

## CURRICULUM VITAE

### 1. Personal Details

Name : Rae MACKAY

Place of Birth : Culford, Bury St Edmunds, England

Date of Birth : 29 February 1956

Profession : Chartered Civil Engineer

Present Position : Professor of Geotechnical and Hydrogeological Engineering  
Federation University Australia  
Gippsland Campus,  
Churchill 3842,  
Victoria

Present Address : 15, Lang Way  
Tyers, 3844  
VICTORIA

### 2. Qualifications and Professional Affiliations

- Doctor of Philosophy in Civil Engineering, University of Newcastle Upon Tyne. Awarded 1994.
- Bachelor of Science (Engineering) : Upper Second, Imperial College of Science & Technology, London, England. Awarded 1978
- Corporate Member of the Institution of Civil Engineers (MICE).

- Chartered Engineer (CEng).
- Member of the British Hydrological Society.
- Member of the Australian Geomechanical Society.

### 3. Career Resume

2014 to date	Professor of Geotechnical and Hydrogeological Engineering, Federation University Australia, Director Geotechnical and Hydrogeological Engineering Research Group (GHERG)
2011 to 2013	Professor of Geotechnical and Hydrogeological Engineering, Monash University
1997 to 2011	Professor of Hydrogeology, University of Birmingham
1999 to 2002 1995 to 1997	Head of School of Earth Sciences, University of Birmingham Director, Centre for Land Use and Water Resources Research, University of Newcastle upon Tyne
1987 to 1997	Lecturer in Hydrology, Department of Civil Engineering, University of Newcastle  Specialisation: Modelling the migration and fate of contaminants in subsurface environments; integrated environmental systems modelling and risk analysis
1985 to 1987	Research Associate, NERC Water Resource Systems Research Unit, University of Newcastle  Specialisation: Modelling contaminant transport in porous media; geostatistics
1978 to 1985	Water Resources Engineer, Sir M. Macdonald & Partners Ltd., Consulting Engineers, Cambridge, England  Specialisation: Irrigation and groundwater engineering
1976	Research Student, Water Research Centre, Medmenham, UK (8weeks)

Specialisation: Experimental studies of reservoir flow characteristics

#### 4. Experience

2011 to date **Professor of Geotechnical and Hydrogeological Engineering, Federation University Australia (2014-date), Monash University (2011-2013)**

Emeritus Professor Robert H. T. Smith Professorial Research Fellow.

Director, Geotechnical and Hydrogeological Engineering Research Group

Chair, Gippsland Campus Professoriate of Federation University.

##### PhD and MRes supervision

An investigation of the Batter Failure at Yallourn Mine using Time-Dependent Three Dimensional Numerical Analysis. Catherine Couling (2015 – date)

Understanding batter movements in response to deep aquifer depressurisation. Sid Rastogi (2015 – date)

A non-linear finite element model for Road Pavement Response. Negin Zhalehjoo (2014 – date)

Advance techniques for Evaluation and Simulation of Cutter Soil Mixing. Kaveh Pouya (2014 – date)

Groundwater Recharge and Surface Water Impacts of Coal Mining in the Latrobe Valley. Chow Hirunteeykul (2011-date)

Geotechnical Properties of Victorian Brown Coal. Fatemeh Moein (2012-2015)

Environmental Assessment of Ash disposal into mine voids. Michael Taylor (2013-date)

Salinity Modelling to Study the Effect of Sea Level Rise in Coastal Zone: South West Region of Bangladesh. Javed Bhuiyan (2014-date)

Impacts of climate change on Gippsland Wastewater and Sewerage networks. Joseph Daniel (2012-date)

Contract Research

*Chief Investigator: Development of the Geotechnical and Hydrogeological Engineering Research Group (\$2.475M)[2014-2019]*

External Activity

Member Technical Review Board (2011-date), constituted to assist Victoria's Minister for Energy and Resources, Earth Resources Regulation, Department for Economic Development, Jobs, Training and Resources and industry better manage ground control associated with mining in Victoria

Member Coal Resources Victoria (CRV) Advisory Committee (2013-date), the committee is created to review the work of CCV and provide expert and strategic advice and comment to CCV and Victoria's Minister for Energy and Resources about the direction, processes and ideas in relation to strategic planning for the Gippsland coal resource.

