

## **Jamie Van Gulck, Ph.D., P.Eng.**

Principal

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### **EDUCATION**

- Ph.D., Geotechnical and Geoenvironmental Engineering, Department of Civil Engineering, Queen's University
- B.E.Sc., Civil and Environmental Engineering University of Western Ontario

### **EMPLOYMENT HISTORY**

- ARKTIS Solutions Inc., Principal (08/2007 to present)
- ARKTIS Piusitippaa Inc., Chief Technical Officer (04/2010 to present)
- VGQ Consulting Inc., Director (04/2004 to present)
- University of Manitoba, Department of Civil Engineering, Adjunct Professor (08/2007 to 08/2010)
- University of Manitoba, Department of Civil Engineering, Assistant Professor (05/2003 to 08/2007)
- Queen's University, Research Assistant (09/2000 to 04/2003)
- Geotechnical Research Centre, University of Western Ontario, Research Assistant (04/1997 to 07/2000)

### **PROFESSIONAL SOCIETIES**

- Member, Association of Professional Engineers, Geologist & Geophysicists of NWT & Nunavut
- Member, Professional Engineers Ontario
- Member, Canadian Dam Association
- NSERC 1509 Committee Member

### **SUMMARY OF EXPERIENCE**

Prior to being a co-founder for Arktis Solutions Inc., Jamie worked as an Assistant Professor in the Department of Civil Engineering at the University of Manitoba. Jamie left academia to become a private consultant to link business and research opportunity to the science and engineering sectors and resulted in the development of VGQ Consulting Inc.

Jamie is a Principal and founding partner with Arktis Solutions Inc. and lead engineer within the organization. Jamie's roles include contributing to the strategic, business and financial operations of the organizations, as well as, lead technical resource and project management.

Jamie's experiences span the following areas: geotechnical and environmental engineering; mining and oil and gas; hydrogeology; northern infrastructure development; policy and regulatory review and development; land and environment management, and research and development. He has authored and co-authored numerous technical papers in various refereed journals and conferences. Additionally, he has contributed to the development of regulations and guidance documents for Government and Aboriginal organizations in the sectors of mining, oil and gas, and municipal infrastructure.

Jamie specializes in cross-disciplinary design and analysis which has led to fluid collaborations with multi-disciplinary and multi-sector teams. He has acted as an expert technical reviewer of: northern mining and site remediation projects; contaminated site clean up projects; and municipal infrastructure design and construction projects. Additionally, Jamie has been a lead designer and project manager for mine closure and reclamation plans and municipal infrastructure projects.

## MINING

- **Government of the Northwest Territories (NT)** – Expert technical reviewer of Dominion Diamond Corporation’s Ekati Diamond Mine Jay-Pipe Environmental Assessment report and Water Licence application. Review focused on geotechnical design of the open pit and surrounding dykes and hydrogeology. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Environmental Impact Review Board (2015) and Mackenzie Valley Land and Water Board (2016/17). Expert witness at the public hearing.
- **Government of the Northwest Territories (NT)** – Expert geotechnical technical reviewer of Diavik Diamond Mine Corporation’s Diavik Diamond Mine A-21 Pit Dyke engineering design and construction specifications (2015).
- **Government of the Northwest Territories (NT)** – Expert geotechnical technical reviewer of Diavik Diamond Mine Corporation’s Processed Kimberlite containment facility dam design and water management (2018).
- **Government of the Northwest Territories (NT)** – Expert hydrogeological and geochemical technical reviewer of Diavik Diamond Mine Corporation’s Processed Kimberlite water licence application materials to deposit processed kimberlite into the open pit and the associated water quality in the pit lake (2018 to 2019).
- **Government of the Northwest Territories (NT)** – Expert hydrogeological technical reviewer of Canadian Zinc Corporation’s Prairie Creek Mine associated with the underground mine development and groundwater management (2020).
- **Government of the Northwest Territories (NT)** – Expert technical reviewer of Avalon Rare Metals Inc.’s Nechalacho Rare Earth Metals Project Type A Water Licence application. Review focused on tailings management, tailings pond design, geochemistry, closure and reclamation and financial security. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Land and Water Board (2014).
- **Government of the Northwest Territories (NT)** – Expert technical reviewer of North American Tungsten Corporation’s Cantung Mine Type A Water Licence amendment application. Review focused on tailings management, tailings pond design and geochemistry. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Land and Water Board. Expert witness at the public hearing (2014).
- **Government of the Northwest Territories (NT)** – Expert technical reviewer of Nighthawk Gold Corporations Interim Closure and Reclamation Plan and acid rock drainage management (2019).
- **Government of the Northwest Territories (NT)** – Financial security assessment of Fortune Mineral NICO Mine Access Road (2019).
- **Government of the Northwest Territories (NT)** – Financial security assessment of NWT Rare Earth’s 2020 Demonstration Project (2020).
- **Aboriginal Affairs and Northern Development Canada (NT)** – Expert technical reviewer of the Tyhee Gold Project environmental impact assessment. Review focused on geotechnical and hydrogeological aspects of the project, as well as, water quality and quantity of surface water and groundwater from the mine site and tailings containment facility. Assisted in the development of information requests for submission to Mackenzie Valley Environmental Impact Review Board (2012).
- **Yukon Government (YU)** – Development of an Adaptive Management Monitoring Plan for the Ketzá Mine for the care and maintenance phase (2019/20).
- **Qikiqtani Inuit Association (NU)** – Project lead in the development of the annual financial security assessment (2013 to 2018) for the Baffinland Iron Mines Corporation Mary River project on behalf of the land owner. Expert technical lead in regulatory and lease negotiations and workshops pertaining to financial security. Expert witness regarding security arbitration determination (2020).
- **Qikiqtani Inuit Association (NU)** – Technical resource and lead in the completion of an annual environmental inspection and audit (2009 to 2018) of the Baffinland Iron Mines Corporation Mary River

project. Development of a site inspection protocol to evaluate site conditions in relation to environmental and lease requirements.

- **Qikiqtani Inuit Association (NU)** – Environmental impact assessment and regulatory expert technical reviewer for the Baffinland Iron Mines Corporation proposed iron mine (2011 to 2013, 2018 to 2019). Project manager of the Environmental Assessment team in the topics of socio-economics, terrestrial, marine, aquatic resources, engineering and regulatory. Assisted in the development of information requests and the intervention for submission to Nunavut Impact Review Board. Expert witness at the public hearing.
- **Qikiqtani Inuit Association (NU)** – Expert technical reviewer of the abandonment and restoration plan and security estimate for Baffinland Iron Mines Corporation Marry River Bulk Sampling Program. Development of the 2010 financial security estimate for the landowner.
- **Qikiqtani Inuit Association (NU)** – Expert technical and regulatory review of the Baffinland Iron Mines Corporation Type A and Type B water licence applications (2008 to 2015, 2018 to 2019). Assisted in the development of information requests and the intervention for submission to Nunavut Water Board. Expert witness at the public hearing.
- **Qikiqtani Inuit Association (NU)** – Expert technical and regulatory review of the Baffinland Iron Mines Corporation Aquatic Effects Monitoring Program, Interim Closure and Reclamation Plan, Annual Report, Annual Work Plan and Quarry/Borrow Management Plans. Reviews submitted to the Nunavut Water Board (2013 to 2018).
- **Qikiqtani Inuit Association (NU)** – Project manager and technical lead in the development of the annual Quarry Concession Report (2014 to 2017) that determines the royalty payments associated with borrow and quarry material used by Baffinland Iron Mines Corporation. Assessment of material usage and methodology for quantification on behalf of the land owner.
- **Qikiqtani Inuit Association (NU)** – Project manager and technical lead in the development of an Operations Guide that is used by the Baffinland Iron Mines Corporation to ensure fulfillment of their obligations under the Commercial Production Lease with the Qikiqtani Inuit Association (2014-2015).
- **Qikiqtani Inuit Association (NU)** – Project manager and technical lead in the review and implementation of the Water Compensation Agreement between the Qikiqtani Inuit Association and Baffinland Iron Mines Corporation (2013 to 2019).
- **Kivalliq Inuit Association (NU)** – Comprehensive review and benchmarking to establish fees applied to Regional Inuit Owned Lands and Specified Substances designated through the Nunavut Land Claim Agreement (2018).
- **Parks Canada Agency (NT)** – Expert technical reviewer of the Canadian Zinc Corporation, Prairie Creek environmental impact assessment and water licencing materials.
  - In 2011, the review focused on winter road construction and geotechnical stability, spill contingency and risk, geochemistry of tailings predictions, and mine water management and treatment. Assisted in the development of information requests on behalf of Parks Canada Agency for submission to Mackenzie Valley Environmental Impact Review Board. Expert witness at the public hearing.
  - In 2015-2017, the review focused on the all-weather road construction and geotechnical stability, spill contingency and risk, and quarry/borrow source management. Assisted in the development of information requests on behalf of Parks Canada Agency for submission to Mackenzie Valley Environmental Impact Review Board. Expert witness at the public hearing.
  - In 2018- 2020, the review focused on review of the water licence application submitted to the Mackenzie Valley Land and Water Board. Expert witness at the public hearing and expert review of all road construction, borrow source management, engineering, and monitoring reports. Review of reclamation security and closure plan.
  - In 2020, provided expert review of various design and management plans including: pioneer winter road design and construction report, traffic control plan, spill contingency plan, avalanche management plan, water monitoring plan, sedimentation and erosion control plan, geochemical verification plan and permafrost management plan.

