

Bill Wingle, Ph.D.
Hydrogeologist / Programmer



Dr. Wingle has over 21 years of experience focused on geology, hydrogeology, groundwater modeling, statistics, geostatistics, geographic information systems (GIS), and software development. He has been applying state-of-the-art groundwater models to solve local to regional scale contaminant, mine site, and water supply problems. His experience in these fields and extensive software engineering expertise enable him to develop and distribute proprietary and open-source software systems designed to integrate groundwater flow and contaminant transport models, statistical and geostatistical techniques, computer visualization, and desktop and web-based GIS systems. These tools ultimately reduce costs and improve product quality. In addition to custom software, he is well versed and consults using MODFLOW, MT3D, FEFLOW, PEST, UCODE, and ArcMap.

SELECTED GROUNDWATER MODELING AND COMPUTING EXPERIENCE

Groundwater Flow, Contaminant Transport, and Surface Water Modeling

FEFLOW (including the IFM API), Groundwater Vistas, MODFLOW (96, 2000, 2005, SURFACT), MT3D, PEST, UCODE, VS2DTi, CFEST, and CFEST-INV, and UNCERT.

GIS Applications and Programming

ArcMap and ArcObjects, Spatial Analyst, Google Map API.

Programming Languages

C, C# (.Net), C++, VBA, Python, PHP, Flash MX and ActionScript, FORTRAN, Pascal, Java, JavaScript, KML, CGI, Perl, Postscript, SQL, and X11 and OSF/Motif, and HTML.

EXPERIENCE

Hydrogeologic Characterization | Ground-Water Flow and Contaminant Transport Modeling

- *Copper Mine, Peru (Confidential)*: Used FEFLOW to run 3D steady-state and transient flow models to evaluate groundwater flow patterns and seepage issues arising from operation of a mine tailings dam. Developed custom FEFLOW add-ons (IFM plug-ins) to perform specific tasks (water-table and storage analyses), and integrated Access database methods to automatically generate material distributions (hydraulic conductivity, specific yield, storativity) based on site geology and engineered structures.

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- *Heap-Leach Pad, Mexico (Confidential)*: Aided modeling analyses to predict the capture and containment of pregnant leach solution (PLS) under no-engineering and various engineering conceptual design scenarios. A 2D, cross-sectional, transient, variably-saturated model simulated flow of PLS through the ore heap to discharge points and estimated PLS loss to underlying geologic materials.
- *Freeport McMoRan Safford Inc. (FMSI)*: Aided in the development, calibration, and data processing of a detailed 3D FEFLOW model evaluating the regional impacts of open pit mining. Developed custom ArcMap programs, FEFLOW IFM add-ons, and stand-alone programs to perform specific tasks (cross-section analysis, automated mesh smoothing and layer spacing, pit-lake formation, storage analysis, etc.).
- *Michigan Superfund Site (Confidential)*: Updated model to account for new cut-off wall and wetland to contain contaminated zone. Predicted effects of alternative pumping designs intended to contain contaminant plumes so that the plumes do not impact nearby streams and wetlands. Calibrated MODFLOW model to historical data and to a series of pump tests designed to stress local site and creek system.
- *U.S. Bureau of Reclamation (BOR) Red Bluff Diversion Dam (RBDD) and Fish Passage Improvement Project (FPIP)*: Assisted development of a 3D FEFLOW model to evaluate the effects of the proposed FPIP on the flow system, and its impacts to water-table levels in an adjacent landfill. Responsibilities included pre- and post-processing model data, and setting up and running model predictions. Developed custom tools in C++ and Python for ArcMap and Spatial Analyst libraries to automatically convert model input and output data into GIS ready file formats. Extensive work with ArcMap used to visually communicate project tasks, data, results, and issues to the BOR.
- *Southern Nevada Water Authority (SNWA)*: Team member that developed a 3D regional ground-water flow model for the Clark, Lincoln, and White Pine Counties Groundwater Development Project. Model results used in support of an EIS to develop an alternative water supply for Las Vegas. Responsibilities included pre- and post-processing of model data, programmatically building model files from source data, calibration, sensitivity analysis, parameter estimation, and predictions. Used MODFLOW-2000 and UCODE for automated calibration. Developed custom data visualization and evaluation tools in C++ and Python, in conjunction with ArcMap and Spatial Analyst. Extensive work with Google Earth and ArcMap to visually communicate results to key stakeholders.