Member, Scientific Reference Panel (2014 – date) for the Department of Environment, Land and Water Planning and Department for Economic Development, Jobs, Training and Resources to provide rigorous peer review of Water Studies being undertaken for Onshore Gas Development.

Foundation Chair, Latrobe Valley Regional Interest Group, Australian Geomechanics Society (2013-2014).

1997 to 2011 **Professor of Hydrogeology, University of Birmingham**

Head of Hydrogeology Research Group. (1997-2010)

Head of the School of Earth Sciences (1999-2002)

Member of the Earth Science and Technology Board, N.E.R.C. (1997-2000)

Member of the Micro to Macro Steering Committee, N.E.R.C. (1997-date)

**Member of International Committee of Referees for quarterly scientific-technical journal "Geologia Tecnica & Ambientale"**

Secretary for Hydrology of the Earth's Crust, European Geophysical Society (1997-2000)

Associate Director of the Centre for Environmental Research and Training, University of Birmingham, UK.

Board Member of the Centre for Water Research, University of Birmingham, UK. (2000-2005)

External Examiner for the MSc in Engineering Geology, University of Durham. (2001-2003).

Member of the West Midlands Regional Advisory Board, British Geological Survey. (2001-2004)

Member of the Geosphere Characterisation Advisory Panel (GeoCAP), United Kingdom Nirex Limited & Nuclear Decommissioning Authority (2005-2011)

#### Contract Research

*Co-Investigator: EPSRC Consortium in Biogeochemical Applications in Nuclear Decommissioning and Waste Disposal (£900K of £2.4M)*

*Co-supervisor: WATERBUGMODEL – EU Marie Curie Fellowship linking microbiological models with contaminated land remediation models. [2009-2011]*

*Management Team member: U21 City Water Futures Network (£290K) [2007-2008]*

*Principal Investigator, Subject Leader and Theme Coordinator: SWITCH EU Vith Framework Project (£900K of £15M) [2006-2011]*

*Co investigator: Hydrology of Small Scale Watersheds, North-east Brazil, DFID project (£30K of £180K) [2003-2005].*

*Principal Investigator: Ground Heat Storage - DTI Innovation project. Sub contractor to Ove Arup plc. (£15K, of £120K). [2003-2004]*

*Principal Investigator: Towards a methodology for determining recharge through drift sequences. NERC LOCAR thematic programme (£224K). [2003-2007]*

*Co Investigator: Understanding Salt Migration in Fractured Rocks (ALIANCE) EU funded programme in Framework 5. (£300K). [2002-2006]*

*Principal Investigator: Quantifying the Scaling of Physical Transport in Structured Heterogeneous Porous Media, NERC Micro to Macro thematic programme - (£124K) [2001-2004]*

*Principal Investigator: Upscaling coupled thermo-hydro-mechanical processes for Performance Assessment - DECOVALEX. For United Kingdom Nirex Limited - (£50K) [2000-2003]*

*Principal Partner: - Small Scale Irrigated Agriculture in North East Brazil, Joint with Universidade Federale Rural de Pernambuco and Universidade Federal de Pernambuco, DfID Link Programme (2000-2003).*

*Principal Investigator: Using Urban Aquifers: Sustainability at different space and time scales.* URGENT Thematic Programme, NERC (£167k) [1998-2002]

*Principal Investigator: Assessment of DECOVALEX II (Modelling thermo-hydro-mechanical processes affecting the deep disposal of hazardous waste).* Environment Agency (£8K) [1998]

*Chairman: Review of Spatial Heterogeneity Research,* United Kingdom Nirex Limited (£7K) [1998]

*Principal Investigator: Geostatistical Analysis of Sellafield.* Environment Agency (via sub-contract to University of Newcastle Upon Tyne) (£17K) [1997-1998]

*Principal Author: Retrospective Review of the HMIP research and assessment programme (Book project).* Environment Agency (via sub-contract to W.S.Atkins plc) (£22K) [1997-1999]

#### External Activity

Member of the Geosphere Characterisation Advisory Panel, the Nuclear Decommissioning Authority 2005 – 2008, renewed 2008 -2011 .

