

GORD McKENNA, PhD, PEng, PGeol (AB, BC, SK, YT)
Principal Geotechnical Engineer

Education

PhD Geotechnical Engineering, University of Alberta (2002)

BASc Geological Engineering, University of British Columbia (1987)

Experience

2007 - Present, Principal Geotechnical Engineer, BGC Engineering Inc

2014 - Present, Adjunct Professor, Department of Renewable Resources, University of Alberta

2004 - 2007, Senior Geotechnical Consultant, Norwest Corporation

2004 - 2009, Adjunct Professor, Department of Civil and Geological Engineering, University of Saskatchewan

1987 - 2004, Geotechnical Engineer, Syncrude Canada

Affiliations

Association of Professional Engineers and Geoscientists of Alberta (PEng, PGeol)

Association of Professional Engineers and Geoscientists of British Columbia (PEng, PGeo)

Association of Professional Engineers & Geoscientists of Saskatchewan (PEng, PGeo) Engineers Yukon (PEng)

Canadian Geotechnical Society

Canadian Institute of Mining

Canadian Dam Association

Canadian Land Reclamation Association

Boundary Bay Flying Club

Dr Gord McKenna is a geotechnical engineer specializing in tailings and mine waste management, landform design, and reclamation and land-use planning. He has more than 25 years of experience as a geotechnical engineer at a large oil sands mine and as a consulting engineer for mines in Canada, the United States and South America. Gord has served on several geotechnical and geo-environmental review boards and expert panels and has authored over 80 papers and book chapters. Following is a summary of select projects in which Dr. McKenna has been involved...

LANDFORM DESIGN, MINE RECLAMATION, AND LAND-USE PLANNING

Building on oil sands experience and his 2002 PhD thesis in landform design, Gord has led teams that have developed numerous mine closure plans (landscape scale), landform and watershed designs, and technical guidance documents for end pit lakes, wetlands, covers and landform design. His design efforts led to the relinquishment of the first oil sands landform to the Crown and turned attention to make new dams and dumps easier to reclaim.

Gord has led the design and construction of a 15 large mine reclamation watersheds (totalling 37 km² with 21 wetlands and 28 km of watercourses). Six of these projects were instrumented watersheds for reclamation research, each of which fostered several post-graduate degrees. The information acquired from the design, construction, operation, and research has been synthesized and communicated to practitioners and regulators as part of novel tech-transfer programs.

- Syncrude Mildred Lake Settling Basin East Toe Berm 1999 (182 ha)
- Syncrude SWSS Cell 32 2000 (39 ha)
- Syncrude S5 Dump 2001 (74 ha)
- Syncrude MLSB Coke Watershed 2001 (11 ha)
- Syncrude South Bison Hills Dump 2002 (100 ha)
- Syncrude S4 Dump/Gateway Hill 2004 (107ha)
- Syncrude W1/W2 Dumps 2004 (7 watersheds covering 244 ha)
- Suncor MD2 Dump 2009 (34 ha)
- Syncrude Composite Tailings Prototype 2009 (80 ha)
- Suncor Pond 1 / Wapisiw Lookout 2010 (225 ha)
- Suncor Pond 5 and Pond 6 2011 (1168 ha)
- Suncor Nikanotee Fen and Watershed 2012 (35 ha)
- Syncrude East InPit / Sandhill Fen 2012 (52 ha).
- Faro Waste Rock Dump 2016 (350 ha)
- Faro Rose Creek Tailings Watershed 2016 (212 ha)
- Shell MRM External Tailings Facility 2016 (1420 ha)

Gord has also helped lead several breakthroughs in mine closure planning and relinquishment, including the use of formal goal-setting, design checklists, GIS tools, and various communication techniques that have become routine in oil sands closure planning, such as project design topographic surfaces, constraint maps, and landscape design risk assessments. Gord's main messages are to work with stakeholders, clearly define and obtain agreement on measurable goals, and work toward creating landforms that can be reclaimed reliably and efficiently.

GEOTECHNICAL INVESTIGATIONS AND DESIGNS

Gord carries out geotechnical site investigations and designs for a variety of mining foundations, dumps, dams, and borrow. Many site investigations involve characterizing large mine waste facilities for landform design. Major design/construction projects have included highwall dragline

Years of Relevant Experience: 25+

mining (1987-1991), refinery foundation designs (1991-1994), sulphur block burial (2002-2004), development of grouted piezometers (1991-1995), Questa Rockpile investigation and geotechnical risk assessment (2004-2007), Wolverine Tailings Dam design (2004-2006), Galore Creek Tailings Dam design (2007-2009), Coal Valley waste rock dumps (2013-2014), and various dam safety inspections and reviews.

