Pete Sinton

Principal Hydrogeologist

Mr. Sinton has over 28 years of experience developing and applying groundwater flow and transport models, and presenting modeling results to a wide variety of stakeholders. For the past 19 years, Mr. Sinton has been applying state-of-the-art groundwater models in support of mining clients around the world. In this work, he has modeled the complicated conditions often encountered at mining sites. In addition to modeling, he provides technical expertise for groundwater flow system characterization, including: data analysis and visualization, geochemical modeling and characterization of groundwater quality, analysis of particularly complicated pumping test and slug-test data, statistical analysis of environmental data, and expert testimony. He frequently consults on the application of FEFLOW, MODFLOW, RT3D, MT3D and PEST computer codes and models based on his extensive practical experience.

EXPERIENCE

Mining and Groundwater Resources

- Safford District, Arizona: Prepares summary reports of groundwater conditions based on water-level monitoring, water chemistry and groundwater production data. Responsible for recent and ongoing groundwater modeling using FEFLOW, an update of the previous EIS MODFLOW model.

- Coal Mine, Columbia (Confidential): Modeled transient pore-pressure distribution in support of slope-stability analyses of current and future configurations of the open-pit mine. Two-Dimensional variably-saturated FEFLOW model.

- Copper Mine, Peru (confidential): Team leader for groundwater modeling in support of design of one of the largest tailings impoundment facilities in the world. Three-dimensional FEFLOW model used to predict the influence of the facility on groundwater flow conditions in fractured rock terrain.

- Buckhorn Mountain, Washington. Developed transient, variably-saturated, 3D FEFLOW model of fractured rock aquifer to predict regional impacts resulting from dewatering of an underground gold mine. Leader of multidisciplinary modeling group. Simulation of tunnels, mine flooding, seasonal and drought conditions.

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526

Pete Sinton
Principal Hydrogeologist

AquaGeo

- Heap-Leach Pad, Mexico (confidential): led modeling analysis aimed at predicting the effectiveness of the capture and containment of PLS under the no-engineering and various engineering conceptual designs. The two-dimensional, cross-sectional model simulates transient, variably-saturated flow of PLS through the ore heap to points of discharge and loss PLS to underlying geologic materials.

- Led groundwater modeling in support of EIS evaluations of the Safford District, Arizona. Constructed and calibrated a three dimensional MODFLOW model to simulate regional groundwater flow under pre- and post-mining conditions. Predicted regional changes in groundwater flow to or from rivers and drawdown associated with proposed mining. Simulation of fault controlled groundwater flow is critical to the analysis.

- Lead modeler for estimating groundwater inflow to an open-pit gold mine located on a small tropical island. Gold deposits are hosted in a hot dormant volcano with active geysers near the ocean. 3D modeling predicted dewatering requirements under the coupled effects of groundwater flow, heat flow, and saltwater intrusion.

- Oversight of 3D flow and multi-species transport modeling for a new coal mine in New Mexico. FEFLOW is used to simulation current and future conditions in a highly heterogeneous sedimentary environment.

- Interpretation of long-term multi-well pumping test conducted in fractured bedrock. Primary flow occurs along bedding plane "aquifers". Accounted for influence of nearby tidally influenced river.

- Predicted the effects of developing alternate groundwater resources for an open-pit copper mine in Arizona. Interpretation of 3-month multi-well aquifer pumping test (fractured bedrock and basin fill). Provided modeling predictions in support of water-well network design and pit inflow.

- Analyzed aquifer pump test data and hydrogeologic data for a water supply project in Seattle, WA. Analysis of pump test data has shown the importance of heterogeneity in a setting previously thought to be a simple layer-cake system. Findings used to show infringement of protected water rights and to aid in remedial measures.

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526

- Prepared a three dimensional flow model to assess the feasibility of groundwater production for a site in eastern Saudi Arabia. The model compared favorably to aquifer testing results, and was used to predict pumping well efficiency, drawdown, pumping rates and locations. The site is characterized by a multilayered fractured limestone aquifer system with oceanic, oasis and sabkhah discharge.

- Lead modeler for an open-pit copper mine in New Mexico. Developed, verified and applied unique modeling approach to predicting pit-lake development. Code has been reviewed and accepted by New Mexico Environment Department. This code has also been applied at the Morenci Mine, AZ, and reviewed and accepted by the Arizona Department of Environmental Quality.

- Prepared detailed three-dimensional hydrogeologic model of a multi-aquifer system near Los Angeles, CA, using diverse information including numerous well logs, agency reports, climatic data, etc.