Associate Editor – Hydrogeology Journal 2007-2010

Groundwater Modelling Forum - Committee Member 2007-2008

Member of the Nuclear Waste Disposal Critical Processes Group for the DTI and DEFRA. (March – June 2007)

Member NERC Peer Review College 2005-2008

Academic Mentor – NERC Consortium on Carbon Storage (2007-2008)

#### Teaching

Postgraduate Research Tutor, Earth Sciences 2007-2009

Programme Director: MSc in Hydrogeology. [In receipt of 11 NERC studentship awards 2006-2011 – value to the School £440K]

Course Director: Hydroinformatics and Water Resources Management (in collaboration with Sheffield University and Newcastle University), EPSRC Integrated Graduate Development Scheme (total value £285K)

Course Tutor: Short courses on Risk Assessment of Contaminated Land (2001,2003); Applied Groundwater flow and Contaminated Transport Modelling (2003).

Course Lecturer: Short courses on Site Investigation for Contaminated Land, Hydrogeological Assessment (2002); Groundwater Remediation (2001,2002), Applied Groundwater Flow and Contaminant Transport Modelling (2001).

Module leader: Engineering Geology, Groundwater Flow Theory 1, Groundwater Flow Theory 2, Surface Water Interactions.

Lecturer on modules in: Water Resources Case Studies, Information Technology for Geology; Human Impact on the Environment.

### Consultancy

Short term consultancies on Waste Disposal, and groundwater control including performance assessment software assessment for Nuclear waste disposal and new codes of practice for statistical sampling of potentially contaminated materials

#### PhD Supervision (while at Birmingham)

Development of an Optimal Hazard Assessment Method for Contaminated Sites, J. A. Morakinyo [Awarded 2002]

Hydrogeological Assessment of the Hadat Al Sham basin, Saudi Arabia, N. Al Amri [1999-2003][Awarded 2005]

Quantifying Vertical Tracer Migration in the Triassic Sandstone - Field Experiments and Modelling. R. Sauer [1998-2002] [Awarded MPhil 2011]

Understanding the redistribution of LNAPL's on a fluctuating groundwater table. S. Chompusri [1998-2002] (not completed)

Understanding Urban Stream-Aquifer flow and quality interactions. P. Ellis [1999-2002] [Awarded 2002]

A model of the Water balance for two Karst aquifer catchments in Lebanon. A. R. Arkadan [2000-2004][Awarded 2004]

Upscaling flow and transport in fractured rock formations for waste disposal performance assessment. P. Blum [2000-2004][Awarded 2005]

Development of genetic models of the structure of the Triassic Sandstone formations. M. Bunch. [2001-2005] [Awarded 2006]

Understanding recharge processes through drift deposits, M. Cuthbert [2002-2005][Awarded 2006]

Quantifying the heterogeneity of drift deposits and its impact on recharge, K Thatcher [2004-2007] [Awarded 2008]

Thermal Energy Storage in Aquifer Systems, R. Law [2005-2008][Awarded 2010]

Systems Modelling for Urban Water Sustainability, E. Last [2006-2010][Awarded 2010]

Using a groundwater model to explore the potential long-term impact of gold mining on groundwater systems in a hard rock terrain in Ghana. F. Sam [2008-2011]

The impact of urbanisation on a hard rock aquifer – Malaysia. N. Roslan [2008-2011]

Development of a new model to quantify the impact of free-phase gases in the Hyporheic Zone on water, chemical and energy transport. Kim Hicks [Part time 2009-2013]

[8 PhD students supervised successfully at Newcastle upon Tyne]

1995 to 1997 **Director, Centre for Land Use and Water Resources Research, University of Newcastle upon Tyne**

Responsible for the research and development programme of the Centre, a collaborative venture between the Department of Agricultural and Environmental Science, Civil Engineering and Agricultural Economics and Food Marketing, involving a team of 5 lecturers, 6 researchers and 10 PhD students. The Centre is an interdisciplinary research unit focused on the development of modelling systems encompassing ecology, hydrology and economics and their integration through the design and application of decision support technologies.

