



Klohn Crippen Berger

Tailings

Hydroelectric

Water Supply

Multi-purpose

DAMS

STATE OF PRACTICE

ABOUT KCB

Klohn Crippen Berger is an international engineering, geoscience and environmental consulting firm with its head office in Vancouver and eight offices in strategic locations in Canada, Peru, and Australia. We are registered and have an ongoing presence in the United States, United Kingdom, Papua New Guinea, Indonesia, Mauritania, Mongolia and Brazil. We have over 60 years of participation in some of the largest and most challenging engineering projects in the world and are typically working on projects in over 20 countries. KCB offers a full range of services in water, power and transportation, oil and gas and mining environment sectors. We have a strong reputation for quality service and the capacity to support a practical “on-the-ground” approach.

QUALITY

ISO 9001

ENVIRONMENT

ISO 14001

HEALTH & SAFETY

OHSAS 18001



Our commitment to excellence is the driving force behind everything we do and as a result, we are the recipient of over 50 awards for business leadership and project innovations. Our projects stand the test of time and we continue to work on many sites that we helped develop decades ago.

STEWARDSHIP

INTERNATIONAL COUNCIL ON MINING AND METALS

AUDITS TRAINING

CANADIAN DAM ASSOCIATION

QQC CONSTRUCTION

INTERNATIONAL COMMISSION ON LARGE DAMS

MANAGEMENT SYSTEMS

MINING ASSOCIATION OF CANADA

BEST PRACTICES ISO

FIRST NATIONS AND INDIGENOUS CONSULTATION



UNDERSTANDING TAILINGS

60 YEARS OF EXPERIENCE WITH TAILINGS
SOLUTIONS IN ALL TYPES OF ENVIRONMENTS

LARGE COPPER PROJECTS

OIL SANDS

MASSIVE SULPHIDE AND NICKEL MINES

URANIUM AND RARE EARTH METALS

TAILINGS TECHNOLOGIES



We were among those to revolutionize modern tailings facility design fifty years ago, and our engineering approaches remain a hallmark of international practice. Today we continue our pioneering role by coupling our mine waste designs with environmental, socioeconomic, and water management solutions. Our teams have worked on hundreds of mining projects worldwide, including some of the largest tailings projects developed.

HYDRO ENGINEERING

INTEGRATED TEAMS & TECHNOLOGIES

We offer full engineering and environmental services for power projects. Our project design experience ranges from a 7 MW, single-unit project in Canada to a large 1074 MW, multi-unit project in Laos. Our multi-disciplinary teams deliver total facility design and environmental assessments on projects across the globe.