- *Nye County, Nevada*: Assessed the impacts of simplifying assumptions made in the conceptualization and simulation of the of the Death Valley Regional Flow System (DVRFS) model created by the USGS and DOE. Developed cross-sectional ground-water models to assess uncertainties that might potentially alter predicted impacts. Extensive work with Google Earth and ArcMap.
- *Open Pit Mine, Nevada*: Modeled steady-state and transient conditions using MODFLOW SURFACT and Groundwater Vistas. Evaluated and validated existing calibrated models. Developed and evaluated mining alternatives and the no-action scenario. Modeled sediment compaction using MODFLOW's IBS package. Modeled pit-lake formation at the end of mining using LAK2. Performed sensitivity analysis on selected parameters using PEST on steady-state and transient models.
- *Contaminant Transport and Biodegradation, Florida*: Adjusted existing SUTRA model to predict α -BHC travel times and concentrations to a nearby lake. Used BioScreen to calibrate biodegradation rates.
- *Slurry-Wall Evaluation, New Jersey*: Updated and re-calibrated a model of a site bordered by a containment (slurry) wall and adjacent to a river. Integrated USGS stream-gage data into the model. Integrated well logs. Updated well, water level, and river data in the SQL database. Performed steady-state sensitivity analysis using PEST. Primary modeling software was Groundwater Vistas and MODFLOW SURFACT.

GIS & Database Software Development

- *FEFLOW*: Develop C++ and python plug-ins using the DHI-WASY IFM API to simplify zone-based data input, schedule boundary-condition changes, calculate transient water storage, simulate mine-pit dewatering and the formation of post-mining pit lakes, and calculate the elevation of the water-table from simulated saturation.
- *FEFLOW and MODFLOW*: Develop C++ programs for pre- and post-processing FEFLOW and MODFLOW data sets. Automated generation of ArcMap shape files for efficient visualization. Automated generation of model input data from diverse data streams. DOS, UNIX (bash), and python scripting.
- *Owens Lake (SCADA)*: Developed C# program and Microsoft Access database to calculate evapotranspiration rates from temperature, vapor pressure, solar radiation, and time of day using the Penman Equation. Used VBA to evaluate transient pond levels.

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- *Google Earth*: Developed tools to convert site and model data into 2D and 3D data files for visualization.
- *Google Maps*: Developed a web site using Google Maps API, linked to MySQL database, for mapping trails and geo-locating photographs. Wrote C# program to geo-locate photographs, based on GPS coordinates.
- *GPS Maps*: Created custom maps for Garmin GPSs (contours, hydrology, human features) using various commercial and custom software. Data from USGS 10m DEM data, US Census Bureau TIGER data, and various other federal, state, and local sources.

Geostatistical Software Development

- *NFGeostats*: Developed an ArcGIS Add-In to interactively select and statistically evaluate 2D point data in ArcMap. Developed a supporting C# program to model semivariograms and kriging the point data.
- *UNCERT*: Developed open-source software to integrate groundwater flow and transport modeling, geostatistical techniques (kriging, conditional simulation, imprecise data), and 2D and 3D computer visualization. The software is written in C (with some FORTRAN) utilizing X11 and motif libraries, socket communications for parallel process on multiple computers, and Postscript.
- Developed interactive, web-based semivariogram tutorial using JavaScript, and Java applets.

Groundwater Modeling Software Development

- [*ZoneTable*](#): Plug-in for FEFLOW to manage zone-based parameter values.
- [*PitLakeBC*](#): Plug-in for FEFLOW to simulate formation of a pit lake after mining of an open pit ceases.
- [*ModelUtil*](#): Plug-in for FEFLOW to calculate water-table levels and transient changes in storage.
- *VS2DTi*: Collaborated with the USGS to develop a GUI interface for *VS2DT* using Java with the Swing library.
- *CFEST-INV*: Improved *CFEST-INV*, an inversion enhancement to *CFEST* developed by Battelle. Improvement tested on data from the Hanford 300 Area, Richland, Washington.