Contract Research

*Principal Investigator: Development of a Prototype Hazard Assessment System for Contaminated Land Mapping of Newcastle (1996).*

Development of a GIS based mapping system for the identification of potentially contaminated land giving priorities for on-site assessment (£20K).

*Principal Investigator: Assessment of NIREX Proposals (1996-1997).* Subcontract to WS Atkins to support the Environment Agency's assessment of NIREX proposals for the deep disposal of radioactive waste. Support includes: development of joint research on coupled stress/hydraulic models (DECOVALEX); evaluation of recent hydrogeological developments and review of current international research programmes; review of NIREX documentation (£80K).

*Principal Investigator: Geostatistical Analysis of the hydrogeology of the Sellafield Region, Cumbria, HMIP, UK Department of the Environment (1993 - 1996)*

Development of new and improved geostatistical procedures and simulation tools for the analysis of the complex hydrogeology of the Sellafield region. (£240K)



### PhD Supervision

5 students completed studies on various issues concerned with catchment scale hydrology, upscaling flow and transport phenomena and geostatistical applications for risk analysis of salinity problems.

1987 to 1997 **Lecturer, Department of Civil Engineering, University of Newcastle upon Tyne**

### Contract Research

*Principal Investigator: Hydrocarbon Reservoir Modelling: Linking Sedimentary Basin Geological Models with Reservoir and Basin Flow and Transport Models, EC (1993-1996).*

Joint research with Ecoles des Mines, France to develop methods for quick up-scaling of hydrogeological property fields produced by alternative geostatistical models. (£120K)

*Principal Investigator: Spatial Variability and Scaling, Intera Environmental Sciences Ltd (1993-1994)*

Analysis of the effect of spatial variability on the estimation of waste migration in the 'averagely' fractured rock of the Borrowdale Volcanics Group. (£14K)

*Group Leader: Land Use Programme, NERC/ESRC (1989-1995)*

Development of the hydrological modelling components of the NELUP Decision Support System for land use change. The system integrates economics, ecological and hydrological models and has been applied to two river basins, the Cam and the Tyne. (£200K)

*Principal Investigator: Feasibility Study of the Potential for Hydraulic Modelling of Contaminated Industrial Sites, ICI Chemicals and Polymers plc (1994)*

Evaluation and demonstration of the requirements for the development of a hydraulic modelling system to be applied to contaminated industrial site assessment. (£11K)

*Principal Investigator: Modelling Contaminant Migration in the Subsurface Environments of the Thames Basin. Thames Water Utilities Ltd (1991-1995)*

Development of a 'state-of-the-art' integrated modelling system for the prediction of the fate of reactive contaminants in subsurface environments. (£500K)

*Principal Investigator: Is the 'Dual Porosity' Hypothesis Valid for Solute Transport in Saturated Consolidation Aquifers, NERC (1992 - 1995)*

Development of the modelling component of a joint research programme between British Geological Survey, University of Birmingham and University of Newcastle upon Tyne. Research is centred on the characterisation of flow and transport through fissured and jointed carbonate rocks and the quantification of the processes represented in dual porosity models. (£60K)

*Principal investigator: A Study of the Effect of the Extent of Site Investigation upon the Estimation of Radiological Performance, HMIP, UK Department of the Environment (1989 - 1993)*

Research into the role of new data, acquired during a phased site investigation, in reducing the uncertainty in the prediction of contaminant migration from a deep radioactive waste repository. (£110K)

*Principal Investigator: Small scale borehole experiments, British Geological Survey (BGS) (1988 - 1989)*

Execution of joint research with the Fluid Processes Research Unit, BGS on the application of a fine resolution tracer testing technique for analysis of dispersion in shallow aquifer systems. (£12K)

*Principal Investigator: The scale dependence of dispersion in heterogeneous media, Harwell UKAEA (1988)*

Numerical analysis of the effect of scale on the simulation of contaminant dispersal in groundwaters. (£30K)

*Principal Investigator: Geostatistical Analysis of the Prevailing Groundwater Conditions at Elstow, Bedfordshire, Associated Nuclear Services Ltd (for HMIP) (1987-1988)*

Development and testing of a novel geostatistical approach to the prediction of the migration of contaminants released from a shallow hazardous waste repository. (£20K)

#### Software Development

**TRACE123:** A powerful, integrated modelling system for flow and contaminant transport in heterogeneous, fissured aquifer systems. The system links interactive data handling utilities with three coupled component modelling systems: TRACE1, for multi-species, multi-phase flow in unsaturated regions; TRACE2, for density dependent flow and solute transport in regional groundwater systems; TRACE3, for density dependent flow and multi-species transport in the vicinity of wells and adits.

