



# Going further together

Integrated engineering and environmental solutions  
to help you achieve more





There are problem solvers and innovative thinkers behind all developments, including every mine, water dam, or highway. When we take on a project, we see more than an assignment—we find opportunities. Whether it's looking for operational efficiencies or adapting approaches to varied conditions, we find smart ways to support the development of your projects.

At Knight Piésold, we understand that each project is unique. From drilling in permafrost to finding groundwater in the desert, we look for creative ways to overcome challenges. It all begins with ideas that we nurture and transform into innovation—all with you in mind.

Our multidisciplinary specialists work together to provide you with the right solutions tailored specifically for your project. We can support you in all aspects of project development, including:

- Project identification and concept development
- Environmental and social baseline studies
- Environmental and social impact assessments
- Environmental, Social, and Governance standards
- Site investigations
- Project planning, scheduling, and cost estimating
- Engineering scoping, pre-feasibility, and feasibility studies
- Closure planning and costing
- Dam breach assessment
- Tailings liquefaction assessment
- Detailed engineering designs and specifications
- Tender documentation and evaluation
- Contract administration and monitoring
- Quality control, quality assurance, and inspections
- Project management and data management
- Due diligence reviews

## Mining

The mining industry is constantly evolving and adapting in response to societal needs and advances in technology.

For decades, our mining expertise has been applied to hundreds of surface and underground mining projects in a variety of climatic and seismic conditions, in every major mining district in the world. From deserts to arctic tundras, our integrated engineering and environmental team provides a comprehensive range of services through all stages of mine development, from evaluation and permitting through to design, construction, and closure.

- Tailings and mine waste management
- Mine water management
- Rock mechanics
- Geotechnics for mining
- Heap leach pad design
- Mine geochemistry
- Pipelines and pump stations for mining
- Environmental and permitting support for mining
- Mine closure and reclamation
- Power supply, transmission, and renewable energy integration for mines

## Power

Access to low-cost, reliable power is a key driver to progress and eliminating energy poverty around the world.

We have been assisting clients in identifying and developing clean energy projects since 1925 and have grown our capabilities throughout the years to become a world leader in identifying and engineering cost-effective energy solutions for private and public sector clients throughout the world.

- Hydropower (run-of-river, water storage, pumped storage)
- Renewable energy
- Thermal power
- Hybrid systems
- Transmission lines, substations, and interconnection studies
- Environmental studies for power





## Water Resources

Water is the world's most valuable resource, and its allocation and management are key considerations in all infrastructure and resource development activities.

From site wide water management for mining projects to designing hydroelectric schemes, we provide a full spectrum of services that support the development, utilization, and protection of surface water and groundwater resources.

- Hydrology
- Hydrogeology
- Climatology
- Fluvial geomorphology
- Dam engineering
- Water conveyance
- Wastewater treatment design

## Environmental

Resource projects today can face a number of challenges from regulatory bodies, communities, and stakeholder groups. If not appropriately overcome, these can manifest as construction delays, operational constraints, or other project setbacks.

We work with our clients to reduce project risks and integrate project design to enhance acceptability to regulators, communities, and lenders.

- Environmental and social impact assessments
- Environmental baseline studies
- Social studies and community engagement
- Environmental analysis and modelling
- Environmental management plans and monitoring
- Environmental auditing and due diligence
- Permitting

## Infrastructure

Infrastructure is fundamental to the success of our communities.

From initial feasibility and cost studies, to detailed design, specification, and construction supervision, we provide specialized geotechnical and structural engineering and environmental services to a wide variety of infrastructure projects.

- Transportation
- Water infrastructure
- Pipelines



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Knight Piésold is an employee-owned, global consulting firm providing specialist services to the mining, power, water resources, and infrastructure industries. We are engineers, environmental scientists, geoscientists, and technologists, focusing on what we do best to create value for our clients at every stage of a project.

Founded in 1921, we have an over 1,000-strong team operating from 29 offices across 16 countries. Our globally integrated team, together with our industry expertise and regional understanding, allows us to support clients in identifying and mitigating risk, navigating challenges, and achieving long-term success in today's complex business environment.

We work collaboratively, harnessing professional excellence and innovation, to deliver a multidisciplinary, fit-for-purpose approach for each project and to help clients realize their goals. We have led numerous award-winning projects to completion and have fostered many long-term client relationships that hold strong today.