- Provided modeling support for an underground diamond mine and an underground coal mine in Australia.

Fracture Flow Modeling

- Waste-water Injection Project, Russia (Confidential): FEFLOW modeling used to predict the impacts of high-pressure injection of saline waste fluids resulting from nearby oil and gas production. Highly detailed, transient, three-dimensional flow modeling of fractured basin fill and volcanic rock. Local hydrofractures induced by injection directly simulated using 2D discrete elements. Modeling of real-time injection data. Density, salinity and temperature evaluations.

- Senior modeler and project manager for a 3D FEFLOW model of a site in New Jersey. The site, deemed one the most contaminated in the state, is impacted by significant LNAPL, DNAPL and dissolved solvent contamination. Groundwater flow and transport occurs in bedrock (fractured siltstone and arkose) and in overlying glacial till. FEFLOW model simulates transient flow in fracture zones, low-permeability bedrock and till. Presented modeling results to NJDEP and EPA.

- Lead modeler and project manager for 3D modeling of an underground gold mine in Washington. FEFLOW model used to simulate groundwater flow in fracture zones and low-permeability bedrock, and to predict mining effects on baseflow in nearby streams.

- Dounreay Shaft Isolation Project, Northern Scotland. Senior modeler of team using FEFLOW to analyze 3D flow to shaft in which radioactive waste material is buried at this seashore site. Simulation of horizontal tunnels and transient groundwater flow due to tidal pumping.

Remediation/Optimzation

- Provided technical support for detailed review of a large three-dimensional flow and transport model of a $2M/year injection/extraction system at the Tooele Army Depot for the US Corps of Engineers. The model will be used to evaluate non-operation test results and methods of implementing alternative measures and reducing remediation costs. Presented results on the utility of using parameter estimation to characterize and reduce uncertainty (PEST + MODFLOW application).

- Key member of a team of professionals working to predict the movement of a plume of MTBE near tunnel construction activities under time-critical constraints (Long Island, NY). Developed detailed pumping information used in the model to successfully predict MTBE movement and containment. Predicted optimal pumping rates and well locations for MTBE containment using MODOFC.

- Senior modeler and hydrogeologist for a copper refining plant near Sydney, Australia. Interpretation of bedrock core and groundwater data led to discovery that prolonged acid leakage into bedrock caused localized zones of high permeability and metal contamination.

- Managed modeling activities and technical consultant for VOC leachability and transport study. Agency negotiations. Application of MT3D and MODFLOW. Site is characterized by a three layer aquifer system with complex pumping conditions and contamination by chlorinated solvents.

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526

- Conducted preliminary modeling of a site in Phoenix, Arizona, involving dense chlorinated solvents in fractured bedrock and alluvial materials. Performed calculations to optimize injection and extraction well locations and rates in support of feasibility analyses.

- Lead modeler for OU1, Rocky Flats Plant, Colorado. Presented modeling results, hydrogeologic framework, and analysis of DNAPL release to DOE, EPA and CDPHE.

- Provided technical support and review for electronics manufacturing site, Front Range, Colorado.

- Conducted preliminary geostatistical analysis of hydraulic conductivity data for the West Valley Demonstration Project in New York.

Natural Attenuation/Geochemical Modeling

- Port Kembla Copper, New South Wales, Australia. Acidified copper sulfate from specialty smelter and refinery. Weathered and fractured bedrock. Leader of modeling team. Geochemical modeling using PHREEQC. Presentations to regulatory agencies.

- Analyzed organic geochemistry at a site for a fortune 50 company in New Jersey. The analysis entailed development of unique methods to characterize and understand contamination by a diverse set of organic compounds with many source locations. Results were used to show regulators that the site is sufficiently characterized to proceed with remediation.

- Evaluated groundwater transport and fate of perchlorate and related compounds (energetics) for the Navy's Boardman Bombing Range, Oregon. Three-dimensional simulation of plumes in fractured basalt aquifers that discharge to the Columbia River.

- Conducted analysis to estimate the capacity of country rock to neutralize acidic metal laden leachate for mining client in Arizona. Developed a simple method to estimate the time it would take to exceed the capacity of the country rock to neutralize the leachate.

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526

- Provided geochemical modeling for the Revere Chemical site in Philadelphia. Estimated of partition coefficients based on laboratory data and geochemical modeling. Predicted impact on groundwater beneath the site due to leaching of metals from surface sludge. A thick vadose zone, reworked soils and sludge and fractured metamorphic bedrock, characterizes the site.

