# Jason Mann,P.Geo.

**GEOLOGIST AND DEPARTMENT HEAD – ENVIRONMENTAL SERVICES, ASSOCIATE PRINCIPAL**

## PROFILE

Mr. Mann has over 24 years of experience in geology and geological science, with applications in the field of hydrogeology and environmental management working in the consulting engineering field for over 22 years. His experience includes air photo interpretation and geological mapping, drilling and instrumentation design/installation for hydrogeological and geotechnical engineering projects, hydrogeological assessment, well and aquifer pumping test/dewatering design, groundwater and geological modelling for environmental and geotechnical applications, and water quality assessment. As Department Head for the Environmental Services Group, Mr. Mann is responsible for management and technical design for all hydrogeological and environmental projects at KGS Group, in addition to directing and assisting with field programs and data assessment tasks. As Associate Principal, he is involved with the business enterprise fo KGS Group as a whole on a day to day basis as well.

## EDUCATION

- **Master of Science, Geology**, University of Manitoba (1999)
- **Bachelor of Science, Environmental Science**, University of Manitoba (1995)

### Short Courses

- **Finite Element Groundwater Modeling**, Waterloo Hydrogeologic (2005)
- **Advanced Groundwater Modeling**, Waterloo Hydrogeologic (2003)
- **Canadian Geotechnical Society Air Photo interpretation Short Course**

### Certifications

- **OSHA 40 Hour Course** (2000)
  - Refresher (2003 & 2005)
- **Confined Spaces Entry Course**, Manitoba Workplace Safety and Health WHIMIS

## PROFESSIONAL ASSOCIATIONS

- Engineers Geoscientists Manitoba
- Association of Professional Geoscientists of Ontario

- Association of Groundwater Scientists and Engineers, National Groundwater Association
- Engineers Geoscientists Manitoba – Vice President (2019/2020)
- Engineers Geoscientists Manitoba – President (2020/2021)
- Engineers Geoscientists Manitoba – 2017 - 2022 Council; Chair of Finance Committee 2018/2019
- Director, Manitoba and Prairies Region, Tunnelling Association of Canada
- Editorial Advisory Board, Tunnels and Tunnelling Magazine (North American Edition)

## EMPLOYMENT HISTORY

- **Senior Geologist, Department Head of Environmental Services, and Associate Principal**, KGS Group (2016 – Present)
- **Senior Geologist, and Assistant Manager of Environmental Services Department**, KGS Group (2013 – 2016)
- **Senior Geologist**, KGS Group (1999 – 2013)
- **Quaternary Geologist (Contract Position)**, Geological Survey of Canada (1998 – 1999)
- **Field/Lab Researcher**, University of Manitoba Department of Geological Sciences (1995 – 1999)
- **Drilling Assistant (Contract Positions)**, Manitoba Energy and Mines, Geological Services (1991 – 1993)

## PROJECT EXPERIENCE

- Lake St Martin Outlet Channel – Manitoba Infrastructure and Transportation

  Preliminary and detailed hydrogeological and environmental design, and construction of the LSMOC. Responsible for site investigations and hydrogeological design. Participation in environmental licensing and construction management plans for the project.

- 2011 Lake St Martin Emergency Flood Channel – Manitoba Infrastructure and Transportation

  Participated in site investigations for construction of the Reach 3 emergency flood channel, between Buffalo Creek and Lake Winnipeg. Involved in drilling, testpitting, and seismic refraction surveys, and data interpretation relative to defining the soil stratigraphy, till and bedrock surface elevations along the alignment of the channel.

- LMB and LSM Outlet Channels Conceptual Design Stage 2 – Manitoba Infrastructure and Transportation

  Design and involvement in hydrogeological field program, review of regional well location database, preliminary assessment of channel seepage/blowout conditions during construction and in the long-term, aquifer drawdown during construction and operation of channel options, assessment of risks and possible impacts to regional aquifers and the environment. Input to geotechnical design.

- Groundwater, Surfacewater, and Geotechnical Investigations and Preliminary Engineering for LMB Outlet Channels Options C&D – Manitoba Infrastructure

  Designed and conducted geological and hydrogeological investigations, including test drilling and pumping test programs. Evaluation of geological and groundwater conditions along LMB Options C and D channels, including assessment regional groundwater well use, evaluation of risks and potential impacts to regional groundwater aquifers with construction and operation of the LMB outlet channels. Development of detailed geological cross sections and modeling of bedrock surfaces and overburden thicknesses in the region of the projects. Input to geotechnical design.

- PTH 110 Interchange, Brandon, Manitoba – Manitoba Infrastructure and Transportation

  Designed and conducted hydrogeological investigation, including test drilling and pumping test, relative to design and construction of a groundwater underdrain system. Underdrain was designed to mitigate excess piping pressures within sandy soils during unwatering of the underpass during flood stage conditions along the Assiniboine River. Included preliminary evaluation of regional information and potential impacts on nearby residences, initial assessment of licensing requirements, and design of underdrain system. Included compilation of Tender specifications and Owner's assistance, as required, through construction phase.