# Mining Expertise

Supporting you through all stages of mine development



Concept



Feasibility  
Studies



Detailed Design  
and Construction



Operations



Closure

Knight Piésold's mining expertise has been applied to hundreds of surface and underground mining projects worldwide, under a wide range of climatic and seismic conditions.

From the driest desert on earth, to the frozen arctic tundra, our integrated engineering and environmental team provides a comprehensive range of services through all stages of mine development, from evaluation and permitting to design, construction, and closure.

By providing quality and environmentally sound engineering and science, our professionals work seamlessly together with the client team to successfully move their projects forward.

We work together to identify and reduce risk throughout the project lifecycle, while finding solutions that respect environmental, social, and economic responsibilities.



Tailings and  
Mine Waste  
Management



Water  
Management



Rock Mechanics



Geotechnical  
Engineering



Heap Leach Pad  
Design



Geochemistry



Pipelines and  
Pump Stations



Environmental  
and Permitting



Closure and  
Reclamation



Renewable  
Energy Integration





## Tailings and Mine Waste Management

From siting, design, permitting, construction support, operational monitoring, and closure of tailings and waste rock storage facilities, we tailor the design of every facility to provide economical solutions appropriate to the site conditions, while providing long-term security and environmental protection.

## Water Management

Our site-specific water management plans combine a thorough understanding of the hydrometeorology, surface water hydrology, groundwater, waste characterization, and the various aspects of the overall mine development, including heap leach pads and tailings and waste rock management systems.

## Rock Mechanics

We offer a range of rock mechanics services for open pit and underground mining at all stages of development. We routinely design and manage site investigation programs, develop pit slope designs, conduct stability assessments and operational monitoring for active open pit slopes, evaluate stabilization/support systems for underground mines, and conduct micro-seismic monitoring of underground mines.

## Geotechnical Engineering

Our specialists lead our clients through the full spectrum of geotechnical services for mining projects from site investigations through to construction monitoring and QA/QC. Our geotechnical field and office services can be provided as stand-alone services or integrated into an all-encompassing, engineered approach.

## Heap Leach Pad Design

Our experience in designing heap leach pads encompasses all locations and sizes and includes some of the largest heap leaching operations in the world. Expertise is provided for a variety of liner and solution collection systems, loading, and solution management strategies, including for high fines content ores and wet and cold regions applications.

## Geochemistry

Our geochemists assist in the development of mining projects throughout the world by performing geochemical evaluations, predicting discharge water quality, and modelling reclamation impacts. Key areas include baseline and site characterization, mine waste characterization, ML/ARD management plans, mine water management, and geochemical modelling.

## Pipelines and Pump stations

Our experience in mine slurry and water pipelines and pump stations ranges from design, specification, and construction supervision, including test monitoring, followed by operational assistance and performance monitoring. We tailor the designs to the range of flows, pressures, and material conditions anticipated over the project life.

## Environmental and Permitting Support

Our environmental and social expertise is integrated with our mining project development services to support timely acquisition of all required permits. Services include baseline studies, ESG standards, human health and ecological risk assessment, public consultation programs, field monitoring programs, traditional knowledge studies, ESIA's, cumulative effects assessment, environmental management plans, project permitting, and due diligence.

## Closure and Reclamation

From costing, planning, and design to implementation and monitoring, we offer a comprehensive suite of closure and reclamation design services. Working closely with our clients, we integrate progressive mine closure planning as an ongoing and adaptable component of the mine life cycle. This ensures that liabilities are minimized upon closure, and the project area is prepared for reclamation or redevelopment activities that will meet land use objectives.

## Renewable Energy Integration

A comprehensive energy strategy is paramount to achieving cost-effective mining operations. Our approach in incorporating renewable energy schemes into existing and planned mining projects can improve the mine's bottom line through renewable energy resource evaluation and integration.



# Tailings and Mine Waste Management



The effective, safe disposal of mine waste presents technical and environmental challenges. Each project site is unique, and our approach is to tailor the design of every tailings and waste rock storage facility to provide economical solutions appropriate to site conditions, while providing long-term security and environmental protection.

We have a long history of assisting our clients in the siting, design, permitting, construction support, operational monitoring, and closure of tailings and waste rock storage facilities for a wide variety of climatic and seismic conditions throughout the world.

Our specialists have pioneered and advanced the development of alternative tailings management technologies, such as sub-aqueous systems, drained sub-aerial systems, thickened/ultra thickened/paste tailings disposal, and dewatered 'dry stack' tailings systems.

We provide complete and comprehensive design and operational expertise for tailings management tailored to the specific features of each site and needs of each client.