SCREENING AND ECONOMICS STUDIES

Gord has worked on a dozen of screening studies for tailings, mining, and reclamation projects. Major projects include oil sands tailings technology evaluations, tailings capping projects, and mine waste rock physical/chemical stabilization projects. Gord uses holistic life-cycle design, simple and transparent decision analysis tools, simplified economics, and management/regulatory/stakeholder involvement to help teams make their best decisions.

TAILINGS R&D

Gord has been involved in oil sands tailings research and development for over 25 years in dozens of projects ranging from bench scale, through piloting, prototyping, commercialization, operation, closure and reclamation. Example projects include commercialization of Syncrude composite tailings, development of soft tailings bearing capacity, and new reclamation techniques. Most of this work happens in the field, dealing with real-life conditions in large pilots and in start-up.

REVIEW BOARDS AND EXPERT PANELS

Gord has participated in a number of review panels, guiding operations and landform design for large dams and dumps as well as advising on research and development programs. Belonging to such panels has given Gord a chance to collaborate with experts from many other disciplines.

- CEMA Landform Design Checklist 2003-2004
- Questa Rockpile Weathering ADTI Panel 2006-2009
- Albian InPit Dyke Design and Construction Internal BGC team 2008-2012
- Suncor Pond 5 Coke capping review team 2008-2010
- CEMA End Pit Lake Guidance Document 2010-2012
- CTMC Oil Sands Tailings Roadmap 2010-2012
- Strategic Advisory Panel on Selenium Management 2010-2011
- MEND Cold Regions Cover System Design Technical Guidance Document 2011-2012
- University of Alberta Land Reclamation International Graduate School Management Board 2012-2016
- CEMA Guidelines for Wetlands Establishment on Reclaimed Oil Sands Leases 2012-2014
- De-Licensing of Oil Sands Tailings Dams: Technical Guidance Document 2012-2014
- Syncrude Base Mine Lake R&D Review Panel 2012-2014
- Syncrude EIP Landform Design Review Team 2012-2014
- Shell Albian Tailings Geotechnical Advisory Panel 2013-present
- Council of Canadian Academies Expert Panel on the Potential for New and Emerging Technologies to Reduce the Environmental Impacts of Oil Sands Development 2013-2015
- INAP Cover Systems Guidance Document 2014-2016
- CanAus Water Management Advisory Team 2015-2016

And a half dozen organizing committees for national and international mining and reclamation conferences.

SHORT COURSES

Gord leads short courses for 8 to 80 practitioners and students (including graduate students), often at international conferences. The courses focus on practical, hands-on learning and provides participants with the tools and case histories to complete their own landform designs and closure plans. Gord has hosted over two dozen workshops to date.

- Successful Reclamation - CIM Calgary '99 - Calgary 1999
- Landform design checklist - CEMA - Fort McMurray 2003

- Geostatistics for hydraulic conductivity - Syncrude Canada - Fort McMurray 2004
- Landform design for oil sands tailings - Canadian Geotechnical Society - Calgary 2006
- Landform design - Tailings and Mine Waste '08 - Vail 2008
- Oil sands geotechnique - BGC Engineering - Vancouver 2008
- Landform design - Tailings and Mine Waste '09 - Banff 2009
- Landform design for oil sands - Syncrude Canada - Fort McMurray 2010
- Oil sands geotechnique - BGC Engineering - Vancouver 2010
- Landform design - Tailings and Mine Waste '11 - Vancouver 2011
- Landform design - BGC Engineering - Vancouver 2012
- Oil sands geotechnique - BGC Engineering - Kamloops 2012
- Landform design - ICARD 2012 - Ottawa 2012
- Sustainable Mining Now - Mine Closure '12 - Brisbane 2012
- Landform design and closure planning - University of Alberta Mining Engineering - Edmonton 2013
- Landform design - University of Alberta, LRIGS - Edmonton 2013
- Landform design and covers - CLRA '13 - Whitehorse 2013
- Landform design and cover - Tailings and Mine Waste '13 - Banff 2013
- Landform design for oil sands - oil sands company client course - Calgary 2013
- Landform design for oil sands - oil sands company client course - Calgary 2013
- Mine closure seminar - BGC Engineering - Santiago 2013
- Oil sands geotechnique - BGC Engineering - Vancouver 2014
- Landform design and closure planning - University of Alberta Mining Engineering - Edmonton 2014
- Landform design and covers - Seminar on Cold Regions- Cover Systems and Mine Closure - Whistler 2014
- Landform design for oil sands - oil sands company client course - Calgary 2014
- Hot Topics in oil sands tailings management - International Oil Sands Tailings Conference - Lake Louise 2014
- Landform design and closure planning - University of Alberta Mining Engineering - Edmonton 2015
- Landform design and reclamation for northern mines -- Northern Latitudes Mining Reclamation Workshop - Juneau 2015
- Landform design for oil sands - oil sands company client course - Calgary 2016
- Landform design and closure planning - University of Alberta Mining Engineering - Edmonton 2016