- Powerview, Manitoba – Manitoba Infrastructure and Transportation (2009)

  Designed and conducted hydrogeological investigation, including test drilling and 24- hour pumping test, relative to evaluation of stability of an embankment fill and concrete box culvert installation. Included preliminary evaluation of regional information and potential impacts on nearby residences, initial assessment of licensing requirements, and preliminary design of long-term passive depressurization system.

- Powerview, Manitoba – Manitoba Infrastructure and Transportation (2014)

  Final design, specification development, and tendering of a passive depressurization system to reduce deep foundation confined porewater pressures, and improve stability of an embankment fill and concrete box culvert installation. Construction completed in January, 2014.

- White Horse Rapids Seepage Investigation – Yukon Energy Corporation

  Provided data review, input, and analysis to assessment of seepage conditions associated with the intake power canal located at the Whitehorse Rapids Generating Station in Whitehorse, Yukon. Tasks included evaluation of new geotechnical drilling and instrumentation (completed by others), assessment of foundation groundwater levels, and water quality between reservoir, toe of dike, and sub-power canal rock drain seepage discharge areas.

- Hardy Dam, Atikokan, Ontario – Ontario Ministry of the Environment

  Conducted preliminary geotechnical drilling investigation and provided input to KGS Group contract administrative duties as related to monitoring and control of groundwater conditions during construction of remedial works (designed by others). The installed drainage system was designed to mitigate confined, flowing artesian groundwater pressures within the dam foundation soils.

- Town of Mayo Dike Foundation Seepage Investigation – Yukon Energy Corporation

  Drilling, well installation, and instrumentation to measure the response and seepage characteristics of a pervious granular dike in permafrost-affected ground conditions, along the Mayo River, adjacent to the Town of Mayo. Work to support river ice engineering and winter flooding mitigation studies.

- Slope Stability/Drainage Assessment – Ski Assessippi

Conducted drilling investigations, instrumentation installations, test well drilling, pumping tests, and water quality assessments to determine the stratigraphy and hydrogeological relationship between a piping, valley wall seepage area, and overall slope conditions/stability of a mobilized valley wall. Included assessment of materials and design for subsurface slope drainage systems to improve overall stability of the ski hill slopes, in particular during critical periods such as during spring the spring melt when the soils are under a highly saturated condition.

- Flood Protection Studies for Winnipeg

  Groundwater Section, 2001, Manitoba Conservation. Assessment of potential impact of modifications to the Red River Floodway on groundwater availability, quality and use in the Winnipeg area. Included development of a 3-D finite difference groundwater model using MODFLOW.

- Red River Floodway Expansion Regional Groundwater Modeling (2004)

  Modeling of the potential effects of deepening the Red River Floodway in Winnipeg. 3-D Visual MODFLOW model included model calibration with conditions before and after Floodway construction in the 1960s, updating to current conditions and predictive modeling of several design scenarios.

- Red River Floodway Expansion Surface Water Intrusion Modeling (2004)

  Cross-Sectional Modeling using Visual MODFLOW. Model investigated the potential extent of intrusion of Red River Water in the Floodway into the carbonate aquifer at several representative locations.

- Grand Rapids Generating Station Phase I and Phase II Hydrochemical – Studies Manitoba Hydro

  Conducted studies assessing water quality of the reservoir and water quality of possible seepage pathways through karstic dolomitic limestone bedrock of the dike and main powerhouse structure foundations. Study designed to assess possible variability in groundwater conditions due to seasonality, and whether a signal of changing water quality within seepage pathways could be identified and used as part of a long term dam safety monitoring program. Routine water quality parameters as well as isotopes and groundwater saturation states were analyzed.

- Pine Falls Generating Station Groundwater Assessment Phase I – Manitoba Hydro

  Conducted a study assessing groundwater flow conditions and water quality to determine overall groundwater site conditions, and confined aquifer piezometric pressures relative to stability of lacustrine clay riverbanks downstream of the Pine Falls Generating Station. Study included review of historical data from pre- and post-construction periods.

### Geotechnical Investigations/Instrumentation/Permafrost

- Whiteshell Laboratory – Canadian Nuclear Laboratories

  Project manager and technical design services for geotechnical and hydrogeological standing services agreement. Drilling programs, well installations, and risk assessment work regarding the development of the closure and end state configuration of the facility. Has included GPR and drilling/sampling work in the Waste Management Area, environmental investigations and risk assessments of the lagoon and domestic landfill sites, long-term monitoring well nest installations, well decommissioning activities.

- Nuclear Waste Management Organization (NWMO)
  Project manager for shallow borehole groundwater drilling and geotechnical instrumentation installations (currently underway) in Ignace, Ontario.

- Grand Rapids Generating Station Spillway – Manitoba Hydro

  Along with Manitoba Hydro, developed lab testing program to determine the representative friction angle for karstic limestone bedrock foundations at the Grand Rapids Spillway. Included evaluation of the role of joint surface roughness and joint surface strengths in finalizing laboratory tested rock sample final friction angles. Data was input into a Monte Carlo analysis of geotechnical stability analyses as part of a dam safety review of the structure.

