



Country of Citizenship:	Australia
Educational Qualifications:	BE (Hons), Adelaide, 1986 PhD (Civil), UNSW, 1992
Professional Associations:	Member, Institution of Engineers, Australia Reviewer for several international journals
Publications:	30

SUMMARY

Gareth Swarbrick graduated from Adelaide University in civil engineering in 1987. He subsequently completed a PhD in geotechnical engineering at the University of New South Wales (UNSW) in 1992 after a short period in management of cleaning chemicals manufacturing. After graduation he worked as a lecturer and then senior lecturer in geotechnical and waste engineering at UNSW from 1992 until 2005. He joined PSM in 2005 as an Associate.

FIELDS OF SPECIAL COMPETENCE:

Gareth's fields of specialist expertise are:

- Mine subsidence impacts,
- Tailings management including consolidation and desiccation
- Landfill design and analysis including gas and leachate management,
- Multiphase modelling of air, water, oil and heat.

His major projects include mine subsidence, tunnelling and mining infrastructure. Other areas of expertise include landfill design and operation, settlement and consolidation of slurried mineral wastes and estimating ground movements due to shrink-swell phenomena. He is also an active researcher in the area of alternate landfill cover design and landfill gas biofiltration.

His work as the principal researcher and coordinator for the AMIRA funded project 86/P833 coordinated work from 5 different mine sites in Weipa QLD, Hamersley Iron WA, Mt Newman WA, Riverside QLD and Wambo NSW. The tailings deposition model that was developed has been used in the design of tailings storages such as the COMALCO Weipa tailings dams.

He has lectured extensively in geotechnical engineering including presenting postgraduate courses in foundation engineering, site investigation and geoenvironmental engineering. He has completed research in the design and operation of landfills, desiccation and cracking of clay soils and landfill gas biofiltration.

He has been an active member of the Australian Geomechanics Society and the Waste Management Association of Australia. He is a frequent speaker at symposia both in Australia and overseas. He has authored or co-authored over 35 journal and conference papers in his fields of expertise, and is co-author of a European Patent on estimation of residual NAPL in porous media.

EMPLOYMENT:

2005 - Present

Associate - Pells Sullivan Meynink Pty Ltd, Sydney

1991 - 2005

Lecturer - University of New South Wales, Sydney

Senior Lecturer - University of New South Wales, Sydney

1986 - 1987

Operations Assistant - Research Products Pty Ltd, Sydney



GARETH SWARBRICK
BE (Hons), PhD (Civil), MIEAust

SOCIETIES/STANDARDS:

- Australian Geomechanics Society
- Waste Management Association of Australia

GENERAL:

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- Extensive expertise in the assessment of the impacts of mining on infrastructure. This includes longwall mining beneath canal, aqueducts and open cut mining near underground workings, shafts and other movement sensitive structures.
- Expertise in finite element modelling of underground openings and support including analysis of the LCT collapse and subsequent redesign, Sydney's desalination plant water intake tunnel and Chuquicamata mine collapse, Chile.
- Expertise in aspects of geotechnical engineering as applied to mining in the area of tailings dam design & operation and waste dumps.
- Expertise in planning and supervising geotechnical and geoenvironmental investigations.
- Expertise in bioreactor design including work on the Lucas Heights test cells, Eastern Creek expansion and the Woodlawn bioreactor.
- Expertise in rock fall risk assessment and remediation.
- Expertise in landfill gas biofiltration including the Horsley Park permeable reactive wall biofilter and the Kelso landfill passive biofilter.
- Expertise in the effects of rainfall and evaporation on the shrink-swell characteristics of reactive soils.
- Analysis of settling and consolidation behaviour of several tailings dams including mine tailings (Marlborough, Cadia, Weipa, Hamersley Iron, Paraburdoo, Mt Newman, Riverside and Wambo) and mineral slurries (Gladstone, Curl Curl lagoon and Darwin Harbour).
- Has taught extensively at postgraduate level including courses in: Geoenvironmental engineering; Foundation engineering. Has contributed to graduate teaching subjects in: Site investigations and Waste management.
- Supervised 4 doctoral theses and co-supervised 10 doctoral theses.
- Refereed over 40 papers for national and international journals and conferences.
- Reviewer for several international journals including ASCE, Waste Management and Waste Management Research.