Our team also helps mitigate risk by providing project audits of tailings facilities in jurisdictions around the world in accordance with the Global Industry Standard on Tailings Management (GISTM), assisting our clients in better understanding and managing the risks of their facilities.



**Tailings Dam Design**



**Waste Characterization**



**Tailings Dam Breach Assessments and Inundation Studies**



**Tailings Dam Monitoring and Instrumentation**





## Tailings Dam Design

Our technical experts have designed tailings dams for hundreds of mines in every major mining district in the world. In addition, we have designed dams for water storage, power development, irrigation, and flood control. Dam expertise includes earthfill and rockfill dams; concrete-face rockfill dams; concrete gravity and arch dams; roller-compacted concrete dams; design of appurtenant structures such as spillways and diversion channels or tunnels; and water-retaining and drained tailings dams constructed from mine waste materials. Our full suite of tailings dam services includes dam design; inspections and safety; geotechnical site investigations; hydrology and hydraulic design; dam site alternative studies; seismic risk assessment and stability; construction QA/QC and support; instrumentation monitoring; construction permitting assistance; as-built documentation; and dam rehabilitation.

## Waste Characterization

A complete understanding of ore deposit geology, mineralogy, geochemistry, and hydrochemistry is important for developing mining operations in an environmentally safe fashion. Our expertise in waste characterization, tailings and waste rock, field and laboratory testing, numerical modelling, and the practical application of preventative strategies has been applied to numerous successful mining projects at various stages from initial development to permitting and from operation to closure.

## Tailings Dam Breach Assessments and Inundation Studies

Dam breach studies are generally expected and often required for the design and operation of tailings storage facilities. Understanding the consequences of a dam breach ultimately leads to designing safer dams and properly preparing for emergencies.

Our world-leading specialists conduct dam breach modelling and inundation mapping for a wide range of projects within the mining and hydropower industries. Our team has completed numerous modelling projects for a global client base. The results of such studies are used to determine the hazard classification of a dam through the assessment of dam failure consequences, to support emergency preparedness and response planning, and to inform environmental project assessments.

## Tailings Dam Monitoring and Instrumentation

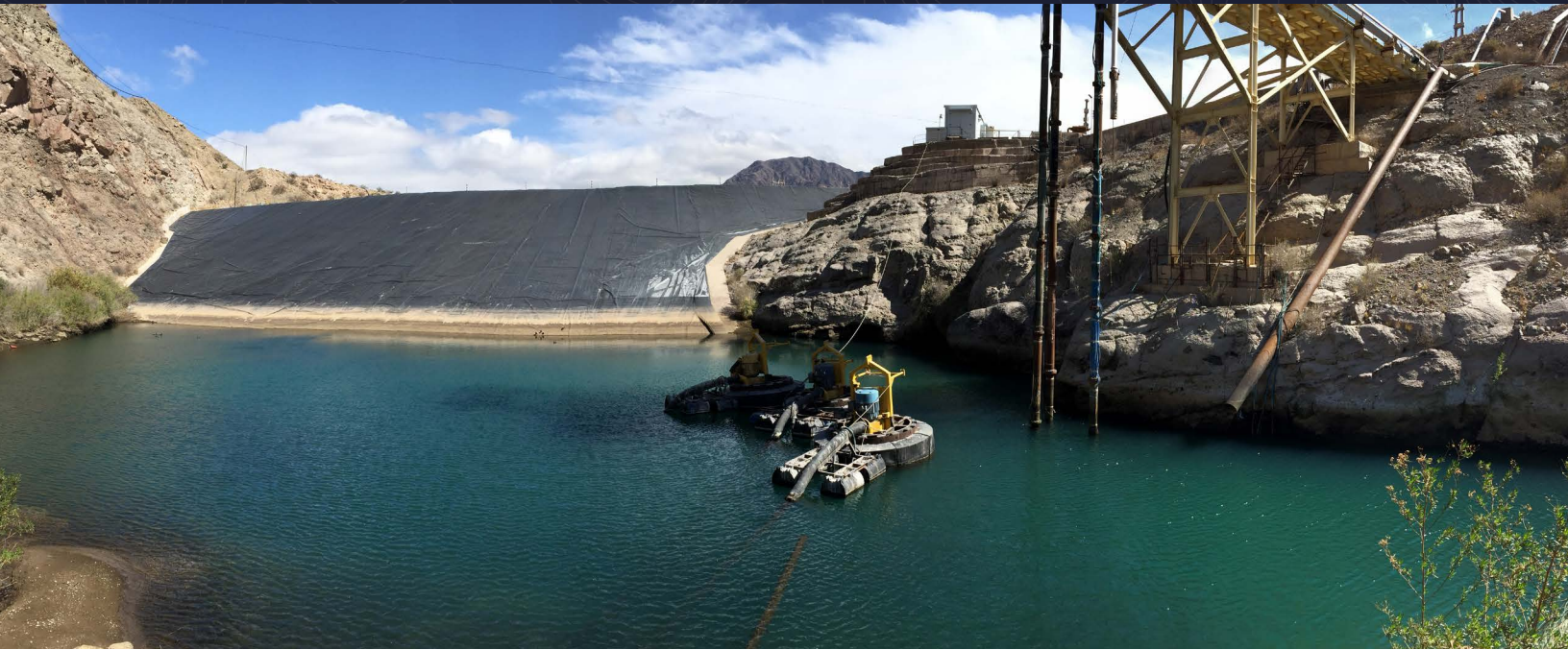
Our experienced tailings dam monitoring and management professionals provide leading-edge monitoring and risk reduction solutions for safe, responsible tailings management. An innovative suite of new instrumentation, remote monitoring techniques, and data management systems provide unprecedented real-time, remote access to data and evaluation tools. These state-of-the-art systems compliment experienced engineering guidance and operational management strategies to enhance safety and environmentally responsible tailings management, control corporate risk and increase public confidence in the mining industry.

