International Association of Hydrogeologists
AUSTRALIAN NATIONAL CHAPTER

NEWSLETTER

Vol. 7 No. 2 NOVEMBER 1990

NATIONAL NEWS

New Executive

Editor: Dr. G. Pantelis, Ansto, PMB 1, MENAI, NSW 2234; Ph. (02) 543 3056; Fax. (02) 543 9260

PROFILES OF COMMITTEE MEMBERS

Michael Knight: President
Don Woolley: Vice President
Robert Carr: Secretary
John Ross: Treasurer
George Gates: State Representatives
Garry Pantelis: Editor

MICHAEL KNIGHT completed BSc and PhD degrees in the Geology Department at Melbourne University by 1971. The following three years saw employment in the Agriculture Department and Geological Survey. Research and Investigations covered groundwater as a resource (crop and village supplies and pollution issues) and as a problem (landslide and underground hydroelectric scheme dewatering). A love affair with rubbish dumps and waste disposal began in PNG.

In 1974 he was appointed lecturer in Engineering Geology. The period 1974-1987 saw active involvement in research, training and consultancy covering Hydrogeology, Waste Disposal, Environmental Geology and Engineering Geology. Four new Master of Applied Science Degree Programs were created over the period. In addition, substantial involvement with the development of Engineering Geology as a profession took place in international and national arenas. Locally this included being a founding member and chairman for several years of the Geological Society of Australia. He is currently Australian representative on IAEG and ISSM Commissions dealing with waste and environmental management.

The National AWRAC Centre for Groundwater Management and Hydrogeology began its life in July 1987 and Michael is its founding Director. He has found it exciting to see the first students to successfully complete the new Masters Degree in Hydrogeology and Groundwater Management. Key personal research interests currently include remediation of contaminated sites and improving borehole efficiency.

Michael is enjoying the challenge of directing a growing enterprise designed to serve the Groundwater Industry through the three roles of training, research and consultancy. Beyond work (there is life after work!) has a wife Janet and four children. He is also actively involved in a local Anglican church.

DON WOOLEY graduated from the University of Tasmania in 1957 with BSc(Hons) in geology. After spending three years with BMR regional mapping parties in Central Australia he was seconded to the Resident Geologist Office in Alice Springs. He provided groundwater advice to landholders and government agencies until 1966, when he joined the Water Conservation and Irrigation Commission (now Dept of Water Resources) in NSW. There he was involved with a number of regional groundwater surveys, town water supply projects, and development and administration of groundwater allocation policies. He was the NSW member and Chairman of the Australian Water Resources Council Groundwater Committee for several years, and AWRC nominee to the Australian Drilling Industry Training Committee, and a NSW member of the Steering Committee for the Commonwealth-State Murray Basin Hydrogeology Project which has recently become the Groundwater Advisory Committee of the Murray Darling Basin Commission. During the earlier part of this period he gained an MSc at UNSW, and did some part-time lecturing there in the early days of its

development of post-graduate training. In early 1989 he resigned as Principal Hydrogeologist to take a position with Coffey Partners International, whence he has recently departed to resume his work on the management of groundwater problems in the Murray Basin in a consulting position with the NSW Dept of Water Resources.

ROBERT CARR is currently an Associate Director of Lawson and Treloar Pty Ltd, a position he has held for the past year after nearly four years with the firm. He completed a Bachelor of Engineering (Civil) at the University of Queensland in 1979 and then spent five years in Iowa, USA completing an MSc and PhD in Stream-Aquifer modelling for unconfined buried channel alluvial systems. Upon returning to Australia in 1985 he spent a year with Cameron McNamara (now Kinhill) and a short stint with Sinclair Knight and Partners before joining Lawson and Treloar in early 1987. Robert's interests are in the numerical modelling of groundwater and river flows both from the quantity and quality aspects.

JOHN B. ROSS is currently employed as Senior Hydrogeologist - Projects with the NSW Department of Water Resources in Parramatta. He has worked in Hydrogeology since 1971 on both investigation and groundwater management projects within the State. His particular skills are in the investigation and analysis of groundwater resources, and in the planning and negotiation of the allocation of these resources across various consumer groups.

John is presently involved with the preparation of a State Groundwater Policy and the development of policy and guidelines for individual issues. Other work involves preparation of Groundwater Management Plans for important aquifer systems, groundwater licensing, and assistance with the Dryland Salinity and Great Artesian Basin programs in NSW.

GEORGE GATES has worked in Hydrogeology since 1970. He has experience both in the government and private sector as well as extensive field knowledge which comes from living for five years in Western NSW. George is particularly involved with groundwater quality/pollution projects. He has undertaken groundwater mapping work and is also heavily involved in Dryland Salinity investigations. George is presently working on a review of the groundwater quality network in NSW. The recognition of both point source and diffuse contamination of aquifer systems has made this an important issue.

GARRY PANTELIS completed his PhD in the Mathematics Department of the UWA in 1985. He has since worked for the Environmental Science Program at the Australian Nuclear Science and Technology Organisation (Ansto) where he has been involved in the development of mathematical and computer models for groundwater contaminant transport. In the last 2 years he has been largely instrumental in the development of models which describe the oxidation of pyritic mining ore waste dumps. Through this he is becoming increasingly involved in several wider commercial projects contracted to Ansto with applications to both commercial low grade ore heap leaching and environmental concerns.

FROM THE PRESIDENT

On behalf of all of us, I would like to thank our IAH colleagues in Western Australia for the excellent way in which they have conducted the affairs of the group over the past few years. The NSW team thanks you, the membership, for entrusting to us the task of leading IAH, and we pledge our best efforts in this regard.

Whilst on acknowledgements, I am sure many of you wish to join with me in congratulating Harry Ventriss and his team on the excellent International Conference on Large Sedimentary Basins in Perth during July. Gerry Jacobson has kindly reported in more detail, elsewhere in this newsletter. I especially appreciated meeting our overseas guests and in particular, Dr Beate Schwerdtfeger, the IAH (International) Treasurer based at the BGR, Hanover, Germany.

Your new Committee has met several times since taking office. Our main focus to date has been on achieving a smooth functioning of IAH administration and launching this newsletter. Whilst overseas recently (July - October), I managed to speak with the IAH Secretary General, Dr Andrew Skinner in the United Kingdom, and briefed him on the excellent progress being made by our South Australian Colleagues on the Organisation of the 1994 International Groundwater Congress (see first circular in this newsletter). The topic "Sustainable Management of Shallow Groundwater Systems" is most timely and I encourage you to indicate your interest in this activity and return the slip to Joseph Mazzone. Joseph has more "first circulars" if you are able to help spread the good news. We really need to aim at a minimum of 400 people so that maximum benefit can be gained from the hard work that will be put in. Plan to be there and encourage others. If you are going to conferences in related fields before 1994, there are both brochures and videos (make sure format is appropriate) available for marketing.

The Committee has given some attention to the issue of use of the IAH accumulated funds resulting from exchange rate fluctuations and wise management by the last Committee. We strongly endorse the concept previously proposed that State Committees be encouraged to put forward financially sound proposals for advancement of our profession. At times these may be hindered by a lack of "seed" or "loan" money. We welcome any suitable proposals.

