

## James O. Rumbaugh, III

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### Summary

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James Rumbaugh, hydrogeologist and groundwater modeler, is a national leader in the field of groundwater modeling and has performed modeling studies in the USA, Caribbean, Australia, Europe, and Japan. Jim was co-founder of Geraghty & Miller's Modeling Group and was Technical Director for Modeling Services until he left to start Environmental Simulations, Inc. (ESI) in late 1994. He is President of ESI and provides a variety of groundwater modeling services to clients worldwide.

Jim is a member of the American Society for Testing and Materials (ASTM) where he is a past Chairman of ASTM Subcommittee D18.21 on Groundwater and Vadose Zone Investigations. Subcommittee D18.21 was funded by U.S. EPA to develop standards for groundwater modeling practice. As part of his work at ASTM, Mr. Rumbaugh authored the first modeling standard (D5447). ASTM presented Mr. Rumbaugh with several standards development awards and three special achievement awards for his work in developing consensus groundwater modeling standards.

Jim is a long-time member of the National Groundwater Association (NGWA) and is a past member of the editorial review board for Ground Water Journal. He was honored by NGWA with the 1999 John Hem Excellence in Science and Engineering Award by NGWA. This award is given to those who have made a significant, recent scientific or engineering contribution to the understanding of groundwater.

Jim has written some of the most popular groundwater modeling software in use today and co-authored the software Groundwater Vistas and MODFLOW<sup>win32</sup>. He has taught numerous groundwater modeling seminars to private industry and to government clients. He teaches all ESI seminars in the U.S. and is a guest lecturer at ESI seminars in Europe as well. Jim also teaches seminars for the Australian Centre for Groundwater Studies.

In addition to teaching, standards development, and software design, Mr. Rumbaugh is actively involved in consulting projects around the world. He has conducted modeling studies of groundwater flow, contaminant transport, variably-saturated flow & transport, fracture flow and NAPL flow & transport. Mr. Rumbaugh has also developed and applied inverse models for calibration of groundwater models. Much of Mr. Rumbaugh's focus now is on optimization of remedial systems for more cost-effective groundwater treatment.

## Experience

**Environmental Simulations, Inc. (1/95 - present).** Mr. Rumbaugh is President of ESI, a company that specializes in groundwater modeling services, environmental software development, and training.

## Depositions & Testimony

Dura Automotive Systems of Indiana, Inc. (Plaintiff) vs. CTS Corporation, Civil Action No. 3:00CV0688, United States District Court, Northern District of Indiana, South Bend Division. Mr. Rumbaugh worked for Plaintiff and gave a deposition on April 12, 2002.

Vernon Dunaway, et al. vs. Plantation Pipe Line Company, et al., Case No. 98-0044, Circuit Court of Marion County Mississippi, Columbia, Mississippi. Mr. Rumbaugh worked for the Plaintiff and gave a deposition and presented testimony at trial on September 11, 2003.

City of Ann Arbor, Michigan vs. Gelman Sciences, Inc., Case No. 04-513-CF, Circuit Court of Washtenaw County Michigan. Mr. Rumbaugh worked for Defendant and gave a deposition on December 9, 2005.

Sierra Club, et al. v. Flowers, et al., Case No.: 03-23427, United States District Court for the Southern District of Florida. Mr. Rumbaugh worked for Defendant and gave a deposition on June 7, 2006.

City of Lakeland, Florida vs. Southwest Florida Water Management District, Case No. 07-0564, State of Florida, Division of Administrative Hearings. Mr. Rumbaugh worked for Defendant and gave a deposition on June 15, 2007.

Water Rights Hearing, Nevada State Engineer, Pending Water Right Applications 70818-27, 72695-98, 73545-52, 74857, 75979-76004, and 76483-86, filed by Idaho General Mines, Inc. and Kobeh Valley Ranch, LLC. Mr. Rumbaugh presented testimony on October 17, 2008. Testimony concerned the groundwater model developed in collaboration with Interflow Hydrology, Inc. and rebuttal of protestants modeling critique.