- GEOTECHNICAL
- CIVIL / HYDROTECHNICAL
- STRUCTURAL
- MECHANICAL / ELECTRICAL
- ENVIRONMENTAL



WATER RESOURCES

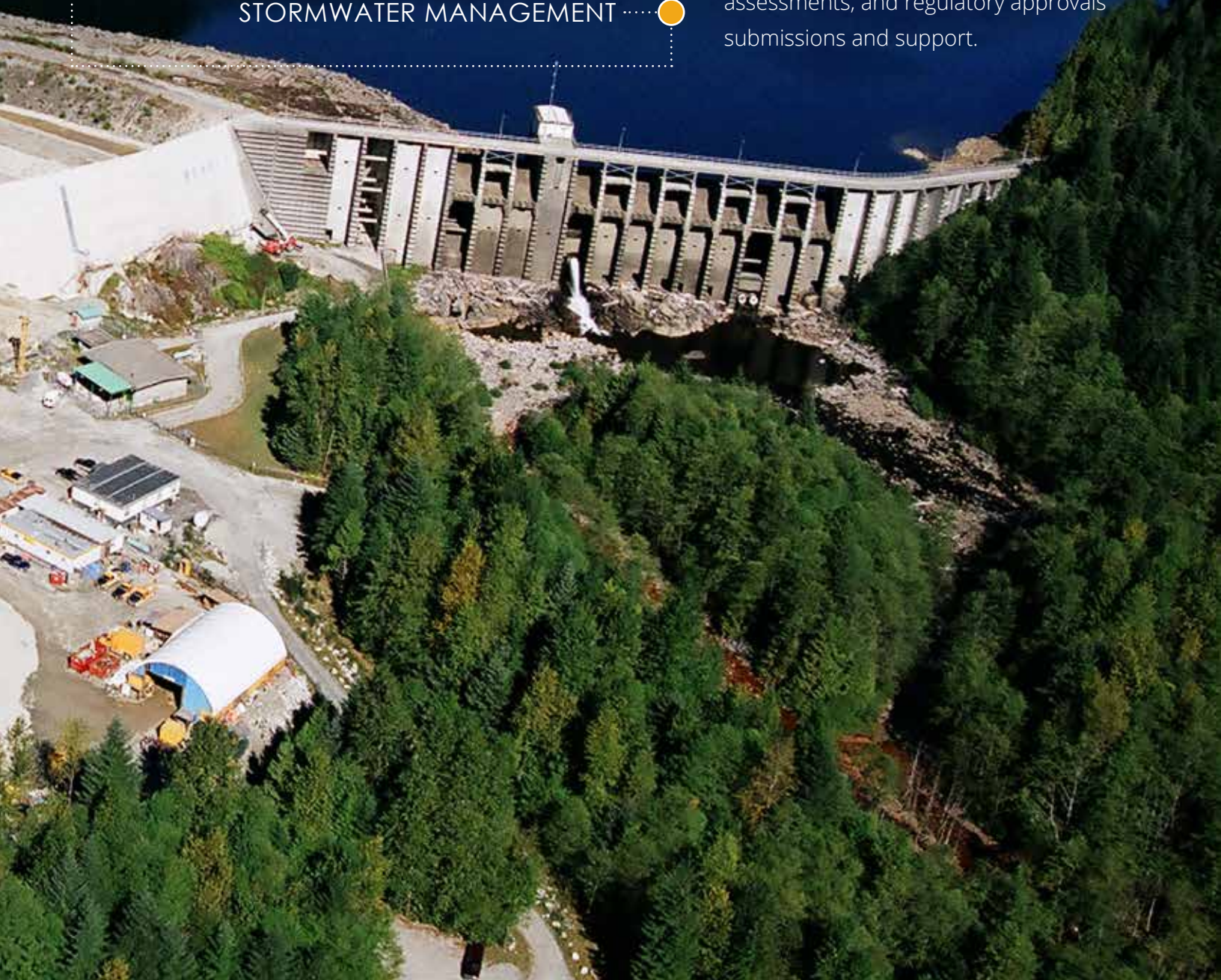
HYDROLOGY / HYDROTECHNICAL

WATER STORAGE AND CONVEYANCE

FLOOD INUNDATION AND PROTECTION

STORMWATER MANAGEMENT

We deliver a complete range of engineering services that enable us to take your projects from conception through to operation. These services include feasibility studies, detailed designs, field investigation and monitoring, contracting, construction, administration and inspections, commissioning, site impact assessments, and regulatory approvals submissions and support.



TAILINGS

EXPER

| RECENT PROJECTS | DAM TYPE | DAM HEIGHT (M) | PROJECT STAGE |
|--|------------------------|----------------|---|
| Oyu Tolgoi, Mongolia | Rockfill | 80 | Construction |
| Morrison Copper, BC, Canada | Cycloned sand | 120 | Feasibility – Environmental Assessment |
| Bell-Granisle Copper, BC, Canada | Cycloned sand | 90 | Pre-feasibility |
| Kerr-Sulphurets, BC, Canada | Cycloned sand | 235 | Feasibility – Environmental Assessment |
| Highland Valley Copper, BC, Canada | Cycloned sand | 160 | Annual construction |
| Gibraltar, BC, Canada | Cycloned sand | 150 | Annual construction |
| Resolution Copper, Arizona, USA | Cycloned sand | 130 | Pre-feasibility |
| Greens Creek, Alaska, USA | Dewatered tailings | 50 | Annual construction |
| La Granja, Peru | Cycloned sand | 200 | Alternatives assessment |
| Tasiast, Mauritania | Rockfill | 35 | Feasibility, detailed design & construction |
| A-Tailings Area, Ontario, Canada | Unclassified tailings | 35 | Seismic upgrade & detailed design |
| P- and M- Tailings Areas, Ontario, Canada | Classified tailings | 40 | Seismic upgrade & feasibility design |
| Strathcona Mine, Sudbury, Ontario, Canada | Earthfill and tailings | 15 | Detailed design (for closure) |
| Tulsequah Chief, BC, Canada | Lined earthfill | 15 | Tender |
| Montanore Copper, Montana, USA | Cycloned sand | 90 | Permitting |
| Fruta del Norte, Ecuador | Rockfill | 65 | Feasibility |
| Tampakan Copper, Philippines | Rockfill | 300 | Feasibility |
| Wolverine, Yukon, Canada | Lined earthfill | 25 | Construction/operations |
| Selwyn Zinc, Yukon, Canada | Earth and rockfill | 100 | Feasibility |
| Potasio Rio Colorado, Argentina | Earthfill | 40 | Permitting and detailed design |
| Hidden Valley Gold, Papua New Guinea | Earth and rockfill | 80 | Construction/operations |
| Ok Tedi Copper Gold, Papua New Guinea | Dredged tailings | 50 | Annual construction |
| Bougainville, Papua New Guinea | Cycloned sand | 175 | Scoping level |
| Suncor, Alberta, Canada | Sand | 60 | Annual construction |
| Fort Hills, Alberta, Canada | Sand | 70 | Construction |
| Jackpine, Alberta, Canada | Sand | 60 | Construction |
| Muskeg River, Albian, Alberta, Canada | Sand | 70 | Construction |
| Boundary Ash Lagoons, Saskatchewan, Canada | Earth and tailings | Various | Annual inspections |
| Keephills Ash Lagoons, Alberta, Canada | Earth and tailings | Various | Annual inspections |
| Poplar River Ash Lagoons, Saskatchewan, Canada | Earth and tailings | Various | Annual inspections |
| Myra Falls, Saskatchewan, Canada | Paste | 30 | Inactive |
| Horizon Mine, Alberta, Canada | Earthfill | 33 | Dam safety review |