- Keeyask Generating Station – Manitoba Hydro

  Test pitting, sonic drilling, sampling, laboratory testing, and instrumentation programs related to investigations along the 20+ km of Keeyask north and south dyke alignment foundations, and south abutment dam to dyke transition area. Included investigations and evaluations within ice-rich permafrost affected areas, and assessment of groundwater conditions for optimization of deep foundation excavations.

- Grand Rapids Generating Station Spillway Stability – Manitoba Hydro

  Core logging, sample selection, and development of laboratory testing program to determine representative bedrock friction angle, for input to stability analyses of the karstic limestone foundations.

- Keeyask Generating Station – Manitoba Hydro

  Geotechnical materials investigations, sampling, and testing of the G1 and G3 borrow material deposits. Work was required for confirmation of project construction materials sources (concrete aggregate and granular dam/dyke embankment fills), and deposit mapping to optimize materials utilization planning. Information compiled for, and provided to the construction contractor.

- Field Assessment of Possible Future Hydro Sites – SaskPower

  Conducted site visits and site walkovers to assess feasibility of a series of six potential future hydro development sites on the Churchill River and Fond Du Lac River systems in northern Saskatchewan. Field activities included preliminary bedrock/overburden mapping along proposed conveyance routes, and preliminary geotechnical assessment of each proposed project, including review of possible permafrost affected soils and potential for occurrence of natural in-situ uranium mineralization zones, at a number of sites.

- Future Bipole III HVDC Transmission Line Route – Manitoba Hydro

  Managed a program of geotechnical drilling, soils logging, and soils laboratory testing/analysis for a series of 31 drilling sites located in central Manitoba along the proposed Bipole III transmission line route. Included delineation of till surface and soils conditions at key site locations.

- Future Conawapa Generating Station – Manitoba Hydro

  Historical data analysis, reporting, assessment, and input to reactivation of ground temperature monitoring for permafrost at the future Manitoba Hydro Conawapa Generating Station. Included a detailed desktop review of historical site conditions and instrumentation readings for permafrost conditions, used as a guide to identify new instrumentation needs and installations, which were advanced in 2009/2010. Data compilation, QA/QC, and reporting of detailed ground temperature measurements recorded in the field, and to the Manitoba Hydro MAFIC database system, between 2009 and 2013.

- Manitoba Hydro – Future Conawapa Generating Station

  Historical data analysis, reporting, assessment, and input to reactivation of piezometric aquifer pressure monitoring at the future Manitoba Hydro Conawapa Generating station. Included data review, input, and involvement with investigations and instrumentation installations advanced in 2006/2007. Input to and

overview of database management and QA/QC programs for piezometric instrumentation and data collection, MAFIC database system, and development of instrumentation reports between 2009 and 2013.

- Tazi Twe Geotechnical Investigation Program – SaskPower

  Organized and developed a geotechnical investigation program to assist with preliminary design and further definition of bedrock shear zones located at the future Tazi Twe hydroelectric site on the Fond Du Lac River, in northern Saskatchewan (2013). Tasks included technical input to all permitting, program cost estimates, development of technical specifications and contracts, and contract administration duties related to site preparation (drill pad clearing and line cutting), helicopter procurement, geophysical (seismic refraction) investigations, and diamond drilling program, which included geotechnical coring, downhole water pressure (Lugeon) testing, downhole acoustical and optical oriented televiewer tool, and installations for groundwater monitoring and sampling requirements associated with the design of the intake power tunnel. Duties included coordinating reporting and providing technical input to geotechnical report, along with KGS Group/subconsultant team.

- Mayo A Power Tunnel Intake Rock Slope Stabilization – Yukon Energy Corporation

  Field investigation, structural bedrock mapping, design, specification development, and contract administration for the scaling and layback of the rockslope above the Mayo A power tunnel intake (2010), Mayo, Yukon. Work completed stabilized a 25 m high, weathered and frost affected rock face, comprised of weak phyllite/chloritic schists, to mica schists, which was subject to toppling and wedge failures.

- Mayo B Generating Station – Yukon Energy Corporation

  Geotechnical investigation programs 2008/2009 and 2010/2011 construction, Mayo B Generating Station, Mayo, Yukon. Tasks included overseeing field based drilling programs, core logging, soils and bedrock sample collection for geotechnical and geochemical analyses, structural bedrock mapping for tunneling assessment and excavation, collection of field data and assessment of packer testing and falling head permeability results in overburden and bedrock, gradation envelope development for classifying overburden material types, sampling and instrumentation for ground temperature (permafrost measurements), and definition of the groundwater regime, soils conditions, and conceptual approach for construction dewatering required within overburden and bedrock excavations.

