



Global leader in the mining industry

From concept and pre-feasibility through to decommissioning and closure, we provide services to mining projects throughout the world.

MINE SERVICES

Mine waste and geotechnical design

Total mine water management solutions

Socio-environmental and consultation

Environmental guidance for design and permitting

Down to Earth. Up to the Challenge.

About us

Klohn Crippen Berger Ltd. (KCB) is an international engineering and environmental consulting firm with its' head office in Vancouver and nine offices in strategic locations in Canada, Peru and Australia. We have a strong reputation for quality service and technical excellence in a range of services including: Mining, Environmental, Water, Power, Transportation, and Oil and Gas. Since forming in 1951, we have a long history of participation in local projects, as well as a strong international reputation. We are working on some of the largest, most challenging engineering projects, both nationally and internationally.

"In business for 58 years, its [KCB's] quality of engineering gives it a stellar reputation."

National Post. Feb. 2, 2009.

Team leaders



Len Murray, Vice President, is a civil and geotechnical engineer with 30 years' experience in the design, construction, and management of mining projects worldwide.

Harvey McLeod has 35 years' experience in all aspects of mine waste management including major studies for more than 100 mining projects internationally.

Howard Plewes, Regional Manager, B.C., is a civil engineer with more than 20 years' experience in dam engineering and mine waste management on some of the largest tailings facilities in the world.

Dan Etheredge, Regional Manager, South America, has more than 20 years of experience in environmental consulting and construction management.

Chris Dickinson, Regional Manager, Australia, has 14 years' experience as a geologist and hydrogeologist in Australia, Asia, the Pacific and Canada.

Debra Lamash, Manager Socio-Environmental Division, has over 20 years of experience undertaking socioeconomic, regulatory review, consultation and First Nations programs in Canada and internationally for clients in a variety of sectors.

Arvind Dalpatram has more than 30 years of civil engineering experience relating to water resources and infrastructure developments in Canada and overseas.

Lawrence Clelland, Regional Manager Ontario, has more than 25 years of experience in the study, design and construction supervision of major civil engineering projects.

Neil Singh is a geological engineer with over 20 years of experience with dam design, natural hazards, and geotechnical engineering.

Gerrad Suter has 15 years of experience with geotechnical engineering for mine projects.

Greg Noack has 20 years of experience with all aspects of mine water management.

Bing Wang is a geotechnical engineer with over 20 years of design and management experience on mining projects around the world.

Chris Strachotta has more than 10 years of international experience focusing on mine water management.

Franky Li has 10 years of experience working on tailings, hydrogeology, and surface water management projects.





Mining Environmental Group

The Mining Environmental Group provides comprehensive services for environmental and engineering management of mine development projects with a focus on mine waste management and environmental stewardship. We have worked on hundreds of mining projects worldwide, including some of the largest mining projects developed. We are qualified in tailings dam design and have designed hundreds of dams, some up to 300 m high. Our integration with environmental and social design drives our continued development as a leading-edge provider of these services to major clients worldwide.



PSMJ Resources, Inc.



ISO 9001:2008 Registered

Our Values

- People first
- Ethics, integrity, honesty
- Professionalism
- Innovation
- Quality
- Technical excellence
- Recognition of individual contributions
- Teamwork
- Sustainability
- A satisfying and fun workplace

Our Vision

Excellence, teamwork, and innovation building a better world.

Our Mission

To attract, develop, and retain talented staff and quality clients who thrive and excel as a team while undertaking exciting projects.



Mine Tailings and Rock Engineering

INTEGRATED ENGINEERING DESIGN, FROM THE ARCTIC TO THE TROPICS

Services

Tailings Technologies: Designs to reduce water management and project footprints using dewatered, paste and thickened tailings. Alternative technologies using co-disposal with waste rock, cells to limit evaporation losses, cycloning and thickening of select tailing streams and combinations of conventional tailings storage and new technologies.

Dam Design: Geotechnical design of major dams, considering seismicity, seepage control, stability, natural hazards, and water management.

Environmental Design: Integration of limiting environmental factors, such as water quality, seepage, water treatment/discharge, and social concerns.

Waste Management: Integration of international best practices following Mining Association of Canada, International Congress of Large Dams and World Bank/IFC guidelines. Preparation of Operation, Maintenance and Surveillance Manuals and Emergency Preparedness Plans (EPP).

Construction: Focused on building a project that works for the client, QA/QC services, construction supervision/monitoring and cost control.

Waste Rock and Water Management: Geotechnical and environmental design of waste rock dumps. Water balance, water management and hydraulic structures associated with dams, waste dumps and open pits.