**PARADIGM:** A fast, parallelised density dependent flow and transport modelling code for use in probabilistic risk analysis systems codes.

MODPAC: An interactive two-dimensional groundwater flow and transport modelling system for use in teaching basic groundwater simulation.

### Teaching

Lecturer Postgraduate courses in Groundwater Modelling, Risk Analysis, Groundwater Hydraulics, Numerical Methods in Subsurface Flow and Transport, Water Resources in Arid Environments, Geostatistics, Computational Methods and Computing skills.

### Research

Supervision 5 Ph.D. students, 5 Ph.D. staff members and 2 M.Phil. student.

### Course

Tutor MSc in Groundwater Engineering (1987-1990)

Courses Lecturer/Organiser- Groundwater Resource Evaluation in Arid Zone Environments. (11th-22nd April, 1994)

Lecturer - Practical Hydrogeology: A Conversion Course for Experienced Geologists. (16 August to 24 August 1993)

Lecturer/Organiser -Intensive Programme on Geostatistics, University of Newcastle upon Tyne, UK (May 1991)

Lecturer - Short Course on Groundwater Flow, St. Augustine, Trinidad, West Indies (Jan. 1991)

Lecturer - Short Course on Groundwater Flow Modelling, Aquater, Italy(1989)

Organiser/Lecturer - Two week short training course on Groundwater Flow & Transport Modelling, University of Newcastle Upon Tyne (1988)

Lecturer - CEFIGRE International Course on Water Resources, Antibes, France (1988)

### Administration

Area Leader Centre for Land Use and Water Resources Research  
(1994 - 1995)

Area Leader Water Resource Systems Research Unit (1987 - 1995)

Member Department of Civil Engineering Research Committee

Treasurer/ Pennines Hydrological Group, ICE.  
Chairman

#### Consultancies

Advisor to HMIP, UK Department of the Environment on hydrology and hydrogeology in Radioactive Waste Disposal Assessments (1993-date).

Consultant to Risk Management Consultants Ltd on Paleohydrogeological modelling (1994-date).

Consultant to Sandia National Laboratories, New Mexico on geostatistical methods for subsurface waste migration studies (1992/1993).

Consultant to Intera ECL, UK on hydrogeological modelling and spatial variability (1993 - to date).

Consultant to Atkins Engineering Sciences on hydrogeological assessment of Dounreay, Scotland (1989).

Consultant to Newcastle City Council on Contaminated Land Remediation. (1996-date)

1985 to 1987 **Research Associate, NERC Water Resource Systems Research Unit**

#### Fundamental Research

Modelling of the scale dependence of hydrodynamic dispersion in heterogeneous porous media.

#### Contract Research

Execution of joint research with British Geological Survey (BGS) aimed at modelling the controls on contaminant migration from a waste disposal site near Coventry, U.K. (£5K)

Modelling of low level hazardous waste disposal. Department of the Environment/ Associated Nuclear Services Ltd (1986-1987). (£20K)

Consultant to CAP Scientific (UK) Ltd, parameterising groundwater models for modelling radionuclide migration.

Software

MODPAC	An integrated groundwater modelling software package for training, postgraduate studies and contract modelling studies on NIMBUS and IBM-PC computers.
HIGHDEN	A 'high density' simulation package for heterogeneous media studies of flow and transport.
MCMOD	A 2D areal particle migration model for waste disposal studies.

