



STATEMENT OF QUALIFICATIONS for HYDRO(GEO)LOGICAL SERVICES

1.0 Introduction

This Statement of Qualifications (SOQ) summarizes the specialized services provided by Robertson GeoConsultants Inc. (RGC) in the field of hydrogeology and hydrology. This SOQ is organized into four sections with an overview of RGC as a company, followed by a presentation of our in-house technical skills, the relevant experience of our personnel and a summary of relevant hydro(geo)logical projects.

2.0 Robertson GeoConsultants Inc.

Robertson GeoConsultants Inc. (<http://www.robertsongeoconsultants.com/>) is an employee-owned consulting firm specializing in hydrogeology, geotechnical and environmental engineering for the mining industry. Our firm is based in Vancouver, B.C. and consists of a small team of specialty consultants with expert knowledge in hydrology, hydrogeology, geochemistry, geotechnical engineering and their application to mining. Since incorporation in 1995, we have completed over 70 projects in 10 countries, including some of the largest mining projects in the world. Our experience, integrity and quality of work is widely recognized in the environmental mining community, as demonstrated by our broad client base which includes many international mining companies and other industries, real estate developers, government regulatory agencies and other consulting firms.

Our international experience has also given us recognition as one of the leading experts in hydrogeology, in particular groundwater flow modeling. As a result, our senior staff now assists other consulting firms in their hydrogeological modeling needs and carries out independent third-party reviews of groundwater flow modeling on a regular basis. Recent examples of senior review work includes our participation in the hydrogeology expert meetings for the Giant Mine, NWT, Canada, review of model predictions on the impact of aquifer dewatering on a large Salar in South America threatened by aquifer dewatering, and review of groundwater flow and solute transport predictions for the Grasberg Mine, in Indonesia.

Robertson GeoConsultants Inc. takes an active role in the advancement of new hydrogeological technologies applied to mining through participation in various research projects, industry initiatives and sponsorship of the HYDROMINE (<http://www.infomine.com/technology/hydromine/>) and ENVIROMINE (<http://www.infomine.com/technology/enviromine/>), the premier websites for hydrogeological and environmental information and technologies related to mining.

3.0 Hydro(geo)logical Services

RGC offers a broad range of hydro(geo)logical consulting services for mining, industrial and municipal properties, including:

- Aquifer Characterization (including drilling, monitoring well installation & hydraulic testing);
- Watershed Hydrology and Water Balance Studies;
- Watershed Geochemistry and Load Balance Studies;
- Groundwater Modeling (unsaturated/saturated flow and solute transport);
- Open-pit Water Balance Studies;
- Assessment & Prediction of Groundwater Quality;
- Development of Aquifer Protection and Remediation Strategies;
- Design and Implementation of Groundwater Monitoring Plans;
- Dewatering/depressurization studies (often integrated with geotechnical design); and
- Corporate Consulting and Senior Review.

Robertson GeoConsultants Inc. provides a full suite of technical services related to field investigations including drilling, monitoring well installation, hydraulic testing, water level monitoring and water quality sampling. Our staff has experience with all major drilling and well installation methods and is familiar with local and international guidelines and regulations pertaining to surface water and groundwater monitoring and sampling. RGC has developed an expertise in hydraulic testing ranging from single borehole testing (slug test, single well pump test or packer testing) to full-scale pump tests of larger aquifers. We routinely employ computer-aided techniques for interpretation of well testing, including 3D groundwater flow modeling for interpretation of full-scale aquifer pump tests.

Robertson GeoConsultants Inc. provides a range of surface water and groundwater modeling services related to water management and aquifer remediation. Our modeling team is experienced with a wide range of numerical modeling techniques and commercial modeling software packages giving us flexibility to select the modeling approach most suited to project objectives. We offer modeling services ranging in scope and scale from solute transport in streams and rivers; infiltration through the uppermost, unsaturated zone; to deep, regional groundwater flow in large aquifer systems. Groundwater flow and transport models are often integrated with hydrological and/or geochemical models to provide the correct boundary conditions. The results of field investigations and numerical modeling are commonly used in environmental assessments, development of surface water and groundwater protection and/or remediation strategies and design of monitoring programs.

