

CHRISTOPHER J. NEVILLE

Hydrogeologist

AREAS OF EXPERTISE

- Quantitative Interpretation of Hydrogeologic Data
- Groundwater Flow Modeling
- Solute Transport Modeling
- Peer Review
- Litigation Support and Expert testimony
- Professional Instruction

SUMMARY OF QUALIFICATIONS

Mr. Neville directs the Canadian operations of S.S. Papadopoulos & Associates, Inc. from its Waterloo, Ontario office. His experience is as a groundwater hydrologist, with particular emphasis on quantitative analysis of groundwater flow and solute transport. He has synthesized hydrogeologic data, evaluated and designed protections for groundwater resources, developed regional groundwater flow models, and analyzed and designed remedial measures.

Mr. Neville has developed and documented large-scale three-dimensional numerical models for industrial, mining, and government clients, and has reviewed numerous site-specific hydrogeologic analyses and groundwater modeling codes. He has extensive experience in the development of work plans for groundwater projects, directs groundwater modeling studies, and serves as a senior peer-reviewer. Mr. Neville is actively involved in the development of professional short courses in the interpretation of pumping tests and groundwater modeling, and he assists in teaching graduate courses at the University of Waterloo.

REPRESENTATIVE EXPERIENCE

S.S. Papadopoulos & Associates, Inc., Waterloo, Ontario
Canada

INTERPRETATION OF HYDROGEOLOGIC AND GEOCHEMICAL DATA

- **Onondaga, New York** — Developed a solute transport analysis to estimate Darcy flux through lakebed sediments from concentration profiles.
- **Region of Waterloo, Middleton Street Well Field** — Interpreted hydraulic testing data in fractured rock.
- **Schlage Lock Company, Colorado Springs, Colorado** — Modified and applied an axisymmetric finite-difference model for the interpretation of aquifer pumping tests.
- **Chem-Dyne site, Hamilton, Ohio** — Developed and applied MODFLOW models for the interpretation of stepped-rate aquifer tests.
- **Texas-Eastern Gas Transmission Company, Houston, Texas** — Prepared a closure plan for a pump-and-treat remediation system of a BTEX plume in fractured porous-media.

YEARS OF EXPERIENCE: 20+

EDUCATION

- MSc**— Earth Sciences (Hydrogeology), University of Waterloo, 1992
- MEng**—Course work for Civil Engineering (Geotechnical), University of Alberta, 1985–1987
- BEng**—Civil Engineering, McGill University, 1985

REGISTRATIONS

- Professional Engineer**
Ontario No. PEO#100013705
Alberta No. APEGGA #M6100

PROFESSIONAL HISTORY

- S.S. Papadopoulos & Associates, Inc.**
Associate, 2010
Senior Hydrogeologist, 1999 to present
Project Hydrogeologist, 1993–1996
- Conestoga-Rovers & Associates, Inc.**
Senior Hydrologist, 1998
- Klohn-Crippen Consultants Ltd.**
Senior Hydrogeologist, 1997
- University of Waterloo**
Dept. of Earth Sciences, Research Assistant, Research Associate in Hydrogeology, 1987–1992

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GROUNDWATER FLOW MODELING FOR WATER RESOURCES DEVELOPMENT AND PROTECTION

- **Region of Waterloo, Ontario** — Directed the development of a regional groundwater flow analysis to support an application for additional water takings in the Cambridge East area.
- **Itapúa, Paraguay** — Directed the development of a regional groundwater flow model of the Guaraní transboundary aquifer for the region adjacent to the Paraná River in eastern Paraguay.
- **Prey Veng and Svay Rieng Provinces, Cambodia** — Directed the development of a regional groundwater flow model of southeastern Cambodia for the evaluation of the feasibility of the development of large-scale groundwater withdrawals for irrigation.
- **Town of Colgan, Ontario** — Developed a regional groundwater flow model to delineate a wellhead protection area for a proposed new municipal supply well.
- **Region of Waterloo, Middleton Street Well Field** — Directed the development of groundwater modeling analyses to support the delineation of capture zones and the estimation of the sustainable yield of the well field.
- **Region of Waterloo, Greenbrook Well Field** — Developed analyses to predict water-level recoveries following the shutdown of the well field.
- **Region of Waterloo, Cedar Creek Groundwater Study** — Conducted the development of conceptual and numerical regional models.
- **Region of Waterloo, Mannheim Well Field** — Directed the delineation of capture zones for municipal supply wells.
- **Town of Marathon, Ontario** — Directed the development of a groundwater model to delineate wellhead protection areas for municipal wells.