Risk and Benefit Assessment: Risk assessment and risk management plans for mine waste and water facilities. Benefit assessment to balance and mitigate potential risks.

Closure: Design for long-term sustainable closure of dams, tailing impoundments and waste dumps.

International Reputation: We have been trusted with some of the largest, most challenging tailings dams, and some of our clients have been with us for over 30 years.

Some of our clients have been with us for over 30 years.





Experience

Large Copper Projects: Design of tailings storage facilities for some of the largest copper mines in the world. Recent and active projects include international projects, such as: Oyu Tolgoi (Mongolia), Tampakan (Philippines), Ok Tedi (Papua New Guinea), and Montanore and Resolution Copper (USA). Canadian projects include: Kerr-Sulphurets, Yellowhead, Kemess North, Morrison, Gibraltar, and Highland Valley Copper. Designs for production rates ranging from 30,000 tpd to 170,000 tpd, include different combinations of cycloned sand dams, waste rock dams, high density thickening, tailings desulphidization and co-disposal of ARD waste rock with tailings. Dam heights range from 80 m to 300 m in height.

Oil Sands: KCB is the designer of record for many of the large oil sand tailings facilities located in northern Alberta. The projects range up to 240,000 tpd and integrate evolving technologies for management of

mature fine tailings. Recent and active projects include: Syncrude, Suncor, Fort Hills and Albion.

Massive Sulphide and Nickel Mines: Design and management of numerous facilities in Canada and worldwide, including many of the Vale Inco nickel mines in the Sudbury basin. Massive sulphide mines in western Canada include: Yukon Zinc, Tulsequah Chief, J & L. Peruvian mines have included: Andaychagua, Huaron, Cobriza and others.

Uranium and Rare Earth Metals: Projects include design of the tailings facility for a confidential mine in Australia and a Tantalum-Niobium mine in British Columbia.

Tailings Technologies: KCB has integrated evolving tailings technologies into the dewatered tailings at Greens Creek (Alaska), paste tailings at Myra Falls (British Columbia), tailings desulphidization at Ok Tedi (Papua New Guinea), and cycloning and thickening of cyclone overflow at Albion

(Alberta).

Waste Rock Facilities: KCB incorporates the waste management planning of waste rock dumps into the design of the project and have included co-disposal with tailings into the Kemess North design and the Yellowhead mine tailings designs. Water management facilities for waste dumps have been designed and constructed for the Antamina zinc-copper mine in Peru, which includes treatment ponds and wetlands.





Water Management

MANAGING WATER SAFELY, FROM EXPLORATION TO POST-CLOSURE

Services

Acid Rock Drainage and Metal Leaching:

Geochemical assessment of mine waste rock and tailings. Water quality predictions for operations and closure. Limiting water quality issues and integration of controls as part of facility engineering design.

Water Balance and Water Management:

Optimizing water recovery in arid climates and improving storage, treatment and release of water in wet climates.

Mine Dewatering: Design of mine dewatering systems that manage both quantity and quality of mine water. Design of depressurization systems for pit wall stability.

Water Supply and Water Rights:

Groundwater and surface water supply and storage assessment of mine water supply.

Hydraulic Structures: Design and construction of diversion structures, diversion channels, spillways, sediment ponds and decant systems. Assessment of hypothetical “Dam Break” and “Tailings Run-out” effects to support Emergency Preparedness Planning (EPP).

Environmental Design: Water quality modelling to integrate facility engineering design with limiting environmental factors in the receiving waters, such as aquatic life or downstream water use.

Groundwater: Groundwater plume modelling, including dispersion modelling and absorption/attenuation models. Groundwater monitoring programs and the design and construction of groundwater remediation systems.

Wetlands: Design and construction of wetlands to mitigate water quality and/or to enhance aquatic habitat.



Experience

Antamina Mine, Peru: Design and construction of an engineered wetland at 4000 m elevation and sediment and water treatment ponds for runoff from the mine waste rock dumps.

Lihir Gold Mine, Papua New Guinea: Development of a mine water, sediment and acid rock drainage plan for a mine located on an island formed around 5 volcanoes.

Vale Inco Mine, Sudbury, Canada: Conceptual design, detailed design and construction monitoring of a site-wide Water Management System to reduce hydraulic overload at the central Waste Water Treatment Plant. The system services 60 square kilometers of Canadian Shield watershed and features 21 ponds, reservoirs and lakes connected by fibre optic monitoring and remote control discharge systems.

Water Balance and Flood Design: Water management for all of the active tailings projects being carried out by KCB, including design of spillways, decant systems, erosion protection works and diversions.