Robertson Geoconsultants Inc. employs a wide variety of computerized tools to assist in surface and groundwater investigation projects:

- Modeling packages: PHREEQ, MINTEQA2, EQ3/6, OTIS, Groundwater Modeling System (GMS), MODFLOW (FD), MODPATH, MT3D, FEFLOW, SEEP/W, HYDRUS, SOILCOVER
- Data analysis software: AQUIFERWIN, AquaChem, LogPlot, QuickSurf, AutoCad

In addition, RGC has developed interactive Flow Analysis Tools, which are currently available to the general public on the HYDRO TOOLS section of the HYDROMINE website (<http://www.infomine.com/technology/hydromine/>).

4.0 Personnel

This section summarizes our key personnel with experience in hydrogeology and/or hydrology, including associated consultants, who work with RGC on a regular basis. Brief descriptions of the key individuals with particular emphasis on each member's experience in hydrogeology and/or hydrology are provided below. Detailed resumes for the key project team members can be found on the company website (<http://www.robertsongeoconsultants.com/personnel/personnel.asp>).

Andrew MacG. Robertson, Ph.D., P.Eng.: **Dr. Robertson** has a B.Sc. in Civil Engineering, a Ph.D. in Rock Mechanics, and 30 years of experience in geotechnical and environmental engineering. He was the lead investigator and/or designer for numerous project teams for mining companies and provides review, senior evaluation, and counseling to a number of mining companies, research establishments, professional associations and provincial, state and federal agencies. Dr. Robertson has an international reputation as a specialist in the prediction/control of acid rock drainage.

Dr. Robertson is president of Robertson GeoConsultants Inc. He serves as lead investigator in geotechnical studies and serves in a review capacity for hydrogeological projects.

Christoph Wels, Ph.D., M.Sc.: **Dr. Wels** has a M.Sc. in Watershed Hydrology and a Ph.D. in Hydrogeology and has over 15 years of experience in groundwater related studies. He completed his doctorate at the University of British Columbia on the subject of numerical modeling of groundwater flow and solute transport in fractured rock. Dr. Wels has led numerous groundwater investigations and groundwater modeling studies for international and local clients. He is experienced in the use of a wide range of modeling tools ranging from specialized models to simulate infiltration and percolation in unsaturated soils to simulating complex, regional aquifer systems. Dr. Wels also assists other consulting firms as an advisor and has participated on review boards and carries out peer reviews for hydrogeological projects. Dr. Wels has authored numerous publications on various aspects of groundwater flow modeling and is currently editor of the HYDROMINE website.

Dr. Wels is Principal and Senior Hydrogeologist with Robertson GeoConsultants Inc.. He serves as lead investigator in most hydrogeological projects. His responsibilities include project management, supervision of modeling studies and senior review.

Shannon Shaw, B.Sc. M.Sc.: **Ms. Shaw** has a B.Sc. in Chemistry and Geological Sciences, a M.Sc. in Geological Sciences and 6 years of consulting experience in geochemical related studies. Her specialization is in the assessment of the geochemical impacts of mining to the surrounding environment, (in particular to surface and groundwater resources) and the development of contaminant control strategies for impacted areas. Ms. Shaw has extensive field and modeling related experience including geochemical speciation and transport modeling for a wide range of projects. She also assists other consulting companies as a third party reviewer for geochemical projects.

Ms. Shaw is the Senior Geochemist with Robertson GeoConsultants Inc. and serves as the lead investigator in most geochemical studies. Her responsibilities include project management, all aspects of geochemical and load balance studies and third-party review.

Laura Findlater, B.Sc.: **Ms. Findlater** holds a B.Sc. in Geology and has recently completed her undergrad thesis on groundwater flow modeling under the supervision of Dr. Leslie Smith. Since joining RGC in 2001, she has completed several modeling assignments including the development of a comprehensive groundwater flow and solute transport model for the Woodcutters Mine site and the prediction air and water movement in waste rock piles (using TOUGH AMD). Laura was also responsible for the development of the interactive Flow Analysis tools available on the HYDROMINE website.

Ms. Findlater is a Staff Hydrogeologist with Robertson GeoConsultants Inc. and is responsible for numerical modeling using a range of numerical modeling tools (including standard groundwater flow and solute transport models).

Patrick Bryan, M.Eng., P.Eng.: **Mr. Bryan** is a hydrologist with 17 years of consulting experience, largely centered on the preparation of water resource and environmental studies. This has encompassed a broad range of projects from analysis of rainfall and runoff in major catchments to estimation of runoff from small, un-gauged watersheds. Both water quality and quantity have been issues in the majority of Mr. Bryan's experience and he has developed models for predicting water quality in large rivers, reservoirs and at mine sites. He has considerable experience in characterizing the hydrology and climate of British Columbia. He is currently providing hydrological and hydraulic consulting services for the Britannia Mine Reclamation Study.

