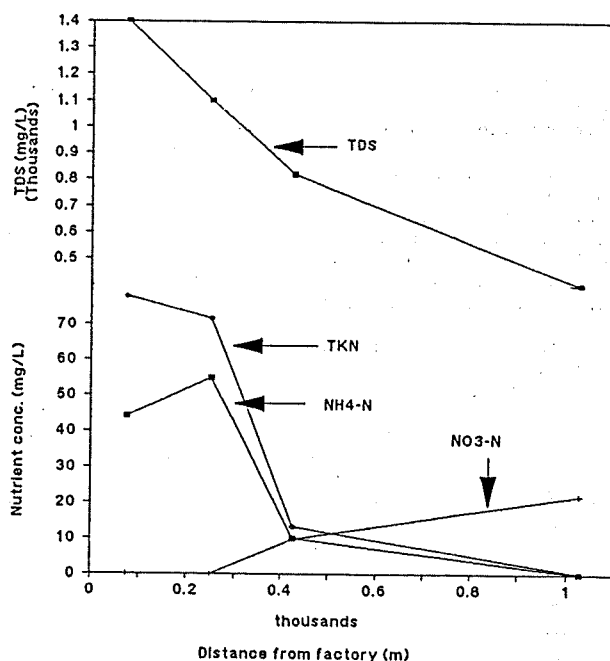
This project involves study of a point source groundwater pollution plume originating from wastes disposed directly to the aquifer from a cheese factory and abattoir at Yahl near Mt Gambier. Geophysical techniques were successfully used to delineate the contamination. A series of observation bores were drilled, preliminary results of the groundwater chemistry from these bores are shown in the figure. These depict both the movement of the conservative species (TDS) and the microbiological transformations evident with the nitrogen cycle. Note that the most contaminated water contains no nitrate, due to the strongly reducing conditions close to the contaminant source. A major aim of the project is to study the biochemical changes in the groundwater with a view to incorporating these processes into a solute transport model.

DIFFUSE-SOURCE NITRATE CONTAMINATION OF GROUNDWATER

Robert Scott (CGS) ; supervised by Peter Dillon & Santo Ragusa (CSIRO) and Gordon Stanger (Flinders Univ)

It has been estimated that most of the nitrate in shallow groundwater near Mt Gambier originates from grazed leguminous pastures. This study aims to estimate of the amount of nitrate leached to groundwater by taking measurements on three spatial scales ; point, paddock and regional. The processes affecting nitrate leaching are being studied and those found to have the largest influence on rates of nitrate leaching will be examined in detail. The effects on groundwater quality of alternative land management practices will be evaluated. This project is being supported by E&WS and SA Dept of Agriculture.

Groundwater chemistry near Yahl cheese factory



SECRETARY'S NOTES

HYDROLOGICAL SOCIETY OF SOUTH AUSTRALIA

1989/90 EXECUTIVE COMMITTEE

	Work	Home	Fax
P Smith (Chairman)	274 7691	272 3319	272 7597
P Harvey (V. Chairman)	226 2502	272 4091	226 2161
C Wright (Secretary)	366 2269	278 8818	366 2283
W Lipp (Treasurer)	343 2264	277 5802	343 2585
A Auckland (membership)	274 7570	(085) 226 090	272 7597
F Leaney	274 9396	270 3266	338 2144
C Purton	223 5583	339 3112	223 5237
A Simpson	228 5874	271 3132	224 0464
G Fisher	226 2506	339 6545	226 2161
R Clark	226 2532	223 6104	226 2161
J Argue (Newsletter)	343 3131	796 272	349 6939

SECRETARY'S NOTES (continued)

Note that John Argue is away until the end of the year on sabbatical leave at Wallingford. Contributions for the next newsletter are due by Jan 31.

PETER SMITH is a Senior Geologist in SADME's Groundwater and Engineering Branch, and is involved in groundwater projects on Eyre Peninsula and the Mt Lofty Ranges. His other groundwater interest is in waste disposal and its interaction with groundwater. From 1971 to 1977, Peter worked on groundwater exploration projects in the far north-west of the State then spent six years in Mt Gambier working on a wide range of groundwater issues. Peter takes over the role of Chairman for this year and is already tackling important issues with gusto!

PAUL HARVEY is currently the unit leader, Water Resources Management for the Metropolitan Region, E&WS Department. His main interests are water quality management in both surface and ground waters and water resources policy development. He was secretary to HSSA 1982/83 to 1985/86.

CHRIS WRIGHT worked for 9 years with Kinhill before joining the Bureau of Meteorology in the newly formed Hydrology Section. He is now responsible for flood warning for the whole of South Australia, but is for the time being, concentrating his efforts on the catchments affecting Metropolitan Adelaide.