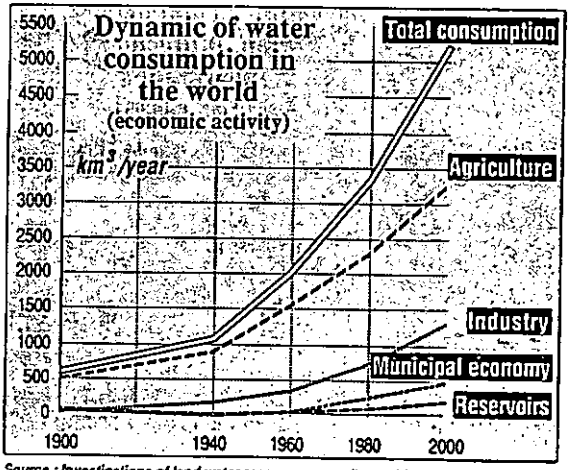
In my overseas travels and reading over the past months, I have been struck by a number of significant trends that will influence our thinking about water. One is the simple increasing worldwide demand for water (Figure 1).

This graph shows the evolution of world water consumption from 1900 to the year 2000. Globally, consumption has increased ten-fold in one century, and, by the year 2000 almost half of the available water supplies will be in use.

Agriculture, and particularly irrigation, remains the thirstiest consumer despite a continuing fall in the amount of water it uses, which will have dropped from a high of 90.5% of available supplies in 1900 to 62.6% in 2000.

During the same period, the portion used by industry will have passed from 6.4% to 24.7%, with cities sharing the same rate of growth, climbing from 2.8% in 1900 to 8.5% in 2000.

UNESCO,SOURCES No. 13 - MARCH 1990



Source : Investigations of land water resources : results, problems and prospects. A. Shiklomanov, Leningrad, 1988.

Figure 1 Trend in world consumption of water

Other Unesco statistics indicate that Europe and Asia are the largest users in proportion to resources available.

From our point of view, groundwater will increase in importance worldwide as part of the overall supply asset. Primarily, and underlying these rises in water demand, is the global population increase and, more specifically, the growth in urbanisation (Table 1).

Table 1 Rural-Urban population migration shift 1950-2000*

% Population Living in Cities	Year 1950	1990	2000
Developed Countries	52	76	80
Developing Countries	16	36	53

** [UN Report in 'South' January, 1990]*

Such focussing of people in limited areas will require re-thinking about water supply and use. If very large piping distances from surface or groundwater supply areas are to be avoided, increasing water re-use, via treatment may be the norm in the near future. Treatment methods involving aquifers as storage and renovating vehicles as well as engineered solutions will need to be explored. The practice of waste water disposal to rivers or sea will be a luxury in the near future. Aquifers below or near urban areas will gain in importance and will be under increasing potential contamination pressure.

Parallel with urbanisation I anticipate there will be a shift in rural areas to more intensive food production involving feedlots, chemical use etc., These practices will increase groundwater contamination pressures. Agreements on the extent of groundwater protection zones and appropriate quality standards will need to be resolved case by case. Some principles are beginning to emerge from the AWRC Study.

As urbanisation increases waste production may be expected to rise. Hydrogeologists will need to also increase their involvement with waste disposal system design where land is involved. Pro-activity here is to partly minimise groundwater contamination but also, in some cases, to recover valuable resources, eg. land application of waste water.

Finally, let me exhort all members to think about writing some short technical article or note which could be submitted to our Editor, and in some cases, the AWWA Journal "Water". The June Focus on Hydrogeology showed that there are latent articles out there. There has been a suggestion to the Committee that an "Australian Journal of Hydrogeology and Water Research" might be appropriate. If there is a genuine rising demand it should be demonstrated via these outlets.

NEWS FROM THE TREASURER

1990 SUBSCRIPTIONS

A reminder to all members if you haven't sent in your 1990 membership fees. Invoices were recently sent to all those members with outstanding accounts for 1990, recommending that these be paid by the 31st December 1990. Please note that subscriptions are on a 'calender year' basis, not a 'financial year' basis.

Members in arrears for 1989 and 1990 will be sent final reminders in February 1991 as under the rules of the Association, membership lapses after 2 years of non-payment.

For 1991 and subsequent years, members will be reminded to pay their annual subscriptions in the February and June Newsletters and then sent reminder invoices in October. Please help your National Committee to keep costs down by paying your 'subs' early in the calender year.

NEW MEMBERS

If you know of any potential members for the IAH, now is the time to sign them up. Joining now will cover their 1991 membership fees and ensure receipt of material from the International body in 1991.

IAH TIES

The Committee still has stock of IAH ties. These are available from the treasurer at $18.50 each.

OTHER NEWS

The Australian Water and Wastewater Association has had several responses to membership because of its special June issue on Hydrogeology. One of the main reasons for the groundwater theme was to encourage more hydrogeological articles and papers. More papers will broaden the understanding of groundwater issues and studies in Australia amongst water resource planners and other specialists. You are encouraged to use their journal "WATER" for the timely publication of articles of broad appeal or special significance.

GROUNDWATER IN LARGE SEDIMENTARY BASINS

Conference Report

This conference, held at Perth, July 9-13, was a huge success. More than 50 papers were presented. The conference substantially enlarged our knowledge of Australian sedimentary basins, especially as a result of multiple papers on the Perth, Murray, Amadeus, Great Artesian and Canning Basins. As usual with the AWRC groundwater conferences, the publication of the conference proceedings will add considerably to the published documentation of these major groundwater systems. The documentation of Australian hydrogeology is still deficient and this poses serious problems for anyone engaged on regional or national scale studies.

Comparisons with overseas basins were useful, and day to day hobnobbing with such groundwater greats as Toth, Lloyd and Mazor was an experience in itself.

Meetings of the Australian groundwater fraternity (increasingly sorority as well, great to see!) are of course keenly appreciated. We are so dispersed! In five Perth days a great many deals were done, problems thrashed out, faces put to names ... This being so, one must ask, why do we have to wait so long between these important meetings (last one 1986, next one not till 1994)?

I enjoyed the 10 minute presentations - as a speaker this presents a real challenge. However the discussion sessions were of uneven quality. These sessions provide the opportunity for non-presenters of papers to discuss issues. It is not easy to group papers appropriately for discussion or for the group leaders to generate serious discussion of issues. Nevertheless I judge the format to be better than the standard half-hour time slots which necessitate concurrent sessions.

Organisation was impeccable - take a bow Harry Ventriss, committee, helpers - down to usefule satchets! Social events were memorable, especially a wine-tasting in an ancient vineyard. However I wonder whether the modest attendance, around 170, justified the enormous amount of work involved. In view of the international billing of the 1994 conference, the AWRC should look closely at the reasons why groundwater people dont attend such good conferences. For instance apparently a large number of papers were rejected - could they not have been presented in poster form? In many agencies, presenting a paper is mandatory for one's attendance being funded. Ways of facilitating the attendance of overseas people also needs to be reviewed.

Gerry Jacobson

INTERNATIONAL HYDROLOGY AND WATER RESOURCES SYMPOSIUM 1991

Perth, Western Australia
2-4 October 1991

The Symposium will provide a forum for papers and discussions on topics covering all aspects of hydrology and water resources management. The theme, "Challenges for Sustainable Development" will provide a focus for communication between technical specialists and managers.

Call for papers - submitted papers should focus on any of the following:

Water resources planning and management; public participation in decision making; planning for a sustainable environment; hydrological processes; extreme hydrologic events; water quality; groundwater contamination; salinity, erosion and land degredation; land use and catchment management; model calibration and software applications; urban hydrology; hydrological instrumentation.

Organisations and individuals are also invited to submit proposals for conducting pre-symposium workshops on 1 October, 1991. Accepted workshops will be advertised in January, 1991.