GROUNDWATER FLOW MODELING TO SUPPORT THE DESIGN OF REMEDIAL MEASURES AT CONTAMINATED SITES

- **Glenn Springs Holdings, Inc. (Occidental Chemical Corporation), Hyde Park Landfill, Niagara Falls, New York** — Directed the development of a large-scale MODFLOW model to evaluate capture of contaminated groundwater and to optimize remedial actions. Assignments included the development of work plans for data collection and interpretation, the supervision of hydraulic test analysis, and supervision of groundwater modeling.
- **Gurabo, Puerto Rico** — Directed numerical flow and solute transport modeling to evaluate the performance of a pump-and-treat system.
- **Massachusetts Military Reservation, Cape Cod** — Developed an analysis to predict the extent of groundwater mounding due to the re-injection of treated groundwater.
- **Schlage Lock Company, Colorado Springs, Colorado** — Developed a MODFLOW model to assist in the evaluation of alternative pump-and-treat designs for remediation of a PCE plume.
- **Pacific Gas & Electric Company, California** — Developed and documented a MODFLOW-MT3D model for simulating the evolution of a plume of chromium-contaminated groundwater; developed and documented a groundwater-flow and solute-transport model for the evaluation of remedial pumping alternatives.
- **Oregon Department of Environmental Quality, Portland** — Developed and applied a method of analysis for optimizing the placement of recovery wells for remediation of a large plume of TCE-contaminated groundwater and protection of the City of Portland's emergency water supply.

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- **Eastman Kodak Company, Rochester, New York** — Assisted in the development of a regional groundwater model with automatic telescopic mesh refinement capabilities. Developed a user manual for the model and provided a training course to enable Kodak staff to evaluate proposed remedial measures at the facility. Directed the updating of the model.
- **Pyrite Canyon Group, California** — Developed numerical air-flow and groundwater-flow models to assist in the evaluation of remedial measures at the Stringfellow Acid Pits. Conducted analyses for feasibility studies of remediation of shallow organic contamination, using dewatering and soil vapor extraction. Also developed analyses for evaluating the performance data from a horizontal well constructed in fractured bedrock and for predicting the long-term efficacy of the well for plume remediation.

SENIOR PEER REVIEW

- **Hanson Brick Co., Oakville, Ontario, Canada** — Provided senior peer review for the Region of Halton for the assessment of a proposed shale quarry.
- **Nelson Quarry, Burlington, Ontario, Canada** — Provided senior peer review for the Region of Halton for the assessment of a proposed expansion of a dolostone quarry.
- **Ontario Ministry of the Environment** — Served on the peer review panel for the development of guidance documents for Source Water Protection.
- **Credit Valley, Toronto and Region, and Central Lake Ontario Conservation Authority (CTC) Source Water Protection Region, Canada** — Served as senior peer review for the development of water budget studies and water quantity risk assessment.
- **Grand River Conservation Authority Source Water Protection, Canada** — Served on a peer review panel for the development of water budget studies and water quantity risk assessment.
- **Lake Erie Source Water Protection Region, Canada** — Served on a peer review panel for the development of water budget studies and water quantity risk assessment for the Long Point, Kettle Creek, and Catfish Creek Conservation Authorities.
- **York-Peel-Durham-Toronto (YPDT) Oak Ridge Moraine Groundwater Model, Ontario, Canada** — Provided senior peer review for the development and application of a large-scale regional groundwater flow model of the Oak Ridge Moraine area.
- **Waste Management Canada Richmond Landfill, Ontario** — Provided senior peer review for the analysis of the impacts of landfill expansion.
- **Arkell Spring Grounds, City of Guelph, Ontario, Canada** — Provided senior peer review in the analysis of impacts of increased water takings.
- **Vancouver Wharves Berth 1 Site, Canada** — Provided senior peer review for the modeling of measures to remediate groundwater contaminated with heavy metals.
- **CH2M HILL-Canada, Alder Creek Groundwater Study, Region of Waterloo** — Provided senior peer review in the development of the Alder Creek model.
- **Region of Waterloo Ontario, Canada** — Reviewed the delineation of capture zones for municipal supply wells in the Waterloo Moraine.
- **Smithville Phase IV, Ontario, Canada** — Reviewed groundwater-flow and solute-transport models for the evaluation of remedial alternatives for the Smithville PCB contamination site.