CLIENTS/PROJECTS

Approximately half of Gord's work is currently for the oil sands industry, the rest is in coal and metal mining and heavy civil works.

- AANDC Giant Mine (Yellowknife NWT)
- Andina Minerals Volcan Gold Project (Chile)
- Barrick Gold Pueblo Viejo (Dominican Republic)
- Barrick Gold Hemlo Gold Mine (Marathon ON)
- BC Hydro Site C Reservoir (Hudson Hope BC)
- BHP Billiton Potash (Jensen SK)
- BP Yerington Mine (Reno NV)
- Canadian Dam Association (Edmonton AB)
- CanAus Coal (Sparwood BC)
- CEMA/RWG Oil sands multi-party group (Fort McMurray AB)
- Chevron Molycorp Questa Mine (Questa NM)
- CNRL Horizon Mine (Fort McMurray AB)
- Coal Valley Mine(Edson AB)
- Council of Canadian Academies (Ottawa ON)
- Imperial Oil Kearl Oil Sands Project (Fort McMurray AB)
- NovaGold Galore Creek (BC)
- OSRIN Oil Sands Research Information Network (Edmonton AB)

- OSTC/COSIA Tailings Consortium (Calgary AB)
- PetroCanada/UTS Fort Hills Oil Sands Project (Fort McMurray AB)
- Pimenta Consultoria - VALE Capo Xavier Mine (Brazil)
- Shell Canada Muskeg River and Jackpine Mines (Fort McMurray AB)
- Suncor Energy Tar Island Steepbank and Millennium Oil Sands Mines (Fort McMurray AB)
- Syncrude Canada (Mildred Lake Aurora North and Aurora South Oil Sands Mines (Fort McMurray AB)
- Synenco Energy Northern Lights Oil Sands Project (Fort McMurray AB)
- Teck Coal Fording Greenhills Line Creek Elkview Cheviot and Cardinal River Mines (Sparwood BC, Hinton AB)
- Teck Resources Frontier Oil Sands Project Calgary (Fort McMurray AB)
- Total E&P Canada Joslyn Creek Oil Sands Project (Fort McMurray AB)
- Western Canadian Coal Wolverine Coal Mine (Tumbler Ridge BC)
- YG/INAC Faro Mine (Faro YK)

Gord has toured over 100 mines in North America, South America, Europe, and Australia as part of his landform design and reclamation work.

PUBLICATIONS

Abbott RM & McKenna GT. 2012. **Sustainable mining now. turning ideas and ideals into reality.** Mine Closure 2012. Brisbane. Australian Centre for Geomechanics. p771-781.

McKenna G., An R, Scordo E, & McGreevy J. 2013. **Toward effective closure planning: From progressive reclamation to sustainable mining.** Tailings and Mine Waste '13. Proceedings of the Seventeenth International Conference on Tailings and Mine Waste, November 3-6, Banff. University of Alberta Geotechnical Center, Edmonton. p615-625.

Ansah-Sam M, Hachey L, McKenna G, & Mooder B. 2016. **The DBM approach for setting engineering design criteria for an oil sands mine closure plan.** Fifth International Oil Sands Tailings Conference, December 4-7. Lake Louise, Alberta. University of Alberta Geotechnical Group, Edmonton. 11p.

Aubertin M & McKenna G. 2016. **Tailings Disposal Challenges and Prospects for Oil Sands Mining Operations.** Geo-Chicago 2016: Geotechnics for Sustainable Energy. Aug 14-18. Chicago. p359-371.