Our specialists provide world-renowned expertise in tailings management and have been involved in the design, construction, operational monitoring, and closure of tailings facilities around the globe. Our industry-leading tailings monitoring and management professionals design and implement state-of-the-art tailings monitoring programs tailored to project specific site conditions and our clients' operational requirements. We offer a comprehensive range of instrumentation, monitoring, and dam safety services that take advantage of leading-edge technologies and draw upon our extensive industry experience. Our relevant technical services include:

- Site investigation and characterization of tailings facilities using best available drilling, testing, and sampling methods
- Specification, installation, and expert analysis of geotechnical and hydrogeological instrumentation
- Application of remote sensing and monitoring, including InSAR, satellite imaging, photogrammetric monitoring
- Implementation of state-of-the-art automated remote monitoring and data management systems
- Development of tailings management and risk reduction programs, including specification of performance objectives and development of Trigger Action Response Plans
- Provision of regulated dam safety services, including dam safety inspections and review, Engineer-of-Record oversight, and regulatory engagement



# Integrated Mine Water Management



Effective and efficient water management is a key aspect of all mining operations and is often the single most important consideration for developing an environmentally safe and sustainable mining project.

Our specialists have designed water management systems for mining projects all over the world, from rainforests to deserts to permafrost conditions. Our site-specific water management plans combine a thorough understanding of the site-specific hydrometeorology, surface water hydrology, groundwater hydrogeology, waste characterization, and the various aspects of overall mine development, including heap leach pads and tailings and waste rock management systems.



Hydrogeological  
Data Collection



Watershed  
Modelling



Baseline Studies



Water Quality  
Modelling



Engineering  
Designs



Water Balance  
Modelling



Geochemistry  
Assessments



Numerical  
Groundwater  
Modelling





## Hydrogeological Data Collection

Our hydrogeological team has a proven track record in the design and implementation of effective hydrogeological data collection programs. Knight Piésold's field staff have considerable experience in the drilling and installation of groundwater wells, from deep multi-point vibrating wire and standpipe monitoring piezometers, to large-diameter water supply and mine dewatering wells. Hydrogeological testing is tailored to fit the requirements and scope of each project, and may include rising/falling head (slug) tests, packer injection tests, aquifer pump tests, and borehole geophysical surveys.

## Baseline Studies

Our multidisciplinary team uses an integrated approach to collect hydrological, hydrogeological, climate, and water quality baseline data to provide a sound basis for developing a comprehensive understanding of the water resources in a study area. All baseline data are stored and managed in FULCRUM, our in-house web-based data management system. This baseline information forms the foundation for numerous other project specific studies and assessments.

## Engineering Designs

Our team works closely together to tailor water management plans and water management structure designs to meet the requirements of each client within the constraints of a project site, the mandate of the regulatory agencies, and best management practices. Areas of mine water management engineering expertise include: hydraulic modelling and hydraulic structure design; settling pond and spill containment works design; dam, pump station, pipeline, decant canal, and diversion structure design; and construction supervision and contract administration.