## Florida-Specific Projects

Development of a model reporting and simulation system for the Suwannee River Water Management District, Live Oak, Florida. Mr. Rumbaugh also offered a peer review of the SRWMD regional model. The system will assist District staff in evaluating water use permits and their effect on surface streams and springs. This project is ongoing.

Development of a regional groundwater flow model for the Southwest Florida Water Management District. The model covers the entire district and will be used by the water use department in evaluating consumptive use permits for water supply. The model is being constructed and calibrated to conditions in 1993/94 and incorporates the Surficial Aquifer, Intermediate Aquifer, Upper Floridan Aquifer, and Lower Floridan Aquifer Systems. As part of the project, Mr. Rumbaugh developed a new telescopic mesh refinement technique in Groundwater Vistas to streamline the

modeling by District staff. Two versions of the model and software have been delivered to the District. A third contract is currently under way.

Development of a Focus Telescopic Mesh Refinement process in Groundwater Vistas for the St. Johns River Water Management District. This system is similar in concept to the procedures developed for SWFWMD but focused on SJRWMD models. The first model to be incorporated into the Focus TMR technique was the East Central Florida (ECF) model. This project is ongoing.

Peer review of four models for the South Florida Water Management District. Mr. Rumbaugh reviewed and provided comments on the Broward County, North Miami-Dade County, South Miami-Dade County, and South Palm Beach County models. The review focused on the calibration and over-all quality of the models.

Peer review for the South Florida Water Management District of the Lower West Coast Seawater Intrusion Model. Mr. Rumbaugh served on the panel with Chunmiao Zheng and Shawn Leppert. The project required extensive review of the model with several meetings and weekly conference calls over a 4-month period. The peer review report is available on the SFWMD web site.

Served on a scientific peer review panel for the South Florida Water Management District. The panel was reviewing the *Proposed Minimum Water Level Criteria for the Lower West Coast Aquifer System*.

Modification of the Groundwater Vistas software to implement the Wetlands and Diversions Packages for MODFLOW developed by the South Florida Water Management District. Groundwater Vistas was modified to import existing MODFLOW models that utilize these new packages. The software can also create new models using these packages, however, the focus was to allow District staff to review models submitted as part of a water use permit application.

Simulation of a slurry wall and reactive barrier combination for a RCRA landfill near Tampa, Florida. The model was calibrated to water levels measured in the shallow aquifer and deeper limestone aquifer (Upper Floridan). The model was then used to evaluate several alternative designs for the slurry wall and reactive barrier.

Construction and calibration of a site-wide groundwater flow model and several local-scale transport models to support a RCRA CMS at a major manufacturing facility in Palm Beach County, Florida. Transport models were constructed for each SWMU in support of a natural attenuation alternative.

### **Other Projects**

Groundwater modeling at several Pennsylvania and Maryland Quarries for Lehigh Cement Company, Allentown, PA. The models were in support of permit applications for new and existing permits. The models were used to predict future impacts from quarry operations.

Groundwater modeling at the Mt. Hope Mine in Kobe Valley, Nevada. The model is being constructed and calibrated for Idaho General Mines at a major molybdenum deposit in central Nevada. The model was used to support a water rights application to the Nevada State Engineers Office. Mr. Rumbaugh testified at a water rights hearing in October 2008.

Development of a regional groundwater flow model of the Powder River Basin in Wyoming. The work is being performed for the U.S. Bureau of Land Management through a subcontract to ENSR. The modeling work is ongoing and will focus on the effects of coal mining and coal bed methane production in the basin on groundwater resources. The model includes all coal mines in eastern Wyoming.

Groundwater modeling in the Smoke Creek Desert of northwestern Nevada. The model is being constructed and calibrated for a power company that intends to build a power plant in the area. The modeling work is ongoing and will be used to support a water rights application to the Nevada State Engineers Office.

Development of a basin-wide groundwater model for the Fremont Valley, California. The modeling was performed under subcontract to ENSR for evaluation of groundwater resources in the area. The model simulations were used to support a permit application for a solar power plant.