Mr. Bryan is a close associate of Robertson GeoConsultants Inc. and assists RGC in all aspects of surface hydrology and water balance studies.

5.0 Relevant Experience

This section summarizes several hydro(geo)logical projects, which Robertson GeoConsultants Inc. has successfully completed in recent years. A more complete description of our experience can be found on the company website.

Woodcutter's Mine, Australia

The Normandy Woodcutters Mine Site is located 80km south of Darwin, Northern Territory, Australia. Between 1985 and 1998, the Woodcutters mine exploited a large lead-zinc deposit using open pit and underground mining techniques. Decommissioning of the mine began in 1999 and included reflooding of the open pit and relocation of all (sulphidic) tailings into the open pit. In November 2000, Normandy decided to temporarily stop reclamation work in order to re-assess their reclamation plan due to concerns about the faster than predicted recovery of groundwater levels in the open pit.

Robertson GeoConsultants Inc. was retained to carry out a detailed hydrogeological investigation and to predict future recovery and solute transport. A comprehensive drilling and monitoring well installation program was carried out and a water level and water quality monitoring program was initiated. In addition, a field and laboratory-based geochemical study of the waste rock and associated plume delineation was completed. This field data was used to calibrate a 3D groundwater flow (MODFLOW) and transport model (MT3D) for the Woodcutters site. This model was then used to predict future recovery of the groundwater levels and to evaluate the impact of pit reflooding and various cover options for the waste rock dump on the local groundwater system. Predictions were made for future off-site migration of contaminants in the groundwater system.

Questa Tailings Facility, USA

Molycorp, Inc. (Molycorp) owns and operates a large tailings facility (240ha) located adjacent to the town of Questa, in northern New Mexico, USA. The facility contains over 1 million tones of tailings from the Questa molybdenum mine, located 3.5 miles east of Questa.

Molycorp retained Robertson GeoConsultants Inc. to study the potential impact of tailings seepage on the groundwater system and to develop closure measures to mitigate any impacts. A field investigation was carried out to characterize the tailings and the local groundwater system. Geochemical modeling was performed to estimate long-term pore water quality. A three dimensional groundwater flow model (MODFLOW) was developed to evaluate the fate of tailings seepage in local and regional aquifer systems ("telescopic modeling approach"). Modeling of tailings seepage was also performed to predict the rate of dewatering (leachate flux) over time. The results of these analyses were combined to predict trends of metal and sulphate concentrations after closure in the most vulnerable, perched groundwater system beneath the tailings impoundments.

Zortman and Landusky Mines, USA

Pegasus Mining Co. operated the Zortman and Landusky mines, located in north-central Montana, from 1979 until 1998 as open pit gold heap leach operations. As a result of the company's bankruptcy, the mines became the responsibility of the regulatory agencies, who began reclamation studies in 1999 utilizing the funds from an established bond. One of the main reclamation issues for the sites relates to water quality and water management.

Robertson GeoConsultants Inc. (RGC) was retained as a sub-contractor to Spectrum Engineering in order to assist in a number of technical investigations for reclamation planning, including site wide water and load balances. The work was completed in stages and consisted of geochemical characterization and load balance calculations utilizing hydrological and hydrogeological information on the site. This included a detailed assessment of the effects of draindown and water-rock interactions in the leach pad facilities on the leach pad water quality and subsequent water management strategies. In addition, an analysis of the potential loads not being captured by existing capture systems was completed thereby

allowing an assessment of the potential down gradient surface and groundwater impacts. As a result of these assessments, some modifications to water management on the site have been made in order to best utilize existing facilities, minimize cost and protect the receiving environment. RGC also predicted the net infiltration into alternative mine waste covers proposed for closure to allow a water and load balance analysis for post-closure conditions.

Fullerton Site, North Vancouver, Canada

Historic leakage of diesel fuel from several storage tanks located on the former Home Oil Depot in North Vancouver had resulted in hydrocarbon contamination of the local groundwater. In 1996, Concert Properties Ltd. purchased the adjacent Fullerton Property with plans to develop a Harbourside Business Park. However, one important condition for approval of the development plans by the City was the cleanup of the hydrocarbon contamination on this site.