Teaching

Lecturer	Programme development for the new MSc Course in Groundwater Engineering, Department of Civil Engineering (1986/87)  Postgraduate courses in Groundwater Engineering and Groundwater modelling
Courses	International UNDP/WMO Course on Water Resources, Nairobi, 1986  International CEFIGRE Course on Water Resources, Antibes, 1985 and 1986
Supervision	8 MSc Projects covering a range of various water resources related topics

1978 to 1985 **Water Resources Engineer, Sir M Macdonald and Partners Ltd., Consulting Engineers, Cambridge**

**Groundwater Engineer, Pakistan (1984-1985)**

Responsible for the drilling and geophysical investigations undertaken to define the lateral and vertical extent of fresh groundwater lenses overlying saline water in the region. These studies formed part of the Left Bank Outfall Drain drainage project covering an area of 1.6 million hectares.

**Project Engineer, England (1983-1984)**

- (i) Dhalla Flood Damage Reconstruction Project including design and procurement by International Competitive Bidding of Flood Warning Stations, Agricultural and Well Construction Equipment to be operated in the Dhalla region of the People's Democratic Republic of Yemen.

- (ii) FDWR/EDF Water Resources Project. Procurement of drilling equipment and support plant and materials for the setting up and operation of a groundwater investigation training unit at the Institute of Water Resources, Kaduna, Nigeria.
- (iii) Kano State Rural Water Supplies. Support for the inspection and procurement of equipment for the construction of 1000 village water supply tubewells in Kano State, Nigeria.

#### **Training Officer (1984), UK**

Training of two senior Burmese hydrogeologists in Groundwater Modelling techniques for regional aquifer studies. The programme included the setting up, calibration, and analysis of a groundwater model of a catchment in Burma being developed for groundwater irrigation.

#### **Groundwater Modeller (1983), UK**

Wadi Mawr Project. Modelling of the Wadi Mawr Aquifer system in the Yemen Arab Republic; development of planning and management of the groundwater resources of the region.

#### **Irrigation and Drainage Engineer, Bura, Kenya**

Assistant Design Engineer (1 year):

'on site' redesign of the irrigation and drainage system for the 5,700 ha development.

Assistant Resident Engineer (1 year):

supervision of the construction of the irrigation canal and drain earthworks and main canal structures for the project.

#### **Hydrologist (1979-1980)**

People's Democratic Republic of Yemen. Wadi Tuban Water Management Study.

- (i) inventory, collation and interpretation of data describing groundwater use in the Abyan delta.
- (ii) development of surface/subsurface modelling of the Tuban Delta aquifer for use as a predictive tool for the siting of a new wellfield in the Upper Delta Region to supply Greater Aden. Comprised part of an analysis of the total water resources development of the region.

**Groundwater Engineer (1979)**

Saudi Arabia. Umm er Radhuma Project. Supervision of construction and testing of deep tubewells (800 'm) for the exploration of the Umm er Radhuma aquifer, Saudi Arabia. Development of a multiple layer aquifer flow model for analysis of the Umm er Radhuma aquifer.

**Irrigation Engineer (1978)**

Irrigation and Drainage Engineer UK, Bura Irrigation Settlement Project, Kenya. Preliminary design of the primary and secondary canals and drains and drain fall structure.


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 Language Capability
 

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	<b>Speaking</b>	<b>Reading</b>	<b>Writing</b>
English	Excellent	Excellent	Excellent
French	Moderate	Fair	Moderate

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### Publications List:

#### Journal Papers

1. Younger, P.L., Mackay, R. and Connorton, B.J. (1993) Stream Bed Sediment as a Barrier to Groundwater Pollution: Insights from fieldwork and modelling in the Thames Basin, *Journal of the Institution of Water and Environmental Management*, Vol 7, pp 577-585.
2. Adams, R., Dunn, S. M., Lunn, R.J., Mackay, R. and O'Callaghan, J.R. (1995) Assessing the Performance of Hydrological Models for River Basin Planning, *Journal of Environmental Planning and Management*, Vol 38. p53-76.
3. Dunn, S.M. and Mackay, R. (1995) Spatial variation in evapotranspiration and the influence of land use on catchment hydrology, *Journal of Hydrology*, 171, 49-73.
4. Lunn, R.J. and Mackay, R. (1995) Solution of Multispecies Transport in the Unsaturated Zone Using a Moving Point Method, *Journal of Hydrology*, Vol 168, p29-50.
5. Lunn, R.J., Adams, R., Dunn, S.M. and Mackay, R. (1995) Development and application of a nitrogen modelling system for large catchments, *Journal of Hydrology* 174, 285-304.
6. Dunn, S.M., Mackay, R., Adams, R. and Oglethorpe, D.R. (1996). The Hydrological Component of the NELUP Decision Support System: An Appraisal. *Journal of Hydrology*, 177 213-235.
7. Dunn, S.M. and Mackay, R. (1996) Modelling the hydrological impacts of open ditch drainage, *Journal of Hydrology*, 179, 37-66.
8. Little, R., Muller, E., and Mackay, R., (1996) Modelling contaminant migration in chalk aquifer - A case study, *Journal of Hydrology* 175, 473-509.
9. Lunn, M., Lunn, R.J., and Mackay, R., (1996) Determining analytic solutions of multiple species contaminant transport, with sorption and decay. *Journal of Hydrology*, 180 (1-4): 195-210.
10. Mackay, R., Cooper, T.A., and O'Connell, P.E., (1996) Stochastic modelling of contaminant transport in heterogeneous porous media, Part 1 - Methodology. *Journal of Hydrology* 175, 383-406.
11. Mackay, R., Cooper, T.A., and Metcalfe, A., (1996) Stochastic Modelling of contaminant transport in heterogeneous porous media, Part 2 - Application. *Journal of Hydrology* 175, 429-452.
12. Lloyd, J.J.W., Gresswell, R., Williams, G.M., Ward, R. S., Mackay, R and Riley, M. S. (1996) An integrated study on solute transport in the Lincolnshire Limestone, *Quarterly Journal of Engineering Geology*. 29, 321-339.
13. Lunn, R.J., Lunn, A.D. and Mackay, R. (1997) Development of a hydrogeological model of the Borrowdale Volcanics at Sellafield. *Hydrology and Earth Systems Science*, Vol 1, 35-46
14. Montenegro, S. Montenegro, A. and Mackay, R. (2000) Caracterizao da variabilidade espacial de parametros hidraulicos em sols alluviais no estado de Pernambuco. *Revista Brasileira de recursos Hidricos* 4(2), 5-18.
15. Renard, P, Le Loc'h G., Ledoux, E., de Marsily, G., Mackay, R. (2000) A fast algorithm for the estimation of the equivalent hydraulic conductivity of heterogeneous media. *Water Resources Research* 36 (12) 3567-3580.