Construction and calibration of a groundwater model for the Ivanpah Valley in California. The model was created for the Lahonton Region Water Quality Control Board. The model was developed to support long-term water management strategies in the valley, including the new Las Vegas airport.

Stochastic simulation of two new wellfields in Sacramento, California to determine the probability that the new wells would capture an existing contaminant plume. The work was conducted under the review of a blue ribbon panel created by the State of California. A groundwater flow model was developed for the basin containing the well fields and calibrated to water levels collected in the area. The probabilistic assessment proved that the well fields could be protected and the State of California approved the drilling of the new wells.

Peer review of a modeling effort in Redlands, California. Mr. Rumbaugh provided an expert review of the ongoing groundwater flow and contaminant transport simulations for a major contaminant plume in the Redlands area. The modeling was conducted to find the best way of managing the plume at the least cost to the client. As part of this project, Mr. Rumbaugh also developed documentation of the model application so that it could be used by outside modelers.

Peer review of a groundwater model developed by the USGS for the City of El Paso, Texas. Mr. Rumbaugh served on a peer review panel for the El Paso Water Utilities. The purpose of the review was to determine whether a model developed by the USGS for the City could be used to make future predictions with regard to groundwater usage in the area.

Peer review of the Dungeness Groundwater Model, Clallam County, Washington. The review was prepared for the Washington Department of Ecology. The purpose of the review was to assist Clallam County Government in determining future uses and upgrades to the groundwater model.

Peer reviewer and project advisor on model calibration for the City of Portland. Mr. Rumbaugh was teamed with CH2M Hill to revise a large-scale model of the city's wellfield along the Columbia River. The project required significant modifications to the existing model and used Mr. Rumbaugh's structured calibration approach.

Peer review of a modeling project in Wisconsin in support of a landfill expansion. Mr. Rumbaugh provided modeling assistance to the modeling team, composed of Applied Environmental Services, Inc. and BT<sup>2</sup>, Inc. both of Madison, Wisconsin. The model comprised a complex multi-aquifer system with glacial deposits overlying a regional bedrock aquifer system.

Calibration of a contaminant transport model and optimization of a remedial design strategy for an industrial facility in Sydney, Australia. The work was conducted in association with Alan Laase, Groundwater Consultant for a confidential client in Australia.

Simulated impacts of a new water supply well for the City of Gresham, Oregon. The modeling used the previously developed DAY Model from the City of Portland to estimate impacts of a new well on adjacent supply wells. The model was modified based on new data collected in the vicinity of the new well.

Software development for a new wellfield optimization technique called *Brute Force* for Oak Ridge National Laboratory. *Brute Force* was first developed and applied at the Kansas City Plant for Department of Energy. A subsequent contract continued development of the technique for application at a site in western Colorado. The purpose of the modeling technique is to minimize the cost of pump & treat containment strategies.

Simulation of remedial measures at a refinery in Texas. The model simulates a shallow aquifer and evaluates a remedial system comprised of a slurry wall and recovery trench. The model was calibrated using the new Pilot Point technology. This work is ongoing.

Simulation of the Army Creek Landfill in New Castle County, Delaware. The project is ongoing and is designed to optimize the existing pumping system so that a neighboring water supply well field will not be impacted by an existing contaminant plume.

Simulation of groundwater flow within a slurry wall for mitigation of liquefaction potential at a petroleum refinery in Japan. Mr. Rumbaugh served as a peer reviewer for a major oil company to evaluate the modeling of a Japanese engineering firm. Mr. Rumbaugh also simulated variably saturated flow within the slurry wall to confirm the engineering firm's modeling results. The project resulted in a multi-million dollar savings over the originally chosen dewatering/treatment scheme.

Optimization modeling of a pump & treat system in Phoenix, Arizona. A groundwater flow model was constructed for a site in Phoenix to simulate a pumping and injection system designed to remediate a VOC plume. The modeling used ESI's *Brute Force* optimization technology to modify the system to contain the plume with the lowest possible pumping rate. The final rate of 680 gpm was approximately half of the initial designed pumping rate.