- **Parks Canada Agency (NT)** – Contracted to complete an expert technical reviewer of Selwyn Chihong’s environmental impact assessment for the Howard’s Pass Access Road Upgrade Project. The review is to focus on the all-weather road construction and geotechnical stability, spill contingency and risk, and quarry/borrow source management.
- **DeBeers Canada (NT)** – Engineering lead in the development of a closure and reclamation plan (2011, 2013, 2016, 2018) for the Snap Lake mine in Northwest Territories. Expert witness at the water licence public hearing. Organized and facilitated community engagement workshops regarding mine closure planning.
- **DeBeers Canada (NT)** – Engineering lead in the development of mine closure financial liability estimate (2011, 2013, 2016, 2018, 2019/20) for the Snap Lake mine in the Northwest Territories. Assessment of closure cost implications resulting from updates the Metal Mines Effluent Regulations (2017). Expert witness at the water licence public hearing.
- **DeBeers Canada (NT)** – Research and development engineering lead associated with closure and reclamation of the Snap Lake mine in Northwest Territories (2010 to 2019). Focus of research and development is associated with progressive reclamation of impacted land, revegetation and contaminated site investigations and reclamation action plans.
- **De Beers Canada (NT)** – Waste rock and PK pile cover research (2013-2015) involving fully instrumented trail cover pads. Engineering lead to complete a 50% design of the cover (2015).
- **DeBeers Canada (NT)** – For the Snap Lake mine, project manager and technical resource in the completion of various environmental agreement and water licence annual reports, including: Annual Closure and Reclamation Plan Progress Report (2011 to 2018); Air Quality and Emissions Reporting (2016 to 2020); Vegetation Monitoring (2016 to 2020), Geotechnical Instrumentation Monitoring Data Report (2016 to 2019); Seepage Survey Report (2016 to 2020); Acid Rock Drainage and Geochemical Characterization Report (2016 to 2020); Hydrology Report (2015 to 2020); Environmental Agreement Annual Report (2015 to 2020), Wildlife Effects Monitoring Plan (2016 to 2018), Wildlife and Wildlife Habitat Protection Monitoring Plan (2016 to 2018).
- **DeBeers Canada (NT)** – Project manager and engineering lead in the completion of the following air quality assessments for the Snap Lake mine: updates to the Air Quality and Emissions Reporting and Management Plan for C&M (2017) and Final Closure (2018 and 2020), air dispersion modelling for the care and maintenance phase (2017), air dispersion modelling for the final closure phase (2018).
- **De Beers Canada (NT)** – Review of and workshop participant in the bowtie risk assessment associated with closure of the Snap Lake Mine (2019).
- **De Beers Canada (NT)** – Engineering lead in the Snap Lake mine site landform design and water drainage plan (2018 and 2020) and sedimentation and erosion control plan (2020).
- **DeBeers Canada (NT)** – Engineering lead in the completion of closure revegetation research for the Snap Lake mine (2014-2020).
- **De Beers Canada (NT)** – Engineering lead in the final revegetation design for the Snap Lake mine (2019 and 2020).
- **De Beers Canada (NT)** – Engineering lead in the Snap Lake mine site environmental hazards assessment plan, final closure air quality plan, final closure hydrology monitoring program (2018 and 2020)
- **DeBeers Canada (NT)** – Project manager for the 2013 implementation assessment of the four separate impact benefit agreements in place between De Beers and the local First Nations for the Snap Lake mine.
- **DeBeers Canada (NT)** – Project manager and design engineer for the development of a new hazardous material containment facility and the expansion of an existing hazardous material containment facility at the Snap Lake mine (2014).
- **DeBeers Canada (NT)** – Project manager and technical resource to complete a dam feasibility study, and the engineering design and construction tender documents for two water retention dams at the Snap Lake mine (2011).

- **DeBeers Canada (NT)** – Project manager and technical lead for the preliminary design of a quarry and water retention sump, as well as, a water balance and chemical load balance model for the sump at the Snap Lake mine (2012).
- **DeBeers Canada (NT)** – Project manager for the development of emergency preparedness and emergency response plans for two dams at the Snap Lake mine (2011).
- **DeBeers Canada (NT)** – Project manager and technical resource for the development of the Gahcho Kue mine's Interim Closure and Reclamation Plan (2016 to 2018), Reclamation Research Plan (2016 and 2017) and Annual Closure and Reclamation Report (2015, 2017, 2018, 2020) for submittal to the Mackenzie Valley Land and Water Board. Completed a community engagement workshop (2015) and regulator workshop (2016, 2017) regarding mine closure planning.
- **DeBeers Canada (NT)** – Engineering lead in the development of mine closure financial liability estimate (2016, 2018) for the Gahcho Kue mine's Land Use Permit amendment applications.
- **DeBeers Canada (NT)** – Engineering lead in the development of mine closure financial liability estimate (2017/18, 2020) for the Gahcho Kue mine. Expert witness at the water licence public hearing.
- **DeBeers Canada (NT)** – Engineering lead in the completion of closure revegetation research for the Gahcho Kue mine (2017-2020).
- **De Beers Canada (NT)** – Engineering lead for a research study regarding wildlife interactions with rock and PK pile and implications on design for the Gahcho Kue mine (2019/20).
- **De Beers Canada (ON)** – Engineering lead in the study of closure cover options for the Victor Mine in Ontario (2020).
- **De Beers Canada (ON)** – Engineering lead for the Operations, Maintenance and Surveillance Manual and annual geotechnical inspections associated with various soil and mine waste piles for the Victor mine in Ontario (2020).
- **De Beers Canada (ON)** – Engineering lead in the mine site final landform design for the Victor mine (2019/20).
- **De Beers Canada (ON)** – Project manager and engineer in the final landform design for the coarse processed kimberlite and low grade ore stockpile at the Victor mine (2019/20).
- **De Beers Canada (ON)** – Project manager and engineer in the final landform design for the north waste rock stockpile at the Victor mine (2020).
- **De Beers Canada (ON)** – Project manager and engineer for the open pit spillway design at the Victor mine (2019/20).
- **De Beers Canada (ON)** – Review of the bowtie risk assessment associated with final closure of the process kimberlite and waste rock stockpiles at the Victor mine (2019).
- **De Beers Canada (ON)** - Engineering lead in the development of mine closure financial liability estimate for the Victor mine (2018).
- **Huckleberry Mines Ltd (BC)** – Project manager in the evaluation of mine water quality and sources of nutrients in mine water (2017).
- **Yellowknives Dene First Nation (NT)** – Expert technical reviewer in the evaluation of the Giant mine's environmental impact assessment. Technical review focused on water quality, waste management, and site closure conditions. Assisted in the development of information requests and the intervention for submission to Mackenzie Valley Environmental Impact Review Board (2015/16).
- **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Bullmoose Area Mine Sites, NWT Remedial Action Plan (2013).
- **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Seven Mines Sites, NWT Remedial Action Plan (2015).
- **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Great Slave Lake Mines, NWT Remedial Action Plan. Participated in community engagement workshop regarding mine closure planning (2018).



- **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Tundra Mine, NWT Remedial Action Plan (2009).
- **Yellowknives Dene First Nation (NT)** – Expert technical reviewer for the Hidden Lake Mine, NWT Remedial Action Plan (2011).
- **Tlicho Government (NT)** – Technical resource development consultant and contributed to the regulatory and technical review of Proponent information in their advancement towards entering into an environmental assessment (2014).
- **Wek’eezhii Land and Water Board (NT)** – Technical review of Dominion Diamond’s Ekati Mine proposed 2019 reclamation security changes (2019).
- **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer for the Phase II Remedial Action Plan for the Tundra Mine Site that included reclamation and closure of: tailing containment area for ARD/ML tailings and waste rock, site water management and treatment, petroleum hydrocarbon contaminated soil and rock. Lead engineer in technical/regulator meetings with proponent and participant in the public hearing. Assisted in the development of the water licence (2010).
- **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer for the Miramar Northern Mining Ltd. Con Mine closure plans for backfill and cover of the tailings containment ponds and hazardous waste areas (2009).
- **Mackenzie Valley Land and Water Board (NT)** – Project manager for a team of scientist and engineers in the water licence review of the North American Tungsten Corporation mine in the NWT. Technical lead in the review of surface infrastructure, hydrologic, hydrogeologic, geochemistry, abandonment and reclamation, and security components. Lead engineer in technical/regulator meetings with proponent and participant in the public hearing. Assisted in the development of the water licence (2008/09).
- **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer of the following De Beer’s Snap Lake mine engineering documents pertaining to the waste rock, ore storage and tailings management (2009).
- **Lutsel K’e Dene First Nation (NT)** – Expert technical reviewer for following BHP Billiton Diamonds Inc. – EKATI diamond mine engineering documents pertaining to adaptive management, closure and reclamation, financial security, waste rock and tailings management (2009).
- **Lutsel K’e Dene First Nation (NT)** – Expert technical reviewer for the following Diavik Diamond Mine Inc. – management documents pertaining to hazardous materials and spill contingency (2009).
- **Lutsel K’e Dene First Nation (NT)** – Participated in Deze Energy Corporation Taltson Hydroelectric Expansion Project, Environmental Impact Assessment technical sessions organized by the Mackenzie Valley Environmental Impact Review Board (2009).
- **Mackenzie Valley Environmental Impact Review Board (NT)** - Project manager for the socio-economic review of the proposed Gahcho Kué diamond mine in the NWT (2009).
- **Saskatchewan Environment Resource Management (SK)** – Expert technical reviewer of groundwater and brine migration model predictions below the Cory, Mosaic, Mosaic K1, Mosaic K2, and Patience Lake, Saskatchewan potash mines during operation and post-closure (2006-2009).
- **Nunavut Water Board (NU)** – Expert technical reviewer and licence compliance assessor for the Miramar Hope Bay Limited Windy Lake and Boston Exploration Camps, specifically, the water monitoring program, QA/QC plan, annual reporting, and abandonment and restoration plan (2007/08).
- **Nunavut Water Board (NU)** – Technical reviewer of the following Tahara Diamond Corporation- Jericho Diamond Mine application documents for water licence consideration (2007/08).
- **Nunavut Water Board (NU)** - Technical reviewer of the following Miramar Hope Bay Limited- Doris North Gold Mine application documents for water licence consideration (2008).
- **UMA Engineering Ltd. (MB)** - Chemical treatment of mine water effluent at the closed Fox Lake, Manitoba (2006).
- **INCO LTD. (MB)** - Contributed to the characterization and trial revegetation of mine tailings at INCO Ltd., Thompson, Manitoba (2005/06).