- Future Conawapa Generating Station – Manitoba Hydro

  Data assessment, information/database compilation, and updating of the Geological Interpretation of the Project report, as part of Stage IV Engineering Studies. Included compilation of overburden and bedrock geological and hydrogeological conditions, permafrost conditions, and 3D seepage modeling assessment of the south abutment. Preliminary modeling included characterization of potential post-impoundment seepage pathways and sensitivity analyses of possible ranges in geological conditions, and of projected seepage pathways to the planned grouting designs.

- New Post Creek - Ontario Power Generation

  Provided well design, specifications, contract administration, and data analysis for test well drilling and pumping tests completed at the proposed New Post Creek project, located near Cochrane, Ontario. Extensive construction dewatering within sand soils, with a direct hydraulic connection to the adjacent New Post Creek, required assessment and evaluation to assist with design and construction staging considerations.

- Bridges B1 and B3 – East Side Road Project

  Conduced site visits, inspections and bedrock outcrop mapping during bridge abutment excavation for the B1 (Wapiginow River) and B3 (Bloodvein) bridge sites.

- Future Conawapa Generating Station – Manitoba Hydro

  Reassessment and integration of detailed bedrock discontinuity data into a proper standardized Access database, for integration to 3D visualization tools, and overall assessment of karstic bedrock conditions at the future Manitoba Hydro Conawapa Generating Station. Database includes nearly 30,000 lines of data, entered using a standardized drop-down menu system compatible with Manitoba Hydro standards, and active QA/QC program for data entry verification.

- Duties have included bedrock coring and well installation for groundwater monitoring adjacent to an operational industrial site and landfill, and the coring and pump testing of a bedrock geothermal well within the city of Winnipeg. Bedrock well installation, logging, pump testing, and aquifer analysis were completed for a large-scale groundwater based industrial space cooling project at Dorsey Station for Manitoba Hydro. Reports including well logs and well construction details were produced.
- Various field-based investigations, including riverbank stability studies, and foundation evaluations. Duties include borehole logging, field soil shear strength and density testing, soil sampling for laboratory analyses. Detailed soil logging using continuous samplers and split spoon samplers is common.
- Other geotechnical projects have included bedrock coring to evaluate the condition/stability of concrete bridge abutments. Details included examination of the condition of the concrete/bedrock bond at the abutment base, the bedrock and concrete condition. Also important was the evaluation of the interconnection between the river and groundwater hydrology.
- Bedrock coring and logging for input to the foundation design of the Human Rights Museum in Winnipeg, Manitoba.

### Terrain Mapping and Analysis/All Season Road Feasibility Studies

- Marten Falls Community Access Road and Phase II Access to the Ring of Fire

  Lead geologist regarding route selection mapping and borrow materials development, and input to KGS Group Lead on Geotechnical Design – Roads. Aerial photography mapping, geotechnical materials testing and data analysis, route selection, and design. KGS Group is a key part of a consortium of consultants led by AECOM for this project.

- Geological Survey of Canada

  Authored two surficial geology maps as part of the “A” Series NATMAP program for the Geological Survey of Canada in the Nopiming (NTS 52L 11-14) and Big Whiteshell Lake (NTS 52L 3-6) areas, Manitoba. Tasks included all fieldwork, till sampling, stereoscopic airphoto analysis and mylar generation for digital mapping transfer and map generation.

- Bell Aliant

  Stereoscopic air photo interpretation, mapping, and terrain assessment for installation of fibre optic lines in northwestern and northern Ontario. Study included approximately 900 km of cable route mapping and terrain analysis.

- Birch Tree to Wuskwatim Transmission Line – Manitoba Hydro

  Terrain analysis and assessment of tower foundation conditions of the proposed 45 kilometer power transmission line right-of-way extending from Manitoba Hydro's Birch Tree Station to the Wuskwatim Generating Station area. The assessment included a review of existing information including topography, surficial and bedrock geology and stereo aerial photographs, a review of major water crossings with respect to tower foundations and riverbank stability, and consideration of possible permafrost degradation along the proposed right-of-way with respect to river crossings and angle towers.

- Pre-feasibility study for construction of All Season Road, Keewatinook Okimakinak Tribal Council, Red Lake Ontario. Stereoscopic ariphoto based surficial geology mapping, terrain assessment, and route location selection for 420 km of roads to provide an all season road connecting the six First Nations of the K.O. Tribal Council.

- Feasibility level investigations, surficial geology mapping, and corridor selection, for Muskrat First Nation to Mussel White mine, all season road project. The project length was 120 km.

### Hydrogeology and Geological/Groundwater Modeling

- Future Conawapa Generating Station – Manitoba Hydro

  Developed a 3D geological model in Mining Visualization Systems (MVS) for the future Conawapa Generating Station for Manitoba Hydro. Model to be used as a design tool relative to karstic limestone foundation design and geotechnical analysis of foundation bedrock conditions, excavation, and permafrost conditions.