Simulation of sulfate migration from slurry waste at a coal mine in Illinois. Mr. Rumbaugh reviewed a flow model constructed by another consultant and then calibrated a contaminant transport model to better understand the movement of sulfate at the mine. The model is being used in negotiations with a local water company over mitigation efforts at the mine.

Modeling the fate and transport of radionuclides from potential releases at the Waste Isolation Pilot Project (WIPP) site in New Mexico. The modeling is being conducted for the U.S. EPA as part of a peer review of work being performed by Sandia National Laboratory and their consultants to evaluate potential release scenarios. The modeling is being performed with STAFF3D, a 3D finite-element code that simulates flow and transport in fractured rock.

Construction and calibration of a groundwater flow model at a manufacturing facility in northwest Ohio. The results of the flow model were used to compute how much groundwater flows to a surface stream. The data were then used in a risk assessment to show that on-site activities have not had adverse effect on the environment.

**Geraghty & Miller, Inc. (11/87 - 12/94).** National Technical Director for Modeling Services and co-founder of the G&M Modeling Group, headquartered in Reston, Virginia with staff worldwide. Responsibilities included project management, training and technology transfer, QA/QC review of modeling projects, hands-on ground-water modeling, preparation of technical reports, and business development. Mr. Rumbaugh also managed G&M Software which distributes commercial software to the environmental industry.

While at Geraghty & Miller, Mr. Rumbaugh developed extensive experience in the application of numerical and analytical modeling techniques to ground-water problems. He has developed models in a wide variety of settings across the United States from Florida to Alaska. He has developed models for a variety of problem areas from hazardous waste management (RCRA, CERCLA, and litigation) to water resource management (water rights, wellhead protection and seawater intrusion). He has experience in a wide variety of techniques including finite-difference and finite-element ground-water flow, contaminant transport, variably-saturated flow & transport, density-dependent flow, and multiphase flow & transport.

Mr. Rumbaugh has also developed numerous commercial and proprietary software packages that employ graphical and visualization techniques to increase the efficiency of ground-water modeling. Mr. Rumbaugh was the primary author of Air3D, a graphical airflow model developed for the American Petroleum Institute. Mr. Rumbaugh also developed a simpler graphical airflow model for Mobil Oil Corporation, called Air2D. Other modeling software developed by Mr. Rumbaugh includes ModelCad and QuickFlow described later in this resume.

### Specific Projects

Software development project for the American Petroleum Institute (API). Mr. Rumbaugh developed a graphical user interface for a model that simulates the movement of air in the subsurface. The purpose of the model was to design and optimize vapor extraction systems (VES). The software was developed in a combination of C and FORTRAN. The resulting software was called Air3D and is marketed commercially by API.

Fate and transport modeling of radioactive and organic chemicals at the Portsmouth Gaseous Diffusion Plant in Portsmouth, Ohio. The model simulated groundwater flow and contaminant transport in a multi-aquifer system. The aquifers included an alluvial sand overlying two bedrock aquifers. The modeling supported a major RFI study and was used to successfully negotiate the use of 60 percent fewer wells in ongoing RCRA monitoring. MODFLOW and MT3D were the models used on the project.

Peer review and evaluation of the MT3D model for the U.S. EPA Office of Radiation and Indoor Air. The project involved a critical review of the MT3D code, both for general groundwater transport modeling and specifically related to the model's applicability to simulating the fate and transport of radioactive compounds.

Directed the modeling of groundwater flow, contaminant transport, and seawater intrusion for an industrial facility on the north shore of Puerto Rico. The model was used to successfully renegotiate U.S. EPA's ROD at the site. The SWIFT III model was the simulator for the study.

Served on a peer review panel for U.S. EPA to evaluate the performance of the International Groundwater Modeling Center. Mr. Rumbaugh was the only representative from private industry selected for the panel.

**GeoTrans, Inc. (2/85 - 11/87).** Mr. Rumbaugh was Senior Hydrogeologist responsible for project management, application of models to ground-water problems, and business development. He was principal investigator for a wide variety of ground-water investigations ranging from three-dimensional ground-water flow and transport modeling to surface geophysical investigations.