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LITIGATION SUPPORT

- **Pinnacle Heights Golf Course, Orangeville, Ontario** — Provided expert opinion on the reliability of groundwater modeling conducted to evaluate the potential impacts of irrigation pumping for a proposed golf course.
- **Thomson Facility, Marion, Indiana** — Provided expert opinion on the groundwater velocity at the site. The analysis was developed within a stochastic framework.
- **Homestead Golf Course, Michigan** — Reviewed the environmental impact of a proposed golf course development adjacent to a sensitive river.
- **Cities of Vaughn and Pickering, Ontario** — Evaluated the design calculations for proposed municipal waste landfills having complex liners. Reviewed methods for predicting leakage through composite geomembrane liners, developed groundwater mounds due to failure of leachate collection systems, and performed benchmarking of the solute transport code POLLUTE.
- **Duntroon Quarry Expansion, Singhampton, Ontario** — Served as expert witness for the Niagara Escarpment Commission for the assessment of hydrogeologic aspects of the proposed extension of the Duntroon Quarry. Prepared expert witness reports and provided testimony for the Joint Board under the *Consolidated Hearings Act*.
- **Nelson Quarry Expansion, Burlington, Ontario** — Served as expert witness for Halton Region for the assessment of hydrogeologic aspects of the proposed extension of the Nelson Quarry. Prepared expert witness reports and assisted counsel in preparation of cross-examination for the Joint Board under the *Consolidated Hearings Act*.
- **MAQ Highland Quarry, Singhampton, Ontario** — Directed the Experts Meeting and prepared the Statement of Agreed Facts for the proposed MAQ Highland Quarry.

HYDROGEOLOGY TRAINING

- **Critical Thinking in Aquifer Test Interpretation** -- Developer and instructor of professional short course on hydrogeologic testing.
- **International Ground-Water Modeling Center, Colorado School of Mines, Golden, Colorado** — Provided professional short courses in MT3D solute transport modeling.
- **Environment Institute for Continuing Education** — Developed and presented Internet-based seminars.
- **Midwest Geosciences** — Presented short course lectures, developed and presented Internet-based seminars on the interpretation of aquifer tests.
- **Kingdom of Cambodia Ministry of Water Resources and Meteorology** — Provided training for groundwater modeling expertise in Cambodia.
- **Eastman Kodak Company, Region of Waterloo** — Developed and led training courses for site-specific models and technology transfer.

LANGUAGES

French, Portuguese, Spanish

AWARDS & HONORS

Graduate Scholarship, University of Waterloo, 1990

Citation for Reviewing Excellence, Water Resources Research, 2005

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PROFESSIONAL SOCIETIES

International Association of Hydrogeologists
International Ground Water Modeling Center
National Ground Water Association
American Geophysical Union
Canadian Geotechnical Society
Canadian Dam Association

APPOINTMENTS

2010 to Present Canadian Geotechnical Society, Chair of the Hydrogeology Division
1999-2009: Canadian National Chapter of the International Association of Hydrogeologists,
Vice President.
2006-2009: University of Waterloo, Department of Earth Sciences, Adjunct Lecturer.

