

# MAHMOUD HUSSEIN, Ph.D.

PRINCIPAL GROUNDWATER MODELER/ HYDROGEOLOGIST



## EDUCATION

Ph.D., Hydrogeology, University of Leeds, Leeds, UK, 2013

M.Sc., Groundwater, Zagazig University, Egypt, 2007

B.Sc., Civil Engineering, Zagazig University, Egypt, 2002

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## EXPERIENCE SUMMARY

Mahmoud Hussein has over 11 years of consultancy experience and 5 years of research experience in the field of hydrogeology. Mahmoud specializes in the application of groundwater flow and solute transport modelling techniques to assess seepage and associated groundwater impacts from mine waste facilities. Mahmoud also specializes in the application of these modeling techniques to design and predict the performance of proposed mitigation measures (such as drains, extraction wells, cut-off walls, injection wells). Mahmoud has applied these techniques to a wide range of mining applications, including seepage from tailings impoundments and tailings dams, open pits, underground mine workings and waste storage facilities for mine sites located in Canada, Chile and Australia.

Mahmoud is also experienced in the field of physical hydrogeology including: Aquifer storage and recovery testing; Design, implementation, supervision and interpretation of hydrogeological investigations; Analysis of aquifer and well performance testing; Time series analysis applied to borehole water levels response to natural and anthropogenic influences. Mahmoud applied these techniques for a wide range of consultancy and research projects for sites located in the UK, Qatar and Egypt.

Mahmoud Hussein has written 5 technical papers on groundwater flow & contaminant transport, time series analysis and groundwater vulnerability.

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## PROFESSIONAL HISTORY

2018 - Present: Principal Groundwater Modeler, Robertson GeoConsultants Inc., Canada.

2016 - 2018: Senior Hydrogeologist, Robertson GeoConsultants Inc., Canada.

2013 - 2016: Hydrogeologist & Groundwater modeler, AMEC Foster Wheeler, Qatar.

2009 - 2012: Marie Curie Research Fellow in Hydrogeology at University of Leeds, UK.

2007 - 2008: Part Time Groundwater Modeler at SD Consultants, Cairo, Egypt.

2003 - 2008: Hydrogeologist at the Research Institute for Groundwater, Cairo, Egypt.

2002 - 2003: Structural Civil Design Engineer at CID Consultants, Cairo, Egypt.

## PROJECT EXPERIENCE (SELECTED STUDIES)

### ***Las Tortolas Mill Site, Anglo American Chile (AACH), Chile. 2020.***

- Work is ongoing to update the conceptual model and the transient groundwater flow and transport model (developed by RGC in 2015) to assess the proposed mitigation plan for the Ex-Bosque land application sector.
- Completed a draindown study to estimate seepage rates from the Las Tortolas Tailings Impoundment to be collected in the seepage interception systems of the different dam reaches for the post-closure period. Basal seepage rates induced by self-weight consolidation and gravity-driven flow were simulated, during filling and post-closure, to predict upper and lower bound seepage rates post-closure.
- Contributed to the design and update of site characterization programs (drilling and installation of monitoring wells and seepage interception pumping wells) to delineate seepage plumes and/or update SIS systems downstream of the Main Dam, West Dam and East Dam.
- Supervised aquifer testing analysis for monitoring and pumping wells installed as part of the 2018/2019 Phase I drilling program in the Ex-Bosque sector.

### ***Former Bouchard Hebert Mine Site, Quebec, Canada. 2020***

- Developed a conceptual hydrogeological model of the groundwater flow regime near the flooded pit and downgradient of the industrial area. A scoping level numerical flow model was constructed to provide a 3D representation of conceptualized hydrostratigraphic units and to calculate the groundwater budget for low flow and high flow conditions.

### ***The Rum Jungle Mine Site, Northern Territory, Australia. 2019.***

- Updated and refined the calibration of the transient groundwater flow and transport model (developed by RGC in 2016) for the Rum Jungle Mine site in support of the Environmental Impact Statement (EIS). The numerical model was updated to reflect additional information from the hydrogeological field investigations and additional monitoring data in 2017/2018.
- The updated model was developed to simulate groundwater flows and contaminant transport for historic conditions, current conditions and predict future conditions during the construction phase of rehabilitation and conditions once rehabilitation is completed.
- The transport model simulates and predicts concentrations of dissolved sulphate and copper in groundwater and loads to the East Branch of the Finniss River (EBFR) and its tributaries.
- Report is publicly available at:  
[https://ntepa.nt.gov.au/data/assets/pdf\\_file/0004/786892/draft\\_eis\\_rum\\_jungle\\_rehab\\_project\\_robertson\\_geoConsultants\\_2019\\_groundwater\\_surface\\_water\\_modelling\\_1.pdf](https://ntepa.nt.gov.au/data/assets/pdf_file/0004/786892/draft_eis_rum_jungle_rehab_project_robertson_geoConsultants_2019_groundwater_surface_water_modelling_1.pdf)

### ***Nyrstar Myra Falls Mine Site, Vancouver Island, BC, Canada. 2018.***

- Updated the conceptual hydrogeological site model for the Myra Valley Aquifer.
- Developed a numerical groundwater flow and transport model, using MODFLOW NWT and MT3D-USGS, to simulate the movement of groundwater and the transport of Zn in the MVA.