Deadlines:

Receipt of synopses and workshop proposals	30 November 1990
Notification of provisional acceptance	11 January 1991
Receipt of full text for final review	5 April 1991

All correspondence relating to the Symposium should be addressed to:

The Conference Manager
International Hydrology and Water Resources Symposium 1991
The Institution of Engineers, Australia
11 National Circuit
BARTON ACT 2600 Australia

Telephone: +61 (06) 270 6562 Fax: +61 (06) 270 6530

IAH AUSTRALIAN CHAPTER MEMBERSHIP LIST

NEW SOUTH WALES

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
ACWORTH	DR R	UNIVERSITY OF NSW	KING ST	MANLY VALE	NSW 2093
BELL	MR M	AUST. HYDROGEOLOGISTS INT.	REYNELLA	VIA DALGETY	NSW 2630
CAROSONE	DR F	AUSTRALIAN GROUNDWATER CONS.	11/19 GOODCHAP RD	CHATSWOOD	NSW 2067
CARR	DR RS	LAWSON & TRELOAR PTY LTD	PO BOX 799	NORTH SYDNEY	NSW 2060
COLLIN	MR D		1 WATTLE CRESCENT	MOREE	NSW 2400
CORPUZ	MR M	CENTRE FOR GROUNDWATER	UNSW BOX 1	KENSINGTON	NSW 2033
DALE	MR M	GROUNDWATER TECHNOLOGY INC	35 BELMORE ST	ROZELLE	NSW 2039
ELLIOTT	MR JM	CUNEC PTY LTD	66 GIPPS ST	BIRCHGROVE	NSW 2041
GATES	MR G	NSW WATER RESOURCES	PO BOX 3270	PARRAMATTA	NSW 2124
GIBSON	DR OK	AUST NUCLEAR SCI & TECHNOL ORG	PRIVATE BAG 1	MENAI	NSW 2234
HAMILTON	MS ST	DEPT. OF WATER RESOURCES (NSW)	58 BEETHOVEN ST	SEVEN HILLS	NSW 2147
HARWOOD	MR RC	GROUNDWATER TECHNOL INC	6 BIAMI CLOSE	BANGOR	NSW 2234
HATLEY	MR RK	AUSTRALIAN GROUNDWATER CONS	74/5-13 HUTCHINSON ST	SURREY HILLS	NSW 2010
JASWANT	DR SJ	NSW DEPT OF WATER RESOURCES	8 TALBOT STREET	GUILFORD	NSW 2161
JEFFRIES	MR R	DAMES AND MOORE	84 ALEXANDER ST	CROWS NEST	NSW 2065
JEWELL	MR CM	COFFEY & PTNRS. PTY. LTD.	2/2 LIBYA PLACE	MARSFIELD	NSW 2122
JOHNSON	DR M	NSW DEPT. MIN. RES.	12/6 TARANTO RD	MARSFIELD	NSW 2122
KALF	MR F	AUSTRALIAN GROUNDWATER CONS.	SUITE 16,273 ALFRED ST	NORTH SYDNEY	NSW 2060
KIDD	MR C	AUSTRALIAN GROUNDWATER CONS	SUITE 16, 273 ALFRED ST	NORTH SYDNEY	NSW 2060
KNIGHT	DR MJ	DEPT. OF APPLIED GEOLOGY	UNIV. OF NSW PO BOX 1	KENSINGTON	NSW 2033
LAWSON	MR SJ	DEPT. OF WATER RESOURCES (NSW)	235 COORIENGAH HEIGHTS RD	ENGADINE	NSW 2233
LE	MR VT		34 MORLAND ST	YAGOONA	NSW 2199
LYTTON	MS L		12 KURRAHA AVE	COOGEE	NSW 2034
MACKIE	MR CD	MACKIE MARTIN AND ASSOCIATES	4 ROSS PLACE	WAHROONGA	NSW 2076
McLAUGHLAN	MR A	DEPT. OF APPLIED GEOLOGY	UNIV. OF NSW PO BOX 1	KENSINGTON	NSW 2033
MERRICK	MR N	DEPT. OF APPLIED GEOLOGY	UNIVERSITY OF NSW	KENSINGTON	NSW 2033
MORTON	DR W	MORTON RESEARCH PTY LTD	2/9 ILUKA AVE	MANLY	NSW 2095
PANTELLIS	DR G	ANSTO	PRIVATE MAIL BAG 1	MENAI	NSW 2234
PHILLIPS	MR SS		4 POPLAR PLACE	KIRRAWEE	NSW 2232
PLEASE	MS P	CTR FOR GROUNDWATER MANAGEMENT	UNIV NSW PO BOX 1	KENSINGTON	NSW 2033
PUNTHAKEY	MR JF	DEPT OF WATER RESOURCES	P O BOX 3880	PARAMATTA	NSW 2124
RITCHIE	DR AI	AUSTRALIAN ATOMIC ENERGY COMM.	22 BORONIA PDE	LUGARNO	NSW 2210
ROSS	MR J	WATER RESOURCES COMMISSION	17A ROPER CRES	SYLVANIA WATERS	NSW 2224
SALAS	MR G	NSW DEPT. OF WATER RES.	22 SAPPA BULGA RD	DUBBO	NSW 2830
SAUNDERS	MS BJ	GROUNDWATER TECHNOL INC	16/9 BORTFIELD DRIVE	CHISWICK	NSW 2046
SECRETARY	EX C.	AUSTRALIAN DRILLING IND. ASSOC.	PO BOX 1579 MACQUARIE CTR	NORTH RYDE	NSW 2113
SULLIVAN	MR MK	GOLDER ASSOCIATES PTY LTD	161A COPELAND RD	EAST BEECROFT	NSW 2119
TUCKSON	DR M	SELF EMPLOYED	108 LUCINDA AVENUE	WAHROONGA	NSW 2076
WILLIAMS	MR RM	DEPT. WATER RESOURCES (NSW)	PO BOX 3720	PARRAMATTA	NSW 2150
WILLIAMSON	MR WH		6 HUGHES AVE	ERMINGTON	NSW 2115
WOOLDRIDGE	MR D		75 TYNESIDE AVENUE	WILLOUGHBY	NSW 2068
WOOLLEY	MR D	NSW DEPT. OF WATER	3 BARWON AVE	TURRAMURRA	NSW 2074

QUEENSLAND

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
BEDFORD	MR KA	QLD WATER RES COMM	4 WOORAMA RD	THE GAP	QLD 4061
BINCH	MR I	COFFEY & PTNRS PTY LTD	PO BOX 4011	EIGHT MILE PLAINS	QLD 4113
BRIESE	MR E	COFFEY & PTNRS PTY LTD	PO BOX 118	E BRISBANE	QLD 4169
CALLOW	MR IP		PO BOX 118	EAST BRISBANE	QLD 4169
ELLIS	MR R	QLD WATER RESOURCES COMMISSION	PO BOX 316	NOOROOKA	QLD 4105
FORTH	MR JR	GROUNDWATER RESOURCE CONS	93 GRACEVILLE AVE	GRACEVILLE	QLD 4075