- **INCO LTD., Manitoba Sustainable Development Innovation Fund, and University of Manitoba (MB)** - Field and laboratory measurement of unconsolidated and cemented (hard-pan) tailings hydraulic properties and implications on metal leachate and acid mine drainage (2004/05).
- **Manitoba Mines Branch, Manitoba Sustainable Development Innovation Fund, and University of Manitoba (MB)** - Assessment of attenuation and potential mobility of arsenic at the abandoned New Britannia Mine, Manitoba (2004/05).
- **Federal University of Rio Grande do Sul, Brazil and University of Manitoba (MB and Brazil)** – Project manager and engineering advisor in the assessment of contaminant transport properties through compacted soil liners subjected to acid mine drainage percolation (2004/05).
- **Federal University of Rio Grande do Sul, Brazil and University of Manitoba (MB and Brazil)** - Project manager and engineering advisor in the measurement of geotechnical strength characteristics of residual soils, with and without cement additives, subjected to acid mine drainage percolation (2004/05).

## OIL AND GAS

- **Government of the Northwest Territories (NT)** – Development of reclamation security estimate for Strategic Oil and Gas' Cameron Hills project (2020).
- **Inuvialuit Regional Corporation (NT)** – Evaluation of oil and gas drilling waste sump performance in the Inuvialuit Settlement Region and implications of climate change on future sump conditions (2019/20).
- **Government of the Northwest Territories (NT)** – Review of Imperial Oil Limited's Long Term Waste Management Facility Plan and participation in workshop (2019-2020).
- **Government of the Northwest Territories (NT)** – Review of Strategic Oil and Gas' Conceptual Closure and Reclamation Plan and Site Wide Monitoring Plan (2019).
- **Government of the Northwest Territories (NT)** – Development of a reclamation security estimate for Paramount's East and West Liard gas wells (2019).
- **Government of the Northwest Territories (NT)** – Review of Imperial Oil Limited's Annual Closure Report with specific focus on closure and reclamation (2019, 2020).
- **Government of the Northwest Territories (NT)** – Review of Strategic Oil and Gas' Annual Water Licence report with specific focus on closure and reclamation (2019).
- **Government of the Northwest Territories (NT)** – Expert technical reviewer of Imperial Oil Limited's Norman Wells Production Facility security estimate and development of a reclamation security estimate for the GNWT (2014 and 2018).
- **Government of the Northwest Territories (NT)** – Development of a RECLAIM Oil and Gas user manual to complete reclamation liability estimates (2017).
- **Government of the Northwest Territories (NT)** – Expert technical reviewer of Imperial Oil Limited's Norman Wells Production Facility Interim Closure and Reclamation Plan (2015).
- **Aboriginal Affairs and Northern Development Canada (NT)** – Review and update of the existing RECLAIM model used in the NWT for estimating reclamation liabilities at oil & gas sites through to oil & gas production sites (2013).
- **Inuvialuit Water Board (NT)** – Expert technical and regulatory assessment of Imperial Oil Limited's Type B water licence application pertaining to the reclamation of Bar-C in the Inuvialuit Settlement Region (2012).
- **Inuvialuit Water Board (NT)** – Expert technical and regulatory assessment of Shell Canada's Closure and Reclamation Plan for the Camp Farewell site (2013).
- **Government of Northwest Territories (NT)** – Expert technical reviewer of Oil & Gas Drilling Waste Disposal Practices for the Proposed Type A Water Licence in the Cameron Hills, NWT Region. Expert technical witness during the water licence public hearing (2012).

- **Mackenzie Valley Land and Water Board (NT)** – Expert technical reviewer for Paramount Resources Ltd. water licence and land use permit application materials to support their Cameron Hills extension project (2012).
- **Department of Indian Affairs and Northern Development (NT)** – Technical and regulatory reviewer for the Paramount Resources Ltd. Cameron Hills Type ‘B’ Water Licence Application that included aspect to evaluate impacts on surface water quality and quantity (2010).
- **Northwest Territories Water Board (NT)** - Preliminary technical review of Shell Canada Ltd. Camp Farewell, NT Environmental Site Assessment (2009).
- **Northwest Territories Water Board (NT)** - Preliminary technical review of MGM Energy Corporation 2D, 3D, and seismic drilling operations and review of draft water licence conditions (2009).

## REGULATORY

- **Inuvialuit Water Board (NT)** – Expert technical reviewer for the Inuvik to Tuktoyuktuk all-weather highway project. Acted as regulatory officer throughout the licensing process, and prime expert witness during the water licence public hearing (2013). Post hearing activities involved review of the Type A water licence submittals (as needed, 2013-2018), including: road design and construction plan, water monitoring plan, fish and fish habitat protection plan, sedimentation and erosion control plan, spill contingency plan, permafrost management plan, and various borrow source management plans.
- **Government of the Northwest Territories (NT)** – Completed a state of knowledge report for groundwater resources within the transboundary reaches of the NWT to support the bi-lateral water agreements with the Yukon, British Columbia, Alberta, and Saskatchewan (2018).
- **Government of the Northwest Territories (NT)** – Expert technical reviewer of the draft solid waste facility design and operation guidelines developed by the Mackenzie Valley Land and Water Board (2017).
- **DeBeers Canada (NT)** – Provided expert technical reviewer of the draft guidelines for closure and reclamation cost estimates for mines developed by the Mackenzie Valley Land and Water Board (2015, 2017).
- **Wek’eezhii Land and Water Board (NT)** – Expert technical review of the Government of Northwest Territories, Tlicho Road camp – wastewater lagoon (2020).
- **Wek’eezhii Land and Water Board (NT)** – Project manager in the jurisdictional review of land and water use permits in Saskatchewan, Yukon, Alberta, Alaska, British Columbia, and Ontario. Focus of review was focused on the following resource sector activities: waste disposal sumps, diamond drilling on land and ice, camp waste management, on-land seismic activities, and winter road activities on land and ice (2015).
- **Qikiqtani Inuit Association (NU)** – Contributed to the development of a lands resource security policy in conjunction with this landowner (2013, 2015).
- **Plan Review Process & Guideline Working Group – Mackenzie Valley Land and Water Boards (NT)** – Lead engineer and technical resource consultant in the completion of a guideline for waste management practices that proponents seeking a water licence can use to ensure that their plans and designs capture elements necessary to understand waste management and the expectations that the Water Boards within the Mackenzie Valley. The guideline is applicable to the mining, oil and gas, exploration, industrial, and municipal sectors, and includes all sources of waste ranging from tailings, construction & demolition waste, hazardous waste, contaminated soil, and municipal refuse (2013).
- **Environment Canada (YK, NT, NU)** – Project manager and lead engineer to evaluate the legal obligations (e.g., permitting, compliance promotion, and enforcement) and authorities of governments and Boards within the Canadian North responsible for environmental legislation and protection. Also, evaluated the potential implementation issues for the new CEPA Storage Tank regulation in the North and the proposed federal Clean Air Regulatory Agenda for the Northern Oil and Gas Sector (2012/13).
- **South Australia Environmental Protection Authority (Australia)** - Contributed to the development of the landfill standards, specifically, barrier system design and contaminant transport, test methods for



organic mater and calcium content for leachate collection drainage materials, leachate collection system design and service life predictions, and expert review of draft standards (2005).

- **Nunavut Water Board (NU)** – Lead engineer responsible for the development of draft guidance document for northern waste and water containment facilities, specifically, landfills, landfarms, lagoons, and water retention structures. Document provides proponents involved in these facilities of the hydrology, hydrogeologic, geotechnical, design, operation, monitoring, and maintenance issues that may be considered and detailed in an application for the purposes of obtaining a water licence (2006-2007).
- **Nunavut Water Board (NU)** - Contributed to the development of application guidelines for Miramar Hope Bay Ltd.- Doris North Gold Mine and Cumberland Resources Ltd.- Meadowbank Gold Mine (2007/08).
- **Nunavut Water Board (NU)** - Technical review and licence compliance assessment for monitoring program, QA/QC plan, annual reporting, and abandonment and restoration plan for the following Distant Early Warning (DEW) line sites: DYE-M- Cape Dyer; CAM-2- Gladman Point; FOX-2- Longstaff Bluff; FOX-5- Qikiqtarjuaq; BAF-5- Resolution Island; and, CAM-1- Jenny Lind Island (2007/08).
- **Ontario Ministry of Environment (ON)** - Contributed to the review of state-of-the-art of landfill design, specifically pertaining to leachate characteristics for municipal solid waste landfills, leachate collection system design, and geosynthetics use in leachate collection system and cover applications (2002).

## MUNICIPAL INFRASTRUCTURE

- **Government of the Northwest Territories (NT)** – Technical reviewer the Hay River solid waste disposal facility groundwater flow components (2020).
- **City of Iqaluit (NU)** – Project manager and technical lead in the contract administration support for various water, wastewater, and solid waste infrastructure projects, including: solid waste facility fence design (2016 to 2017), water and sewer inventory update and model development (2017), supplementary water supply pipeline (2017), construction contractor support package (2017). As needed (2016 to 2017).
- **City of Iqaluit (NU)** – Project manager for the construction administration of the city’s solid waste and wastewater treatment facility (2016).
- **City of Iqaluit (NU)** – Project manager for the structural and electrical evaluation of the City of Iqaluit’s Fire Station back-up generator (2016).
- **Inuvialuit Water Board (NT)** – Expert technical review of the Hamlet of Aklavik’s water licence application materials (2016).
- **Environment Canada (YK, NT, NU)** – Expert technical reviewer of draft guidance document “Solid Waste Facilities in Northern Climate” (2016).
- **Environment Canada (YK, NT, NU)** – Expert technical support for the development of the document “Modern Municipal Solid Waste Facilities in Northern Climate”. Performed consultation activities between Environment Canada and various Territorial Government departments (2015-2016).
- **Environment Canada (YK, NT, NU)** – Project lead in the development of a foundation report for a technical document on municipal solid waste landfills in northern conditions: engineering design, costing, construction, and operation (2015).
- **Environment Canada (YK, NT, NU)** – Project lead in the review of the state of waste management practices for community solid waste within the three territories. The focus of the study was on regulatory requirements, territory wide solid waste profiles and challenges, as well as, community scale operations and challenges (2014).
- **Government of Nunavut (NU)** – Project manager and technical lead in the completion of best management practices for landfills in Nunavut. Analysis includes strategic planning, options analysis, and cost-benefit analysis (2013/14).