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Other Software Development

- *Companion Touchscreens*: Developed attractive, easy-to-use, easy-to-install, graphical touch-screen software to control multiple home systems, including security, lighting, HVAC, and audio / video systems using C, C++, ActionScript, JavaScript, and Macromedia Flash MX for quasi-embedded Linux client / server platforms. Communication protocols used for device interaction: RS-232, RS-485, ethernet, and HTTP. Duties included software design and implementation, quality assurance, and customer support.
- *iCenter Touchscreen*: Developed user-friendly, graphical, touch-screen interface for a home security system. System capable of standard security functions, scheduling, X10 lighting, and paging; in-house messaging, and download of headlines, stories, weather from the internet; and automated, remote software updates. Software written in C, C++, and ksh for QNX embedded OS on a custom National Semiconductor GEODE x86 platform.
- *Gas Furnace*: Wrote a control system in Pascal, C, and Assembly for a 64 KB embedded system to control a throttled 200,000 to 600,000 btu gas furnace. Controls involved monitoring thermistors, positioning step motors (gas/air throttles), monitoring and toggling switches, and tracking energy demand through time

SELECTED PUBLICATIONS/PRESENTATIONS

Journal Articles:

Wingle, W.L., E.P. Poeter, and S.A. McKenna, 1999, UNCERT: Geostatistics, Uncertainty Analysis, and Visualization Software Applied to Groundwater Flow and Contaminant Transport Modeling, *Computers and Geosciences*, Vol. 25, No. 4, pp 365-376.

Poeter, E.P., S.A. McKenna, and W.L. Wingle, 1997, Improving Groundwater Project Analysis With Geophysical Data, *The Leading Edge*, November 1997, pp 1675-1681.

Wingle, W.L., and E.P. Poeter, 1993, [Uncertainty Associated with Semivariograms Used for Site Simulation](#), *Ground Water*, Vol. 31, No. 5, pp. 725-734.

Proceedings, Articles, & Abstracts:

Sinton, P., and W.L. Wingle, 2015, FEFLOW Model of a Copper Mine, Arizona, USA, FEFLOW 2015 Conference: Modeling the World of Groundwater With Mike by DHI, September 21-25, 2015, Berlin, Germany.

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Wingle, W.L., and P. Sinton, 2015, A Pit-Lake Module for FEFLOW, MODFLOW and More 2015: Modeling a Complex World, June 1-3, 2015, Colorado School of Mines, Golden, Colorado.

Wingle, B., 2014, We Can All Make Good Maps, Hoof Print, Summer 2014, North American Trail Ride Conference, <http://www.natrc.org/hooftprint/2014SmrHoofPrint.pdf>.

Wingle, W.L., 2013, Comparing Models: A MODFLOW Model Calculator with GIS Support (poster), MODFLOW and More 2013: Translating Science into Practice, June 2013, Colorado School of Mines, Golden, Colorado.

Wingle, W.L., and E.P. Poeter, 1999, Geostatistical Analysis and Training via the Internet, APCOM'99: Computer Applications in the Minerals Industries 28th International Symposium, October 20-22, 1999, Colorado School of Mines, Golden, Colorado.

Wingle, W.L., and E.P. Poeter, 1998, [Classes vs. Thresholds: A Modification to Traditional Indicator Simulation](#), Advances in Geostatistics, 1998 AAPG Annual Meeting, Salt Lake City, Utah, May 17-20, 1998.

Wingle, W.L., and E.P. Poeter, 1998, [Directional Semivariograms: Kriging Anisotropy Without Anisotropy Factors](#), Advances in Geostatistics, 1998 AAPG Annual Meeting, Salt Lake City, Utah, May 17-20, 1998.

Wingle, W.L., and E.P. Poeter, 1996, [Evaluating Subsurface Uncertainty Using Zonal Kriging](#), Uncertainty '96 (ASCE), University of Wisconsin, Madison, Wisconsin, August 1-3, 1996. (*Download 148 K*)

Wingle, W.L., and E.P. Poeter, 1996, [Site Characterization, Visualization, and Uncertainty Assessment Using Zonal Kriging and Conditional Simulation](#) (Live Demonstration / Poster), Global Exploration and Geotechnology, 1996 AAPG Annual Meeting, San Diego, California, May 19-22, 1996.

Wingle, W.L., and E.P. Poeter, 1993, Evaluating Uncertainty Associated with Semivariograms Applied to Site Characterization, IGWMC Ground Water Modeling Conference, Golden, Colorado, pp. P-96 to P-105.