**Dunn Geoscience Corporation (5/83 - 2/85).** Mr. Rumbaugh was a Hydrogeologist in the Harrisburg, Pennsylvania office responsible for designing and implementing all field programs and for report preparation related to hydrogeologic and geophysical investigations. He had extensive experience in ground-water investigations related to sanitary landfills and fly-ash disposal facilities.

**Pennsylvania State University (9/81 - 5/83).** Thesis research on the occurrence and movement of naturally occurring radionuclides in ground water in eastern Pennsylvania. The research was funded by a grant from the Department of Energy.

**GEO-Technical Services, Inc. (5/81 - 9/81; part-time to 5/83).** Staff geologist working on a variety of projects including acid mine drainage abatement, ground and surface water monitoring, and design of a levee along the Juniata River.

## Education

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- B.A.           Susquehanna University, Selinsgrove, Pennsylvania  
                  Graduated Summa Cum Laude with Honors in Geology in 1980.
- Graduate      University of Nevada-Reno, Reno, Nevada  
Work           Research Fellow at the Desert Research Institute
- M.S.           The Pennsylvania State University, University Park, Pennsylvania  
                  Graduated with an M.S. in Geology in 1983.

## Professional Certification

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- Registered Professional Geologist:   Florida No. 492  
Registered Professional Geologist:   Pennsylvania No. 76

## Professional Affiliations

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### National Water Well Association

- Past Editorial Review Board for Ground Water Journal
- Received 1999 Hem Award for Significant Contribution to Understanding of Groundwater

### American Society for Testing and Materials (ASTM)

- Chairman Subcommittee D18.21 on Groundwater and Vadose Zone Investigations
- Chairman Section D18.21.10 on Groundwater Modeling from 1992 to 1998.
- Co-chairman of the 1995 ASTM Symposium on Groundwater Modeling
- Received a Standards Development Award in June 1994 for authoring the first groundwater modeling standard for D-18.21
- Received a Special Achievement award in 1996 for co-chairing a symposium on groundwater modeling held in Denver, 1995.
- Received a Special Achievement award in 1999 for serving as Chairman of D18.21.10 on Groundwater Modeling for six years.
- Received a Special Achievement award in 2001 for serving as Chairman of D18.21 for four years.

### Association of Engineering & Environmental Geologists (AEG)

- Co-Chairman of a Symposium on Groundwater Modeling at the 50<sup>th</sup> Anniversary Meeting, Los Angeles, California, September 2007



## **Seminars Presented by Mr. Rumbaugh**

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Introduction to Groundwater Modeling – This is a general course offered periodically to the public as an overview of groundwater modeling using ESI's Groundwater Vistas software. The course is usually taught at least twice per year and has also been taught to organizations including the Texas Water Development Board, South Florida Water Management District, Southwest Florida Water Management District, St. Johns River Water Management District, and other private companies.

Advanced Model Calibration and Uncertainty Analysis – The Advanced seminar is also taught at least twice per year. Approximately half of the course is on model calibration, focusing on the use of Pest. The other advanced topics include analysis of uncertainty, optimization for wellfield management & remedial design, unsaturated zone modeling with MODFLOW-SURFACT, and 3D visualization.

Groundwater Modelling School for the Australian Centre for Groundwater Studies. These seminars are taught in Sydney, Brisbane, and Perth, Australia and in Wellington, New Zealand. Seminars were taught in 2004 and 2007. The next series of seminars will likely be in 2010.

## **Software Development**

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Groundwater Vistas. A complete groundwater modeling environment for Microsoft Windows. Currently under development, Groundwater Vistas supports pre- and post-processing of MODFLOW, MODPATH, MT3D, PEST, MODFLOW-SURFACT, and MODFLOWT models. Groundwater Vistas was chosen as the standard groundwater modeling interface by England's Environment Agency.

