MICHAEL L. VOORHEES, Ph.D.

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Education

Ph.D. - Civil Engineering - University of Illinois, Chicago, Illinois *1982*

M.S. - Engineering- University of Illinois, Chicago, Illinois *1976*

B.S. - Engineering - Colorado State University, Fort Collins, Colorado *1974*

Professional Background

Michael L. Voorhees, Consultant, Broomall Pennsylvania - Sole Proprietor *1998 – Present*

Dr. Voorhees contracts to GeoHydros on an as needed basis to perform numerical groundwater modeling and parameter estimation/ optimization. To that end, Dr. Voorhees has designed and developed a proprietary suite of software to perform automated statistical model parameter optimizations that result in globally optimized model calibrations. His work is specifically designed to render the most reliable and legally defensible groundwater and/or fate and transport models achievable. Dr. Voorhees is one of the best known groundwater resource modelers in the nation and is continually called upon by federal, state, and county agencies to assist in defensibly delineating groundwater protection zones and identify capture zones for municipal supply wells. Through his various capacities for those agencies, he has developed customized 2-D and 3-D modeling software and GIS interfaces, trained agency staff on model usage, and independently performed and optimized models to support delineation efforts. In addition, Dr. Voorhees is routinely called upon to review models developed by other firms for projects involved in litigation or other forms of scrutiny. He has provided expert testimony for numerous cases including Osceola Fish Farmers vs. State of Florida and the City of Wichita vs. Reid Supply Company.

EH Systems, Inc., Sarasota Florida **-** *President, Chairman of the Board, Principal Engineer* *1997 – 1998*

Dr. Voorhees was a partner in the development of a water resources consulting firm. He served as the primary engineer responsible for source water protection as well as groundwater and surface water modeling projects, and water resource projects. He managed four engineers and geologists in the office, guided project development, provided expert testimony services.

Environmental Science & Engineering, Inc., Sarasota Florida- Vice President *1985 – 1994*

Dr. Voorhees was the Vice President in charge of all water resource modeling for company nation-wide. He directly managed 60 engineers and geologists in the Tampa and Sarasota offices performing all levels of water resources consulting. He also provided expert testimony services for cases in state and federal courts including the Bull Creek, Florida salt water intrusion problem which was ultimately settled in the Florida Supreme Court and the State of Florida vs Great Lakes Chemical, which was heard in federal court.

Projects of Note

Broward County, Florida Department of Natural Resource Protection - Regional Groundwater Water Supply Protection Modeling Study

Calibrated a 3D regional model utilizing a revised version of the MODFLOWP and InterSat inverse solution models using his proprietary model optimization software. The model included over 40 major public water supply wells, numerous canals that are used for artificial recharge, salt water intrusion areas which were modeled near the Atlantic coastline, and over 200 transmissivity measurements from the Biscayne surficial aquifer. Recharge to the aquifer for all land uses was calibrated using over 2,000 groundwater monitor well measurements throughout Broward County from 1989 through 1992 and was subsequently verified to data collected from the same wells from 1993 to 1994. Software was developed for interactive development of wellhead capture zones that was linked to an ARC/INFO system. The results of this effort have been considered for use as a groundwater recharge forecasting tool (using feed-forward control) in the management of droughts by the South Florida Water Management District who is responsible for the water resources management and the restoration of the Everglades.

Bull Creek Salt Water Intrusion Project - Water Resource Modeling & Project Management

Project manager of study to evaluate the potential impacts of proposed pumpage on saltwater intrusion. Includes the development of a three-dimensional groundwater flow model as well as a three dimensional density-dependent solute transport model. Performed expert testimony on what has been termed "The Mother of all Florida Water Wars" in five-week hearing. Modeling effort was successfully defended and the hearing officer ruled in favor of all modeling efforts performed by ESE.

Groundwater Modeling, Geostatistics, and Neural Network Technology

Task Manager for modeling at one of the largest RCRA contamination facilities in the Eastern U.S. Have performed formal inverse solution modeling using MODFLOW Inverse to the solution of observed transient groundwater flow at over 250 monitor wells with over 600 observations. Flow model is calibrated to a highly anisotropic saprollite. Geostatistics, using GeoKrige, was performed to determine the spatial variability of hydraulic conductivity. Neural network technology was developed and performed to independently determine the spatial variation of aquifer recharge and specific yield. This work is presently being defended before the regulatory agencies.

Well Field Protection Study, Collier County, Florida - Project Director

Author and Project Director of study to determine well field protection areas for 10 well fields in Collier County. A regional groundwater flow model was calibrated using a nonlinear optimization technique and water-level records for 128 monitoring stations to describe boundary conditions for individual well field models. Contour maps of transmissivity were developed using kriging. Well field submodels of groundwater flow and solute transport were used to describe the diversion area in which ground water flows through the aquifer to the production well. Diversion areas were mapped for each well field and each production well. County staff were trained on the use of groundwater flow and transport models. This represented one of the most comprehensive wellhead protection studies that has been performed.

Everglades Alligator Lake Chain Drawdown - Expert Testimony

Developed three-dimensional unsaturated/saturated groundwater flow model based on proprietary model developed by author (InterSat). Successfully calibrated regional model to wetlands, surficial aquifer, Floridan aquifer, and surface water lakes, canals, and streams. Model is being used by landowners impacted by excess lake drawdown initiated by the State of Florida and the Corps of Engineers.