- Future Conawapa Generating Station – Manitoba Hydro

  Developed a 3D groundwater model in the finite element program FEFLOW for the future Conawapa Generating Station for Manitoba Hydro. Model to be used as a design tool relative to karstic limestone foundation design and grouting design, relative to analysis of groundwater flow conditions, possible seepage pathways, and sensitivity of the proposed foundation and grouting designs to overall groundwater regimes and seepage.

- Future Keeyask and Conawapa Generating Stations – Manitoba Hydro

  Peer review of Environmental Impact Study (EIS) technical work for the regional hydrogeology and groundwater flow system studies (by others) for Manitoba Hydro. Studies used 3-D models with EVS visualization software and groundwater model FEFLOW to assess bedrock and overburden groundwater regimes, including existing conditions and predicted conditions, with and without a reservoir.

- Manitoba Hydro – Dorsey HVDC Converter Station

  Compiled a hydraulic and groundwater heat flow model in HST3D for evaluation of a large-scale industrial groundwater based space cooling system. The model incorporated thermal and hydraulic (pumping rate) balancing in a fractured, high permeability bedrock aquifer system.

- Prairie Farm Rehabilitation Administration (PFRA)

  Under the Hill Farms, Irrigation Development 2002. Hydrogeologic study on the Assiniboine Delta Aquifer. Included field drilling, aquifer mapping, groundwater modeling using Visual MODFLOW.

- Water Rights License Documentation, Carberry, Manitoba – MidWest Food Products (2000)

  Assessment of groundwater supply system and lagoon wastewater disposal and effects on local and regional hydrogeology and stream flow. Included groundwater quality analysis and development of a 3 dimensional conceptual and numerical groundwater model.

- Township of Manitouwadge Groundwater Study (2002)

  Comprehensive groundwater study to define the aquifer used by the municipal wells. Included field studies, inventories of wells and potential contaminant sources, aquifer vulnerability mapping, modeling of wellhead capture zones using MODFLOW and development of groundwater protection action plan. All mapping was delivered in GIS format (ArcView) and data was included in the provincial Microsoft Access Data Base.

- Conceptual 3-D model of a portion of Brady Landfill, Winnipeg, Manitoba

  Developed conceptual 3-D model of a portion of the Brady Landfill to address leachate conditions, as input to landfill operations design, and assessment of improvements proposed for leachate monitoring systems.

- 3-D Visual MODFLOW Computer Models

  Developed and constructed three-dimensional Visual MODFLOW computer models of several different project areas, including model calibration and evaluation of model results. Visual MODFLOW tasks included the evaluation of the impacts of a wastewater plume from a leaky industrial storage lagoon, simulation of artificial recharge enhancement to an unconfined aquifer, various irrigation feasibility assessments, and the hydrogeological assessment of possible floodway expansion in the city of Winnipeg. Many of these models included groundwater flow budget evaluations, and particle tracking for groundwater flow and wellhead capture zone delineation. Additionally, evaluations of aquifer vulnerability (surface water to groundwater infiltration and exfiltration) have been completed.

### Construction Dewatering and Water Supply Wells

- Future Keewatinoow Converter Station – Manitoba Hydro

  Groundwater, investigation program design, well design, tender preparation, administration of contract, and site supervision to develop a well system capable of supplying fire suppression water for the converter station. Included two 24-hour pumping tests, instrumentation, data collection, data analysis, aquifer characterization, initial water quality assessment, and reporting.

- Future Keeyask Generating Station – Manitoba Hydro

  Groundwater investigation program design, well design, tender preparation, administration of contract, and site supervision to develop a well system capable of supplying potable water for the main construction camp. Included a 48 hour pumping test, instrumentation, data collection, data analysis, aquifer characterization, initial water quality assessment, and reporting.

- Future Conawapa Generating Station – Manitoba Hydro

  Groundwater investigation program design, well design, tender preparation, administration of contract, and site supervision to develop a well system capable of supplying potable water for the main construction camp. Included a 72 hour pumping test, instrumentation, data collection, data analysis, aquifer characterization, initial water quality assessment, and reporting.

- Dorsey HVDC Converter Station – Manitoba Hydro

  Design and field supervision of deep sandstone aquifer multi-casing well decommissioning for brine disposal wells at Dorsey Station. Wells extended through sensitive limestone and karstic limestone aquifer zones, requiring proper sealing of deep saline aquifer zones under artesian pressure. Tremie placement of cementitious grout (including admixtures for pumpability and long term degradation protection from possibly saline waters) were employed.

- Boundary Dam, Estevan, Saskatchewan – SaskPower (2008 – 2010)

  Designed investigation and testing programs to develop required depressurization system for reconstruction of the Boundary Dam spillway structure. Well design, system layout, tendering, construction supervision, assessment of monitoring data, and overall performance monitoring was required. Included provision for a french drain installation as part of the overall depressurization design.