PROJECTS RELATED TO TUNNELS AND MINES

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Olympic Dam Expansion	Olympic Dam, SA	Finite element modelling of pit slope stability and potential impacts on mining infrastructure.
Muja Pumped Storage Scheme	Muja Mine, WA	Geotechnical design and assessment of the proposed pumped storage scheme.
Desalination Plant	Kernel, NSW	Discrete element modelling of proposed tunnel lining systems.
Lane Cove Tunnel	Lane Cove, NSW	Discrete element modelling of collapse mechanisms and remedial design
Woodlawn Bioreactor	Woodlawn, NSW	Assessment of the potential impact of underground mining on landfill operations.
Cadia Hill Deposit	Cadia Hill, NSW	Analysis of sedimentation and consolidation for a existing and proposed tailings dams.
Investigation of the Deposited Properties of Mine Tailings	Australia Wide	Principal researcher and coordinator for the AMIRA funded project 86/P833. The project coordinated work from 5 different mine sites in Weipa QLD, Hamersley Iron WA, Mt Newman WA, Riverside QLD and Wambo NSW.

PROJECTS RELATED TO WASTE DISPOSAL

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Kelso Landfill Biofiltration	Gas	Bankstown, NSW	Design, analysis, construction and monitoring of Australia's first landfill gas biofiltration field scale trial.
Horsley Park Landfill Gas Biofiltration		Bankstown, NSW	Design, analysis, construction and monitoring of Australia's first passive gas interception and biofiltration system.
A-ACAP		Australia Wide	Principal Investigator for the Australian Alternative Cover Assessment Program
Eastern Creek Stage 2		Eastern Creek, NSW	Bioreactor design and in-situ moisture analysis for the proposed Eastern Creek bioreactor
Residual NAPL prediction		Utrecht, the Netherlands	Theoretical development and computational analysis of the level of non aqueous phase liquid remaining during flow of air-oil-water mixtures.
Woodlawn Bioreactor		Woodlawn, NSW	Assessment of the effect of water quality on biological methane potential
Waste Service Landfill Bioreactor Test Cell		Lucas Heights, NSW	Project design team for the Lucas Heights Bioreactor. Designed the in-situ system to monitor temperature, gas, moisture and leachate.

PROJECTS RELATED TO CIVIL INFRASTRUCTURE

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Tahmoor Mine	Tahmoor, NSW	Assessment of potential impacts of underground longwall mining on Bargo Gorge.
Cataract Tunnel	Appin, NSW	Analysis, remediation and monitoring of Cataract Tunnel and Canal system during undermining
Devines Tunnel	Appin, NSW	Analysis, remediation and monitoring of Devines Tunnel and Canal system during undermining
City Circle Tunnels	Sydney CBD	Analysis of SRA rail tunnels in response to deep basement excavations
Yass Dam	Yass, NSW	Foundation assessment and determination of strength properties.
Redbank Creek Dam	Mudgee, NSW	Foundation assessment and determination of strength properties.
Cracking of Dams	Australia Wide	Theoretical, experimental and field investigation of the development and propagation of cracks in embankment dams.