MODFLOW-SURFACT Visual Modeling System. ESI has collaborated with HydroGeoLogic, Inc. to develop a visual modeling system and enhancements to the MODFLOW model. The visual portion of the system, Groundwater Vistas, is developed by ESI. MODFLOW-SURFACT, developed by HydroGeoLogic includes unsaturated flow modeling, transport modeling, and numerous other features that extend the functionality of MODFLOW.

SEFTRAN. Co-developer of SEFTRAN model (two-dimensional finite-element ground-water flow and solute transport) with P. S. Huyakorn, B. H. Lester, D. S. Ward, and others.

SWANFLOW. Codeveloper of the SWANFLOW model with C. R. Faust. SWANFLOW is a three-dimensional finite-difference model that simulates the migration of air, water, and a non-aqueous phase liquid. The model treats both light and dense organic liquids.

ModelCad. Computer-Aided Design for Ground-Water Modeling. ModelCad is a graphical preprocessor for model design. ModelCad significantly increases the efficiency and accuracy of applied modeling. ModelCad is sold commercially by G&M.

QuickFlow. A menu-driven, interactive analytical ground-water flow model incorporating steady-state and transient analytical solutions for ground-water flow. QuickFlow incorporates a graphical

user interface with interactive contouring and visualization of model results. QuickFlow is sold commercially by G&M.

WinFlow. An enhanced version of QuickFlow for the Microsoft Windows operating system. WinFlow incorporates interactive graphical processing of model results with a Windows-standard interface. WinFlow is sold commercially by Environmental Simulations, Inc.

WinTran. An enhanced version of WinFlow which includes a finite-element transport model embedded in the analytic element flow model.

## **Selected Publications**

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Rumbaugh, J. O., J. R. Pepper, P. C. Lowe, and J. F. Villaume, 1984. Evaluation of ground-water monitoring wells and sampling techniques, Proceedings of the NWWA Technology Division Eastern Regional Conference, NWWA, Boston, MA.

Rumbaugh, J. O., and R. R. Parizek, 1983. Effect of fracture permeability on radon-22 concentration in ground water of the Reading Prong, PA, Abstracts with Programs, G.S.A. National Meeting, Indianapolis, IN.

Rumbaugh, J. O., J. A. Caldwell and S. T. Shaw, 1987. A geophysical monitoring program for a sanitary landfill, implementation and preliminary analysis, Proceedings of the First National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring and Geophysical Methods, May 21, 1987.

Cohen, R. M., R. R. Rabold, C. R. Faust, J. O. Rumbaugh, and J. Bridge, 1987. Investigation and hydraulic containment of chemical migration at four landfills in Niagara Falls, New York, Civil Engineering Practice, the Journal of the BSCE.

Rumbaugh, J.O., G.M. Duffield, D.R. Buss, and C.F. McLane, 1988, The role of ground-water modeling in hazardous waste management, Hazardous Waste Management Magazine, March 1988.

Rumbaugh, J. O., 1989. Increasing the efficiency and accuracy of applied modeling using a database approach, Proceedings of the NWWA Solving Ground-Water Problems with Models Conference, February 7-9, 1989, Indianapolis.

Hauptmann, M.G., J.O. Rumbaugh, and N. Valkenburg, 1990, Use of Modeling during Superfund cleanup, In Proceedings of the 11th National Superfund Conference, Hazardous Materials Control Research Institute.

Rumbaugh, J.O., C.F. McLane, G.M. Duffield, and D.R. Buss, 1990, Ground-water modeling as a Management Tool for Pennsylvania's Water Resources, in: Water Resources in Pennsylvania: Availability, Quality, and Management, Edited by S.K. Majumdar, E.W. Miller, and R.R. Parizek.