Ok Tedi Mine, Papua New Guinea: Design of pit dewatering system for a 300 m deep pit extension in a high-rainfall (10 m/yr) environment.

Dam Break Assessments: As part of the new Canadian Dam Safety Guidelines, dam break analyses are carried out for all tailings and water supply dams to classify key characteristics, to formulate design criteria, and to assess downstream flood impacts. KCB has carried this out for the 150m-high Highland Valley Copper tailings dam in British Columbia and other projects.

Ruby Creek Water Supply, Canada: Hydrological and hydrogeological studies, groundwater field investigations, and detailed design of surface water diversion, groundwater extraction and water conveyance works for the proposed mine.

Ruby Creek Aquatic Habitat, Canada: Civil and hydrotechnical design for habitat compensation/migration works incorporating bio-engineered structures such as large woody debris, rootwads, boulder clusters, etc.

*Excellence,
teamwork and
innovation
building a better
world*



Socioeconomics and Consultation

ADDRESSING SOCIAL CONCERNS THROUGH DESIGN - BUILDING A BETTER WORLD

Services

Stakeholder and First Nations/Aboriginal

Consultation: Facilitating understanding, involvement, and information exchange during all project stages through use of a variety of tools and techniques such as meetings, communications materials, and open houses.

Communications and Consultation Plans and

Materials: Developing and implementing project-specific plans and supporting communications materials, including culturally appropriate materials.

Regulatory Consultation and Advisory

Services: Developing strategies that advance the review and regulatory approval processes. KCB has experience with federal, provincial and territorial processes in Canada and International Finance Corporation standards, World Bank guidelines, Equatorial Principles, and numerous country specific processes worldwide.

Socioeconomic Baseline and Impact

Assessments: Characterizing pre-project social and economic conditions in the potential area of influence of a project; assessing the potential short, medium and long-term effects on people, communities and economies; and developing mitigation, enhancement and monitoring strategies in concert with stakeholders and First Nations.

Capacity Building: Training, skills development and capacity building for local communities and First Nations/Aboriginal groups.

Traditional Use and Traditional Ecological

Knowledge: Incorporating traditional use and traditional ecological knowledge into socioeconomic and environmental baseline and impact assessment studies.

Corporate Social Responsibility and

Sustainability: Working with clients to integrate social, economic, and environmental considerations into corporate decision making.

Health and Safety: Development of Health & Safety programs and integration of safety into project design.

Joint Ventures:

IEG Consultants Ltd. and IEG Nunasi Consultants Ltd. are joint ventures between Klohn Crippen Berger and the Inuvialuit Development Corporation and Nunasi Corporation, respectively. Dedicated to the communities and people of northern Canada, the joint ventures deliver quality environmental and engineering services to industry, government and aboriginal organizations.

*Integrating
community
needs and
values.*





Experience

Rainy River Gold Mine, Canada: KCB initiated baseline data-gathering for this advanced exploration-phase gold project in 2009. In 2010 we will complete the baseline, and work with local community members and First Nations to identify means through which to enhance socioeconomic benefits, minimize effects, and develop a conceptual closure plan. Ongoing consultation will be key to project success.

Minto Mine Phase IV Expansion, Canada: KCB is undertaking the socioeconomic assessment for the expansion of the Minto Mine located on Selkirk First Nation Category A Settlement Lands.

Ruby Creek Molybdenum Mine, Canada: This remote mine, located in the traditional territory of the Taku Tlingit First Nation, was approved by federal and provincial regulatory agencies. KCB led the socio-environmental assessment; consulted with the community, First Nations and regulatory

agencies and designed the waste management facilities. First Nations participated in project studies and we worked with First Nations to develop an adaptive management plan.

Fenix Nickel Mine, Guatemala: KCB worked with a team of local consultants to develop a baseline and complete a socio-environmental impact assessment for the re-opening of a mining and milling operation. The studies were undertaken in accordance with IFC Performance Standards, World Bank guidelines and Government of Guatemala regulations.

Mica Units 5 and 6, Canada: KCB led the socio-environmental assessment for this Project located in the overlapping traditional territory of 25 First Nations. We also advised and supported the client in consultation and regulatory activities, undertook an alternatives assessment and worked with First Nations to involve them in project studies.

Tampakan Copper Mine, Philippines: KCB completed a Social Impact Assessment and Community Consultation Program for a mine access road. We worked closely with local consultants and experts from the local university to complete the project.

Molejon Gold Mine, Panama: KCB developed consultation protocols for use by our client to gather input from local communities. We also conducted due diligence reviews, and completed the socio-environmental studies for the Project.