- Red River Floodway Expansion, Construction Dewatering Projects – Manitoba Floodway Authority (10 Projects, 2004 – 2010)

  Assisted with data collection and preparation of water rights licensing submissions for investigations and groundwater withdrawals. Conducted drilling and pump testing investigations, evaluated results, provided design, tender, and construction supervision / testing of bedrock groundwater depressurization systems for the following projects: a cutoff wall in bedrock at the Floodway Outlet Structure (contract CE1); a cutoff wall in sand/till overburden and bedrock depressurization wells at Oasis Road (contract C6B); a deep excavation at a Flood Pumping Station at Kildare Ave. (contract C5), and deep trench excavations at the City of Winnipeg Branch I and Branch II Aquifer Crossings (contract A1). Provided technical assistance and assisted with regional monitoring of drawdown effects for construction depressurization projects at bridge piers at TransCanada Highway Bridge, PTH 59 South Bridge, CNR Redditt Bridge, PTH 15 Bridge, CP Keewatin Bridge, and PTH 44 Bridge.

- CentrePort, Inkster Interchange, Perimeter Highway Interchange, Groundwater and Geotechnical Investigations – Ministry of Infrastructure and Transportation (2009)

  Designed exploration program, assisted with preparation of exploration permit for Manitoba Water Stewardship to include test drilling and 24- hour pump tests of wells at each site. Included evaluation of regional information and potential impacts on nearby residences. Bedrock coring, geotechnical core logging, pumping test evaluation, water quality evaluation, and reporting.

**Regional Groundwater and Groundwater Under Direct Influence of Surface Water Studies (GUDI)**

- Future Conwawapa Generating Station – Manitoba Hydro

  Evaluation of available regional water quality to evaluate the surface water-groundwater interaction with winter river ice staging as a proxy to appraise the possible long-term implications for karstic bedrock alteration.

- Red River Floodway Expansion

  Remediation of groundwater Spring sites, 2009/2010. Involved with design, instrumentation, and evaluation of a reverse sand filter installation for remediation of surface water-groundwater spring connections along the base of the Winnipeg Floodway. Included administering and evaluating a trial program in addition to developing a full program for treatment of known groundwater spring sites.

- Red River Floodway Expansion Groundwater Investigations (2004)

  Extensive investigation of hydrogeologic conditions adjacent to the Red River Floodway. Included drilling program in fractured carbonate bedrock, till and clay, installation of instrumentation, aquifer testing, analysis of historic piezometric and water quality data and groundwater discharge baseflow measurements within the floodway channel.

- Groundwater Study – Municipality of Greenstone (2004)

  Local Study of Nakina, Ontario well field developed in sand and gravel. Included groundwater investigation program, contaminant source inventory, wellhead protection modeling (EPA WhAEM Model). Production of GIS based mapping and ARCVIEW Data Bases.

- GUDI Study – Municipality of Greenstone (2003)

  Investigation of the influence of a lake on the Nakina, Ontario municipal wellfield. Included water quality, particle counting, and analysis of pressure transducer data and time of travel modeling.

- GUDI Study – Municipality of Chapple (2003)

  Hydrogeologic Study to investigate possible surface water influence on a municipal wellfield developed in fractured crystalline bedrock in Barwick, Ontario.

- GUDI Study (Groundwater Under the Direct Influence of Surface Water) – Township of Hornepayne (2002)

  Hydrogeologic study to determine status of a small municipal well field close to a creek in Northwestern Ontario. Included field studies, water quality testing.

- GUDI Study – Township of Manitouwadge (2002)

  Hydrogeologic study to determine status of a Municipal wellfield close to a creek and lake in Northwestern Ontario.

- Monitoring for Irrigation Projects – Prairie Farm Rehabilitation Administration (PFRA) (2001)

  Completed groundwater, surface water and domestic well monitoring programs in support of irrigation projects in the Portage, Manitoba area.

- Other duties have included all fieldwork, geological mapping, groundwater and surface water sampling, monitoring well and pressure transducer/instrumentation installations, soil sampling, Visual MODFLOW and WhAEM WHPA model development, data assessment and reporting for comprehensive Groundwater and GUDI studies in Ontario, and other major projects in Manitoba.

### Waste Rock Assessment and Rehabilitation

- Geotechnical Investigations, Assessment and Remediation of Ruttan Mine, Northern Manitoba – Province of Manitoba, Department of mineral Resources (formerly Mines Branch)

  Responsible for the preliminary Acid Rock Drainage (ARD) and metals leaching assessment of bedrock construction materials at the Ruttan Mine site remediation project in Leaf Rapids, Manitoba.

- Mayo B Hydroelectric Project – Yukon Energy

  Responsible for ARD and metals leaching assessment of tunnel and penstock rock excavation materials for the Mayo B expansion of the hydroelectric facility at Mayo, Yukon Territory. Included defining monitoring

program and sampling requirements for waste rock runoff surface water, for environmental licensing compliance.

### Environmental Licensing

- Future Conawapa Generating Station – Manitoba Hydro

  Authorship of the permafrost and groundwater sections of the Conawapa Environmental Impact Statement (EIS) Physical Environment volume, existing and future environments. Includes groundwater quality assessment within the Water volume, existing and future environments. Includes sensitivity analysis of possible effects of future climate change. (Manitoba Hydro postponed EIS process during July of 2014).