SCIENCE

HYDRO & WATER SUPPLY

| RECENT PROJECTS | DAM TYPE | DAM HEIGHT (M) | PROJECT STAGE |
|--|-----------------------------------|----------------|--|
| Snoqualmie Falls Redevelopment Project, Washington, USA | Concrete gravity | <10 | Feasibility design, detailed design and construction |
| Site C, BC, Canada | Earthfill | 60 | Definition design |
| Nam Theun 2 Hydroelectric Project, Laos | Roller-compacted concrete gravity | 40 | Bid design, detailed design and construction |
| Elko Project, BC, Canada | Concrete gravity | <10 | Identification phase |
| Jim Mitchell Dam Raise and Spillway Upgrade, BC, Canada | Concrete-faced rockfill | 20 | Preliminary design, detailed design and construction |
| Waneta Expansion Project, BC, Canada | Concrete | 60 | Conceptual design and Owner's Engineer |
| Buck Lake Dam Upgrades, BC, Canada | Earthfill | 10 | Preliminary design, detailed design and construction |
| Glenmore Dam Upgrades, Alberta, Canada | Concrete | 30 | Preliminary design, detailed design and construction |
| Highvale Mine Drainage, Alberta, Canada | Earthfill | 12 | Preliminary design, detailed design and construction |
| Terzaghi Dam, BC, Canada | Rockfill | 55 | Detailed seismic assessment |
| Balambano, Indonesia | Roller compacted concrete | 100 | Safety assessment (design and construction, 1996 – 2000) |
| Ok Menga Hydro Project, Papua New Guinea | Concrete gravity | <10 | Redevelopment feasibility design |
| Kemano Hydro System and Nechako Reservoir Dams, BC, Canada | Rockfill | 90 | Dam safety inspections, detailed design and construction engineering |
| Morrison Dam, Saskatchewan, Canada | Earthfill | 15 | Preliminary design, detailed design and construction |
| Seymour Falls, BC, Canada | Concrete / earthfill | 30 | Detailed design and dam surveillance |
| Cleveland Dam, BC, Canada | Concrete | 90 | Dam surveillance |
| Mica Dam, BC, Canada | Earthfill | 240 | Upgrade preliminary design and dam safety inspections |
| Dickson Dam, Alberta, Canada | Earthfill | 40 | Dam safety review and stability study |
| McGregor Dam, Alberta, Canada | Earthfill | 15 | Preliminary design, detailed design and construction |
| Nipawin Dam, Saskatchewan, Canada | Earthfill | 45 | Dam safety inspection / review |
| Brazeau Dam, Alberta, Canada | Earthfill | 50 | Seismic foundation assessment and design |
| Alameda Dam, Saskatchewan, Canada | Earthfill | 40 | Dam stability review and structures assessments |
| Little Bow River Dam, Alberta, Canada | Earthfill | 15 | Preliminary design, detailed design and construction |
| Boundary Dam, Saskatchewan, Canada | Earthfill | 29 | Annual inspections and dam safety audit |

DAM SAFETY

RISK & DECISION ANALYSIS | REHABILITATION
DAM BREACH & INUNDATION MAPPING | HYDROLOGICAL

PROJECTS INCLUDE

TAILINGS

Alwin Mine
Antamina Mine
A-Tailings Area
BGM Goldstream Mine
Brenda Mine
Bullmoose Mine
Cheni Mine
Elliot Lake Mine
Faro Mine Dam
Fording River
Fort Hills
Gibraltar
Golden Giant Tailings Facility
Greenwood Tailings Dam
Highland Valley Copper
Jackpine
Kemess South
L-L Dam
Las Cruces Tailings Facility
Line Creek Coal Tailings Dam
Max Mine Tailings Dam
Mildred Lake Settling Basin
Mount Nansen Tailings Facility
Muskeg River Mines
Petaquilla Tailings Facility
Quintette Mine
Red Chris Mine
Red Mountain Mine
Sa Dena Hes Mine Dam
Strathcona Mine
Sullivan Mine Tailing Facility
Suncor Dam Breach
Wolverine Mine Tailings Facility