- **Government of Nunavut, Hamlet of Sanikiluaq (NU)** – Technical resource in the design, construction, and costing of the community’s wastewater lagoon expansion cell. Evaluation of the existing lagoon and wetland treatment capabilities and design of modifications to the current system to achieved effluent water quality criteria (2015-2017).
- **Government of Nunavut, Hamlet of Igloolik (NU)** – Project manager and technical resource in the design and construction of a new drinking water containment structure and associated infrastructure / piping for water treatment/delivery (2015-2018).
- **Government of Nunavut, Hamlet of Resolute Bay (NU)** – Project lead and engineer in the development of a new solid waste facility and decommission of the existing solid waste site (municipal landfill, recycling area, and bulky metals site) in Resolute Bay, Nunavut. Core activities included: siting and design of a new solid waste disposal facility; waste audit and development of waste management plan for the new disposal facility; construction costing; closure and reclamation plan; and, provision of tendering services upon acceptance of design including tender documents, construction specifications and QA/QC plan, drawings, and contract administration during construction (2012-2015).
- **Government of Nunavut, Hamlet of Grise Fiord (NU)** – Technical resource in the development of a new solid waste facility and decommission of the existing solid waste site (municipal landfill, recycling area, and bulky metals site) in Grise Fiord, Nunavut. Core activities included: siting and design of a new solid waste disposal facility; construction costing; closure and reclamation plan; and, provision of tendering services upon acceptance of design including tender documents, construction specifications and QA/QC plan, drawings, and contract administration during construction (2013-2016).
- **Government of Nunavut, Hamlet of Pangnirtung (NU)** – Project manager and lead environmental and geotechnical designer and engineer in the optimization of the hamlet’s water supply facility and completion of a Comprehensive Performance Evaluation report. Activities include: assessment and repair of water retention structure and associated infrastructure; geotechnical and geothermal modelling of the water reservoir slopes; and, design of an improved water supply facility to meet current and future community needs (2015-2018).
- **Government of Nunavut, Hamlet of Arviat (NU)** – Lead geotechnical designer in the geothermal modelling of the water retention structure slopes and foundation (2015).
- **Mackenzie Valley Land and Water Board (NT)** – Project manager for a technical team to technically review the City of Yellowknife’s water licence application and supporting documents. Topics covered included review of the proponent’s landfilling and wastewater treatment practices and future expansion plans. Participant in technical /regulatory meetings with the proponent. Assisted in the development of the water licence (2012).
- **Mackenzie Valley Land and Water Board (NT)** – Technical reviewer of the Town of Hay River’s water licence application and supporting documents. Topics covered included review of the proponent’s landfilling and wastewater treatment practices and future expansion plans. Participant in technical /regulatory meetings with the proponent. Assisted in the development of the water licence (2012).
- **Department of Indian Affairs and Northern Development (NT)** – Lead geotechnical engineer in the completion of a desktop study for a leased land in Ft. Simpson, NT that is proposed for two storage facilities (2011).
- **Department of Indian Affairs and Northern Development (NT)** – Project manager and geotechnical engineer in the completion of a geotechnical field investigation for a leased land in Ft. Simpson, NT that is proposed for two storage facilities (2011).
- **Wekweeti Community Government – Tlichio (NT)** – Project manager for a community energy audit (2011).
- **Gameti Community Government – Tlichio (NT)** – Project manager for a community energy audit (2011).
- **Infrastructure Canada- Knowledge-building, Outreach, and Awareness Program (Canada)** - Assessment of national incidence of water well infrastructure deterioration in Canada, life-cycle cost analysis of groundwater extraction wells with consideration given to operations and maintenance, and

characterization of water quality, hydrogeology, and well design and operation impacts on water well deterioration (2007/08).

- **Grundfos Management A/S (Denmark)** – Grundfos is the world leader in the manufacturing of pumps. Acted as an expert participant in a workshop in Denmark to review mechanisms and process leading to biological, chemical, and physical clogging mechanisms and process for groundwater wells and pumps (2009).
- **Agriculture and Agri-Foods Canada Water Supply and Expansion Program and City of North Battleford (SK)** – Project lead and engineer to complete a groundwater capture zone study. The capture zone objectives were to: establish the causes of well and water quality deterioration and formulate methods of predicting long term well performance and service life (2005-2007).
- **Nunavut Water Board (NU)** – Expert technical reviewer of the geotechnical, construction specifications, containment function, and water quality impact, for the following (2006-2008):
  - Hamlet of Qikiqtarjuaq- lagoon, landfill, landfarm hazardous waste storage area, and water reservoir
  - Hamlet of Kugluktuk- lagoon, landfill, and landfarm
  - Hamlet of Kugaaruk- lagoon
  - Hamlet of Taloyoak- landfarm
- **Deline Land Corporation (NT)** - Lead geotechnical engineer in the investigation of the Grey Goose Lodge foundation evaluation and repair (2009).
- **UMA Engineering Ltd. (MB)** – Field engineer to completed aquifer pump tests at Keewatin and PTH 59 North locations (2006).
- **City of Winnipeg, Manitoba Waste Reduction and Pollution Prevention (MB)** – Project manager and engineering advisor for the field measurement of refuse hydraulic properties and efficiency of leachate extraction wells to reduce leachate levels in municipal solid waste landfills (2004-2005).
- **City of Winnipeg, Manitoba Waste Reduction and Pollution Prevention (MB)** – Engineering advisor for the bench top assessment of submerged membrane bioreactor to aerobically treat landfill leachate (2005-2006).

## ENVIRONMENTAL ASSESSMENTS AND SITE REMEDIATION

- **Public Works and Government Services Canada (NU)** – Project manager and construction contract administrator for the demolition and reclamation of a building in Baker Lake, NU. Environmental engineer responsible for soil and water reclamation requirements (2016).
- **Inuvialuit Water Board (NT)** – Expert opinion on water licence sampling and reporting with regards to the Prince Patrick Island reclamation project (2016).
- **Wekweeti Community Government – Tlicho (NT)** – Environmental engineer responsible to complete a fuel spill investigation that occurred adjacent to a community building in Wekweeti, NT. In addition to an assessment of the physical site characteristics, soil samples were collected and analyzed for total petroleum hydrocarbon levels. General recommendations for site restoration were provided (2012).
- **Smiths Landing First Nation (AB)** – Lead engineer to complete a Phase 1 Environmental Site Assessment of a transfer land from the Crown to the Band through the provisions set in the Treaty Lands Entitlement framework (2015).
- **Smith Landing First Nation (AB)** – Expert review the findings of Hay Camp, Wood Buffalo Park Phase 1, 2, and 3 Environmental Site Assessment, and remediation action plan, to understand environmental and human health risk for the First Nation. Participant in technical meetings with consultant and government organizations regarding clean up strategies and proposed remedial action (2014-2015).
- **Smith Landing First Nation (AB)** – Expert technical and regulatory support pertaining to risk management and remedial actions associated with uranium and radiation contamination on Reserve lands. Participant in technical discussions on behalf of First Nation with various government organizations with regards action plans (2015).

- **Government of Northwest Territories – Transportation: Policy, Planning, and Environment (NT)**  
– Phase 1 Environmental Site Assessment of leased land within the First Simpson, NT airport (2011).

## AGRICULTURAL

- **Prairie Farm Rehabilitation Association- Agriculture and Agri-Foods Canada (Canada)** - Clogging of agricultural tile drains, impacts on performance, and field crop revenue loss (2006).
- **Prairie Farm Rehabilitation Association- Agriculture and Agri-Foods Canada (Canada)** - Review of impressed current systems to mitigate biofouling clogging effects in groundwater extraction wells (2006).
- **Manitoba Conservation and University of Manitoba (MB)** - Measurement of contaminant and nutrient migration below earthen manure storage lagoons in southern Manitoba. Evaluation of contaminant transport parameters for inorganic and nutrient constituents in various aquitards below manure lagoons (2006).

## EDUCATION AND TRAINING

- **Government of the Northwest Territories (NT)** – Development and execution of a 1-day workshop on the RECLAIM method for reclamation security estimations for mining and oil and gas undertakings (2019).
- **Saskatchewan Ministry of Environment (SK)** – Developed and delivered a workshop to the Ministry of Environment on the topics of: groundwater flow and contaminant transport, site remediation, and porous media flow and transport modelling (2016).
- **Tlicho Government (NT)** – Developed and delivered a workshop to the Tlicho Assembly on the proposed NICO mine development (2014).
- **Nunavut Arctic College (NU)** - Developed and instructed a five day course for municipal operators and foremen in the areas of drinking water treatment, wastewater treatment, and solid waste management. The course was held in Rankin Inlet, NU in January, 2014.
- **Nunavut Municipal Training Organization (NU)** – Developed and instructed a translation workshop to assist translators in communicating scientific and construction terms, common in municipal infrastructure activities, from English to Inuktitut (2009).
- **Nunavut Municipal Training Organization (NU)** – Developed and instructed a five day course for municipal operators and foremen in the areas of drinking water treatment, wastewater treatment, and solid waste management. The course was held in Iqaluit, NU and Rankin Inlet, NU in May, 2009, and in Iqaluit, NU in October, 2009.
- **Building Environmental Aboriginal Human Resources –BEAHR (Canada)** – Developed student manual, instructor manual, and instructor presentation materials for a solid waste coordinator course. Curriculum materials are to be licenced by BEAHR to instructors to train Aboriginals in topics relevant to operate and manage a solid waste facility (2011/12).
- **Environmental Monitoring Advisory Board – EMAB (NT)** – Developed and facilitated a mining closure and reclamation workshop in Yellowknife, NT. EMAB is a consensus board of ensuring the protection of Lac De Gras environment where the Diavik Diamond Mines is located. Workshop participants included members of Aboriginal communities and regulators who ensure compliance with licences and leases, and Diavik personnel (2012).
- **Government of Northwest Territories – Municipal and Community Affairs** – Managed, developed, and instructed an eight day Introduction to Environmental Management course in Inuvik, NT in 2008 and 2011. Course topics included: general environmental awareness; roles and responsibilities of regulators and legislation that helps protect the environment; Mackenzie Valley Resource Management Act and associated Boards; Inuvialuit Land Administration; challenges of waste disposal and community infrastructure such as sanitary landfills and wastewater lagoons; contaminants in the North

and their effects; site inspection; remediation technologies; and understanding of Government of Northwest Territories and Indian and Northern Affairs Canada programs.