Antamina Mine, Peru: KCB managed a team of consultants that undertook a social baseline study and consultation for a mine closure plan in accordance with Peruvian law. KCB developed a plan to monitor the results and effectiveness of social programs.



Mine Environment

ENVIRONMENT BY DESIGN: INTEGRATING THE ENVIRONMENT INTO PROJECT PLANNING AND DESIGN TO BUILD SUCCESSFUL PROJECTS

Services

Environmental Baseline Studies:

Characterizing pre-project environmental conditions in the potential project area of influence, such as climate, aquatic and terrestrial biology, water quality, hydrology, hydrogeology, noise, visual terrain, soils. Working with First Nations to incorporate traditional ecological knowledge into the baseline.

Environmental Impact Assessment:

Assessing potential short, medium and long term environmental effects of a project including developing mitigation, enhancement, compensation, and monitoring plans.

Aquatic Biology: Fisheries and fish habitat assessment including inventory, impact assessment, mitigation and compensation planning.

Terrestrial Biology: Wildlife inventory surveys, terrestrial ecosystem mapping, identification and management of species at risk, vegetation assessments, monitoring, and management plans.

Water: Hydrology, hydrogeology, and geochemistry baseline and impact assessment.

Permitting: Guidance and support for permitting throughout the EIA stage, construction, operations and closure.

Monitoring and Evaluation: Developing monitoring and evaluation programs and undertaking monitoring during construction, operations and closure.

Environmental Management Plans (EMPs): Preparing EMPs for construction and operations.

Environmental Audits and Risk Assessment:

Assessments of existing operations or acquisition targets. Conducting risk assessment workshops and preparing risk management plans.

Closure and Sustainability: Incorporating environmental and social factors into the final land and water use planning for the mine. Design for closure to optimize opportunities and minimize long-term risks.

Challenge us to take on your toughest projects





Experience

Rainy River Gold Mine, Canada: KCB initiated baseline data-gathering and planning of waste management facilities for this advanced exploration stage gold project in 2009. In 2010 we will complete the baseline, advance the project into the environmental assessment stage, and identify preferred waste management facility locations.

Ruby Creek Molybdenum Mine, Canada: KCB guided this project from conception to award of an Environmental Assessment Certificate. We completed the environmental baseline and assessment, developed monitoring programs, and led project permitting. We also designed the tailings and waste rock facilities to minimize potential effects during operations and closure.

Red Chris Mine, Canada: KCB, with field assistance from the Tahltan First Nation, developed the detailed fish habitat compensation plan. This included fish sampling, habitat surveys and on-ground

delineation of the proposed compensation sites that will more than offset any project related habitat losses, ensuring no net loss of productive fish habitat.

Morrison Lake Mine, Canada: KCB completed the environmental and geochemical assessment of potential effects on aquatic life in Morrison Lake and its' tributaries and completed the conceptual fish habitat compensation plan. We will finalize the detailed compensation plan in 2010 and undertake further hydrology, water quality and fisheries work.

Copper Mountain Mining Project, Canada: KCB conducted intensive fish and benthic invertebrate sampling and completed an impact assessment and habitat compensation plan. The Upper Similkameen Indian Band provided field assistance.

Oil Sands "end of pit" Lakes Research Study, Canada: KCB is part of a team carrying out a full scale pilot program to test the potential for reclamation of oil sand

open pit mines with a sustainable lake. The work will include a worldwide research program and construction of a full scale prototype "End Pit Lake" in a completed open pit area.

Molejon Gold, Panama / Tassawini Gold, Guyana: KCB conducted socioeconomic and environmental impact studies for these projects. Studies included preparing field protocols for baseline data collection by national consultants; due diligence field assessments; and preparation of the Social Environmental Assessment to International Finance Corporation standards.

Antamina Mine, Peru: KCB received an award of merit from the Consulting Engineers of BC and the Canadian Consulting Engineering Award for our innovative work on this mine located high in the Andes. These highest-altitude wetlands were constructed to treat seepage water from the mine waste rock dumps. We also carried out the detailed closure plan.





Through our association with the Louis Berger Group, Inc., a leading infrastructure engineering, environmental science, and economic development consultant we have access to over 100 offices worldwide.

500-2955 Virtual Way, Vancouver BC V5M 4X6, Canada

T +1.604.669.3800 | F 604 669 3835 | E info@klohn.com | www.klohn.com



OFFICE LOCATIONS

CANADA Vancouver | Calgary | Edmonton | Saskatoon | Sudbury | Lloydminster | Inuvik | Castlegar

INTERNATIONAL Brisbane | Perth | Lima | London