FREE	MR D	WATER RESOURCES COMMISSION	11 KATOOMBA CRESCENT	TOOWOOMBA	QLD 4350
GROUNDS	MR JA	AUSTRALIAN GROUNDWATER CONS.	6/6 QUALTROUGH ST	BURANDA	QLD 4102
HAIR	MR ID	AUSTRALIAN GROUNDWATER CONS	6/6 QUALTROUGH ST	BURANDA	QLD 4102
HARMAN	MR J	MACKIE MARTIN & ASSOCIATES	34 ALTON TCE	THE GAP	QLD 4061
HARMAN	MR J	MACKIE MARTIN AND ASSOCIATES	34 ALTON TERRACE	THE GAP	QLD 4061
HILLIER	MR JR	QLD WATER RES COMM	38 LYTHAM ST	INDOOROOPILLY	QLD 4068
JOHNSON	MR CL	GEOLSEARCH AUSTRALIA	BEAUARABA	VIA SOUTHBROOK	QLD 4352
LAING	MR C		3319 MOGGILL RD	BELLBOWRIE	QLD 4070
LAIT	MR RW	QLD WATER RESOUCES COMMISSION	6 PETERS ST	MAREEBA	QLD 4880
LEACH	MR L		7 TWELFTH A AVE	MOME HILL	QLD 4806
LLOYD	MR J		36 EDWARD ST	NTH. ROCKHAMPTON	QLD 4701
LLOYD	MR T	AUSTRALIAN GROUNDWATER CONS	6 QUALTROUGH ST	BURANDA	QLD 4102
LUCAS	MR KG		GPO BOX 2514	BRISBANE	QLD 4001
PAUL	MR RJ		23 HOOPER ST	WEST IPSWICH	QLD 4305
PEARCE	MR B		168 FLOCKTON STREET	EVERTON PARK	QLD 4053
POPLAWSKI	DR WA	WATER RESOURCES COMMISSION	GPO BOX 2454	BRISBANE	QLD 4001
R-STEFFENS	MS M	GEOPHYS. GROUNDWATER PROSP. Co.	TAHITI ROAD	TIARO	QLD 4650
SMITH	MR PE		12 KINNAIRD ST	ASHGROVE	QLD 4060
SMOLSKI	MR B	HOLLINGSWORTH CONS	33 PICASSO ST	CARINA	QLD 4152
WALL	MR LN		74 VORES RD	WHITESIDE	QLD 4503
WALL	MR LN		74 VORES RD	WHITESIDE	QLD 4503
WEEKS	MR MD	QLD WATER RESOURCES COMM.	7 CARAWATHA ST	EVERTON PARK	QLD 4053

NORTHERN TERRITORY

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
BRITTEN	MR R		PO BOX 4277	DARWIN	NT 5794
HALL	MR JW	AUSTRALIAN GROUNDWATER CONS.	7 EMPIRE COURT	ANULA	NT 5793
KARP	MS D		PO BOX 4729	DARWIN	NT 5794
MARTIN	MR KD	WATER RESOURCES	PO BOX 1096	DARWIN	NT 0801
McDONALD	MR P	POWER AND WATER AUTHORITY	PO BOX 1521	ALICE SPRINGS	NT 0871
MEGIRIAN	MR D	NT MUSEUM OF ARTS & SCIENCES	GPO BOX 4646	DARWIN	NT 5794
PIDSLEY	MR D		PO BOX 1226	PALMERSTON	NT 0830
PROUSE	MR G		9 HOLTZE ST FANNIE BAY	DARWIN	NT 5790
PROWSE	MR G		PO BOX 3231	DARWIN	NT 0801
QURESHI	MR M		25 WULAGI CRES	SANDERSON	NT 5793
ROWSTON	MR PA	WATER RESOURCES	9 KINGSTON PL	RAPID CREEK	NT 0810
SANDERS	MR RA	POWER AND WATER AUTHORITY	GPO BOX 1096	DARWIN	NT 0801
VERMA	MR M		14 WANDIE CRES ANULA	SANDERSON - DARWIN	NT 5793
WISCHUSEN	MR JD	POWER AND WATER AUTHORITY	PO BOX 8240	ALICE SPRINGS	NT 0871
YIN FOO	MR D		PO BOX 3231	DARWIN	NT 5794
ZAAR	MS U		4/27 ROSSITER STREET	RAPID CREEK	NT 0810

SOUTH AUSTRALIA

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
ALDAM	MR RG	SADME	24 MARTIN AVE	MASLINS BEACH	SA 5170
ARMSTRONG	MR D		77 HAWTHORNEDENE DR	GENALTA	SA 5052
BARNETT	MR SR	SA DEPT. OF MINES & ENERGY	PO BOX 151	EASTWOOD	SA 5063
BLEYS	MR C	CHRIS BLEYS & ASSOC.	24 KYRE AVE	KINGSWOOD	SA 5062
BOWYER	MR DG	SANTOS LTD	1/104 EAST AVE	CLARENCE PARK	SA 5034
COBB	MR M	WATER SEARCH	PO BOX 191	ANGASTON	SA 5353
DILLON	DR P	CSIRO	PRIVATE BAG 2	GLEN OSMOND	SA 5064
GERGES	MR NZ	SA DEPT. OF MINES & ENERGY	PO BOX 151	EASTWOOD	SA 5063
HARRIS	MR B	ENG. AND WATER SUPPLY DEPT.	38 ROYAL AVE	BURNSIDE	SA 5066
JOLLY	MR I	SA DEPT. OF AGRICULTURE	25 GRENFELL ST	ADELAIDE	SA 5000
LOVE	MR AJ	SA DEPT MINES & ENERGY	6/78 WATTLE ST	FULLERTON	SA 5063
READ	MR R	SA DEPT MINES & ENERGY	PO BOX 151	EASTWOOD	SA 5063
REED	MR JA	SA DEPT. OF MINES & ENERGY	30 SHERWOOD DRIVE	GLENALTA	SA 5052
ROWAN	MR IS	AUSTRALIAN GROUNDWATER CONS.	RIVERVIEWDELI LIVERPOOL ST	GOOLWA	SA 5214

SECRETARY	TH	HYDROLOGICAL SOC. - W.R. BRANCH	GPO BOX 1751	ADELAIDE	SA 5000
SHEARD	MR MJ	SA DEPT. OF MINES & ENERGY	PO BOX 151	EASTWOOD	SA 5065
SIBENALER	MR XP		PO BOX 359	GAWLER	SA 5118
SMITH	MR PC	SA DEPT. OF MINES & ENERGY	PO BOX 151	EASTWOOD	SA 5063
STADTER	MR MH	SA DEPT. OF MINES & ENERGY	PO BOX 83	NARACOORTE	SA 5271
WOODS	MR P		2/248 ANZAC WAY	PLYMPTON	SA 5058