Barbour S & McKenna G. 2010. **Engineering for Wetland Reclamation,** Reclamation and Restoration of Boreal Peatland and Forest Ecosystems: Toward a Sustainable Future. Edmonton. March 25-27. Paper 3-6.

BGC Engineering Inc. 2010. **Oil Sands Tailings Technology Review.** OSRIN Report No. TR-1. BGC Engineering Inc. Vancouver. 136p. (co-author)

BGC Engineering Inc. 2010. **Review of Reclamation Options for Oil Sands Tailings Substrates.** OSRIN Report No. TR-2. BGC Engineering Inc. Vancouver. 59p. (co-author)

Cassie J & McKenna G. 2016. **Mine closure planning, design and implementation: from hand-waving to reality.** Planning for Closure 2016: First International Congress on Planning for Closure of Mining Operations. Santiago, Chile. November 20-22. Gecamin. Santiago. 9p.

Chow R, McKenna G, Win SMK, & Journault J. 2013. **Recovery of Bitumen from Oil Sands Tailings Streams and Deposits: Potential Opportunities and Benefits.** Consultant's report for Alberta Innovates, Energy and Environment Solutions (AI-EES) and the Canadian Oil Sands Innovation Alliance (COSIA). Report dated Dec 18, 2013.

Consortium of Tailings Management Consultants (CTMC). 2012. **Oil Sands Tailings Technology Deployment Roadmap: Project Report – Volume 2, Component 1 Results.** Consultants report to Alberta Innovates – Energy and Environment Solutions. June 22, 2012. 112p. (Co-author)

Council of Canadian Academies (CCA). 2015. **Technological Prospects for Reducing the Environmental Footprint of Canadian Oil Sands: The Expert Panel on the Potential for New and Emerging Technologies to Reduce the Environmental Impacts of Oil Sands Development.** Council of Canadian Academies. Ottawa. 254p. (Panel member and author)

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Cumulative Environmental Management Association (CEMA). 2005. **Landscape Design Checklist**, Revised RSDS Government Regulator Version. May 2005. CEMA-RWG Landscape Design Subgroup. 8p. (editor and contributor)

Cumulative Environmental Management Association (CEMA). 2012. **Oil Sands End Pit Lakes Guidance Document**. CEMA. Fort McMurray. 494p. (chapter author, technical advisor)

Cumulative Environmental Management Association (CEMA). 2014. **Guidelines for Wetland Establishment on Reclaimed Oil Sands Leases** (3rd Edition). CEMA. Fort McMurray. 436p. (chapter author, technical advisor)

Daly C, Atkinson J, Birkham T, Chapman D, Ciborowski J, McKenna G, O'Kane M, Price J, Rochefort L, & Russell B. 2010. **Novel wetland reclamation design: The Suncor pilot fen and Wapisiw wetland**. 37th Annual Aquatic Toxicity Workshop October 3-6. Toronto. Fisheries and Oceans Canada.

Eaton BR, Fisher JT, McKenna GT, & Pollard J. 2014. **An Ecological Framework for Wildlife Habitat Design for Oil Sands Mine Reclamation**. OSRIN Report No. TR-67. Oil Sands Research and Information Network, University of Alberta. Edmonton. 83p.

Holden A, McKenna G, Fan X, & Biggar K. 2014. **The potential impact of different types of tailings on water quality and quantity reporting to oil sands end pit lakes: a preliminary modeling exercise**. International Oil Sands Tailings Conference (IOSTC 2014). December 7-10. Lake Louise, Canada. University of Alberta Geotechnical Centre. Edmonton.

Jakubick AT & McKenna GT. 2001. **Stabilization of soft tailings. practice and experience**. Eighth International Conference on Radioactive Waste Management and Environmental Management (ICEM'01). Brugge Belgium. American Society of Mechanical Engineers.

Jakubick AT, McKenna GT, & Robertson AM. 2003. **Stabilisation of tailings deposits: international experience**. Sudbury 2003. Mining and the Environment. Sudbury.

Keys MJ, Ducharme J, & McKenna G. 2000. **Incorporating landscape design into closure planning at the Syncrude Mine Site**. Global Land Reclamation/Remediation 2000 and Beyond. Proceedings of the Canadian Land Reclamation Association 25th Annual Meeting, Edmonton, Alberta

Keys MJ, McKenna G, Sawatsky L, & Van Meer T. 1995. **Natural analogs for sustainable reclamation landscape design at Syncrude**. Environmental Management for Mining. Saskatoon.