- **Government of Northwest Territories – Municipal and Community Affairs (NT)** – Managed, developed, and instructed a five day Class 1 Drinking Water Treatment Plant Operator course in Inuvik, NT in 2008. Hay River, NT in 2010, and Inuvik, NT in 2011.
- **Government of Northwest Territories – Municipal and Community Affairs (NT)** – Managed, developed, and instructed a five day Class 2 Drinking Water Treatment Plant Operator course in Norman Wells, NT in 2010 and Fort Smith, NT in 2010.
- **University of Manitoba – Department of Civil Engineering (MB)** – Managed, trained, and operated an independently funded research program to support the completion of 2 Ph.D, 6 M.Sc., and 2 B.Sc. student theses.
- **University of Manitoba – Department of Civil Engineering (MB)** – Developed curriculum and instructed the following undergraduate and graduate student courses (2003-2007):
  - Groundwater hydrology
  - Hazardous waste management
  - Fluid mechanics
  - Groundwater contamination
  - Solid waste engineering
  - Physical and chemical hydrogeology
  - Geoenvironmental engineering

## BOOK CHAPTERS

1. VanGulck, J. and Rowe, R.K. 2010. Landfilling: Geotechnology. Chapter 10, Solid Waste Technology and Management, eds. Christensen, Wiley-Blackwell.
2. Clark, R., Koda, E., Lipinski, M., Wolski, W., Rowe, R.K., and VanGulck, J. 2005. Environmental Geotechnics- Chapter 1: Design Basics and Performance Criteria. Report for International Technical Committee No. 5 (ITC5) on Environmental Geotechnics of the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE).

## ARTICLES IN REFEREED PUBLICATIONS

3. Lozecznik, S., Oleszkiewicz, J., Clark, S., Sparling, R., and VanGulck, J. 2012. Effects of Turbulence and Temperature on Leachate Chemistry. *Journal of Environmental Engineering*, **138**(5): 562-569.
4. Lozecznik, S., Sparling, R., Clark, S.P., VanGulck, J.F., and Oleszkiewicz, J.A. 2012. Acetate and propionate impact on the methanogenesis of landfill leachate and the reduction of clogging components. *Bioresource Technology*, **104**: 37-43.
5. Sherriff, B.L., Etcheverry, D.J., Sidenko, N.V., and VanGulck, J. 2011. Spatial and temporal evolution of Cu-Zn tailings during dewatering. *Applied Geochemistry*, **26**(11): 1832-1842.
6. Simpson, S., Sherriff, B.L. VanGulck, J., Khozhina, E., Londry, K., and Sidenko, N. 2011. Source, attenuation and potential mobility of arsenic at New Britannia Mine, Snow Lake, Manitoba. *Applied Geochemistry*, **26**(11): 1843-1854.
7. Lozecznik, S., Sparling, R., Oleszkiewicz, J.A., Clark, S., and VanGulck, J.F. 2010. Leachate treatment before injection into a bioreactor landfill: clogging potential reduction and benefits of using methanogenesis. *Waste Management*, **30**(11): 2030-2036.
8. Lozecznik, S. and VanGulck, J.F. 2009. Full-scale laboratory study into clogging of pipes permeated with landfill leachate. *ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management*, **13**(4): 261-269.
9. VanGulck, J., Lozecznik, S., and Murdock, J. 2009. Hydraulic design tables for horizontal liquid injection systems in bioreactor landfills. *ASCE Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management (special edition)*, **13**(3): 147-155.



10. Sherriff, B.L., Ferguson, I., Gupton, M.W., VanGulck, J.F., Sidenko, N., Priscu, C. 2009. A Geophysical and geotechnical study to determine the hydrological regime of the Central Manitoba gold mine tailings deposit. *Canadian Geotechnical Journal*, **46**: 1-12.
11. Knop, A., VanGulck, J., Heineck, K.S., and Consoli, N. 2008. Transport of contaminants through a compacted soil liner subjected to acid mine drainage (AMD) percolation. *Journal of Hazardous Materials*, **155**(1): 269-276.
12. VanGulck, J.F. and Rowe, R.K. 2008. Parameter estimation for modeling clogging of granular medium permeated with leachate. *Canadian Geotechnical Journal*, **45**(6): 812-823.
13. Sadri, S., Cicek, N., and VanGulck, J. 2008. Aerobic treatment of landfill leachate using a submerged membrane bioreactor – prospects for on-site use. *Environmental Technology*, **29**: 889-907.
14. Sherriff, B., Salzsauler, K.A., Simpson, S., Sidenko, N.V., and VanGulck, J. 2008. Arsenic mobility from arsenopyrite-rich gold mine waste in Snow Lake, Manitoba, Canada. *Chinese Journal of Geochemistry*, **25**(1): 29-30.
15. Cooke, A.J., Rowe, R.K., VanGulck, J.F. and Rittmann, B.E. 2005. Application of the BioClog model for landfill leachate clogging of gravel-packed columns, *Canadian Geotechnical Journal*, **42**: 1600-1614.
16. VanGulck, J.F., Rowe, R.K. 2004. Influence of landfill leachate suspended solids on clog (biorock) formation. *Waste Management*, **24**: 723-738.
17. VanGulck, J.F. and Rowe, R.K. 2004. Evolution of clog formation with time in columns permeated with synthetic landfill leachate. *Journal of Contaminant Hydrology*, **75**: 115-139.
18. VanGulck, J.F., Rowe, R.K., Rittmann, B.E., and Cooke, A.J. 2003. Biogeochemical calcium precipitation in landfill leachate collection systems. *Biodegradation*, **14**: 331-346.
19. Rowe, R.K., VanGulck, J.F. and Millward, S.C. 2002. Biologically induced clogging of a granular medium permeated with synthetic leachate. *Canadian Journal of Environmental Engineering and Science*, **1**(2): 135-156.
20. Cooke, A.J., Rowe, R.K., Rittmann, B.E., VanGulck, J.F. and Millward, S.C. 2001. Biofilm growth and mineral precipitation in synthetic leachate columns. *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, **127**(10): 949-856.

**Education**

*M.A.Sc.  
Biological/Environmental  
Engineering, Dalhousie  
University, Halifax, NS,  
2007*

*B.Eng. Environmental  
Engineering, Dalhousie  
University, Halifax, NS,  
2005*

*B.Sc. Biology, Cape Breton  
University, Sydney, NS,  
2002*

**Languages**

*English – Fluent*

**Calgary**

***Water Quality Specialist***

Alison Snow joined Golder Associates Ltd. in May 2011, as a Water Quality Specialist. Her educational background includes a Bachelor of Science from Cape Breton University, a Bachelor of Environmental Engineering from Dalhousie University, and a Master of Applied Science in Biological/Environmental Engineering from Dalhousie University. Her responsibilities include training junior colleagues, developing models that simulate surface water flow and quality, summarizing large datasets containing water quality for input into water quality models, and preparing modeling reports and presentations.

**Employment History**

***Golder Associates Ltd. – Calgary, AB***  
*Water Quality Specialist (2011 to Present)*

Responsibilities include training junior colleagues, developing models for surface water flow and quality, summarizing large datasets containing water quality for input into water quality models, and preparing modeling reports and presentations.

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## PROJECT EXPERIENCE – DEVELOPING DISCHARGE LIMITS

- Public Services and Procurement Canada  
Giant Mine**  
NT, Canada
- Calculated effluent quality criteria for Giant Mine. Roles involved identifying parameters for which effluent quality criteria should be developed; calculating effluent quality criteria; and, producing a report documenting the effluent quality criteria.
- De Beers Canada Inc.  
Gahcho Kue Mine**  
NT, Canada
- Calculated effluent quality criteria for the De Beers Canada Inc. Gahcho Kue Mine. Roles involved identifying parameters for which effluent quality criteria should be developed; calculating effluent quality criteria; producing a report documenting the effluent quality criteria; and, appearing at technical sessions and public hearings as an expert witness to present and explain the study findings.
- Dominion Diamond  
Ekati Corporation Jay Project**  
NT, Canada
- Calculated effluent quality criteria for the Dominion Diamond Ekati Corporation Jay Project. Roles involved identifying parameters for which effluent quality criteria should be developed; defining appropriate site-specific water quality objectives for Lac du Sauvage for each parameter; calculating effluent quality criteria; producing a report documenting the effluent quality criteria; and, providing support during the water licencing process.
- De Beers Canada Inc.  
Snap Lake Mine**  
NT, Canada
- Calculated effluent quality criteria for the De Beers Canada Inc. Snap Lake Mine. Roles involved identifying parameters for which effluent quality criteria should be developed; defining appropriate site-specific water quality objectives for Snap Lake for each parameter; calculating effluent quality criteria; producing a report documenting the effluent quality criteria; and, appearing at technical sessions and public hearings as an expert witness to present and explain the study findings.