## Geochemistry Assessments

Managing mine drainage water quality resulting from metal leaching and acid rock drainage (ML/ARD) from excavated materials is of critical importance during all phases of mining, from permitting to closure and reclamation. Knight Piésold performs geochemical characterization programs, develops geochemical models that accurately predict discharge water quality during operations, and designs mitigation measures to minimize water quality degradation for mining projects throughout the world. Our geochemists also provide input to closure designs and develop GoldSim based stochastic pit models to evaluate the effectiveness of alternative cover designs.

## Watershed Modelling

Watershed models are an integral tool for assessing the relationship between climate and surface water and groundwater flow at a project site. Our team has developed an in-house watershed model that is transparent and simple, yet flexible enough to incorporate any level of detail required to represent key components of project water management. Knight Piésold routinely develops watershed models to understand baseline hydrologic flows, or assess impacts to streamflow, water quality, and fish habitat.

## Water Quality Modelling

Information from our baseline data collection programs and hydrogeology and water balance models are used as inputs to water quality models, which are prepared in GoldSim or Excel. Results of predictive water quality modelling are used as feedback to the engineering design in an integrative approach to optimize water management plans for the economic and environmental viability of each project.

## Water Balance Modelling

Water balance models are developed to simulate the supply and demand for water on a month-by-month basis, from the initiation of mine operations through mine closure and post-closure for a range of possible climatic conditions. Water balance models are developed using GoldSim or Excel, and can also provide the basis for the water quality model for a project.

## Numerical Groundwater Modelling

Numerical groundwater models are used to understand baseline groundwater conditions and evaluate potential changes to hydrogeological conditions during project development. Our team has developed groundwater models to characterize groundwater flows to pits and underground workings, and assess the potential for groundwater related impacts arising from a proposed mine development. Groundwater modelling results can be integrated with watershed models for a holistic understanding of hydrologic flow at a site, used in the design of slope depressurization measures, and in support of environmental impact assessments.



# Environmental and Permitting Support



The development of defensible environmental and social impact assessments is a requirement for mining projects across global jurisdictions. It is the foundation of the project approval process and the basis of review with governments, financing institutions, Indigenous peoples, and communities.

Our integrated environmental and engineering professionals provide clients with environmental services throughout all stages of the mine life cycle, from exploration through to operation and closure.

We have the technical capabilities to undertake full environmental baseline studies, environmental management plans, environmental and social impact assessments, social studies and community engagement, and permitting for all types of resource developments. These studies are integral to the Environmental, Social, and Governance (ESG) standards of the projects we serve.

We use a multidisciplinary approach with teams drawn from the company's technical staff supported by specialists in specific fields and geographic locations to undertake detailed studies of impacts of new projects throughout the world.



Environmental  
and Social Impact  
Assessments



Environmental  
Baseline Studies



Social Studies  
and Community  
Engagement



Environmental  
Analysis and  
Modelling



Environmental  
Management Plans  
and Monitoring



Environmental  
Auditing and  
Due Diligence





## Environmental and Social Impact Assessments

The development of defensible environmental and social impact assessments (ESIAs) is a requirement for resource projects across global jurisdictions. It is the foundation of the project approval process and the basis of review with governments, financing institutions, Indigenous groups, and communities. The studies we undertake incorporate environmental and social mitigation measures to achieve project designs that maximize project benefits, reduce impacts, and achieve a fusion of development with environmental protection and sustainability.

## Baseline Studies

We provide our clients with a full complement of technical specialists to conduct baseline and other studies in order to achieve a comprehensive understanding of the physical, chemical, biological, and social environment. These areas include air quality, climate, hydrology, hydrogeology, water quality, geochemistry, soil, flora and fauna, fisheries and aquatics, wetland assessment and delineations, and traditional use/knowledge studies.

## Social Studies and Community Engagement

We work with our clients to foster meaningful engagement that satisfies public expectations, regulatory requirements, and lender requests, with due consideration of project realities. Our team of social specialists is highly experienced in the practical development and execution of social baseline investigations, socio-economic analysis, impact assessments, management systems, action plans, resettlement plans, and stakeholder consultation and engagement.

## Environmental Analysis and Modelling

The synthesis of baseline and project design is incorporated in order to produce predictive models and to assess mitigation measures to reduce impacts. In order to defensibly assess the potential impacts of a project, we employ a range of analytical tools. These include specialized software to model water quality and discharge parameters, conducting air quality and noise models that represent different phases of project development, and other model and analyses such as GIS-based assessment of physiography or landscape, including changes to aesthetics, habitat, and ecological function.

