



+

Earth Sciences and Engineering



Planning, designing, and building sustainable earth science solutions for your projects.

Turning challenges into opportunities



Your existing and prospective projects are bigger, more complex, and more strictly regulated than ever before. To plan and execute them the right way, you need an experienced partner who can provide a full range of state-of-the-art engineering solutions.

When your project has multiple stakeholders with competing requirements, you need experts who can design and build assets that meet your expectations and develop strategies to manage the entire process. With a focus on the earliest stages of a project, we will work with you to assess the ground and site conditions, and the environment in which the development will occur. The process starts with our earth science disciplines looking at the geotechnical conditions, hydrogeology impacts, surface water, lay of the land, and environmental surroundings. Our action plans and designs consider all related earth science matters that can impact project costs including geotechnical risk, uncertainty, climate change, land use, water impacts, and the environment to ensure a cost-effective approach and infrastructure resiliency.

Taking a project from concept to operation is a partnership between your organization and Hatch. Together we deliver success. You can count on a team of multi-disciplinary engineers and scientists operating in the earth science space with a shared commitment to the environment. We offer engineering, procurement, and construction management expertise combined with geotechnical, hydrotechnical, civil, environmental and social impact services and implementable technology solutions.

As your partner, we will provide you with knowledgeable, sound advice and our full support with:

- project strategies—from selecting the best sites, obtaining permits, and meeting all safety standards
- understanding and defining the ground and site conditions
- providing cost-efficient design for facilities and structures from concept through to commissioning and operations
- managing risks, cutting capital costs, and reducing operating expenditures

Variable and diverse ground conditions mean innovative solutions to ensure cost, schedule, and operational success. By setting the right course for your project, risks are identified early and viable cost-effective solutions are implemented to achieve predictable outcomes and realize project benefits. Whether brownfield or greenfield, there are going to be challenges—we will help you overcome them.

Hatch's Earth Sciences and Engineering Services

HYDROGEOLOGY

Physical Hydrogeology (aquifer characterization, monitoring, conceptual site models, well design, dewatering)
Quantitative Hydrogeology (analytical and numerical methods)
Hydrogeochemistry (groundwater quality assessment, tracers, gas analysis)
Contamination Assessment and Remediation

GEOTECHNICAL

Geotechnical investigation
Foundations design
Settlement and slope stability analysis
Seepage analysis
Embankment design
Rock mechanics
Ground improvements
Liquefaction analysis
Seismic analysis and dynamic stability
Tailings storage facility design support
Shaft design and underground works support
Construction QA
Geohazard assessment
Pavement design

GEOSPATIAL

Spatial Information Services
Geospatial modeling
Remote sensing survey 3D
Mobile GIS
Database management
Flood Mapping



IN-HOUSE GEOTECHNICAL LAB

Materials testing (rock / soil)

GEO-ENVIRONMENTAL

Soil and ground water monitoring
Support to Phase I and II Environmental Site Assessments
Liner design
Contaminated site characterization
Contaminated site remediation
Contaminated soil transport and disposal
Waste management

CIVIL ENGINEERING

3D modeling
Access roads
Construction QA
Digital terrain modeling
Erosion and sediment control
Earthworks
Plant site selection & layout
Reservoir design earthworks
Site drainage
Stockpiles / landfills

HYDROTECHNICAL

Bridge hydraulics
Creek diversion / flood levees / reservoir design
Dam break analysis
Dam classification
Erosion and scour
Flood inundation and hazard estimation
Hydrology
Stormwater management and associated works
Urban and linear drainage

Earth Sciences and Engineering - Digital Connectivity

Bringing efficiencies and value to our clients through digital systems

Digital representation and modeling

3D Civil modeling – hydrotechnical and surface
3D geotechnical and hydrogeology modeling
Geospatial/ GIS – imagery and reality capture
Data management

Field data collection

Field investigations – geotechnical and hydrogeological via iPad
Civil surveys – topographical and subsurface utility engineering
Drone surveys



Earth Sciences
and Engineering

Analysis and interpretation

Analysis – geotechnical, hydrogeology and civil simulations and design options

Project design realization

Multidisciplinary collaboration and design
Design visualization – digital twin
Information sharing

From concept... to digital... to reality

HATCH

Designing with the land and water in mind

From upgrading established operations to planning and implementing new integrated developments on all surface or sub-surface terrains, we ensure solutions that are reliable and sustainable.



Civil engineering

To maximize the use of your site's features and local construction materials, your projects deserve a team of experts in the design of roads, earthworks, landfills, and drainage for commercial, industrial, and public developments. You can be assured that you will get an expert team from Hatch, because our civil site development group is internationally known as leaders in the field.

We will work with you to develop your operating site and its facilities by designing structures that drain or divert potential storms. By using the latest computer modeling systems and software packages, our design engineers and CAD specialists deliver state-of-the-art design using data-centric architecture. Such computer programs include OpenRoads Designer and Civil 3D.