- Rumbaugh, J.O., 1991, Standard Guide for Application of a Ground-Water Flow Model to a Site-Specific Problem, DRAFT American Society for Testing and Materials guideline, Philadelphia, PA, 12 p.
- Matters, S.E. and J.O. Rumbaugh, 1991, Remediation of a DNAPL Pool and Associated Ground-water Contaminant Plume by Means of an Interceptor Drain, In Proceedings of the 10th Annual Caribbean Haztech Conference, November 13-15, 1991, Haztech International.
- Rumbaugh, J.O., 1992, Development of an Interactive, Analytical, Ground-Water Flow Model, In Proceedings of the Envirsoft 1992 Conference, Portsmouth, UK, September 1992.
- Rumbaugh, J.O., 1993, Combining Analytic Element and Finite Element Techniques for Contaminant Transport Analyses, In the Proceedings of the 1993 Groundwater Modeling Conference, Golden, Colorado, pp. P-77-86.
- Rumbaugh, J.O., G.J. Ruskauff, and R. Claff, 1994, Comparison of Techniques for Simulating Vapor Extraction System Performance, In Proceedings of the 1994 Groundwater Modeling Conference, August 10-12, 1994, Fort Collins, Colorado, pp. 325-334.
- Rumbaugh, J.O. and J.D. Ritchey, 1995, Groundwater Modeling and the Internet, In Proceedings of the ASTM 1995 Symposium on Groundwater Modeling (in Press), June 22-23, 1995, Denver, Colorado.
- Ruskauff, G.J. and J.O. Rumbaugh, 1996, Incorporating Groundwater Flow Direction and Gradient into Flow Model Calibration, In Proceedings of the ModelCARE '96 Conference to be held in October, 1996, Golden, Colorado.
- Rumbaugh, J.O. and J.D. Ritchey, 1996, Subsurface Fluid Flow Modeling, ASTM Special Technical Publication 1288, American Society for Testing and Materials, West Conshohocken, PA.
- Rumbaugh, J.O. and G.J. Ruskauff, 1998, Modification of the MODFLOW BCF Package for Input of Vertical Hydraulic Conductivity, In Proceedings of the MODFLOW'98 Conference, October, 1998, Golden, Colorado.
- Rumbaugh, J.O. and G.J. Ruskauff, 1998, A Practical, User-Friendly Interface for Monte Carlo Simulation with MODFLOW, In Proceedings of the MODFLOW'98 Conference, October, 1998, Golden, Colorado.
- Ruskauff, G.J. and J.O. Rumbaugh, 1999, Effect of Using Gradient and Angle Calibration Data on Parameter Identifiability, In Proceedings of ModelCARE'99, September 1999, Zurich, Switzerland.
- Ruskauff, G.J. and J.O. Rumbaugh, 1999, Comparison of Capture Zone Uncertainty from Particle Tracking and Solute Transport Approaches, In Proceedings of ModelCARE'99, September 1999, Zurich, Switzerland.

- Tonkin, M., Weaver, J., Zheng, C., Muffels, C., and Rumbaugh, J., 2005, Coupled Free and Dissolved Phase Transport: New Simulation Capabilities and Parameter Inversion. Proceedings of the 2005 National Ground Water Association (NGWA) Conference on MTBE and Perchlorate, Assessment, Remediation, and Public Policy, May 26-27, 2005, San Francisco, California.
- Rumbaugh, J., Peterson, R., and K. Weber, 2006, A New Telescopic Mesh Refinement Technique Applied to Water Use Permitting in Florida, MODFLOW2006 Conference, May, 2006, Golden, Colorado.
- Laase, A., N. Merrick, and J. Rumbaugh, 2006, Applied Comparison of Gradient and Particle-Tracking Optimization Schemes, Chlorinated and Recalcitrant Contaminants Conference, May, 2006, Monterey, California.
- Rumbaugh, J.O., 2007, Practical Application of Regularized Inversion in Groundwater Models, Geological Society of America Annual Meeting, Denver, Colorado, Invited Presentation.
- Rumbaugh, J.O. and A.N. Laase, 2008, A Particle-Tracking Technique for Optimization of Groundwater Containment Strategies, GRA Optimization Symposium, October 16, 2008, Sacramento, California, Invited Presentation.
- Hunt, R.J., J. Luchette, W.A. Schreuder, J. Rumbaugh, J. Doherty, M.J. Tonkin, D. Rumbaugh, 2010, Using a Cloud to Replenish Parched Groundwater Modeling Efforts, Groundwater Journal, in review.