- Future Tazi Twe Generating Station – Sask Power

  Input to the Environmental Impact Statement (EIS) compilation, and review/input to Information Requests (IR's) from the regulators. Included participation in community meetings relative to geological aspects (e.g. possible acid rock drainage, metals leaching, and uranium mineralization) of the project.

- Mayo B Generating Station – Yukon Energy

  Input to the Environmental Impact Statement (EIS) compilation, and review/input to Information Requests (IR's) from the regulators. Included participation in community meetings and licensing hearings relative to geological aspects (possible acid rock drainage and metals leaching) aspects of the project.

- Duties have included the ongoing monitoring and data evaluation relative to Provincial licensing requirements for a large groundwater based cooling system for Manitoba Hydro at the Dorsey HVDC converter station. Duties include overseeing hydrogeological data collection by Manitoba Hydro personnel, and reporting.

- Duties have included the ongoing monitoring and sampling of monitoring wells at an industrial water supply and wastewater discharge lagoon site at Midwest Foods, Ltd., in Carberry, Manitoba. The monitoring and evaluation of the large scale water balance of the area, based on a system of plant production wells, groundwater control wells, and a groundwater recharge trench, along with groundwater quality analyses, have been assembled and analyzed for environmental licensing purposes. Hydrogeological analysis included the use of a detailed numeric groundwater modeling program.

### Landfills

- Brady Road Regional Waste Management Facility

  **L**ead responsibility (starting in 2015) where KGS Group has developed and implemented a master plan for the BRRMF. This landfill has a wide variety of uses, and KGS Group recommended a plan that minimized cost, and maximized efficiency and level of service, to site users. The second component of this project included design and construction services for two new geomembrane lined landfill cells, and a centralized leachate collection and storage system.

- Brandon Eastview Landfill

  Lead responsibility for this two-phase project included geomembrane lined cell design and construction, and a master plan for the Eastview Landfill, the second largest Class 1 Waste Disposal Facility in Manitoba serving the City of Brandon and the R.M. of Cornwallis. In 2016 through 2018, KGS Group provided complete design, tendering, and construction administration services for two new landfill cells. In addition,

we were tasked with developing a landfill master plan to guide the operation and expansion of the Eastview Landfill in the near and distant future in line with the vision of the City.

- Mercury Landfill, Marathon, Ontario

  Electrical resistivity surveys, environmental investigations, and landfill closure design for historical Georgia Pacific mercury landfill.

- Groundwater quality interpretation and hydrogeological evaluation of municipal waste and slash (wood waste) landfills near Marathon, and Nipigon in northwestern Ontario. Involves ongoing monitoring and data analysis to evaluate leachate generation and possible leachate movement. Continued evaluation of landfill operation in comparison to the Certificate of Approval, and compliance monitoring is also required.
- Periodic assessment of water quality data including groundwater, surface water and leachate, analysis of trends, water types, evaluation of sampling procedures and laboratory analysis for Marathon Pulp Inc. Landfill, Marathon, Ontario, and a mercury disposal site in Marathon, Ontario for Georgia Pacific.
- Provided site evaluation and development of a conceptual site closure plan for a railyard landfill located at Canadian National (CN) facility in Melville, Saskatchewan. Included site evaluation and development of closure scheme to satisfy Saskatchewan Environmental Code E.1.1, including a post-closure monitoring plan.

### Phase II / III Environmental Assessments

- Duties include project development and borehole placement, soil logging, soil sampling, groundwater sampling, monitoring, and in-situ hydraulic conductivity testing at petroleum hydrocarbon impacted sites. Report preparation, data interpretation and analysis, and hydrogeological evaluations are undertaken following the fieldwork. Sites have ranged from petroleum hydrocarbon impacted sites at more than fifteen locations in Manitoba and Saskatchewan, to several heavy metals impacted sites and an ammonia/nitrate impacted site in Manitoba. Several sites also involved the development and preliminary evaluation of a number of potential remedial options.
- More specialized site assessment programs included the HVDC Converter Stations Oil Spill Risk Analysis for Manitoba Hydro. The risk analysis included evaluation of the potential for transformer oil spills and a preliminary phased design for oil spill containment at the main HVDC converter stations at Dorsey, Henday, Radisson.

### Impacted Sites and Landfarms

- Development and planning for waste characterization drilling for assessment of waste sites, including various landfills for domestic wastes, and organic reactor coolant disposal trenches at Canadian Nuclear Laboratories, Whiteshell Manitoba.
- Various roles as senior reviewer and technical input to data collection, monitoring, and management of the Sutherland Site for Manitoba Hydro, a former manufactured gas plant site impacted with coal tar. Long term planning and risk assessment, including for river bottom ebullition control.
- Lead responsibility for all environmental Emergency Response activities for Canadian National Rail. Geography includes Saskatchewan, Manitoba and Ontario. Site environmental control, assessment, remediation, and closure activities for all manner of derail spills, including for crude oil, and any other bulk product transport. Most recently KGS Group responded to large and complex crude oil spills in 2019 (Manitoba), and 2020 (Ontario).