Vadose-Zone Modeling

- Two-dimensional, cross-sectional model developed using FEFLOW. Transient, variably-saturated using quadrilateral elements. Simulation of heap-leach operation and build-up of heap over time.

- Performed groundwater and contaminant transport modeling in the vadose zone for the Test Reactor Area at the Idaho National Engineering Laboratory. Provided estimates of future concentrations of radionuclides and metals in groundwater in the Snake River Plain Aquifer for risk assessment and feasibility studies. Predicted the time required for contaminated perched water to drain away. Modeling predictions resulted in a "no further action" ROD, the first of its kind at the INEL. Provided technical support during public hearings. Groundwater and contamination occurs in fractured basalt rock and alluvial/cinder interbeds, a thick unsaturated zone and perched groundwater conditions.

- Developed and calibrated a complex 2D variably saturated flow and transport model for a site near Denver, CO. Modeling addressed vadose zone vapor phase VOC transport and uncertainty analysis. Flow and transport occurs through weathered siltstone, sandstone and mudstone that has undergone slumping and has been disturbed by construction and disposal activities.

Litigation Support

- Performed groundwater and contaminant transport modeling and interpretation of metal and VOC concentrations in groundwater for a Superfund site in Nebraska. Provided litigation support and expert testimony in the areas of modeling, hydrogeology, and geochemistry. Analyzed aquifer testing data to show that testing results are complex and atypical. Groundwater flow occurs in clayey loessal material with interbedded sand lenses, and in a prolific fluvial sand and gravel aquifer affected by complex seasonal pumping.

- Provided expertise regarding review and use of specialized groundwater flow and transport models used to predict the movement of a chlorinated-solvent plume in Phoenix, Arizona.

- Gold Mine, Washington, USA (Confidential): Reviewed and responded to expert opinions in anticipation of litigation.

Groundwater Flow and Transport Research and Teaching

- Develops systems to automate the setup of FEFLOW models using common tools such as ArcMap, MS Access, MS Excel, Surfer, etc.

- Developed and verified unique computer codes to simulate complex lake-groundwater interactions for open-pit mines using MODFLOW or FEFLOW. Applied these lake codes to Little Rock and Morenci mines in Arizona, Boddington Gold Mine, Australia, and a proposed open-pit mine in eastern Arizona.

- Consults on FEFLOW, MODFLOW, MODPATH, MT3D and other computer codes and models based on extensive practical experience. Custom FEFLOW instruction.

- Developed: methods to animate three-dimensional groundwater plumes; a unique, automated method for estimating contaminant mass using sparse data; and verified computer code to simulate constant concentration sources in groundwater; tested and applied a model to simultaneously simulate chain decay and groundwater transport; unique statistical model error analysis for a groundwater and contaminant transport model of a site in Utah.

- Provided training, technical support and review in the areas of geochemical and transport modeling for West Valley Demonstration Project in New York.

- Developed and tested methods for simulating aquifer pump tests.

Pete Sinton
Principal Hydrogeologist

AquaGeo

PUBLICATIONS

Sinton, P. O., W. L. Wingle, and R. D. Bartlett, 2015, FEFLOW Model of a Copper Mine, Arizona, USA, FEFLOW 2015 Conference: Modelling the World of Groundwater with MIKE by DHI, September 21-25, 2015, Berlin, Germany.

Wingle, W. L., and P. O. Sinton, 2015, A Pit-Lake Module for FEFLOW, Proceedings of "MODFLOW and More 2015: Modeling a Complex World," May 31 to June 3, 2015, Golden Colorado.

Sinton, P. O., 2013, Comparison of FEFLOW and MODFLOW to Model Mine Sites with Deep Water Tables, Proceedings of "MODFLOW and More 2013: Translating Science into Practice," June 2-5, 2013, Golden, Colorado.

Sinton, P. O., and J. L. Moreno, 2012, Comparison of Methods Used to Model Mine Sites with Deep Unsaturated Zones Using FEFLOW, 3rd International FEFLOW User Conference, September 3-5, 2012, Berlin, Germany.

Moreno, J. L., T. M. Bellehumeur, P. O. Sinton, and R. D. Bartlett, 2008, Conclusions on the Use of Model Predictions Derived from Model Post-Audits and Re-Evaluations: presented at AIPG National Conference, September 20-24, 2008, Flagstaff, Arizona.