WESTERN AUSTRALIA

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
ALLEN	DR AD	GEOLOGICAL SURVEY OF WA	100 PLAIN ST	PERTH	WA 6004
APPLEYARD	DR SJ	GEOLOGICAL SURVEY OF WA	18 CARLTON ST	LEEDERVILLE	WA 6007
BADDOCK	MR L	GEOLOGICAL SURVEY OF WA	100 PLAIN ST	PERTH	WA 6004
BARBER	DR C	CSIRO	17 ALLPIKE RD	DARLINGTON	WA 6070
BARNETT	MR JC	GROUNDWATER RESOURCE CONS.	4 BIRD RD	KALAMUNDA	WA 6076
BARRON	MR A	AUSTRALIAN GROUNDWATER CONS.	300 ALBANY HWY	VIC PARK	WA 6100
BAWDEN	MR J	GROUNDWATER RES CONS	64 STATON RD	E FREMANTLE	WA 6158
BEST	MR PJ	MT NEWMAN MINING	MT NEWMAN MINING	NEWMAN	WA
BOLTON	MR G	ROCKWATER PTY LTD	18 THORBURN AVE	BEECHBORO	WA 6063
BOYD	MR DW	WATER AUTHORITY OF WA	57 RIPLEY WAY	DUNCRAIG	WA 6023
BOYES	MR B	AUSTRALIAN GROUNDWATER CONS.	8/300 ALBANY HIGHWAY	VIC PARK	WA 6100
BRUNNER	MR I	GROUNDWATER RESOURCE CONS.	11 EMPEN CRT	LEEMING	WA 6155
BULMAN	MS T	CAMPBELL ENVIRONMENTAL LTD	22 CORBETT WAY	BOORAGOON	WA 6154
CHANDLER	MR M	GROUNDWATER RESOUCE CONS.	273 STIRLING ST	PERTH	WA 6000
CLARK	MR G	AUSTRALIAN GROUNDWATER CONS.	38 TALBOT DVE	KINGSLEY	WA 6026
CLOTHIER	MR JV	GROUNDWATER RESOURCE CONS	48 MANDORA WAY	RIVERTON	WA 6155
COCK	MR PL		79 MARY ST	COMO	WA 6152
COLMAN	MR R	AUSTRALIAN GROUNDWATER CONS.	209 CRAWFORD RD	INGLEWOOD	WA 6052
COMMANDER	MR DP	GEOLOGICAL SURVEY OF WA	100 PLAIN ST	PERTH	WA 6004
COX	DR J	WATER AUTHORITY OF WA	629 NEWCASTLE ST	LEEDERVILLE	WA 6007
DAVIDSON	MR WA	GEOLOGICAL SURVEY OF WA	100 PLAIN ST	PERTH	WA 6004
DAVIS	DR GB	CSIRO	PRIVATE BAG	GPO WEMBLEY	WA 6014
DEENEY	MR AC	GROUNDWATER RESOURCE CONS	13 SCHACHT COURT	MYAREE	WA 6154
DEROSARIO	MR PC	RESOURCE INVESTIGATIONS	73 FRASER RD	CANNING VALE	WA 6155
DOBIE	MR PL	K H MORGAN & ASSOCIATES	30 WAVERLEY ST	SOUTH PERTH	WA 6151
DOMAHIDY	MR GC	ROCKWATER PTY LTD	64 TATE ST	W LEEDERVILLE	WA 6007
DUNDON	MR P	AUSTRALIAN GROUNDWATER CONS.	300 ALBANY HIGHWAY	VICTORIA PARK	WA 6100
GEORGE	MR R	DEPT OF AGRICULTURE	PO BOX 1231	BUNBURY	WA 6230
HAILU	MR G		C/O 4 BIRD RD	KALAMUNDA	WA 6076
HAMMOND	MR RD	WATER AUTHORITY OF WA	145 KITCHENER RD	ALFRED COVE	WA 6158
HARRIS	PR F	DEPT. GEOLOGY UNIV. OF WA	MOUNTS BAY RD	CRAWLEY	WA 6009
HASELGROVE	MR K	ALCOA OF AUSTRALIA PTY LTD	17 CLEMENTS RD	BOORAGOON	WA 6154
HEARNE	MR CJ	WA DEPT OF AGRICULTURE	DRYLAND RESEARCH INSTITUTE	MERREDIN	WA 6415
HIRSCHBERG	DR K	GEOLOGICAL SURVEY OF WA	100 PLAIN ST	PERTH	WA 6004
HOLMES	MR DN	AUSTRALIAN GROUNDWATER CONS	300 ALBANY HWAY	VIC PARK	WA 6100
HURLE	MR DH	AUSTRALIAN GROUNDWATER CONS.	300 ALBANY HWAY	VIC PARK	WA 6100
KERN	MR AN	GEOLOGICAL SURVEY OF WA	74 FINNERTY ST	KARRINYUP	WA 6018
KUCHAKPOUR	MR A	SELF EMPLOYED	6A BOSWORTH PLACE	LEEMING	WA 6155
LAWS	MR AT	GEOLOGICAL SURVEY OF WA	8 ILLAWONG WAY	KINGSLEY	WA 6026
LEE	MR IR	SINCLAIR KNIGHT & PTNRS	62 BRUCE ST	NEDLANDS	WA 6009
LEECH	MR SJ	MACKIE MARTIN AND ASS	3/420 BARKER RD	SUBIACO	WA 6008
LEWIS	MS M	WA DEPT. OF AGRICULTURE	YORK RD	NORTHAM	WA 6401
MARTIN	DR RE	MACKIE MARTIN & ASSOCIATES	PO BOX 654	NEDLANDS	WA 6009
MARTIN	MR MW	GEOLOGICAL SURVEY OF WA	48 SASSE AVE	MOUNT HAWTHORN	WA 6016
MATHWIN	MR TW		RMB 571	KOJONUP	WA 6395
McAVAN	MR J	WA WATER AUTHORITY	24 COLGATE WAY	DUNCRAIG	WA 6023
McAVAN	MR J	WATER AUTHORITY OF WA	24 COLGRAVE WAY	DUNCRAIG	WA 6023
McFARLANE	DR D	WA DEPT. OF AGRICULTURE	37 WILSON ST	ALBANY	WA 6330
McGOWAN	MR RJ	GROUNDWATER RES CONS	190 SOUTH TCE	COMO	WA 6152

McINTOSH	MR K	ALCOA OF AUSTRALIA LTD	PO BOX 252	APPLECROSS	WA 6153
McNULTY	DR AJ	MACKIE MARTIN & ASSOCIATES	PO BOX 654	NEDLANDS	WA 6009
MCNULTY	DR T	MACKIE MARTIN AND ASSOCIATES	PO BOX 654	NEDLANDS	WA 6009
MEYER	MR GM	WESTERN MINING CORPORATION LTD	PO BOX 91	BELMONT	WA 6104
MONCRIEFF	MR JS	GEOLOGICAL SURVEY OF WA	36 SAMSON ST	WHITE GUM VALLEY	WA 6162
MOORE	MR RR	SELF-EMPLOYED	43 WESTVIEW ST	KARRINYUP	WA 6018
MORGAN	MR KH	K H MORGAN & ASSOCIATES	34 GEDDES ST	VICTORIA PARK	WA 6100
NIDAGAL	MR V	GEOLOGICAL SURVEY OF WA	33 TODD AVENUE	COMO	WA 6152
O'BOY	MR C	AUSTRALIAN GROUNDWATER CONS	300 ALBANY HIGHWAY	VICTORIA PARK	WA 6100
PAGE	MR SJ	K H MORGAN & ASSOCIATES	4/8 YORK ST	SOUTH PERTH	WA 6151
PASSMORE	DR JR	ROCKWATER PTY LTD	94 ROKEBY RD	SUBIACO	WA 6008
PECK	DR A	ROCKWATER	94 ROKEBY RD	SUBIACO	WA 6008
PLAYFORD	DR PE	DIRECTOR GEOLOGICAL SURVEY	100 PLAIN ST	PERTH	WA 6000
RIHA	MR M	SOLARVAN PTY LTD	25 PURDUN RD	WEMBLEY DOWNS	WA 6019
RIVERA	MR W	SELF EMPLOYED	23/22 KING GEORGE ST	VICTORIA PARK	WA 6100
ROBERTS	MR P	WESTERN MINING CORPORATION	21 GREVILLEA CRES	KANBALDA WEST	WA 6444
SALAMA	DR R	CSIRO	PRIVATE BAG	GPO WEMBLEY	WA 6014
SCHOFIELD	DR N	ED LAND AND STREAM SALINITY	WATER AUTHORITY OF WA	LEEDERVILLE	WA 6007
SCHWARTZ	MR T		10/304 CASUARINA DRIVE	DARWIN	WA 0810
SECRETARY	EX C.	INST. OF ENGINEERS (WA DIV.)	712 MURRAY ST	WEST PERTH	WA 6005
SMITH	MR RA	GEOLOGICAL SURVEY OF WA	193 KITCHENER RD	BOORAGOON	WA 6154
THORPE	DR PM	GEOLOGICAL SURVEY OF WA	17 HUMBERSTON RD	KALAMUNDA	WA 6076
THROSSEL	MR JS	AUSTRALIAN GROUNDWATER CONS.	37 PHILLIP RD	DALKEITH	WA 6009
TOWNLEY	DR LR	CSIRO	PRIVATE BAG	GPO WEMBLEY	WA 6014
VENTRISS	MR HB	WATER AUTHORITY OF WA	21 COLGRAVE WAY	DUNCRAIG	WA 6023
VOGWILL	MR RI	HYDROEARTH CONSULTANTS	273 STIRLING ST	PERTH	WA 6000
WAINWRIGHT	MR M	M WAINWRIGHT & ASSOCIATES	PO BOX 125	SUBIACO	WA 6008
WATERHOUSE	MR J	AUSTRALIAN GROUNDWATER CONS	8/300 ALBANY HIGHWAY	VICTORIA PARK	WA 6100
WHARTON	MR PH	ROCKWATER PTY LTD	94 ROKEBY RD	SUBIACO	WA 6008
WHINCUP	MR P	GROUNDWATER RESOURCE CONS.	PO BOX 112D	KALAMUNDA	WA 6076
WILLIAMSON	MR DR	CSIRO	PRIVATE BAG	GPO WEMBLEY	WA 6014
WILSON	MR VC	DEPT. PHYSICS & GEOSC., C.U.T.	45 PORTCULLIS DR	WILLETTON	WA 6155
YOUNGMAN	MR NR	K H MORGAN & ASSOCIATES	27 GALWAY ST	LEEDERVILLE	WA 6007