- Input to design and management of the biosparge system for long term mitigation of a hydrocarbon impacted site in Sioux lookout, Ontario.
- Soil remediation and soil farm design, cofferdamoptimization and construction for in-water remediation at 8 Mile Channel Project, and at Split Lake, Manitoba
- Supervision of underground tank removal, soil sampling, data evaluation, and site closures at several sites in Manitoba. Duties include on-site soil screening, enforcement of standard operating procedures, and report preparation.

### First Nations

- English and Wabigoon Rivers Remediation Panel (EWRRP)

  Technical subcommittee member and representative of Wabigoon Lake Ojibway Nation regarding data collection, characterization, and planning for remediation of the legacy mercury impacts that are present in the English and Wabigoon Rivers near Dryden, Ontario.

- 8 Mile Channel Remediation – Manitoba Hydro

  Technical input and design for a hydrocarbon remediation project within Manitoba Hydro 8 Mile Channel. The project was executed by Norway House Cree Nation, as a Joint Venture with Sigfusson Northern Construction. KGS Group was responsible for all aspects of geotechnical and environmental investigations, geotechnical and environmental design, and cofferdam design, required to execute the work.

- Bipole III – Manitoba Hydro

  Project manager and advisor to build capacity, provide training, and deliver environmental monitoring framework for a First-Nations lead consulting firm who provided field environmental monitoring services to the Bipole III Contractors during construction.

- Various Solid Waste Projects

  Project Manager and technical advisor to various solid waste feasibility and environmental solid waste design projects at Pauingassi First Nation, Peguis First Nation, War Lake and York Factory First Nations, and Bunibonibee Cree Nation.

- Petroleum impacted site investigations at first nations communities located at Tadoule Lake, Manitoba, and at Fond Du Lac, Saskatchewan (Lake Athabasca). Duties included directing testpit locations, soil and groundwater sampling, and report preparation. Fieldwork was undertaken in conjunction with the First Nations Communities.

### Publications

- Robak, C., Mann, J., Kenyon, R., and Brown, K. (2018). Rehabilitating the Hardy Dam – Staged Upgrades to an Existing Dam to Meet Standards for Safety and Seepage Control. Canadian Dam Association Annual Conference. Quebec City, Quebec. October 13 – 19, 2018.
- Wilson, J., Mann, J., Pantel, P., and Halim, R. (2018). The Evolution of Identifying Construction Materials Sources. Digital Geotechnics Special Edition, Australian Geomechanics Journal v. 53, No.3, September 2018.

- Kenyon, R., Mann, J., Robak, C. (2017). Rehabilitating Hardy Dam for Stability and Seepage Control. GeoOttawa - Canadian Geotechnical Society Annual Conference.
- Arpin, B., Kenyon, R., Mann, J., Rahman, K. (2016). Passive Groundwater Depressurization for Improving Road Embankment Stability – Case Study: Powerview Creek, Manitoba. GeoVancouver – Canadian Geotechnical Society Annual Conference, Paper 3941.
- Dobson, R., Mann, J., Hamilton, A., Lukajic, B. (2016). Intake Slope Stabilization and Spillway Cut in Rock for Hydropower Projects. American Rock Mechanics Association Annual Conference, Houston, Texas. Paper 16-9.
- Mann, J., Dobson, R., Mc Phail, G., Lukajic, B. (2014). Old Meets New. Technical/Hydropower Supplement, Tunnels and Tunnelling International Magazine, December, 2014.
- Mann, J., Dobson, R., Mc Phail, G., Lukajic, B. (2014). Tunneling in Mayo, Yukon Territory. Tunneling Association of Canada Annual Conference, Vancouver, B.C., October 26 – 28, 2014.
- Sharif, S., Mann, J.D., Smith, J.B., Cook, G.N., (2012). Techniques for 3D Geological and Hydrogeological Modeling. A Case Study of Conawapa Generating Station. Canadian Geotechnical Society Annual Conference, Winnipeg, Manitoba. September 30 – October 3, 2012.
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- Leverington, D.W, J.D. Mann, and J.T. Teller. (2002). Changes in the bathymetry and volume of glacial Lake Agassiz between 9,200 and 7,700 14C yr BP., Quaternary Research 57, 244-252.
- Panagapko, D., L.E. Chackowski, P.G. Lenton, A.H. Bailes, M.T. Corkery, K.H. Poulsen, R. Brommecker, W. Weber, D.E. Ames, R.F.J. Scoates, D.F. Garson, P. Theyer, J.A. Percival, L.H. Thorleifson, G.L.D. Matile, N.M Grant, A.K. Burt, J.D.. Mann, (2001). Geoscience data compilation for southeastern Manitoba., Manitoba Industry, Trade and Mines, Manitoba Geological Survey, Open File Report 2001-8, 1 CD-ROM.
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