PRESENTATIONS, PATENTS

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- Presentation: "Three-Dimensional Modelling of Construction Tolerance in Trapezoidal Segments", Australian Tunnelling Symposium, Melbourne, 2008.
- Presentation: "How to achieve sustainable management of landfill gas in Australia", Enviro2008, Melbourne, Australia, 008.
- Presentation: "Subsidence Monitoring at Cataract Tunnel Portal: Lessons Learnt", *Subsidence 2007*, Wollongong, 2007.
- Presentation: "Passive drainage and biofiltration of landfill gas using recycled waste materials, under Australian conditions," *Sardinia 2005*, Cagliari, Italy, 2005.
- Patent: "Method for predicting final organic saturation in a porous medium", European Patent Office patent submission: 04076931.7, 2004.
- Presentation: "Landfill biofiltration trials: Preliminary design and analysis," *Enviro 2004*, Melbourne, Australia, 2004.
- Presentation: "A thermodynamic model for MSW landfill degradation," *Sardinia 2001, Eighth International Waste Management & Landfill Symposium*, Cagliari, Italy, 2001
- Invited presentation: "Microbiology of landfill," *GeoEnvironment 2001*, Newcastle, Australia, 2001.
- Presentation: "Mass transfer rates for Australian landfills," *GeoEng2000*, Melbourne, Australia, 2000.
- Presentation: "Infiltration rates for an Australian landfill," *4th National Hazardous & Solid Waste Convention*, Brisbane, 1999.
- Presentation: "Physical and numerical modelling of infiltration through a landfill cover," *International Conference on Engineering Geology*, Athens, Greece, 1997.
- Presentation: "Physical and bio-chemical modelling of landfill degradation," *Fifth International Landfill Symposium*, Cagliari, Italy, 1995.
- Presentation: "Prediction of unsaturated hydraulic conductivity using micro-lysimeters," *First International Conference on Unsaturated Soils*, Paris, 1995
- Presentation: "The influence of cyclic drying upon the hydraulic properties of landfill covers," *Congress of the International Association of Hydrogeologists*, Adelaide, Australia, 1994.
- Presentation: "The use of small scale experiments to predict desiccation of tailings," *First International Congress on Environmental Geomechanics*, Edmonton, Alberta, Canada, 1994.
- Presentation: "Shrink-swell prediction using the water balance method," *1st ANZ Young Geotechnical Professionals Conference*, Sydney, Australia, 1994.
- Presentation: "An approximate method for the design of tailings dams using sub-aerial deposition," *Geotechnical Management of Waste and Contamination*, Sydney, Australia, 1993.

LIST OF PUBLICATIONS:

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1. Swarbrick G.E. and Bertuzzi R., "Three-Dimensional Modelling of Construction Tolerance in Trapezoidal Segments", Australian Tunnelling Symposium, Melbourne, Australia, 4-7 May, 2008.
2. Dever S. and Swarbrick G.E. (2008), "How to achieve sustainable management of landfill gas in Australia", Enviro2008, Melbourne, Australia, 5-7th May, WMAA,
3. Dever S. and Swarbrick G.E. (2008), "Field testing of methane from the world's largest bioreactor", Woodlawn, NSW, Enviro2008, Melbourne, Australia, 5-7 May, WMAA,
4. Koupai J., Sohrab F. and Swarbrick G.E. (2008), "Evaluation of Hydrogel Application on Soil Water Retention Characteristics", Journal of Plant Nutrition, 31(2):317-331.
5. Swarbrick G.E. (2007), "Subsidence Monitoring at Cataract Tunnel Portal: Lessons Learnt", Subsidence 2007, Wollongong, 26-27 November 2007, Mine Subsidence Technological Society.
6. Dever S.A., Swarbrick G.E. and Stuetz R.M. (2007), "Passive drainage and biofiltration of landfill gas: Findings of Australian trials", Sardinia 2007, Eleventh International Waste Management & Landfill Symposium, Cagliari, Italy, 1-5 October, CISA - Environmental Sanitary Engineering Centre.
7. Dever, S.A., Swarbrick, G.E., and Stuetz, R.M. (2007), "Biofiltration of landfill gas: Design and construction of Australian field scale trial", Waste Management, vol. 27, pp. 277-286.
8. Swarbrick, G.E., Dever, S.A., and Annett, L. (2005), "Landfill gas bioremediation using methane oxidation in a permeable reactive wall", presented at Sardinia 2005, Tenth International Waste Management & Landfill Symposium, Cagliari, Italy.
9. Dever, S.A., Swarbrick, G.E., and Stuetz, R.M. (2005), "Passive drainage and biofiltration of landfill gas using recycled waste materials, under Australian conditions", presented at Sardinia 2005, Tenth International Waste Management & Landfill Symposium, Cagliari, Italy.
10. Dever, S.A., Swarbrick, G.E., Annett, L., and Stuetz, R.M. (2005), "The effect of landfill gas loading on the performance of a passive biofiltration system operating under Australian conditions", presented at Sardinia 2005, Tenth International Waste Management & Landfill Symposium, Cagliari, Italy.
11. Dever, S., Swarbrick, G.E. and Suen, E. (2004). "Trial of an alternative approach to the management of landfill gas," *Proceedings 8th Annual Environmental Research Conference*, Vol. CD-ROM, Wollongong, Australia, 6-9 December, University of Wollongong, pp. 1-8.
12. Dever, S. and Swarbrick, G.E. (2004). "Biofiltration of landfill gas using recycled materials," *Proceedings 3rd Intercontinental Landfill Research Symposium*, Vol. Presentation, Sapporo, Japan, 29 Nov-2 Dec, International Waste Working Group.
13. Swarbrick, G.E. and Dever, S. (2004). "Landfill biofiltration trials: Preliminary design and analysis," *Proceedings e4259 Enviro 2004*, Vol. CD-ROM, Melbourne, Australia, 28 March – 1st April, WMAA, pp. 1-10.
14. Swarbrick, G.E. and Hofstee, C. (2003). "Modelling the formation of detached NAPL lenses during multi-phase flow," submitted to Adv. Water Resources.
15. Dever, S. and Swarbrick, G.E. (2003). "Biofiltration : An option for the long term sustainable management of landfill gas," *Proceedings iw063 ISWA World Congress*, Vol. CD-ROM, Melbourne, Australia, 9-14 November, WMAA, pp. 1-8.
16. Swarbrick, G.E. and Lethlean, J.J. (2001). "A thermodynamic model for MSW landfill degradation," *Sardinia 2001, Eighth International Waste Management & Landfill Symposium*, Ed.: T.H. Christensen, R. Cossu and R. Stegmann, Vol. 1, Cagliari, Italy, 1-5 October, CISA - Environmental Sanitary Engineering Centre, pp. 99-108, ISBN no ISBN/ISSN.
17. Swarbrick, G.E. (2001). "Microbiology of landfill," *GeoEnvironment 2001*, Ed.: D.W. Smith, S.G. Fityus and M.A. Allman, Newcastle, Australia, 28-30 November, Australian Geomechanics Society, pp. 397-408, ISBN 0 9599250 4 X.

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18. Swarbrick, G.E. and Valsky, A. (2000). "Mass transfer rates for Australian landfills," *GeoEng2000*, Vol. 2, Melbourne, Australia, 19-24 November, Technomic, pp. 288, ISBN 1-58716-068-4.
19. Swarbrick, G.E. and Valsky, A. (1998). "Infiltration rates for an Australian landfill," *Proceedings 4th National Hazardous & Solid Waste Convention*, Vol. CD-ROM, Brisbane, 26-30 April, Australian Water & Wastewater Association, pp. Record 25.
20. Swarbrick, G.E. and Koupai, J.A. (1997). "Physical and numerical modelling of infiltration through a landfill cover," *International Conference on Engineering Geology*, Athens, Greece, July, Balkema, pp. 2203-2208, ISBN 90-5410-877-0.
21. Swarbrick, G.E. (1996). "Land Recycling in Australia: Current Practice," *Brach Flaechen Recycling 1/96*:21-27, ISBN 0948-9983.
22. Swarbrick, G.E., Lethlean, J.J. and Pantelis, G. (1995). "Physical and bio-chemical modelling of landfill degradation," *Sardinia 95, Fifth International Landfill Symposium*, Ed.: T.H. Christensen, R. Cossu and R. Stegmann, Vol. I, Cagliari, Italy, 2-6 October, CISA, pp. 209-215.
23. Swarbrick, G.E. (1995). "Measurement of soil suction using the filter paper method," *First International Conference on Unsaturated Soils*, Ed.: E.E. Alonso and P. Delage, Vol. 2, Paris, 6-8 September, ENDPC, pp. 701-708, ISBN 2-85978-241-9.