AUSTRALIAN CAPITAL TERRITORY

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
BAULD	DR J	BUREAU OF MINERAL RESOURCES	PO BOX 378	CANBERRA	ACT 2601
BIRTLES	MR TG	SEC. AGC, SCH. APP. SCIENCE	CANBERRA COLL. ADV. EDUC.	PO BOX1,BELCONNEN	ACT 2616
BRODIE	MR R	BUREAU OF MINERAL RESOURCES	PO BOX 378	CANBERRA	ACT 2601
ELSOM	MR J	AUST. NAT. COMM. FOR UNESCO	PO BOX 826	WODEN	ACT 2606
HABERMEHL	DR MA	BUREAU OF MINERAL RESOURCES	GPO BOX 378	CANBERRA	ACT 2601
JACOBSON	MR G	BUREAU OF MINERAL RESOURCES	GPO BOX 378	CANBERRA	ACT 2601
LAU	MR J	GC & JE LAU & ASSOCIATES	51 INVESTIGATOR ST	RED HILL	ACT 2603
LIBRARIAN	TH	BUREAU OF MINERAL RESOURCES	GPO BOX 378	CANBERRA	ACT 2601
STEFFEN	MS C	ACADEMY OF SCIENCE	GPO BOX 783	CANBERRA	ACT 2601
TRINDER	MR C	AWRAC - DEPT. OF RES. & ENERGY	GPO BOX 858	CANBERRA	ACT 2601
WATERNEWS		DEPT. OF RESOURCES & ENERGY	GPO BOX 858	CANBERRA	ACT 2601

VICTORIA

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
BARTLEY	MR JG	DEPT. OF WATER RESOURCES	17 DALLY ST	CLIFTON HILL	VIC 3068
BELLAIR	DR J	CONSULTING ENV. ENGINEERS	591 BRIDGE RD	RICHMOND	VIC 3121
BLAKE	MR R	R BLAKE AND ASSOCIATES	671 STATION ST	NORTH CARLTON	VIC 3054
BOCK	MR M	DEPT. OF WATER RESOURCES	32 SHAYFIELD RD	MOUNT WAVERLEY	VIC 3149
BOWDEN	MR A	AUSTRALIAN GROUNDWATER CONS.	9 CARRINGTON GVE	E BRIGHTON	VIC 3187
BRINKLEY	MR AJ	RURAL WATER COMMISSION	590 ORRONG RD	ARNADALE	VIC 3143
BRUMLEY	MR J		49 UNWIN ST	TEMPLESTOWE	VIC 3106

CARNEY	MR P		132 ARVON RD	STRATHMORE	VIC 3041
CLARKE	MR R	DEPT. OF CONSERV.,FOREST & LAND	1/25 LATROBE ST	SOUTH CAULFIELD	VIC 3162
CRAMSIE	MR JN	DIRECTOR GEOLOGICAL SURVEY	140 BOURKE ST (FLOOR 8)	MELBOURNE	VIC 3000
DYSON	MR P	SOIL CONSERVATION AUTHORITY	PO BOX 401	BENDIGO	VIC 3550
ELLIS	MR DC	AUSTRALIAN GROUNDWATER CONS.	26 WOOD ST	BEAUNARIS	VIC 3193
EVANS	DR R		16 MYRTLE AVE	KEW	VIC 3101
GILL	MR BC	RURAL WATER COMMISSION (VIC)	PO BOX 210	TATURA	VIC 3616
GLOE	MR C		23 KIRKWOOD ST	BEAUNARIS	VIC 3193
HANCOCK	MR S	AUSTRALIAN GROUNDWATER CONS.	90 CLAREMONT AVE	MALVERN	VIC 3144
HOLLAND	MR GF	RURAL WATER COMMISSION (VIC)	44 NABILLA CRES	BENDIGO	VIC 3550
HOXLEY	MR GP	RURAL WATER COMMISSION (VIC)	23 LAUGHLIN AVE	MUNAWADING	VIC 3131
HUMPHRYS	MR W	DEPT. OF IND. TECH. & RES.	236 MT ALBERT RD	SURREY HILLS	VIC 3127
IFE	MR D	RURAL WATER COMMISSION	590 ORRONG RD	ARMADALE	VIC 3143
INGRAM	MR T	RURAL WATER COMMISSION	11 GREEN ST	EAST RINGWOOD	VIC 3135
JASMER	MR R	AUST GROUNDWATER CONS	SUITE 6, 456 HIGH ST	PRAHAN	VIC 3181
JOYCE	MR EB	DEPT. OF GEOLOGY	UNIV. MELBOURNE,PO BOX 952	PARKVILLE	VIC 3052
LAKEY	MR RC	MACKIE MARTIN & ASS	20 QUEENS PDE	CLIFTON HILL	VIC 3068
LANE	MR AP	AUST HYDROGEOLOGISTS INT.	2 RUSHMEAD ST	PO BOX 508	MALVERN VIC 3144
LAWRENCE	DR CR	DEPT. OF WATER RESOURCES	35 SPRING ST	MELBOURNE	VIC 3000
LECTE	MR P	FACULTY OF ENG.FOOTSCRAY INST.	BALLARAT RD	FOOTSCRAY	VIC 3011
LEONARD	MR J		28 MERNDA AVE	GLENHUNTLY	VIC 3163
LIBRARIAN	AC .	STATE LIBRARY OF VICTORIA	328 SWANSTON ST	MELBOURNE	VIC 3000
LIBRARIAN	TH	OFFICE OF MINERALS & ENERGY	140 BOURKE ST (FLOOR 1)	MELBOURNE	VIC 3000
MACUMBER	DR P	DEPT. OF WATER RESOUCES	20 RANGEVIEW RD	MITCHAN	VIC 3132
MALTBY	MR D	DAMES AND MOORE	14 AUSTRAL AVE	BRUNSWICK	VIC 3056
MURPHY	MR L	SHELL AUSTRALIA	23 VALENTINE ST	IVANHOE	VIC 3079
NOLAN	MR JG	RURAL WATER COMMISSION	9 BELFORD RD	KEW EAST	VIC 3102
NOTT	MR R	DEPT OF WATER RESOURCES	150 GREVILLE ST	PRAHAN	VIC 3181
OAKES	MR A	RURAL WATER COMMISSION	23 HIGHGATE GROVE	ASHBURTON	VIC 3147
OLSHINA	MR A	GEOLOGICAL SURVEY OF VICTORIA	1 DERMOT ST	SOUTH OAKLEIGH	VIC 3167
PETTIFER	MR G	DEPT. OF IND. TECH. & RES.	PO BOX 173	EAST MELBOURNE	VIC 3002
POTTS	MR IW	RURAL WATER COMMISSION (VIC)	7 JACOBSON ST	MOOROOPNA	VIC 3629
PRATT	MR M	DEPT. OF WATER RESOURCES	20 VICKI ST	BLACKBURN SOUTH	VIC 3130
REID	MR M	DEPT. OF WATER RESOURCES	PO BOX 1404	SHEPPARTON	VIC 3630
ROBINSON	MR KJ	DEPT. GEOL. & GEOL. ENG.- RMIT	PO BOX 150	CARLTON SOUTH	VIC 3053
ROBINSON	MR MA	MACKIE MARTIN AND ASSOC	5/12 WATTLE VALLEY RD	CANTEBURY	VIC 3126
SECRETARY	EX C.	INST. OF ENGINEERS (VIC. DIV.)	191 ROYAL PARADE	PARKVILLE	VIC 3052
SHOEBRIDGE	MS LC	MAUNSELL PTY LTD	1/171 HOWARD ST	NORTH MELBOURNE	VIC 3051
SHUGG	MR A	DEPT. OF WATER RESOURCES	15 PARK RD	MIDDLE PARK	VIC 3206
STEWART	MR G		22 MADDEN ST	BALWYN NORTH	VIC 3104
STILLWATER	DR R	DEPT OF CIVIL AND AGRIC ENG	UNIVERSITY OF MELBOURNE	PARKVILLE	VIC 3052
THORNE	MR R		34 SIMS ST	SANDRINGHAM	VIC 3191
TICKELL	MR S	VICTORIAN GEOLOGICAL SURVEY	107 PATTERSON RD	MOORABBIN	VIC 3189
WALKER	MR G		PO BOX 58 ROSSITER RD	KOO WEE RUP	VIC 3981
WILLIAMS	PR F	DEPT. OF GEOLOGY- MONASH UNIV.	WELLINGTON RD	CLAYTON	VIC 3168
WILLIAMSON	DR RJ	SHEDDEN PACIFIC PTY LTD	15 PENDER ST	THORNBURY	VIC 3071
YOUNG	MR N	ENVIRONMENTAL PROTECTION AUTH.	7/9 CROMWELL RD	SOUTH YARRA	VIC 3141