Wingle, W.L., 1992, [Examining Common Problems Associated with Various Contouring Methods, Particularly Inverse-Distance Methods, Using Shaded Relief Surfaces](#), Geotech '92 Conference Proceedings, Lakewood, Colorado, pp. 362-376. (*Download 435 K*)

Wingle, W.L., and E.P. Poeter, 1992, Evaluation of Uncertainty Associated with Contaminant Migration in Groundwater - A Technically Feasible Approach, (Best Ph.D. Speaker), Proceedings of the Twelfth Annual American Geophysical Union Hydrology Days, Fort Collins, Colorado, pp. 27-37.

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Gaylord, D.R., E.P. Poeter, W. Belcher, P. Townsend, W.L. Wingle, K.A. Lindsey, H.J. Corner, L.D. Stetler, C. Knaack, 1989, Geology and Geohydrology of the 300 Area: Recommendation for FY90-91 Research, Battelle Pacific Northwest Laboratories.

Computer Programs and Tutorials:

Wingle, W.L., and P. Sinton, 2015, [Zone Table](#), AquaGeo, Ltd., Conifer, CO.

Wingle, W.L., and E.P. Poeter, 2000, [Geostatistical Analysis Tutor](#), Colorado School of Mines, Golden, CO.

Hsieh, P.A., W.L. Wingle, and R.W. Healy, 1999, [VS2DTI - A Graphical User Interface for the Variably Saturated Flow and Transport Computer Program VS2DT](#), USGS WRI-99-4130, pp 17.

Wingle, W.L., E.P. Poeter and S.A. McKenna, 1995, [UNCERT: A Geostatistical Uncertainty Analysis Package Applied to Groundwater Flow and Contaminant Transport Modeling](#), Colorado School of Mines.

Wingle, W.L., 1994, Graphix: A simple library of C and FORTRAN callable X-windows/Motif graphics routines, Colorado School of Mines.

Wingle, W.L., 1990, 3D, Isometric Solid Surfacing and Shading, Wingle Hydrogeology.

Dissertation & Thesis:

Wingle, W.L., 1997, Evaluating Subsurface Uncertainty Using Modified Geostatistical Techniques, Ph.D. Dissertation #T-4595, Department of Geology and Geological Engineering, Colorado School of Mines.

Wingle, W.L., 1991, Development of Guidelines for Inverse-Method Groundwater Flow Modeling, Master's Engineering Report #ER-3864, Department of Geology and Geological Engineering, Colorado School of Mines.

EDUCATION

Ph.D., 1997, Geological Engineering, Colorado School of Mines, Golden, CO. Dissertation: *Evaluating Subsurface Uncertainty Using Modified Geostatistical Techniques*, Ph.D. Dissertation #T-4595.

M.E., 1991, Geological Engineering, Colorado School of Mines, Golden, CO. Thesis: *Development of Guidelines for Inverse-Method Groundwater Flow Modeling*, Master's Engineering Report #ER-3864.

B.S., 1988, Geological Engineering (with Math and Computer Science Minor), Colorado School of Mines, Golden, CO.

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B.S.B.A., 1983, Business Management, University of Denver, Denver, CO.

PROFESSIONAL HISTORY

AquaGeo, LTD, Senior Hydrogeologist, 2012 - Present

NewFields, LLC, Senior Hydrogeologist / Programmer, 2006 - 2012

Geomega, Inc., Boulder, CO. Senior Groundwater Hydrogeologist. 2005 - 2006

Convergent Living, LLC, Senior Software Engineer. 2005 - 2006

CorAccess Systems, LLC, Senior Software Engineer. 2002 - 2005

Qubit Technologies, Senior Software Engineer. 2000 - 2001

Colorado School of Mines, Department of Geology and Geological Engineering and Computing and Networking, Golden, CO:

- Research Associate Professor. 1997 – 2000,
- Research Assistant Professor and Research Assistant. 1991 – 1997,
- UNIX System Administrator / Campus Webmaster. 1990 – 2000,
- Research/Teaching Assistant. 1988-1990

Wingle Hydrogeology, Hydrogeologist/Software Developer. 1989 - 2006

Pressel & Company, Computer Programmer. 1987 - 1989

Copper Range, Geological Technician (University CO-OP program). 1986