- Calibrated the groundwater model to observed groundwater levels during high flow and low flow conditions, recent Zn concentrations in groundwater, and estimated Zn loads recovered by the system of under-drains beneath the Old Tailings Disposal Facility (TDF).
- Predict Zn loading to Myra Creek, assess and evaluate options to upgrade the current SIS and to assess the performance of mitigation and closure works in progress and/or proposed at Nyrstar Myra Falls.

***Las Tortolas Mill Site, Anglo American Chile (AACH), Chile. 2016-2017.***

- Developed a conceptual site model for the East Dam sector.
- Developed and calibrated steady-state groundwater flow and transport (MODPATH) model for the East Dam sector to evaluate performance of existing Seepage Interception Systems (SIS) and to develop preliminary conceptual SIS design for future conditions.
- Updated the conceptual model for the Main Dam sector.
- Developed and calibrated transient groundwater flow and solute transport (MT3D) model to evaluate options to improve the current SIS for the Main Dam Sector.
- Contributed to model calibration and conceptual design of SIS for the West Dam sector.

***Magino Gold Project, Argonaut Gold Inc, Ontario, Canada. 2016.***

- Updated the transient 3D numerical groundwater flow model to predict the effects of proposed open pit mining, operation of a Tailings Management Facility (TMF) and Mine Rock Management Facility (MRMF) on local groundwater and surface water bodies, at different stages of development of open pit excavation, TMF, MRMF and reflooding of the open pit for mine closure.

***Aquifer Storage and Recovery (ASR) Feasibility Study, Qatar. 2013-2016.***

- Contributed to the design, implementation, supervision and contractor management of a wide range of site investigations including; borehole drilling and installations, surface and downhole geophysics, aquifer and well performance pumping and injection testing;
- Analyses, interpretation and reporting of step and constant rate discharge tests at ten sites;
- In charge of planning, management and coordination of modelling activities and reports;
- Developed a transient regional scale groundwater flow model for North of Qatar;
- Contributed to the development of three local scale, axisymmetric 2D, transient flow and solute transport models to simulate injection and re-abstraction trials;
- Completed the development, calibration and reporting of a 3D transient flow and solute transport model to simulate a long duration ASR pilot test;
- Liaison and coordination with Ministries and governmental entities in Qatar to acquire and renew permits required to conduct site activities.

***Study on the Effect of Faults on Groundwater Flow, TOTAL Petroleum, UK. 2012.***

- Carried out a hydrogeology feasibility study to evaluate aquifer anisotropy and presence of faults as flow barriers in the UK Sherwood Sandstone Aquifer.
- Completed site reconnaissance, data collection, borehole selection and automatic data logger's installation.
- Liaised with YorkshireWater to arrange for conducting constant rate and cyclical pumping

tests using one of their pumping stations.

- Analysis of borehole water levels in response to pumping tests and other natural and anthropogenic effects.

***Hydrogeologist at The Research Institute for Groundwater (RIGW), Egypt. 2003-2008.***

- RIGW is an affiliate of the National Water Research Center (NWRC) - Ministry of Water Resources and Irrigation in Egypt.
- Contributed to nation-wide projects involving:
  - Field surveys and data collection;
  - Monitoring wells design and drilling supervision;
  - Implementation and analysis of aquifer testing;
  - Groundwater flow and solute transport modeling;
  - Designing and construction supervision of dewatering systems for significant archeological sites suffering water logging issues;
  - Liaised with clients and contractors and preparation of technical reports and specification notes.

***Part Time Groundwater Modeler at SD Consultants, Cairo, Egypt. 2007- 2008.***

- Completed data processing, construction, calibration and report writing of regional and local scale groundwater flow models for projects in Egypt and KSA.

***Structural Civil Design Engineer at Consultants for Investigation & Design (CID), Cairo, Egypt. 2002- 2003.***

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## **PUBLICATIONS**

**Hussein M.**, P. Ferguson, C. Wels and N. Pesonen, 2019. Numerical Modelling of Groundwater Flow and Contaminant Transport at the Myra Falls Mine Site. Proceedings of Tailings and Mine Waste 2019, 755-768. Published by the University of British Columbia.

Ferguson P., **M. Hussein**, C. Wels and N. Pesonen, 2019. Current Acid Rock Drainage Impacts and Seepage Interception Strategies at the Myra Falls Mine Site. Proceedings of Tailings and Mine Waste 2019, 729-738. Published by the University of British Columbia.

N.E. Odling, R.P. Serrano, **M. E.A. Hussein**, M. Riva, A. Guadagnini (2014), Detecting the vulnerability of groundwater in semi-confined aquifers using barometric response functions, Journal of Hydrology, doi.org/10.1016/j.jhydrol.2014.11.016.

**Hussein, M. E.A.**, Odling N. E., and Clark R. A. (2013), Borehole water level response to barometric pressure as an indicator of aquifer vulnerability, Water Resources Research, 49, 7102–7119, doi:10.1002/2013WR014134.

**Hussein M. E.A.**, El Arabi, N., Lefebvre, R. and Mowafy, M. (2008), Modeling Potential Environmental Impact of New Settlements on Groundwater Quality, Quessna City, Nile Delta, Egypt. Groundwater and Development, GeoEdmonton, 61th Canadian Geotechnical Conference & 9th Joint CGS/IAH-CNC Groundwater Conference.