TASMANIA

NAME	INITAL	ORGANIZATION	ADDRESS	CITY	STATE
ROBERTS	MR G		427 STRICKLAND AVE	SOUTH HOBART	TAS 7000

SHE (System Hydrologique Europeen) and its Applicability to Australia

Robert S. Carr
Associate Director, Lawson and Treloar Pty Ltd

Australia faces a severe salinity management problem in the Murray-Darling basin which takes in a large portion of North-Western Victoria, South-Western New South Wales and Eastern South Australia. The combination of existing dry-land salinity, land-clearing (which increases recharge to the groundwater system through decreased evapotranspiration), irrigation, flood and drainage works, road and railway construction and urban developemnts has resulted in a changed hydrology of the area, the product of which is rising water table levels and salinization. Rising water tables have caused groundwater discharge zones to develop, some of which have reactivated old lake systems. Further compounding the problem is the saline nature of the discharge zones. This salinity comes from salt trapped in the soil below the surface through evaporation of water in the unsaturated zone. The problem is not just a groundwater issue, it also contains elements of surface drainage, agricultural practice, flooding, recharge processes and stream-aquifer interaction. The potential losses are not only agricultural, there are many wetland areas in the Basin which will become hypersaline and lose their natural flora and fauna. It is a total basin problem which must be addressed in the proper way.

One possible approach to obtaining information about the possible impact of management scenarios is to construct a numerical computer model of the basin in question. The model would be calibrated against a series of measured field data and verified against an additional independent measured field data series. With this model, management options for controlling the problem can be investigated. The options can take into account the social and economic impacts and a strategy formed to manage the problem for the best interests of the community.

During a Churchill Fellowship to study whole-basin modelling techniques and models in Europe, I spent approximately four weeks in the hydrology section of the Danish Hydraulic Intitute (DHI) working with the SHE system. SHE development was begun in the late 1970's by a consortium of the Institute of Hydrology (UK), SOGREAH (France) and the Danish Hydraulic Institute (Denmark) as a European Economic Community and national research council funded project. The aim was to develop a model that could simulate as many processes in the surface/groundwater system that could be included within the framework of a numerical code. The model includes the processes of overland and channel flow, unsaturated and saturated subsurface flow, evapotranspiration, soil erosion processes, canopy interception, tile drainage, snowmelt and rainfall. The basic structure of the model is shown in Figure 1. Rain and snowfalls are input, and the runoff is generated by either the rainfall or melted snow choosing between runoff and infiltration. Infitration rates are determined by a solution of the

Richard's equation in the unsaturated zone. Each grid square can have different rainfall and soil characteristics, elevation and vegetation type. The Institute of Hydrology worked on the evapotranspiration and root zone modelling. SOGREAH developed the overland and channel flow components and the Danish Hydraulic Institute developed the unsaturated and saturated zone models. The considerable field experience which has gone into the component developments cannot be quantified in terms of lines of code. The entire model is in finite difference form with transfer between the hydrologic components managed by a central unit (the 'frame')

It was originally intended that the model could be physically-based system in which the required parameters could be easily measured in the field, and then placed in the model without the need for additional calibration. Trial catchments were analysed in Wales, New Zealand and Germany. The model was more or less completed in its basic form by 1985. Since that time, each individual organization has added different features to the system. The Danish Hydraulic Institute (DHI) has added three-dimensional groundwater flow, a soil erosion model and transport-dispersion pollutant flow. The model has since been used in Thailand, Denamrk, India and Tanzania. It was therefore appropriate to visit DHI to determine the status of SHE and to find out to what sort of problems it could be successfully applied.

SHE has been designed in such a way as to be flexible in its application through the program structure. Because components of the system were developed in different countries by different organizations, it needed a structure which could incorporate new versions of different components as they became available for testing. The FRAME in SHE is a 'manager' of the system which calls the different components as they are required. Because of this structure, it means that different components can be used or discarded as the problem to be investigated requires. This makes SHE a flexible program which can handle very complex problems and also simple ones within the one program. Rainfall rates can vary across the catchment, as can land use (desert, forest, farm, urban), Drainage (overland flow, stream) and Soil type (permeability, retention curve). Not all the variability and components have to be used in a model. The model can be developed as a simple system first, and then additional components added to determine if they are important. The variability does not have to be specified at each grid point, it can be specified once and applied to a range of locations.