We can help you with:

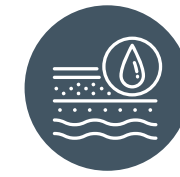
- site investigations (planning and scoping of site and geo-environmental investigations, material sourcing studies, and land use planning)
- site planning (site selection, site master plan)
- spatial information and digital terrain modeling
- transportation studies (prefeasibility and feasibility studies, route selection, and alignment)
- roads and rail (plant, access and haul roads, plant and site access rail, traffic engineering design)
- earthworks (site grading, bulk, and structural-related earthworks)
- site drainage (plant site drainage, storm water ponds, culverts and bridges, open channels, and flood control design)
- residue disposal (investigation, design, and construction of residue disposal systems for mineral processing operations)
- civil engineering for mines and plant buildings, plant services and utilities, construction camps and townships, pavement design and site drainage, area fence, stockpiles and dumps, air strips, storage areas, ramps, and site decommissioning



Water resources and hydrotechnical

From site drainage to complex river and civil structure conveyance hydraulics to basin-wide water-management planning, your projects are our priority. While their scope may vary significantly, our team has been actively involved in water resource development, planning, and management for a wide range of projects around the world. We have built a global team of hydrotechnical engineering specialists focused on municipal hydraulics, riverine and lake hydraulics and hydrology. We will work with you on:

- hydrologic assessment including extreme event estimation
- hydraulic analysis and design including energy dissipation structures
- dam safety assessments
- dam break analysis
- flood modeling and prevention
- sedimentation analysis including transport, accretion, and erosion
- river and coastal shoreline erosion analysis and scour protection design
- river ice mechanics and regime analysis
- municipal hydraulics and stormwater management/drainage
- floodplain management planning (forecasting, inundation modeling, consequence/hazard estimation)



Hydrogeology

For hydrogeological challenges in design and construction development, including complex hydrogeological situations on land and in near-shore marine settings, permafrost areas, groundwater capture and cut-off, and underground and surface excavation, our hydrogeology specialists provide expert assessment and solutions. Rely on our team's strong technical skills and construction experience in site characterization and design.

Physical Hydrogeology

- site investigation, aquifer testing, characterization and conceptual site models
- water well and monitoring well network design, instrumentation and maintenance
- groundwater dewatering, depressurization, diversion, injection and disposal

Quantitative Hydrogeology (analytical and numerical modelling)

- site specific flow modelling for dam, shaft, open pit, tunnel, tailings, and containment
- regional groundwater flow modelling
- surface-groundwater interaction, coupled flow, mechanical loading, thermal & multiphase modelling

Hydrogeochemistry

- groundwater quality sampling, testing, characterization and modelling
- natural and synthetic tracers, and isotopes in hydrogeological investigations

Contamination Assessment and Remediation

- environmental site assessment (Phase I and Phase II)
- contaminant plume characterization, stability analysis, and transport modelling
- groundwater remediation system design and implementation



Mary River
Baffinland Iron Mines Corporation



Fargo Moorhead
Flood Risk Management

Geotechnical



You can count on the deep construction experience and core technical skills of our staff in site characterization, design, and numerical modeling. We ensure and prioritize a safe and sustainable design for the entire life cycle of your project.

Through geotechnical investigations, geological mapping, interpretation of aerial photographs, and satellite imagery, our experts provide geotechnical support for commercial and industrial developments such as process plants, open pits, mines, rail and road, dams, power facilities, and pipelines. The effectiveness of ground investigations are maximized, and you get the best possible results as we work side-by-side with our multidisciplinary teams to meet project development goals. Our services include:

- complex geotechnical investigations on land and in marine settings

- soil mechanics and foundation engineering
- ground and groundwater investigations
- surface and underground rock mechanics
- seismic assessment and earthquake geotechnical engineering
- tailings geotechnical engineering
- embankment dam engineering
- liners and cover systems
- ports and marine geotechnics
- permafrost and soft ground engineering
- geotechnical risk assessment and risk management, analysis, and design
- construction supervision and geotechnical monitoring
- geotechnical laboratory services

Geotechnical laboratory services



Hatch's geotechnical services owns and operates a Canadian Council of Independent Laboratories (CCIL) certified laboratory in Niagara Falls, Canada. Our laboratory is recognized as an exceptional testing facility for soils, aggregate and bedrock. Over the past 50 years, the facility has been developed to accommodate advanced testing to support geotechnical site investigations, foundation designs, and dam safety analysis. It also provides on-site testing equipment and staff to enable major

construction quality assurance programs involving both routine and complex soil, rock, and concrete tests.