WATER / HYDRO

Aeneas (Charlie) Lake Dam
Aishihik Dam
Alameda Dam
Alouette Dam
Arrow Lakes Generating Station
Athabasca Dams
Balambano
Barrier Dam
Bighorn Dam
Binbrook Dam
Boundary Dam
Brazeau Dam
Buck Lake Dam
Cavalier Dam
Chaudiere No. 4 GS
Clayton Falls Dam
Cleveland Dam
Cressday Dam
Cypress Hill Dams
Dickson Dam
Dona Lake
E. B. Campbell Dam
Forty Mile Coulee Dams
Ghost Dam
Glenmore Dam
Goldstream Dam
Horseshoe Dam
Island Falls A-Dam
Jensen Dam
Jim Mitchell Dam
Jump Creek Dam
Kelso Dam
Kenney Dam
La Joie Dam
Ladore Dam
Lake No. 7 Dam
Laura & Mamit Lake Dams
Little Bow Dam
Lois Lake Dam
Mayo and Wareham Dams
Michelle Creek Dam
McGregor North & South Dams
McKay & McAlpine Dams
Middle & Lower Chase Dams
Milk River Ridge Dam
Minnewanka Dam
Morrison Dam
Paddle River Dam
Pine Coulee Dam
Pocaterra Development Dam
Powell Lake Dam
Reesor Lake Dam
Rundle Hydroelectric Dam
Ruskin Dam
Seton Canal
Seven Mile Dam
Seymour Falls Dam
Shebandowan
Skins Lake Spillway
Snare River & Taltson River Dams
Spray Hydroelectric Dam
Spruce Coulee Dam
St. Mary Dam
Sturgeon Lake
Sugar Lake Dam
Terzaghi Dam
Three Sisters Dam
Travers & Little Bow Dams
Vermilion Dam
Vance Creek Reservoir
Wareham Dam
Waterton Dam
White Sand Dam
Wilsey Lake Dam
Wreck Cove Dam

Alberta
Alberta
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Barrick Go
B.C. Ministry of En

Canadian Natural
Canadian P

Capital R

Columbia Pow

Forty
Gibra

| STABILITY ANALYSIS | CONDITION ASSESSMENTS | EMERGENCY PREPAREDNESS PLAN
HYDROLOGY & FLOOD PASSAGE STUDIES | OPERATING & MAINTENANCE PROCEDURES

COMPREHENSIVE INSPECTION AND REVIEW

Our multi-disciplinary team of professionals perform comprehensive inspection and reviews of all aspects of design, operation, maintenance, condition and performance of earthfill, rockfill, concrete and roller-compacted concrete dams.

EARTHQUAKE ASSESSMENT

We use the latest technology to provide innovative solutions to a variety of seismic design problems. We offer you extensive experience in seismic assessment through our involvement in dam designs in high hazard seismic regions of the world.

FLOOD ASSESSMENT & INUNDATION MAPPING

Our professionals are experienced hydrologists and hydrotechnical engineers in all areas of water management.

CLIENTS INCLUDE

Anglo American
Alta Environment
Transportation
Inera Antamina
Aurico Gold Inc.
BC Hydro
BHPB
Bluestone Tin
Wattle Gold Mines
Gold Corporation
Energy and Mines
Brenda Mine
Resources Ltd.
Projects Limited
Capital Power
Regional District
City of Calgary
City of Nanaimo
Power Corporation
Emperor Gold
Two Metals Inc.
Altair Mines Ltd.

Goldcorp Canada
Golden Giant
Greater Nanaimo Water District
Greater Vancouver Water District
Greater Victoria Water District
Harmony
Hidden Valley Mine JV
Highland Valley Copper
Howe Sound Pulp and Paper Co.
Huakan international Mining Inc.
Imperial Metals
Inmet Mining Corporation
Manitoba Hydro
Ministry of Water, Land & Air Protection
Newcrest Mining
Newmont Mining Corporation
Northern Canada Power Commission
Northwest Territories Power Corporation
Nova Scotia Power Inc.
NVI Corporation
Ok Tedi Mining
Ottawa Hydro

Penticton Indian Band
Porcupine Joint Venture
Powell River Energy Inc.
Rio Algom
Rio Tinto Alcan
Sagittarius Mines
SaskPower
Shell Albian Sands
Shell Canada
Silver Star Resort
Suncor Energy Inc.
Syncrude
Taseko Mines Ltd.
Teck Resources Ltd.
TransAlta Utilities Corporation
Vale
Water Security Agency
Xstrata Nickel
Yukon Electric
Yukon Energy Corporation
Yukon Government
Yukon Zinc

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Up to the Challenge.



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