Rosebud Sioux Indian Reservation - Fate and Transport Modeling

Fate and Transport Modeling of Proposed Landfill for Rosebud Sioux Indian Reservation. Developed a model by linking the HELP (Hydrologic Evaluation of Landfill Program) and the EPA MultiMed Models to evaluate risk of multi-constituent transport from a landfill site. Additional software was developed to include the uncertainty of off-centerline plume concentrations which is not available in the present MultiMed model. Dynamic landfill cell propagation was also simulated.

Groundwater Modeling, Geostatistics, and Neural Network Technology - Task Manager

Developed calibrated groundwater model for one of the largest RCRA contamination facilities in the Eastern U.S. Performed formal inverse solution modeling using MODFLOW Inverse for observed transient groundwater flow at over 250 monitor wells using over 600 observation points. Flow model was calibrated to a highly anisotropic saprollite. Geostatistics, using GeoKrige, was performed to determine the spatial variability of hydraulic conductivity. Neural network technology was developed and performed to independently determine the spatial variation of aquifer recharge and specific yield.

Selected Publications & Presentations

Prickett, T.A., Voorhees, M.L., and B.L. Herzog, "Comparison of One-, Two-, and Three-Dimensional Models for Mass Transport of Radionuclides," Camp Dresser and McKee/WRD, Technical Memorandum for Lawrence Livermore Laboratories, University of California Purchase Order 5696609, not for reprint, 87 pages, September, 1979.

Prickett, T.A. and M.L. Voorhees, "Selected Hand-Held Calculator Codes for the Evaluation of Cumulative Strip-Mining Impacts on Groundwater Resources," Prepared for the Office of Surface Mining, Region V, Denver, Colorado, by Thomas A. Prickett & Associates, Urbana, Illinois, March 1, 1981.

Prickett, T.A. and M.L. Voorhees, "Groundwater Flow Model for Exxon Orebody, near Crandon, Wisconsin," Prepared for Exxon Minerals Company, Rhinelander, Wisconsin, January, 1982.

Prickett, T.A. and M.L. Voorhees, "The Hydrologic Impacts of Strip Mining Near Gillette, Wyoming (Caballo and Rawhide Mines)," Report Prepared for Carter Mining Company, March 1982.

Terstriep, M.L., Stall, J.B., and M.L. Voorhees, "User's Guide for ILLUDAS," in Workshop Notes on Storm Sewer System Design, Yen, B.C., Ed., Dept. of Civil Engineering, University of Illinois, Urbana, Illinois, pp. 229-256, 1978.

Terstriep, M.L., Voorhees, M.L., and G.M. Bender, "Conventional Urbanization and its Effect on Storm Runoff," Il DOT, Division of Water Resources, Contract No. 47-26-84-390, August 1976.

Voorhees, M.L. and H.G. Wenzel, "Urban Design Storm Sensitivity and Reliability," V.T. Chow Memorial, Journal of Hydrology, January, 1984.

Voorhees, M.L. and T.A. Prickett, "User's Guide for an Interactive Groundwater Flow Management Model," Prepared for Vulcan Materials Company, Chemicals Division, Wichita, Kansas, May 1982.

Voorhees, M.L. and T.A. Prickett, "Groundwater Inflow Model for the Proposed Crandon Mine (Final Report)," Prepared for Exxon Minerals Company, Rhinelander, Wisconsin, December, 1982.

Voorhees, M.L., and H.G. Wenzel, "Sensitivity and Reliability of Design Storm Frequency," Second International Conference on Urban Storm Drainage, Water Resources Publications, Urbana, Illinois, June 14-19, 1981.

Voorhees, M.L., "TI-59 Calculator Program for Storm Sewer Design Using Rational Method," in Workshop Notes on Storm Sewer System Design, Yen, B.C., Ed., Dept. of Civil Engineering, University of Illinois, Urbana, Illinois., pp. 257-272, 1978.

Voorhees, M.L. and T.A. Prickett, "Selected Hand-Held Calculator Codes for Collector Well Analysis," Camp Dresser and McKee/WRD, Report for Contract with Ranney Company, not for reprint, 98 pages, 1978.

Voorhees, M.L. and T.A. Prickett, "Selected Hand-Held Calculator Codes for Aquifer Analysis," Camp Dresser and McKee/WRD, not for reprint, May, 1979.

Voorhees, M.L., and P.N. Walker, "Tractionability as a Function of Soil Moisture," Transactionsof the ASAE, Vol. 20, No. 5, pp. 806-809, 1977.

Walton, W.C., Voorhees, M.L., and T.A. Prickett, "Conceptual Model for Regional Radionuclide Transport from a Basalt Repository Site," Technical Memorandum for Lawrence Livermore Laboratories, University of California, not for reprint, May, 1980.

Wenzel, H.G. and M.L. Voorhees, "An Evaluation of the Urban Design Storm Concept," University of Illinois Water Resources Center Publication, October, 1981.

Wenzel, H.G., Jr., and M.L. Voorhees, "Adoption of ILLUDAS for Continuous Simulation," ASCE Jour. of Hydraulics, Vol. 106, No. HY11, pp. 1795-1812, November, 1980.

Registrations & Affiliations

Graduation with honors from Colorado State University	1974
Colorado Gamma of Phi Delta Theta Social Fraternity Scholastic Achievement Award	1970-71
Dean's List Colorado State University	1971

Alpha Epsilon Agricultural Engineering Honorary, Secretary at Colorado State University Chapter

Sigma-Tau Engineering Honorary

Jesse E. Hackett Engineering Fellowship Recipient at University of Illinois.

Gamma Sigma Delta Agricultural Honorary

The Society of Sigma Xi Research Honorary

Invited Publication Ven T. Chow Memorial Publication, Journal of Hydrology

Invited Lecturer American Institute of Hydrology C.V. Theis Memorial

Who's Who