## PROJECT EXPERIENCE – WATER QUALITY MODELING

- Public Services and Procurement Canada  
Giant Mine**  
NT, Canada
- Modeled present-day arsenic loading to Baker Creek and Yellowknife Bay to provide support for the Baker Creek Post-Environment Assessment investigations for Giant Mine. Roles involve guiding the modeling of arsenic concentrations and loads to Baker Creek and Yellowknife Bay using GoldSim and producing a presentation and report explaining the study findings.
- Modeled the mixing characteristics of water discharged from a water treatment plant to four locations on Yellowknife Bay for three outfall design options. Roles involve guiding the near-field modeling using CORMIX; calculating parameter concentrations at a distance of 200 m from the outfall; comparing parameter concentrations in Yellowknife Bay to relevant water quality guidelines; evaluating the sensitivity of model results to changes in model inputs; and, producing a presentation and report explaining the study findings.
- Hydrodynamic and water quality modeling lead to support Baker Creek Post-Environmental Assessment investigations for Giant Mine. Roles involve guiding the modelling of water quality in Yellowknife Bay using GEMSS to predict the effects of remediation on bay water quality; producing a report explaining the findings. Constituents modeled included total dissolved solids, temperature, nutrients, major ions, and metals.

- Teck Resources Ltd.  
Frontier Oil Sands  
Project**  
AB, Canada
- Modeled water quality in a compensation lake as part of the Teck Resources Ltd. Frontier Oil Sands Project. Roles involved guiding the modeling of the compensation lake using GEMSS to estimate water circulation patterns, water temperatures, concentrations of total dissolved solids, biochemical oxygen demand, dissolved oxygen, total ammonia, nitrate, phosphate, chlorophyll a, and acute and chronic toxicity to understand if all areas of the lake were predicted to be suitable for fish; and, producing a report explaining the study findings.
- Dominion Diamond  
Ekati Corporation Jay  
Project**  
NT, Canada
- Hydrodynamic and water quality modeling lead to support the Dominion Diamond Ekati Corporation Developer's Assessment Report and Type A water licence application. Roles involved guiding the modelling of water quality in Lac du Sauvage and Lac de Gras using GEMSS to predict the effects of future mine developments on lake water quality; guiding the modelling of stratification potential in Jay Pit and Misery Pit lakes using CE-QUAL-W2; producing a report explaining the findings. Constituents modeled included total dissolved solids, temperature, nutrients, major ions, and metals.
- De Beers Canada Inc.  
Snap Lake Mine**  
NT, Canada
- Modelled the water quality of lakes downstream of Snap Lake to predict the effects of mining on lake water quality as a result of the De Beers Canada Inc. Snap Lake Mine water licence amendment and environmental assessment (EA1314-02). Roles involved guiding the modelling of lakes downstream of Snap Lake using GoldSim; and producing a report explaining the study findings.
- Updated the Snap Lake water quality model that was developed in GEMSS to predict the effects of mining on lake water quality as part of the De Beers Canada Inc. Snap Lake Mine water licence amendment and environmental assessment (EA1314-02). Constituents modeled included total dissolved solids, temperature, oxygen, nutrients, major ions, and metals. Appeared at technical sessions and public hearings as an expert witness to present and explain the model results.
- Seabridge Gold Inc.  
Courageous Lake  
Project**  
NT, Canada
- Modeled the water quality of Courageous Lake using GEMSS to predict the impacts of future mine developments on lake water quality. Constituents modeled included total dissolved solids, temperature and water velocity. Produced a report explaining the study findings.
- De Beers Canada Inc.  
Gahcho Kue Project**  
NWT, Canada
- Modeled the water quality of Kennady Lake using GEMSS to predict the effects of future mine developments on lake water quality as part of the De Beers Canada Inc. Gahcho Kué Environmental Assessment. Constituents modeled included total dissolved solids, temperature, total suspended solids, dissolved oxygen, and nutrients. Produced reports explaining the study findings.

## TRAINING

### *GoldSim Workshop*

*GoldSim Technology Group, June 26-28, 2012*

### *CE-QUAL-W2 Version 3.7 Workshop*

*Portland State University Professional Development Center, June 11-15, 2012*

### *3-Dimensional Hydrodynamic and Water Quality Modeling Using GEMSS*

*ERM Inc. - Surfacewater Modeling Group, May 23-25, 2011*

**Education**

*B.Sc. (Hons), James Cook University, Australia, 1986*

**Professional Affiliations**

*Australian Freshwater Sciences Society*

*Australian Water Association*

*Canadian Society of Limnology*

*Society of International Limnology*

*International Water Association*

*Institute of Corporate Directors*

**Golder Associates Ltd. – Calgary**

***Principal, Senior Water Quality Specialist***

John is a Principal and senior water quality specialist based in the Calgary office. He has over 25 years of experience undertaking and directing surface water quality and limnological assessments of river, lake, and inshore marine environments.

John has been with Golder for 13 years. Prior to joining Golder, John spent the majority of his professional career working on the east coast of northern Australia at the Australian Centre for Tropical Freshwater Research at James Cook University, Townsville, Queensland. While at the Centre, John managed the consulting component of the business, as well as its analytical service laboratory, and collaborated on a number of research projects that focused on freshwater and marine environments. Relevant work John undertook while at the Centre included the assessment of effects of mining and refinery operations to freshwater and inshore marine receiving environments, and the assessment of effects of agricultural runoff to coastal rivers and nearshore environments.

Since joining Golder, John has worked as a component lead, project manager, senior technical advisor, technical director, and project director for projects involving water quality baseline and assessment studies and environmental impact assessments. These projects have focused on mining and municipal business sectors. Although John’s background is water quality, John’s work at Golder has predominantly been associated with leading baseline and environmental impact assessments for mining projects in north-western Canada; the key mining projects John has been involved with include the environmental assessment, permitting processes, and annual environmental monitoring for the De Beers Gahcho Kué Diamond Mine, the Dominion Diamond Mine Jay project, the Fortune NICO, the Agnico Eagle Whale Tail Expansion and Meliadine Expansion projects, as well as the annual aquatic effects monitoring programs for De Beers Gahcho Kué and Snap Lake diamond mines. The key municipal project John has been involved with is leading the annual environmental monitoring program for EPCOR (formerly the City of Edmonton), which he has been associated with since he joined Golder.

Beyond John’s professional role within Golder, he is the leader of Golder’s global Water Quality Technical Community, he is a director of IMG-Golder, and he is also in the Golder Board of Directors development pool.

John has a strong alliance with the north of Canada given that the majority of his project work is based in the Northwest Territories and Nunavut. Although he has devoted a lot of time in Yellowknife since he started at Golder, John spent 18 months between 2017 and 2019 where he rotated between the Yellowknife and Calgary offices on a month on, month off basis. Following on from this rotation, John instigated a program where a team of senior Golder people, who have project or office staff connections, now spend time in the office throughout the year to connect with the staff, and existing and potential new clients.



**EMPLOYMENT HISTORY**

*Australian Centre for Tropical Freshwater Research, James Cook University – Townsville, Queensland  
Senior Water Quality Scientist / Water Quality Laboratory Manager  
(2002 to 2007)*

Design, implementation, management, and interpretation of commercial, municipal and industrial water quality assessments, environmental baseline studies and EIAs, and water quality research projects. Duties included external project development and management, staff management, report preparation, and public presentations. Concurrently managed a water quality laboratory that was responsible for water and sediment quality analysis.

*Australian Centre for Tropical Freshwater Research, James Cook University – Townsville, Queensland  
Water Quality Scientist/Chemist (1988 to 2002)*

Assisted in the design, implementation, management, and interpretation of water quality research projects. Duties included planning and undertaking field surveys, laboratory analyses of water and sediment quality analyses, and preparation of proposals and reports.

*Department of Botany, James Cook University – Townsville, Queensland  
Research Assistant / Demonstrator - Plant Physiology (1986 to 1987)*

Aided in a research program investigating amino acid distribution in C4 plants under sodium deficiency utilizing gel electrophoresis techniques. The position also demonstrated to third-year plant physiology practical classes.

*Department of Geology, James Cook University – Townsville, Queensland  
Research Assistant (1985 to 1986)*

Aided in a research program funded by the Great Barrier Reef Marine Park Authority investigating the occurrence of crown-of-thorn starfish skeletal remains in vibra-core reef sediment samples collected from the Great Barrier Reef to determine outbreak frequency in recent history.

**SELECT MINING EXPERIENCE**

**De Beers Gahcho Kué  
Mine – Environmental  
Impact Statement (EIS)  
/ Permitting /  
Monitoring /  
Regulatory Support  
Northwest Territories,  
Canada**

John is currently the Project Director for all Golder work being conducted at this mine (since 2016). In 2007, John started as the Aquatic Components Coordinator for the initial EIS phase of the Project (2007 to 2009), which included managing an external consultant retained by De Beers for completion of several of the aquatic component sections for the EIS. From 2012, John transitioned into the Technical Director leading the Golder technical team through a rewrite of the EIS and the EIR process with MVEIRB, and through the permitting process. These roles included participating as an expert panel witness in the MVEIRB and MVLWB technical sessions and public hearings. As Project Director, John is responsible for leading the Golder environment, water resource engineering, and construction teams, reviewing all Golder technical environmental products, including De Beers’ environmental regulatory products (when needed), and maintaining a high level of engagement with the De Beers project teams (2007 to current).

**EA/Permitting Agnico  
Eagle Mines Whale Tail  
Expansion Project and  
Meliadine Expansion  
Project**  
Nunavut, Canada

John is the senior water quality technical lead (since 2019) involved in the NIRB and NWB permitting processes, including preparation of technical responses to information requests and technical comments, and attendance at technical sessions and regulatory hearings as an expert panel witness for the water quality component.

**Baseline/EA/Permitting  
/Monitoring Dominion  
Diamond Jay and  
Misery Underground  
Projects**  
Northwest Territories,  
Canada

John has been the senior water quality technical lead since 2013 involved in the completion and reporting of water quality baseline data and the water quality assessment for the Developer's Assessment Report (DAR). This work included writing, reviewing, and preparing components of the assessment that involved summarizing the water management plan, describing site mitigation to reduce or eliminate potential Project effects to water quality (and the aquatic receiving environment), and assessing cumulative effects to a key downstream operation.