PUBLICATIONS

BOOKS

Cohen, H., and C. Neville, 2006. Chapter 8: Fate, Transport, and Modeling of Perchlorate in Groundwater. in *Perchlorate: A Scientific, Legal, and Economic Assessment*. (1st ed.), E. Hagstrom, editor. Tucson, AZ: Lawyers & Judges Publishing Company, pp. 267-294.

THESES

Neville, C.J., 1992. An Analytical Solution for Solute Transport with Multiprocess Nonequilibrium Sorption. MS thesis. Department of Earth Sciences, University of Waterloo, Ontario.

PEER REVIEWED JOURNAL PAPERS

- Karanovic, M., C. Neville, and C. Andrews, 2007. BIOSCREEN-AT: BIOSCREEN with an Exact Analytical Solution. *Ground Water*, v. 45, no. 2, pp. 242-245.
- Neville, C., and C. Andrews, 2006. Containment Criterion for Contaminant Isolation by Cutoff Walls. *Ground Water*, v. 44, no. 5, September-October, pp. 682-686.
- Neville, C., and M. Tonkin, 2004. Modeling Multiaquifer Wells with MODFLOW. *Ground Water*, v. 42, no. 6, pp. 910-919.
- Guyonnet, D., and C. Neville, 2004. Dimensionless Analysis of Two Analytical Solutions for 3-D Transport in Groundwater. *Journal of Contaminant Hydrology*, v. 75, pp. 141-153.
- Andrews, C., and C. Neville, 2003. Ground Water Flow in a Desert Basin: Challenges of Simulating Transport of Dissolved Chromium. *Ground Water*, v. 41, no. 2, pp. 219-226.
- Yager, R., and C. Neville, 2002. Review of "GFLOW 2000, An Analytical Element Ground Water Flow Modeling System." *Ground Water*, v. 40, no. 6, November-December, pp. 574-576.
- Neville, C., M. Ibaraki, and E. Sudicky, 2000. Solute Transport with Multiprocess Nonequilibrium: A Semi-Analytical Solution Approach. *Journal of Contaminant Hydrology*, v. 44, pp. 141-159.
- Neville, C.J., 1994. Discussion of "Recommendations for Usage of SURFER to Gridding Model Results," by C. Shan and D.B. Stephens. *Ground Water*, v. 32, no. 6, p. 1037.