Robertson GeoConsultants Inc. was retained to design a hydraulic barrier system that would protect the Fullerton site from re-contamination by groundwater from the neighboring former Oil Depot site during and post-remediation. A field investigation was carried out to characterize the local aquifer system. This field data was used to calibrate a three-dimensional groundwater flow model (MODFLOW) for the site. The calibrated model was then used to design a hydraulic barrier system consisting of a 270m long Waterloo Barrier®, seven extraction wells and a shallow drain system. The remedial plan for the Fullerton site, one of the largest of its kind in B.C. history, was approved and implemented in 1998. The hydraulic barrier system operated successfully until completion of the remedial work in 2001. Today, the Harbour Business Park is considered one of the prime real estate properties on the North Shore.

Warrego Tailings Impoundment, Australia

Mining of the Warrego copper-bismuth-gold deposit commenced in the late 1950s and operated up to late 1989. In addition to the Warrego mine production, ores from adjacent mines were transported to the Warrego site for processing. In 1999, Normandy Tennant Creek Pty. Ltd. started developing closure strategies for their Warrego tailings storage facilities (TSF).

Robertson GeoConsultants Inc. and O'Kane Consultants Inc. were retained to propose strategies for the rehabilitation of its Warrego TSF. All historic water quality and water level data were reviewed to develop a conceptual model. A geochemical investigation of the tailings was completed and a 3D groundwater flow model (MODFLOW) was then developed for the site to assess current impacts and to evaluate the effectiveness of alternative cover placement scenarios on groundwater quality. The future water quality of the receiving groundwater was estimated with the calibrated groundwater flow model using the mass balance approach. A particle tracking routine (MODPATH) was used to demonstrate the spatial extent of the local aquifer system receiving tailings seepage.

Red River Watershed, USA

The Red River watershed located in the Sangre de Cristo Mountains of New Mexico is a tourism area in which copper, gold and molybdenum mineralization has resulted in localized areas of natural acid rock drainage, as well as historic and current mines and related disturbance. The relative impact of natural and anthropogenic processes on the Red River stream and groundwater aquifer has been a concern to mining operators, regulatory agencies and NGO's in the area.

Robertson GeoConsultants Inc. (RGC) was retained by MolyCorp Inc., a molybdenum mining company in the watershed, to quantify the naturally occurring metal loads from mineralized areas (including naturally occurring hydrothermal scars) upstream of the mine, to define site-specific background concentrations, and to determine key factors impacting spatial and temporal variations in metal concentrations and loads. To meet these objectives, a study was completed that included a comprehensive sampling and testing program of soil and bedrock from mineralized areas, and also a ground water and surface water quality monitoring program in selected mineralized watersheds. The field data were used to calculate sulfate and metal loads from the scar watersheds. In addition, a runoff and load model was developed for the entire Red River basin (290km²), which was calibrated using historic (+30 years) runoff and water quality data.

Lac de Gras Mining Area, Canada

In 1996, BHP Diamonds was seeking approval to develop several open pits in the Lac de Gras Area, Northwest Territories, to mine kimberlitic pipes at depth in the fractured bedrock. Concerns were raised as to the potential impact of this mine development on the regional hydrogeology and the surrounding lakes.

BHP retained Robertson GeoConsultants Inc. (RGC) to study the transient and three-dimensional aspects of groundwater flow in the fractured bedrock characterizing the study area. The work was completed in two phases. First, transient groundwater flow was simulated in representative 2D cross-sections for one proposed pit in order to estimate the time required to reach steady-state conditions and to estimate the volumes of groundwater released from storage during maximum pit development. Second, a regional 3D groundwater model (steady-state) was developed in order to study the impact of one proposed pit on the regional groundwater flow system and to estimate seepage from the various surrounding lakes into the pit.

Cleveland Dam, West Vancouver, Canada

The Cleveland Dam is a 92m high concrete dam structure, which stores approximately 40% of Vancouver's drinking water supply and is currently operated by the Greater Vancouver Water District (GVWD). The creation of the Capilano reservoir has resulted in high gradients in the Lower Aquifer (downstream of the dam) and has created concerns about soil losses in a vertical dewatering shaft.

In 2001, EBA Engineering Ltd. (Vancouver) was retained by the Greater Vancouver Water District to assess the potential for soil losses from the Lower Aquifer. Robertson GeoConsultants Inc. assisted EBA in the conceptualization of the groundwater flow system and development of a groundwater flow model for the site to evaluate alternative depressurization strategies. A 14-day pump test was performed to evaluate hydraulic properties of the lower aquifer. RGC was responsible for the development and calibration of the groundwater flow model (FEFLOW) using the pump tests data.