John supported the Golder and Dominion Diamond project team through the MVEIRB and permitting processes, including attendance at technical sessions and regulatory hearings as an expert panel witness for the water quality component.

John continues to contribute to the design of the Aquatics Effects Monitoring Program (AEMP) for the Jay Project, and worked with the permitting and engineering teams to develop a Total Suspended Sediment Management and Monitoring Plan for the Dyke Construction process.

**De Beers Snap Lake  
Mine – Monitoring /  
Regulatory Support**  
Northwest Territories,  
Canada

John is currently the Project Director for the environmental work being conducted by Golder at this mine site (since 2017). In addition to this role, John has provided senior review and technical support to the AEMP water quality and/or sediment quality component team (since 2008).

**Giant Mine  
Environmental Support  
Services and Civil  
Design Contracts,  
PSPC/AECOM**  
Northwest Territories,  
Canada

John is currently the Project Director for the project management team that provides oversight to the technical services delivery teams for a variety of tasks under two contracts (since 2017). The contracts are currently established under a partnership with AECOM. Under the Civil Design contract, Golder is the prime contractor and AECOM the sub-contractor. For the ESS contract, Golder is the sub-contractor to AECOM. John's responsibilities include engagement with the PSPC Project Director and the AECOM Project Integration Manager.

John also acts as the Golder Project Sponsor to PSPC on the project.

**Giant Mine MDMER  
Annual Reporting  
Program, AECOM  
(formerly DCNJV)**  
Northwest Territories,  
Canada

John provides senior review and technical guidance to the water quality task lead for this program (2010 - 2019).

**Fortune Minerals NICO  
Project – Baseline / EA  
/ Permitting /  
Monitoring**

John was the water quality component lead (2009 to 2014) involved in the completion and reporting of water quality baseline data and water quality assessment for the DAR. The water quality assessment included integrating each of the aquatic components (e.g., hydrology, hydrogeology, sediment quality, aquatic health, and aquatic ecosystems) into the DAR. John participated

Northwest Territories,  
Canada

in the MVEIRB regulatory and the MVLWB permitting processes as an expert panel witness in their respective technical sessions and public hearings.

Since 2016, John has provided project direction supporting the client and project permitting team for aquatics effects monitoring and associated regulatory processes.

**SaskPower Elizabeth  
Falls Project – EA**  
Saskatchewan, Canada

John provided senior review and technical support to the water quality and sediment quality effects assessment component lead and the water quality modelling component lead during the EA process. John also provided technical support to the Golder Project team through the Government and Stakeholder review process (2013 to 2015).

**Farim Phosphate  
Project GB Minerals  
Ltd. – River  
Morphology and  
Physical  
Oceanography  
Baseline Study**  
Guinea-Bissau

John provided senior review and technical support to the water quality component lead, and to the Golder Project team (2013).

**IMG / BP –  
Contaminants  
Sampling Program**  
Nunavut, Canada

John provided senior review and technical support to the field and water quality data analysis component leads during the contaminants program (2011 and 2012). This role included technical review of the field program sampling protocols, analytical techniques, and the water quality report.

**UTS/Teck Cominco  
Equinox Project –  
Water Quality Baseline  
Study**  
Alberta, Canada

John was the component lead (2008 to 2010) involved in the organization, management and preparation of the water quality and sediment quality baseline study for the Equinox Oil Sands development. John was also responsible for providing support and coordination to the client for the Pilot Plant testing program that will service the UTS/Teck Equinox and Frontier Oil Sands developments.

**AREVA Resources –  
McArthur River Ore  
Haulage Project  
Description and EIS**  
Saskatchewan, Canada

John contributed to the environmental assessment for the transportation of uranium ore slurry along existing provincial highways from the McArthur River Mine to the McClean Lake Operation for milling at the JEB Mill. John worked directly with the client and senior Golder project team to deliver the project description and EIS.

**Cameco Corporation –  
Cigar Lake EA,**  
Saskatchewan, Canada

John contributed to the aquatic effects analysis of the environmental assessment process in the development of an expansion to the Cigar Lake Mine in northern Saskatchewan (2009 and 2010). The expansion included the construction, operation, and decommissioning of two new parallel pipelines that will deliver and discharge treated water from treatment facilities on the site to a single deep-water point in Seru Bay. John contributed to the environmental assessment for the Cigar Lake Mine McArthur River Mine in northern Saskatchewan (2010 and 2011).

**Strateco Resources –  
Water Quality Baseline  
Study – Matoush  
Exploration Ramp  
Project**  
Ontario, Canada

John provided senior review and technical guidance to the water quality component lead for the Project (2009 and 2010).

**DIAND-CARD –  
Tailings Lake  
Investigation, Colomac  
Mine**  
Northwest Territories,  
Canada

John provided senior technical review and guidance to the water quality component lead for the project (2009 and 2010).

**Cameco Corporation –  
Millennium Mine  
Project Proposal**  
Saskatchewan, Canada

John provided technical support for the environmental assessment process in the development of a project proposal for the Millennium Mine development in northern Saskatchewan (2009). This work included reviewing sections of the draft project description (e.g., detailed project information and the existing environment) with particular emphasis on the screening of potential Project effects to the biophysical environment.

**Newmont / Miramar –  
Hope Bay Project  
Annual Aquatic Study  
Program**  
Nunavut, Canada

John provided senior review and technical guidance to the water quality and sediment quality component lead for the 2006 to 2008 Annual Aquatic Studies Program (2009).

## **OTHER SELECT PROJECT EXPERIENCE**

**EPCOR – North  
Saskatchewan River  
Environmental  
Monitoring Program**  
Alberta, Canada

John provides the senior technical review and guidance to the project team for a variety of environmental projects completed for EPCOR (originally the City of Edmonton), which includes the annual environmental monitoring program (EMP). The work that Golder completes for EMP includes undertaking a series of annual monitoring and sample collection programs in the North Saskatchewan River (NSR), municipal as well as storm sewer and combined sewer outfalls, tributaries to the NSR, and stormwater collection ponds and wetlands programs, deriving annual loading estimates of water quality constituent inputs, and preparing two annual reports (since 2007).

The role has developed from initially undertaking the data analysis and reporting components for the EMP, to currently providing the senior technical direction for the EMP. John has provided senior technical review and guidance for other related, but standalone, projects, which were conducted for the City of Edmonton, such as the NSR Intensive Intake Monitoring Program, and the Kennedale and Pylypow Wetland Monitoring Programs.

**City of Calgary – Bow  
River Water Quality  
Monitoring Station**  
Alberta, Canada

John provided senior technical review and guidance in the recommendation of a preferred site location of a remote water quality monitoring station on the Bow River downstream of Calgary, and the monitoring infrastructure and equipment required to monitor various water quality parameters in real-time and collect regular, time-based (baseflow) and event-based (stormflow) water samples (2015 to 2017).

**Stantec – Wabamun  
Regional  
Biomonitoring  
Program**  
Alberta, Canada

John provided senior review and technical support to the water quality and sediment quality component leads in this program (2009 to 2014, and 2016). The study area included power station cooling ponds, and adjacent localised lakes and streams.

**Shell Canada Ltd. –  
Environmental Gap  
Analysis / Water  
Quality Baseline Study,  
Groundbirch Project,**  
British Columbia,  
Canada

John provided senior review and technical support to the water quality component for a gap analysis and baseline study for this development (2010 and 2011).

## PUBLICATIONS

### Journal Articles

Chapman, P.M., A. Hayward and J.W. Faithful. 2017. Total suspended solids effects on freshwater lake biota other than fish. *Bulletin of Environmental Contamination and Toxicology*. 99(4), 423–427.

Faithful, J.W. 2016. Physico-chemical changes in two northern headwater lakes in the Northwest Territories, Canada, during winter to spring transitions. *Journal of Great Lakes Research*. 42, 167-172. DOI 10.1016/j.jglr.2016.01.004

Vandenberg, J.A., M. Herrell, J.W. Faithful, A.M. Snow, J. Lacrampe, C. Bieber, S. Dayyani and V. Chisholm. 2015. Multiple Modeling Approach for the Aquatic Effects Assessment of a Proposed Northern Diamond Mine Development. *Mine Water and the Environment*. DOI 10.1007/s10230-015-0337-5.

Brodie, J.E., T. Schroeder, T. Rohde, J.W. Faithful, B. Masters, A. Dekker, V. Brando and M. Maugham. 2010. Dispersal of suspended sediments and nutrients in the Great Barrier Reef lagoon during river discharge events: conclusions from satellite remote sensing and concurrent flood plume sampling. *Marine and Freshwater Research*, 61, 651-664.

Mitchell, A., J. Reghenzani, J.W. Faithful, M. Furnas and J.E. Brodie. 2009. Relationships between land use and nutrient concentrations in streams draining a 'wet-tropics' catchment in northern Australia. *Marine and Freshwater Research*, 60, 1097-1108.

Bainbridge, Z.T., J.E. Brodie, J.W. Faithful, D.A. Sydes and S.E. Lewis. 2009. Identifying the land-based sources of suspended sediments, nutrients and pesticides discharged to the Great Barrier Reef from the Tully-Murray Basin, Queensland, Australia. *Marine and Freshwater Research*, 60, 1081-1090.



O'Reagain P.J., J.E. Brodie, G. Fraser, J.J. Bushell, C.H. Holloway, J.W. Faithful and D. Haines. 2005. Nutrient loss and water quality under extensive grazing the upper Burdekin River catchment, north Queensland. *Marine Pollution Bulletin*, 51, 37-50.

Faithful J.W. and W. Finlayson. 2005. Water quality assessment for sustainable agriculture in the Wet Tropics – A community approach. *Marine Pollution Bulletin*, 51, 99-112.

Faithful J.W. and D.J. Griffiths. 2000. Turbid flow through a tropical reservoir (Lake Dalrymple, Queensland, Australia): responses to a summer storm event. *Lakes and Reservoirs: Research and Management*, 5, 231-247.