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CONFERENCE PUBLICATIONS

- Neville, C.J., 2009. Contaminant Isolation by Cutoff Walls: Reconsideration of Mass Fluxes. Presentation at GeoHalifax 2009 – 62nd Canadian Geotechnical Conference & 10th Joint CGS/IAH-CNC Groundwater Conference, Halifax, Canada, September 20–24, 2009, 7 p.
- Neville, C.J. and G. van der Kamp, 2009. A General Method for Using Recovery Data for Pumping Tests in Complex Hydrogeological Settings. Presentation at GeoHalifax 2009 – 62nd Canadian Geotechnical Conference & 10th Joint CGS/IAH-CNC Groundwater Conference, Halifax, Canada, September 20–24, 2009, 7 p.
- Neville, C., and J. Zhang, 2008. Benchmark Analyses of Solute Transport with Multi-Aquifer Wells. Poster Presentation at MODFLOW and More 2008: Ground Water and Public Policy Conference, International Ground-Water Modeling Center, Colorado School of Mines, Golden, CO, May 18-21, 2008.
- Neville, C.J., 2006. Rehabilitation of the Specified-Concentration Boundary Condition for Solute Transport. Presentation at MODFLOW and More 2006, Managing Ground-Water Systems, International Ground Water Modeling Center, Colorado School of Mines Golden, CO, May 22-24, 2006, v. 2, p. 667–672.
- Tsou, M.-S., K. Tu, J. Kool, C. Neville, and S. Young, 2003. Comparison of Three Numerical Simulation Models for Chain-Decay Transport Simulation at a Closed AFB in Texas. Presentation at MODFLOW 2003, International Groundwater Modeling Center, Colorado School of Mines, Golden, CO, September 17-19, 2003.
- Neville, C., S. Sayko, M. Kuhl, R. Passmore, G. Luxbacher, M. Mateyk, J. Williams, and B. Trytten, 2002. Identification of Groundwater Flow Zones with Borehole Geophysics and Flowmeter Profiling, Hyde Park Landfill Site, Niagara Falls, New York. *in Proceedings of the 2002 Fractured-Rock Aquifers Conference*, National Ground Water Association, Denver, CO, March 2002.
- Williams, J., C. Neville, J. Keizer, and G. Luxbacher, 2002. Characterization of Discrete Flow Zones by Packer Testing, Hyde Park Landfill Site. Presentation at the 2002 National Ground Water Association (NGWA) Northeast FOCUS Ground Water Conference, Burlington, VT, October 3-4, 2002.
- Sorel, D., C. Neville, M. Rafferty, K. Chiang, and C. Andrews, 2002. Hydraulic Containment Using Phytoremediation and a Barrier Wall to Prevent Arsenic Migration. *in Proceedings of the Third International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, Monterey, CA, May 20-23, 2002, A. Gavaskar and A. Chen, editors, Battelle Press.
- Andrews, C., and C. Neville, 2001. Groundwater Flow in a Desert Basin: Complexity and Controversy. *in Proceedings of MODFLOW 2001 and Other Modeling Odysseys*, International Groundwater Modeling Center, Colorado School of Mines, Golden, CO, September 11-14, 2001, pp. 770-775.
- Neville, C., and M. Tonkin, 2001. Representation of Multiaquifer Wells in MODFLOW. *in Proceedings of MODFLOW 2001 and Other Modeling Odysseys*, International Groundwater Modeling Center, Colorado School of Mines, Golden, CO, September 11-14, 2001, v. 1 of 2, pp. 51-59.
- Cohen, H., M. Tonkin, and C. Neville, 2000. Determination of Hydraulic Conductivity Distribution in a Heterogeneous Glacial Sand Aquifer: Correlation between Estimates Based on Impeller Flow Meter Data and Grain-Size Distributions. Poster presentation at the Society for Sedimentary

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Geology / International Association of Sedimentologists (SEPM/IAS) Research Conference, Environmental Sedimentology: Hydrogeology of Sedimentary Aquifers, Santa Fe, New Mexico, September 24-27, 2000.

Neville, C., and J. Markle, 2000. Interpretation of Constant-Head Tests: Rigorous and Approximate Analyses. *in Proceedings of the First Joint IAH-CNC/CGS Groundwater Specialty Conference*, Montreal, Quebec, October 15-18, 2000.

Guo, W., and C. Neville, 1998. Adaptation of MODFLOW for Transient Air Flow Simulation. *in Proceedings of the MODFLOW 98 Conference*, International Ground Water Modeling Center, Colorado School of Mines, Golden, CO, October 1998.

Neville, C., M. Riley, and C. Zheng, 1998. Implicit Modeling of Low-Permeability Features: An Appraisal for Solute Transport. *in Proceedings of the MODFLOW '98 Conference*, International Ground Water Modeling Center, Colorado School of Mines, Golden, CO, October 1998.

Guo, W., C. Neville, and C. Zheng, 1995. Numerical Simulation of Air Flow and Advective Transport Using MODFLOW. Presentation at the American Geophysical Union 1995 Spring Meeting, Baltimore, MD. *in Eos*, v. 76, no. 17, S130.

Neville, C., N. Guiguer, and M. Rivett, 1992. A Review of Batch Flush Models for Pump-and-Treat Remediation. Poster presentation at Aquifer Restoration: Pump-and-Treat and the Alternatives, AGWSE 1992 Education Program, Las Vegas, NV.

PRESENTATIONS

Neville, C.J., 2009. Contaminant Isolation by Cutoff Walls: Reconsideration of Mass Fluxes. Presentation at GeoHalifax 2009 – 62nd Canadian Geotechnical Conference & 10th Joint CGS/IAH-CNC Groundwater Conference, Halifax, Canada, September 20–24, 2009.