BILL LIPP has been with the Drainage Section of the Highways Department for some considerable time. He has been closely involved with the development of stormwater drainage planning by various local government organisations, including drainage studies, and flood mitigation works.

ANWEN AUKLAND is a Technical Officer with the Department of Mines and Energy, having been employed by the E&WS Department's Water Resources Branch until January 1988. She is responsible for developing and maintaining various groundwater related data bases within the DME's Groundwater and Engineering Branch. Anwen is responsible for the Society's membership data base.

FRED LEANEY is an experimental scientist and manager of the Isotope Analysis Service, CSIRO Division of Water Resources. Fred's field of interest is in the use of isotopes (stable and unstable) in

hydrogeological investigations including recharge for arid environments, and water balance determination (evaporation from lakes and the unsaturated zone, and leakage between aquifers.)

CHRIS PURTON is a Meteorologist whose career spans both the Public and Private sectors. He was with the Bureau of Meteorology for twenty years, working in Melbourne, Darwin, Alice Springs and Adelaide. During this period he worked in Aviation and Public Weather Forecasting, as well as in Applied Meteorological Research. Since 1983 he has worked at B.C. Tonkin and Associates, Consulting Engineers, where he practices in hydrology and meteorology. Chris is a Graduate of the Royal Melbourne Institute of Technology and the University of Adelaide.

ANGUS SIMPSON graduated in Civil Engineering at Monash University in 1974. He worked for 3 1/2 years with the MMBW as a hydrologist and on construction of Thomson Dam spent 8 1/2 years in the USA. He obtained a MSc in Hydrology and Water Resources at Colorado State University and a PhD in Hydraulics at the University of Michigan. He worked at Harza Engineering Company in Chicago as a hydraulics engineer for 2 1/2 years. He joined the Department of Civil Engineering at the University of Adelaide in 1987.

GEOFF FISHER is Projects Engineer, Water Resources Investigations Section of the E&WS Department. His current projects include the assessment and management of urban stormwater as a water resource and the assessment of salinity mitigation options for the River Murray near Loxton.

RICHARD CLARK is an engineering hydrologist who had a long and hoary background in surface water hydrology. He is currently head of the Water Resources Investigations Section in the E&WS Department. His responsibilities include the collection of surface water data throughout the state and the undertaking of investigations into water resource management.

JOHN ARGUE, editor of the HSSA Newsletter, is a senior lecturer in the School of Civil Engineering at SA Institute of Technology. He has long-standing research interests in urban hydrology and stormwater hydraulics, and is currently on sabbatic at Hydraulics Research Ltd, Wallingford.

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ODE TO THE HYDROLOGICAL CYCLE Richard Clark

Water comes in drips and drops, and often as a drizzle,  
It falls upon each one of us, and often makes us grizzle.

Along and down and in and out, it wends its wetting way.  
Whilst much of it goes up again, to fall another day.

Illogical poor humans, would love to come to grips  
With the logicity of motion, of a bunch of little drips.

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Theory of Precipitation.

"There are holes in the sky  
Where the rain gets in  
But they're ever so small -  
That's why the rain is thin

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From Claus Schonfeldt's files..

It's fascinating the little treasures one can find in old files. I had an enforced spring clean not so long ago and uncovered some back copies of The Aquatiser, an extinct newsletter of the now defunct Water Resources Branch.

In amongst a lot of obsolete nonsense there was a poem commemorating the great gauge off of the late 1970s, one of the many interesting stories that make up the history of the River Murray.

With some modifications to protect the innocent here it is.

#### THE CUMEC FROM THE MURRAY

There were ripples on the Murray  
for the word had passed around  
a cumec had leaked to South Australia  
it was worth a thousand pound.

The States were quite concerned  
this darned cumec couldn't get away  
They sent their droggies to the border  
to use their skills to save the day.

From Victoria there came Abel  
he reckoned he could make that cumec stop  
with his home made gauging winch  
and a meter made in a blacksmith's shop.

Nifty came from New South Wales  
He'd humbled cumecs many times before  
I'll catch that flamin' renegade  
Before you southern bastards shut the door

South Australia sent in Donny Boy  
He'd get that cumec in a wink  
With the latest, greatest gaugin' gear  
He'd take the blighter for Adelaide to drink.

The engineers and surveyors  
all watched them do their best  
but as the days and nights wore on  
they cursed that damned evasive pest

They chased that jolly cumec  
up and down the river's reach  
but it was harder to ferret out  
than the elusive Lachlan leech.

They sounded and observed  
and wrote the whole lot down  
they sat and talked and calculated  
to find where that cumec had gone to ground.

They argued in the pub at night  
with graphs and lines and charts  
but couldn't find that cumec anywhere  
futility crept upon their hearts.

Droggy science just wasn't up to it  
that cumec wouldn't be beat  
they left the scene with pride destroyed  
and acknowledged their defeat.

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