Kostaschuk RA, Luternauer JL, McKenna GT, Moslow TF. 1992. **Sediment transport in a submarine channel system, Fraser River delta Canada**. Journal of Sedimentary Petrology. 62:273-282.

Kostaschuk RA, Luternauer JL, McKenna GT, and Moslow TF. 1990. **Morphology and sediment transport in a submarine channel system; Fraser River delta British Columbia**. Geological Association of Canada – Mineralogical Association of Canada annual meeting. Program with abstracts Waterloo. 15:71.

Kupper AG, Hurdall B, Morgenstern N, Sobkowicz J, Abeda W, Baldwin G, Cameron R, Eenkooren N, Grapel C, Martens S, McKenna G, Mihiretu Y, Mimura W, Parson K, Paz S, Petersen T, Small A, Tan S, Wog K, & Yazdanpanah S. 2013. **De-licensing oil sands tailings dams - when is a dam no longer a dam?** Tailings and Mine Waste '13. Proceedings of the Seventeenth International Conference on Tailings and Mine Waste November 3-6, Banff. University of Alberta Geotechnical Centre. Edmonton.

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Liu Y & McKenna G. 1999. **Applications of wickdrains in Syncrude composite tailings**. 52nd Canadian Geotechnical Conference, Regina. Canadian Geotechnical Society.

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McKenna G. 2004. **Geoenvironmental characterization of a large sulphur block at Syncrude: results from 2003 field investigation**. Syncrude Canada Ltd. for University of Calgary, Department of Chemistry, Alberta Sulphur Research Ltd.

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McKenna G & Dawson R. 1997. **Landscape engineering for sustainable development**. Geotechnical Society of Edmonton Third Annual Symposium. April 4. Edmonton. 12p.

- McKenna G & Lewko R. 1995. **44 blockslides in the Athabasca Oil Sands**. 48th Canadian Geotechnical Society Conference. Sep 25-27. Vancouver. p909-916.
- McKenna G, Biggar K, Win SMK, Journault J, Eaton T, Segó D, & Morgenstern N. 2010. **Oil sands tailings sand hydraulic conductivity**. 2nd International Oil Sands Tailings Conference. December 5-8. University of Alberta Geotechnical Centre. Edmonton p21-29,
- McKenna G, Dawson R, Hyndman A, LeSueur P & Sobkowicz J. 2012. **The Oil Sands Tailings Roadmap and Action Plan — Oil Sands Tailings State of Practice Overview**. International Oil Sands Tailings Symposium, Edmonton. University of Alberta Geotechnical Centre, Edmonton.
- McKenna G, Keys M, Van Meer T, Roy L. & Sawatsky. 2000. **The impact of beaver dams on the design and construction of reclaimed mines sites**. Proceedings of the 24th Annual British Columbia Mine and Reclamation Symposium, Williams Lake, B. C. 2000.
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- McKenna G, Mann V, Fisseha B, Beier N, & Olmedo N. 2016. **The geotechnical vane strength of soft tailings compared to soft foods**. Fifth International Oil Sands Tailings Conference, December 4-7. Lake Louise, Alberta. University of Alberta Geotechnical Group, Edmonton. 11p.
- McKenna G, Mooder B, Burton B, & Jamieson A. 2016. **Shear strength and density of oil sands fine tailings for reclamation to a boreal forest landscape**. IOSTC International Oil Sands Tailings Conference. Lake Louise. Dec 4 to 7. University of Alberta Geotechnical Group. Edmonton.
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- McKenna G, Scordo E, Shuttleworth D, Straker J, Purdy B, & Buchko J. 2011. **Aesthetics for mine closure**. Mine Closure 2011 Conference. Lake Louise, Canada. Australian Centre for Geomechanics. Perth. 1:603-612.
- McKenna G, Straker J, & O’Kane M. 2016. **Custodial transfer of reclaimed mines: barriers and opportunities**. TRCR 40th Annual BC Mine Reclamation Symposium. Penticton, BC, Canada. Sept 2016. 12p.
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- McKenna G. 1991. **Grouted-in installation of piezometers in boreholes**. 44th Canadian Geotechnical Society Conference. Calgary. Canadian Geotechnical Society. Paper 55. 12p.
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OTHER ACTIVITIES

Gord is an avid traveller, speaker, photographer, and private pilot (more information at www.gordmckenna.com).