Moreno, J. L., A. Przepiora, T. M. Bellehumeur, J. Mueller, and P. O. Sinton, 2008, Experience with Modeling Enhanced Bioremediation Using Observed Half Lives Varying in Time and Space: presented at MODFLOW and More, Ground Water and Public Policy, Golden, Colorado.

Sinton, P. O., J. H. Flynn, R. M. Dixon, D. Banton, L. Smith, 2007, Three-Dimensional Groundwater Flow Model of an Underground Gold Mine near Republic, Washington: presented at the 6thWashington Hydrogeology Symposium, May 1-3, 2007, Tacoma, Washington.

Sinton, P. O., J. H. Flynn, R. M. Dixon, D. Banton, L. Smith, and J. L. Moreno, 2007, Three-Dimensional Groundwater Model of a Gold Mine Near Republic, Washington: presented at AIPG National Conference, October 7-11, 2007, Traverse City, Michigan.

Moreno, J. L., and P. O. Sinton, 2003, Audit of Model Predictions of Dewatering Requirements for a Large Open Pit Mine: presented at the 2003 SME Annual Meeting & Exhibit, Cincinnati, Ohio, February 24-26, 2003.

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526

Moreno, J. L. and P. O. Sinton, 2002, Modeling Mine Pit Lakes: Southwest Hydrology, v. 1, no. 3.

Moreno, J. L, P. O. Sinton, R. D. Bartlett, and A. L. Williamson, 2002, A Method for Simulating Pit Lake Development and Passive Containment Resulting from Complex Geometry Pit Lakes: presented at the U.S. EPA Hardrock Mining Conference, Denver Colorado, May 7-9, 2002.

Sinton, P. O., 1998, Problems Applying MODFLOW-Style Models to Three-Dimensional Flow: Water Resources and the Urban Environment, Proceedings of the 25th Annual Conference on Water Resources Planning and Management, American Society of Civil Engineers, pp. 655-660.

Loehr, C. A., B. H. Becker, D. E. Burns, R. M. Huntley, S. M. Rood, P. O. Sinton, and T. H. Smith, 1994, Preliminary Scoping Risk Assessment for Waste Pits, Trenches, and Soil Vaults at the Subsurface Disposal Area, Idaho National Engineering Laboratory: EG&G Idaho, EGG-WM-11181.2.

Moreno, J. L. and P. O. Sinton, 1994, Are Density Effects of Dissolved Contaminants Important?: presented at 1994 Groundwater Modeling Conference, Colorado State University, Fort Collins, Colorado, August 10-12, 1994.

Lewis, S. M., P. O. Sinton, M. J. Condran, and J. W. Gordon, 1992, Remedial Investigation Report for the Test Reactor Area Perched Water System (Operable Unit 2-12): EG&G Idaho Inc., EGG-WM-10002.

Downey, J. S., and P. O. Sinton, 1990, Geohydrology and Groundwater Geochemistry at a Sub Arctic Landfill, Fairbanks, Alaska: U.S. Geological Survey Water Resources Investigations Report 90-4022.

Sinton, P. O., 1989, Characterization of the Large Horizontal Hydraulic Gradient Beneath the North End of Yucca Mountain, Nevada: AGU v. 70 n. 15.

Sinton, P. O., and J. S. Downey, 1986, Three Dimensional, Finite Difference, Steady State Groundwater Flow Model of the Death Valley Groundwater Flow System, Nevada, California: EOS, v. 67, n. 44; also presented at the Rocky Mountain Section of GSA, May 1987.

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526

Pete Sinton

Principal Hydrogeologist

EDUCATION

M.E., 1987, Geological Engineering (Hydrogeology), Colorado School of Mines, Golden, CO

B.S., 1984, Geological Engineering, Colorado School of Mines

Fundamentals of Stochastic Modeling of Flow and Transport in Porous Formations, IGWMC

Dense, Immiscible Phase Liquid Contaminants (DNAPLs) in Porous and Fractured Media

PROFESSIONAL HISTORY

AquaGeo, Ltd., President and Principal Hydrogeologist, 2007-Present
URS Corporation, Senior Hydrogeologist, 1999 to 2007
Dames & Moore, Hydrogeologist, 1989-1999

REFERENCES

Dr. Leslie Smith, University of British Columbia, 604.822.4108

John Korolsky, Freeport McMoRan Safford Inc., 928.651.5482

Doug Bartlett, Clear Creek Associates, 480.659.7131

Joanna Moreno, Golder Associates, 720.920.4616

Peter Townsend, Formation, 303.442.0267

11560 Penny Rd
Conifer, CO 80433
(720) 324-7863
(720) 841- 5526