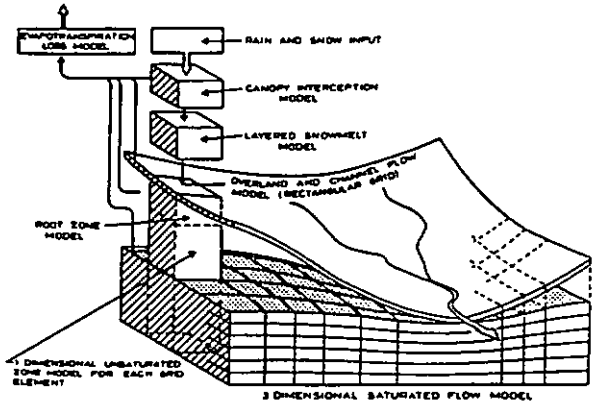
The advantage of the extremely complex nature of SHE is that each individual process (recharge from rainfall, recharge from streams, surface ponding etc) is modelled individually, and can therefore be individually quantified. This is in contrast to less complex models which 'lump' processes together in a 'black box' and the effect of management practices on each individual process cannot be determined. The models do not need to be totally calibrated to provide an insight as to the relative effect of management practices. Because the model has each individual process incorporated, it is possible the assess the relative behaviour of the system. This is the aspect of the model which appears to make it attractive in an inter-reactive hydrologic system such as the Murray-Darling system.

The model is suitable for land use planning and catchment degradation studies in addition to water quality and local scale problems. With the transport model, it is suitable for the analysis of single and multi-layered salinity problems. The density-dependent transport capabilities are presently under development. Since my visit to DHI in May 1990, a project has been completed which incorporates the transport of nitrates through the unsaturated zone and in the overland and channel flow portions of the model. Salt can be considered a contaminant in the fresh water system, so the investigation of salinity modelling and contaminant modelling is the same from a numerical standpoint. It is only the chemistry of the exchange process that differs.

Apart from the water quality expertise within DHI, there is a 'sister' institute nearby, the Water Quality Institute. This organization is where some of the chemical and biological expertise is developed, and then the processes are incorporated into the models.

In general, the results of the trials of SHE were promising. There are some individual processes that would need refinement for Australian conditions, but the model has been used in semi-arid and tropical environments before with success. Although the model is complex, and a good understanding of several hydrologic processes is required, the model proved reasonable to use. It is applicable to both very small-scale and large scale problems. I was able to simulate detailed hill-slopes with seepage faces and unsaturated zones, and also regional groundwater problems in one-layered systems with stream-aquifer interaction.

SHE was originally described as a physically-based system because it was hoped that the parameters could be measeured. This has not proved to be the case through the testing programme and in real-world applications. One problem is that the parameters are not homogeneous within the level of discretization used in the model. The degree of heterogeneity depends on the grid scale being used and on the parameter in question. Work is being done at DHI to attempt to quantify the effects of different grid scale models, and to estimate parameters from satellite imagery.



Structure of SHE

ARID ZONE WATER: A FINITE RESOURCE
Issues in Water Management 6

Conference, 11-14 April 1991 - Alice Springs

The conservation and management of arid-zone water resources are vital for Australia's future. Two-thirds of the continent is arid and the lack of, or poor quality, of water is a serious constraint to development. In this vast region, groundwater is more useful than surface water. However, limited recharge of groundwater aquifers suggests that resources may not be sustainable. Major towns and settlements, such as Alice Springs, draw on 'fossil' groundwater at a considerable rate and in the Great Artesian Basin many bores flow uncontrolled. Can these resources be conserved? Are there hydrological limits to human settlement of arid Australia? Are there real prospects of greening the red heart?

The Aboriginal outstation movement and the program of excisions of pastoral leases are leading to increased needs for community water supplies. Can these needs be met? Are outback communities disadvantaged? Can saline or other water quality problems be avoided or ameliorated?

Conversely, the arid zone can be considered as rich in saline groundwaters which can be used industrially and from which salt minerals can be extracted. Are there prospects for economic and sustainable development of these resources?

The Centre for Continuing Education at the Australian National University, in co-operation with the N.T. Power & Water Authority, is sponsoring a conference in Alice Springs, 11-14 April 1991, to provide a community forum for discussing the range of arid-zone water problems. This conference will be the sixth in a series on Issues in Water Management.

For further information, please contact: Shirley Kral, Centre for Continuing Education, Australian National University, GPO Box 4, Canberra, 2601. Telephone: (06)2494580 or (06)2492892

HONOURS PROJECTS WITHIN THE DEPARTMENT OF GEOLOGY UNIVERSITY OF MELBOURNE

The following abstracts describe two honours projects which were carried out at the suggestion of the Rural Water Commission in Victoria, and supervised by Bernie Joyce in the Department of Geology, with Joe Leach of Ballarat University College jointly supervising Patrick Halewood in his remote sensing work

The Geomorphology, Sediments and Soils of the Mid Campaspe Valley, Victoria and Relationships to Groundwater Recharge

Ross Neivandt

(Honours project report submitted as part of the BSc(Hons) degree in geology within the Department of Geology, University of Melbourne; 31st October 1990)

ABSTRACT

Secondary salinity developed since white settlement in Northern Victoria has become a major problem throughout Australia, resulting in land deterioration and reduced agricultural return. In recent years the lower Campaspe Valley has begun to show effects of increasing groundwater salinity and associated soil salinization.

This study has investigated the colluvial and alluvial deposits of the Barnadown-Elmore region of the Campaspe valley. A system of geomorphic mapping, soil mapping, soil and sediment analysis and field infiltration testing has allowed delineation of units of significant infiltration potential and further considered them in terms of ability to contribute to significant recharge to the underlying deep lead aquifer system.

Results identified the colluvial units as the only unit with significant potential to recharge the aquifers via infiltration through superficial units. The magnitude of groundwater recharge believed to occur in the project areas general vicinity cannot be explained by recharge through colluvium alone.

Further studies showed that significant recharge to the deep lead system also occurs via the flow of water carried by the present day Campaspe River down the plane of a newly discovered fault identified by the author in extended field studies. This fault strikes approximately north-north-west and intersects the course of the river. The western block is up thrown by approximately forty to sixty metres, the present Campaspe River reworking coarse deep lead material exposed by this displacement. Permeability developed along the fault plane allows water to flow downwards from the river's channel to the buried deep lead at depth in the down thrown block, hence recharging the aquifer system.

The Geology of the Rockwood-Dereel area, and the Applications of Landsat TM Data to Groundwater Investigations in the Newer Volcanics Province of Western Victoria.

Patrick Halewood

(Honours Literature and Research Report submitted as part of the BSc(Hons) degree in geology within the Department of Geology, Universty of Melbourne; 31st October 1990)

ABSTRACT

Geological mapping was carried out in the Rockwood-Dereel area. The oldest rocks to outcrop are marine arenites and argillites deposited during the Cambrian to Ordovician in the Bendigo Sedimentary Belt. These sediments underwent deep kaolinitic weathering during the Cretaceous and Tertiary. Remnants of the kaolinitic profile are preserved below ferruginised Early Tertiary fluvial clays, sands and gravels. Modern weathering of the Palaeozoic sediments leads to the development of illite rich profiles.

Early Tertiary sediments, termed here the Illabarook Sand, were deposited pre-Oligocene by north flowing rivers. Their ferruginisation is a post-depositional feature.

To the south the Palaeozoic sediments become buried below post-Miocene basalts and Pleistocene to Recent lacustrine and alluvial deposits. Pre-Miocene fluvial sands and gravels termed the Hanlon Deep Lead are also preserved below these younger rocks. The post-Miocene basalts can be differentiated according to the nature of the weathering profiles developed on them. The oldest flows show deep kaolinite profiles while the younger flows display shallow soils containing buckshot gravel.

Enhancement of raw Landsat TM data, using linear contrast stretching and edge enhancement, the principal components transformation, and band ratioing, was found to produce suitable images for geological and hydrogeological interpretations. Lithological boundaries, structural features and groundwater recharge and discharge zones can be delineated.