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24. Swarbrick, G.E. (1995). "Large strain consolidation in unsaturated porous media," *First International Conference on Unsaturated Soils*, Ed.: E.E. Alonso and P. Delage, Vol. 2, Paris, 6-8 September, ENDPC, pp. 583-590, ISBN 2-85978-241-9.
25. McPherson, B.J. and Swarbrick, G.E. (1995). "Use of the water retention characteristic of Newcastle soils to predict ground surface movements," *Engineering Geology of the Newcastle-Gosford Region*, Ed.: S.W. Sloan and M.A. Allman, University of Newcastle, Newcastle, Australia, 5-7 February, Australian Geomechanics Society & Mine Subsidence Technological Society, pp. 53-61, ISBN 0-947333-81-9.
26. Lethlean, J.J. and Swarbrick, G.E. (1995). "The use of thermodynamics to model the biodegradation processes in municipal solid waste landfills," *MODSIM 95: International Congress on Modelling and Simulation*, Ed.: P. Binning, H. Bridgeman and B. Williams, Vol. 1, University of Newcastle, 27-30 November, Modelling and Simulation Society of Australia, Koupai, J., Swarbrick, G.E. and Fell, R. (1995). "Prediction of unsaturated hydraulic conductivity using micro-lysimeters," *First International Conference on Unsaturated Soils*, Ed.: E.E. Alonso and P. Delage, Vol. 2, Paris, 6-8 September, ENDPC, pp. 651-656, ISBN 2-85978-241-9.
27. Swarbrick, G.E., Lambropoulos, N. and Haggett, K. (1994). "Test cell construction and monitoring", CRC Waste Management & Pollution Control, Project 11.1: Design and Operation of Landfills, June 1994
28. Krol, A., Rudolph, V. and Swarbrick, G.E. (1994). "Landfills: A containment facility or a process operation?," *2nd National Hazardous & Solid Waste Convention*, Melbourne, Australia, 8-12 May, Australian Waste Water Association, pp. 249-256, ISBN 0-908255-26-8.
29. Swarbrick, G.E. and Koupai, J. (1994). "The influence of cyclic drying upon the hydraulic properties of landfill covers," *Water Down Under - 25th Congress of the International Association of Hydrogeologists*, Vol. 3, Adelaide, Australia, 21st - 25th November, I.E. Aust, pp. 495-498, ISBN 0-858256-21-5.
30. Swarbrick, G.E. (1994). "The use of small scale experiments to predict desiccation of tailings," *First International Congress on Environmental Geomechanics*, Edmonton, Alberta, Canada, 10-15 July, BiTech, pp. 563-568, ISBN 0-921095-32-5.

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31. Swarbrick, G.E. (1994). "Shrink-swell prediction using the water balance method," *1st ANZ Young Geotechnical Professionals Conference*, Ed.: G. Mostyn, N. Khalili and J. Small, UNSW, Sydney, Australia, 9-12 February, Australian Geomechanics Society, pp. 201-206.
32. Swarbrick, G.E. (1994). "Current understanding of the physical processes in landfills," *Chemical Engineering in Australia* 19(1):18-23, ISBN 0157-9762.
33. Swarbrick, G.E. (1993). "An approximate method for the design of tailings dams using sub-aerial deposition," *Geotechnical Management of Waste and Contamination*, Ed.: R. Fell, T. Phillips and C. Gerrard, Sydney, Australia, 22-23 March, A.A. Balkema, pp. 463-472, ISBN 90-5410-307-8.
34. Swarbrick, G.E. and Fell, R. (1992). "Modelling the desiccating behaviour of mine tailings," *Geotechnical Engineering Jour.*, ASCE 118(4):540-557, ISBN 0733-9410.
35. Swarbrick, G.E. (1992). "Transient unsaturated consolidation in desiccating mine tailings," PhD thesis presented to the School of Civil Engineering, University of NSW, Sydney, April, 1992.