Neville, C. J., 2008. Flow in Fractured Rock: Implications of Long Open Interval Wells. Presentation at the Kitchener-Waterloo Hydrogeology Seminar Series, Canadian Geotechnical Society/International Association of Hydrogeologists, March 5, 2008.

Neville, C.J., 2006. Rehabilitation of the Specified-Concentration Boundary Condition for Solute Transport. Presentation at MODFLOW and More 2006, Managing Ground-Water Systems, International Ground Water Modeling Center, Colorado School of Mines Golden, CO, May 22-24, 2006.

Neville, C.J., 2003. Contributions of Edward A. Sudicky in Analytical Solutions in Fractured-Porous Media. Presentation at The Geological Society of America 2003 Annual Meeting, Seattle, WA, November 2–5, 2003.

Neville, C., S. Sayko, M. Kuhl, R. Passmore, G. Luxbacher, M. Mateyk, J. Williams, and B. Trytten, 2002. Identification of Groundwater Flow Zones with Borehole Geophysics and Flowmeter Profiling, Hyde Park Landfill Site, Niagara Falls, New York. *in Proceedings of the 2002 Fractured-Rock Aquifers Conference*, National Ground Water Association, Denver, CO, March 2002.

Riley, M., and C. Neville, 2001. Natural Attenuation in Tidal Zones. Presentation at the National Ground Water Association Northwest Focus Conference, Portland, OR, February 2001.

Neville, C., M. Riley, and C. Zheng, 1998. Implicit Modeling of Low-Permeability Features: An Appraisal for Solute Transport. *in Proceedings of the MODFLOW '98 Conference*, International Ground Water Modeling Center, Colorado School of Mines, Golden, CO, October 1998.

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RESEARCH REPORTS

- Neville, C.J., 1992. Contaminant Recovery Test Site: Summary of Geostatistical Analyses of Core Data. Technical Note, Waterloo Centre for Groundwater Research.
- Neville, C.J., 1991. A Numerical Study of Hydraulic Communication Around Packers in Uncased Boreholes. Prepared for Solinst Canada Ltd. Waterloo Centre for Groundwater Research.
- Kaiser, P., D.Chan, D. Tannant, F. Pelli, and C. Neville, 1987. Numerical Simulation of Room 209 Instrument Ring, Interim Technical Report. Prepared for Atomic Energy of Canada. Pinawa, Manitoba. Department of Civil Engineering, University of Alberta, Canada.

DOCUMENTATION OF GROUNDWATER MODELING SOFTWARE

- Neville, C.J., 2004. MPNE1D Analytical Solution: User's Guide. Version 4.1.
- Neville, C.J., 1998. ATRANS: Analytical Solutions for 3D Transport from a Patch Source. Version 2.
- Zhang, Y., C. Zheng, C. Neville, and C. Andrews, 1996. ModIME User's Guide: An Integrated Modeling Environment for MODFLOW, PATH3D, and MT3D. Version 1.1. Bethesda, MD: S.S. Papadopoulos & Associates, Inc.
- Neville, C.J., 1992. Analytical Solutions for Transport with NAPL Sources. Technical Report (computer program and documentation), Waterloo Centre for Groundwater Research, Canada.
- Neville, C.J., 1992. GA83: A Program for Computing the Effective Hydraulic Conductivity and Macrodispersivity Tensors for Three-Dimensionally Heterogeneous Aquifers, Using the Stochastic Theory of Gelhar and Axness [1983]. Technical Report (computer program and documentation), Waterloo Centre for Groundwater Research, Canada.
- Neville, C.J., 1992. Notes on the De Hoog Routine for the Numerical Inversion of Laplace Transforms: Analytical Solutions. Technical Report (computer program and documentation), Waterloo Centre for Groundwater Research, Canada.
- Neville, C.J., 1992. Notes on the De Hoog Routine for the Numerical Inversion of Laplace Transforms: Discrete Numerical Solutions. Technical Report (computer program and documentation), Waterloo Centre for Groundwater Research.