16. Mackay, R., Riley, M. S. and Williams, G. M. (2001) Simulating contaminant migration at Villa Farm Lagoons. *Quarterly Journal of Engineering Geology and Hydrogeology* 34, 215-224.
17. Aliawi, A. S., Mackay, R. Jayyousi, A., Naweseddin, K., Mushtaka, A. and Yacccubi, A. (2001) Numerical simulation of the movement of saltwater under skimming and scavenger pumping in the Pleistocene of Gaza and Jericho areas, Palestine. *Transport in Porous Media* 43: 195-212.
18. Montenegro, A. A., Mackay, R. and Montenegro S. M. G. L. (2002) Coupled unsaturated-saturated modelling of an alluvial irrigated area of North-east Brazil. *Acta Universitatis Carolinae - Geologic*, 46, 593-597.
19. Montenegro, S. M. G. L., Montenegro, A. A. and Mackay R. (2002) Analise estocastica de fluxo e transporte em saturados para avaliacao de salinizacao. *Revista Brasileira de Recursos Hidricos*, Volume 7, Part 2,
20. Montenegro, A. A. , Cruz da Oliveira, A. S., Mackay, R, Montenegro, S. M. G. L. (2003) Dinâmica Hidro-salina em Aquífero Aluvial Utilizado para Agricultura Irrigada Familiar em Região Semi-árida, *Revista Brasileira de Recursos Hidricos*, Volume 8, Part 2.
21. Khazaei, E., Mackay, R. and Warner, J.W. (2004) The Effects of Urbanization on Groundwater Quantity and Quality in the Zahedan Aquifer, Southeast Iran *Water International* 29(2), 178-188
22. Bunch, M. A., Mackay, R., Tellam, J. H. and Turner, P.(2004) A model for simulating the deposition of water-lain sediments in dryland environments, *Hydrology and Earth Systems Science* 8(2), 122-134.
23. Blum, P., Mackay, R., Riley, M. S. and Knight J. L. (2005) Performance assessment of a nuclear waste repository: upscaling coupled hydro-mechanical properties for far-field transport analysis, *Journal of Rock Mechanics and Mining Science* v42, p781-792.
24. Xie, Z., Mackay, R. and Cliffe, K. A. (2005) Precise numerical modelling of physical transport in strongly heterogeneous porous media. In R. P. Shaw (ed.) *Understanding the Micro to Macro Behaviour of Rock-Fluid Systems*. Geological Society, London, Special Publications 249.
25. Morakinyo, J. A. and Mackay, R. (2006) Geostatistical modelling of ground conditions to support the assessment of site contamination – site soil characterisation, *STOCHASTIC ENVIRONMENTAL RESEARCH AND RISK ASSESSMENT* 20 (1-2): 106-118 JAN 2006
26. Mackay, R. and Morakinyo, J. A. (2006) A stochastic model of surface contaminant releases to support assessment of site contamination at a former industrial site *STOCHASTIC ENVIRONMENTAL RESEARCH AND RISK ASSESSMENT* 20 (3): 213-222 APR 2006
27. Ellis P.A., Mackay, R, Rivett, M. O. (2007) Quantifying urban river-aquifer fluid exchange processes: A multi-scale problem. *Journal of Contaminant Hydrology* 91 (2007) 58-80
28. Blum, P., Mackay, R. and Riley, M. S. (2007) Coupled hydro-mechanical modelling of flow in fractured rock. In Sharp, J. M. and Krasny, J. (eds) *IAH Selected papers on Hydrogeology, Groundwater in Fractured Rocks*.
29. Blum P , Mackay R, Riley MS, Knight JL (2007) Hydraulic modelling and the evaluation of the representative elementary volume (REV) in fractured rock *GRUNDWASSER* 12 (1): 48-65 MAR 2007
30. Cuthbert M. O., Mackay R, Tellam J. H. (2009) The use of electrical resistivity tomography in deriving local scale models of recharge through superficial deposits, *Quarterly Journal of Engineering Geology and Hydrogeology*; v. 42; p. 199-209

31. Blum, P., Mackay, R., Riley, M. S. (2009) Stochastic simulations of regional scale advective transport in fractured rock masses using block upscaled hydro-mechanical rock property data. *Journal of Hydrology*. doi:10.1016/j.jhydrol.2009.02.009.
32. Bates, A. J, Mackay, R, Greswell, R. B, Sadler, J.P. (2009) SWITCH in Birmingham, UK: experimental investigation of the ecological and hydrological performance of extensive green roofs, *Reviews in Environmental Science and Biotechnology*,10.1007/s11157-009-9177-8
33. Cuthbert M. O., Mackay R., Tellam J. H. and Thatcher K. E. (2010) A holistic approach to understanding and estimating groundwater recharge through glacial till. *Quarterly Journal of Engineering Geology and Hydrogeology*
34. Law R. and Mackay R. (2010) Determining fracture properties by tracer and thermal testing to assess thermal breakthrough risks for ground source heating and cooling in the Chalk, *Quarterly Journal of Engineering Geology and Hydrogeology*, volume 43; p. 269-278
35. Cuthbert, M., Mackay, R., Durand, V., Aller, M.-F., Greswell, R.B., Rivett, M.O. (2010) Impacts of river-bed gas on the hydraulic and thermal dynamics of the hyporheic zone. *Adv. Water Resour.* 33 (11), 1347–1358.
36. Mackay, R. and Last, E. (2010) SWITCH city water balance: a scoping model for integrated urban water management in *Rev Environ Sci Biotechnol* Volume 9 p291–296, DOI 10.1007/s11157-010-9225-4
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*A large number of internal and 'Commercial in Confidence' reports and proposals have been prepared on behalf of the University of Newcastle upon Tyne, commercial clients, Groundwater Development Consultants Ltd and Sir M. Macdonald and Partners.*