## Environmental Management Plans and Monitoring

Environmental management plans (EMPs) provide a framework for dealing with risks to the environment and socio-economy during a project's lifecycle. Our team develops EMPs to comply with legal or procedural requirements and to assist with project acceptance by local communities and stakeholders. Effective monitoring of EMP implementation is a critical measure of success. We offer environmental and socio-economic parameter monitoring for all stages of a project life cycle, from pre-development through to post-closure.

## Environmental Auditing and Due Diligence

Third party audits of environmental and social programs can assist proponents to demonstrate regulatory compliance, eligibility for certification, and increased transparency for stakeholders. We offer clients specialized review and assessment of environmental and social performance. Similarly, clients that are contemplating investment in other projects benefit from our ability to conduct environmental and social due diligence on their behalf.

## Permitting

Resource projects usually require numerous permits or licenses that allow the construction and operation to lawfully proceed. In many jurisdictions, these permits can be issued only after the project has successfully completed a review of an ESIA. Permit requirements rely on detailed engineering in order to specify environmental controls and comply with local laws and company commitments. Without a proper understanding of project engineering, permit application processes can be lengthy, with potentially serious consequences.

Knight Piésold's integrated expertise in regulatory requirements across global jurisdictions, coupled with our in-house engineering design capabilities allow us to offer a highly efficient permitting approach. We understand which permits are needed and when they are needed, and we provide well thought out permit packages.





# GISTM Support Services and Third-Party Auditing



Established in 1921, Knight Piésold is a world-renowned specialist in tailings and mine waste management for over 100 years. We have a long history of assisting our clients in siting studies, planning and concept development, site investigations, design, permitting and compliance assessments, construction and operational monitoring, closure, and conformance auditing for tailings management facilities around the globe.

The mining industry is constantly evolving and adapting in response to societal needs and increased safety demands. The effective, safe disposal of mining waste presents social, technical, and environmental challenges that the international community is working to address through the implementation of the Global Industry Standard on Tailings Management (GISTM). Knight Piésold has performed numerous conformance audits for multiple mining clients, both internally (gap analysis) and as independent third-party auditors across the world. Additionally, we assist clients with utilizing existing practices in their own programs to achieve conformance.

In undertaking third-party GISTM validation, our auditors review evidence to assess whether each applicable facility either meets, partially meets, or does not meet the requirements of the GISTM. Additionally, our auditors will use direct observations, interviews with appropriate personnel, and results of inspections conducted internally as well as external regulatory agencies. Our auditor will confirm that evidence provided can reasonably be expected to address the GISTM requirements and related criteria.

Knight Piésold has talented professionals based in offices across North and South America, Europe, Africa, and Australia. At Knight Piésold, we focus on working as one team, mobilizing local and global resources to meet the GISTM needs of each client. We are capable of working with investors, insurers, and regulators who influence industry performance and may require GISTM conformance regardless of membership with the International Council on Mining and Metals. With a commitment to safety, quality, and technical excellence, we specialize in creating customized solutions at every stage of a project and have fostered many long-term client relationships that hold strong today.



# Mine Closure and Reclamation



Mine closure is the process of designing and executing plans to safely and responsibly reclaim or redevelop land after mining operations have ended.

Working closely with our clients, we integrate mine closure planning as an ongoing and adaptable component of the mine life cycle. Upon closure, liabilities are minimized and the project area is prepared for reclamation activities that will meet land use objectives.

Our integrated expertise in site and waste characterization, engineering design, impact and risk assessment, consultation, construction, and compliance monitoring combines to develop site-specific closure plans for new and existing mining operations that are:

- compatible with the surrounding environment
- compliant with the appropriate legislative standards and guidelines
- representative of stakeholder inputs and interests
- considers appropriate progressive reclamation activities
- inclusive of accurate reclamation cost estimating and establishing appropriate surety amounts

We leverage our experience in collaborating with Indigenous and local communities for positive social outcomes for post-closure conditions and landforms. We work closely with our clients to develop and implement effective communication and consultation, which is key in producing closure plans that are tailored to the specific needs and circumstances of each project.



Stakeholder  
and Community  
Engagement



Integrated Life of  
Mine Planning



Detailed Closure  
Design and  
Construction



Permitting and  
Regulatory  
Compliance



Environmental  
Monitoring and  
Management



Remediation and  
Reclamation