Faithful J.W. Phosphorus in Wetlands - A Review. 1997. *Queensland Department of Natural Resources, Brisbane*, ISBN 0 7242 7414 6, 53 pp.

Walbran P.D., R.A. Henderson, J.W. Faithful, H.A. Polach and R.J. Sparkes. 1989. Crown-of-Thorn starfish outbreaks on the Great Barrier Reef: a geological perspective based upon the sediment record. *Coral Reefs*, 8, 67-78.

### Conference Proceedings

Herrell, M.K., J. Vandenberg, J.W. Faithful, A. Hayward and L. Novy. 2019. *Influence of Probability Distribution Function Sampling Frequency on Stochastic Water Quality Model Predictions*. Proceedings of the 11<sup>th</sup> International Conference on Acid Rock Drainage & IMWA Annual Conference, September 2015. Pretoria, South Africa.

Herrell, M.K., J. Vandenberg, J.W. Faithful, A. Hayward and L. Novy. 2019. *Long-term Water Management of Saline Groundwater at the Ekati Diamond Mine*. Proceedings of the 11<sup>th</sup> International Conference on Acid Rock Drainage & IMWA Annual Conference, September 2015. Pretoria, South Africa.

Herrell, M., J. Vandenberg and J.W. Faithful. 2015. *Designing meromictic pit lakes as a mine closure mitigation strategy in northern Canada*. Proceedings of the 10<sup>th</sup> International Conference on Acid Rock Drainage & IMWA Annual Conference, 21-24 April 2015. Santiago, Chile.

Lewis, S. E., J.E. Brodie, Z.T. Bainbridge, A.M. Davis, J.W. Faithful, L. Liessman, K. Rohde and B. Masters. 2008. *Herbicide residues in waterways draining sugarcane catchments of the Great Barrier Reef*. Proceedings of the 5th SETAC World Congress, 3-7 August. Sydney, Australia.

Hately, L.R., J.D. Armour, J. Brodie, J.W. Faithful, G.L. Pitt and P.N. Nelson. 2007. *Modelling, monitoring and sediment tracing in the Tully River catchment, north Queensland: a comparison of techniques*. 2007 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December. Auckland, New Zealand.

Brodie, J., A.G. Dekker, V.E. Brando, B. Masters, J.W. Faithful, R. Noble and K. Rohde. 2006. *Extent and duration of the algal bloom in the Great Barrier Reef lagoon following river discharge events in the Mackay Whitsunday's Region, Australia*. 13th Australasian Remote Sensing and Photogrammetry Conference: Earth Observation – from Science to Solutions, November. Canberra.

Cooper, M., G. Shields, J.W. Faithful and J. Zhao. 2006. *Using sediment Sr/Nd isotopic ratios to determine sediment sources in the Burdekin Falls Dam, Queensland, Australia*. 16th Annual V.M. Goldschmidt Conference, August - September. Melbourne, Australia.

Cooper, M., J.W. Faithful, T. Steiglitz and G. Shields. 2005. *Sediment dynamics of a large tropical river system: the Burdekin River and Lake Dalrymple, Australia*. 10<sup>th</sup> International Symposium on the Interactions between Sediment and Water, August -September. Bled, Slovenia.

Taylor, J., T. Lloyd, A. Melzer and J.W. Faithful. 2004. *Conserving ecosystems and managing biodiversity in industrial land and seascapes – Yabulu Nickel Refinery experience*. Minerals Council of Australia, Inaugural Global Sustainable Development Conference, October. Melbourne, Australia.

Lukacs, G.P., C. Perna and J.W. Faithful. 2004. *Coastal wetlands of north-eastern Australia: Condition and management interventions*. Seventh Intecol International Wetlands Conference, July. Utrecht, The Netherlands.

Faithful, J.W. and W. Finlayson. 2004. *Water quality assessment for sustainable agriculture in the Wet Tropics – A community-assisted approach*. Catchment to Reef Conference, Great Barrier Reef Marine Park Authority, March. Townsville.

Faithful, J.W. and D. Burrows. 2003. *From blue to brown: persistently elevated turbidity resulting from damming the tropical Burdekin River*. Ninth International Conference on River Research and Applications, July. Albury.

Connor, R., J. Milsom, A. Melzer, B.M. Butler, J.W. Faithful, W. Dennison, T. Lloyd and G. Swain. 2003. *Ecosystem-based assessment and management of marine and estuarine systems at the QNI Yabulu Nickel Refinery, Townsville*. In: Protecting the Values of Rivers, Wetlands and the Reef. From: 2<sup>nd</sup> National Conference on Aquatic Environments: Sustaining our Aquatic Environments - Implementing Solutions, 20 - 23 November 2001, Townsville, QLD, Australia.

## EXPERIENCE SUMMARY

Mr. Horne is a Senior Geotechnical Engineer and Director of Arctic Engineering in the Edmonton office. He has over 30 years of experience in geotechnical and permafrost engineering for, mining, oil and gas facilities in Northwest Territories, Yukon, Alaska, Russia, and the Beaufort Sea. Areas of expertise include tailings deposition management, water and tailings dam designs, mine development, industrial plant site development, heavy equipment foundations, geothermal and deformation modelling, and project management.

## RELEVANT EXPERIENCE

### Gahcho Kue Diamond Mine, NT. 2010 to 2020

- De Beers Canada, Tetra Tech Project Manager and Senior Design Engineer for the development of a new diamond mine. Involved in the feasibility study, permitting, detailed design and construction. Responsible for permafrost issues, geotechnical investigations, waste and water management plan, tailings management, waste rock dumps, and geotechnical design of plant site and civil infrastructure components (roads and airstrip). The project included an elaborate water management scheme to drain the lakes for three open pits under the lake. A total of 15 dykes were designed to control the water. The mine opened in 2016.

### Meliadine GoldMine, NT. 2018 to 2020

- Agnico, Tetra Tech Project Manager and Senior Design Engineer for the development of water management structures for the mine and other civil infrastructure. Responsible for permafrost issues, geotechnical investigations, tailings management, waste rock dumps, and crusher and ramp design. Technical resource for the Phase II expansion MAA.

### Jericho Diamond Mine, NU. 2006 – 2014

- Tahera Diamond Corporation – Principal Engineer for the design and construction of the tailings facility. Dams and dykes were designed to retain fine processed kimberlite tailings. Both frozen core and geomembrane dams were constructed on a permafrost foundation.
- Shear Diamonds. Principal Consultant for Water License Renewal and Permitting. Responsible for permafrost issues, waste and water management plan, tailings management, waste rock dumps. Prepared management plans, and provided support during the water license renewal process.
- AANDC – Principal Consultant, Project Sponsor for the options analysis examining the closure options for the mine. The study included a Phase III investigation, surface

## EDUCATION

B.Sc., Civil Engineering,  
University of Calgary,  
Calgary, AB, 1983

M.Sc., Geotechnical Engineering,  
University of Alberta,  
Edmonton, AB, 1987

## AREA OF EXPERTISE

Geotechnical and Permafrost Engineering, foundation analysis and design, earth dam designs, numerical modelling, and construction drawings and specifications for variety of mining and hydrocarbon projects

Site investigation, foundation and earth embankment designs

## REGISTRATIONS/ AFFILIATIONS

Member, Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Licensee, Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (NAPEG)

Member, Canadian Geotechnical Society (CGS)

Member, Geotechnical Society of Edmonton (GSE)

## OFFICE

Edmonton, AB

## YEARS OF EXPERIENCE

32

## CONTACT

Bill.Horne@tetrattech.com

water sampling, groundwater sampling, facility inventory, closure plan and costs estimates for three closure options.

### **Diavik Diamond Mine, NT – Tailings Facility Review. 2014**

- Principal Consultant for an independent review of the processed kimberlite containment facility, management, emergency preparedness, dyke design and construction, and performance. The dykes are constructed on a permafrost foundation.

### **Yamal LNG Facility, Russia. 2012 – 2014**

- Technip, Chicago Bridge and Iron Works. Senior Project Engineer and Manager for foundation design for the Yamal LNG Terminal in Sabetta, Russia. Large diameter pipe piles were used to support LNG Tanks and plant facilities in warm permafrost. Nineteen full size pile load tests were carried out and interpreted to support the foundation design. The pile load tests measured the pile creep and capacity. Estimates of long term deformation were calculated based on laboratory creep tests and the pile load tests. Over 5000 piles will be used to support the plant site.

### **Mary River, NU. Landfarm Design. 2010 - 2012**

- Baffinland. Project Manager for assessment of contaminated fuel farm and design of a landfarm to treat the contaminated soils. Treatability studies were conducted to verify the treatment method for the contaminated soil.

### **Mayskoye Gold Mine, Russia. 2007 –2009**

- Mayskoye Gold Mine. Principal Consultant for foundation components of a new gold mine in northern Russia. Facilities were placed on bedrock and ice rich permafrost. A large ventilated pad was designed for the plant site and power house to maintain the permafrost condition. Involved in the project through feasibility design, detailed design and construction.

### **Ekati Diamond Mine, NT. 1995 –2002**

- Geotechnical Engineer, Tailings (Processed Kimberlite) Management and Dam and Dyke and Design for Canada's first diamond mine. The tailings management scheme and details were developed for the 25 year mine life. A combination of filter dykes and frozen core dams were developed to retain the fine PK and maintain annual discharges from the PKCA facility.

### **Publications**

- Kubaka Mine Tailings Design, Construction and Operation of Frozen Core Dam: A Case Study, ASDSO West Regional Conference 2001.
- DEW Line Landfills, IWCSE 2002 Conference, Edmonton, AB
- Permafrost Containment Landfills at Arctic DEW Line Sites, 56<sup>th</sup> Canadian Geotechnical Conference, 2003.
- Performance Measures of Arctic Landfills, Assessment and Remediation of Contaminated Sites in Arctic and Cold Climates, (ARCSACC), 2005.
- Rationalizing Climate Change for Design of Structures on Permafrost: A Canadian Perspective, Ninth International Conference on Permafrost, Fairbanks, 2008.