Soil testing:

- triaxial compression tests on soil
- direct shear tests on soil
- oedometer consolidation tests

- compaction tests
- hydraulic conductivity tests
- particle size - sieve and hydrometer analysis
- soil resistivity tests
- atterberg limits testing

Rock testing:

- uniaxial testing of rock with elastic modulus measurement
- point load tests on rock
- rock mass classification
- swelling potential of shale
- accelerated detection of alkali-aggregate reaction (AAR) in aggregate sources

Field services:

- design and implementation of geotechnical investigations
- borehole and test pitting logging
- soft soil sampling
- undisturbed sampling.
- mobile field data collection using tablet applications with real-time synchronization.

Geospatial



Our geospatial services team designs and builds geographic information systems to support effective and timely decisions based on intelligent location and object data. GIS and proprietary technologies, like HatchMAP, can help you manage and access your project, facility, or portfolio information and is accessible from apps, desktop software, or web-based maps, ensuring you can locate your information where and when you need it. Our services include:

Analysis and desktop mapping solutions

- multi-criteria site analysis
- transportation modeling/routing
- environmental constraints
- thematic/floodplain mapping
- asset management and modeling

Spatial data services and information management

- image processing
- 3D modeling, lidar, remote sensing

Mobile and integrated services

- Mobile GIS
- Web mapping



ONxpress Transportation Partners
Metrolinx GO Rail

Geo-environmental



Our geo-environmental specialists provide you with reliable solutions for contaminated sites, waste management and disposal, sediment management, and erosion. This interdisciplinary field encompasses concepts and inputs from environmental, geotechnical, hydrotechnical, and water resources engineers and scientists. We can help you with:

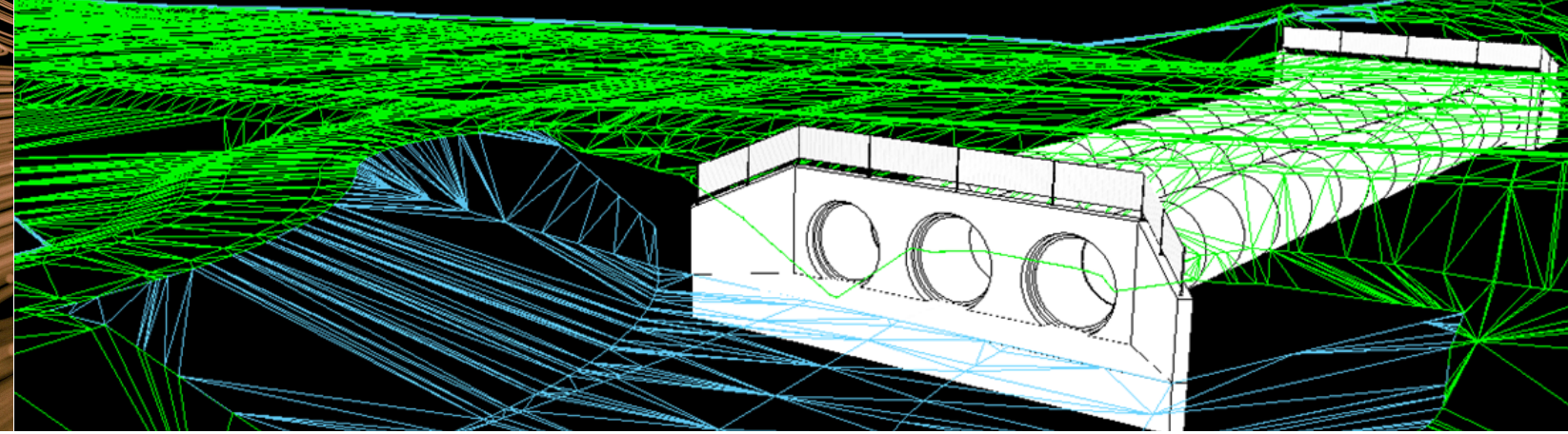
- site environmental investigation
- geotechnical/hydrogeological investigations
- contaminant fate and transport modeling
- contaminated site remediation
- waste characterization
- solid waste: strategic planning and recycling programs
- solid, industrial, and hazardous waste management and disposal
- waste containment systems design
- liner and cover systems design
- leachate collection and management
- landfill gas management including landfill-gas-to-energy systems
- groundwater assessment, monitoring, and remediation
- hydrogeological modeling
- closure/post-closure monitoring
- wetland remediation
- harbor and riverbed investigation
- sediment assessment and remediation
- erosion assessment, control, and slope stabilization



Niagara Tunnel Project

American Council of Engineering Companies Grand Award for Engineering Excellence
Canadian Consulting Engineering Award of Excellence
Consulting Engineers of Ontario Award of Merit
International Water Power & Dam Construction North American Project of the Year
Platts Global Energy Awards Premier Project Award
Tunnelling Association of Canada Canadian Tunnelling Project of the Year

Project experience



3D rendition of culvert for Hall Road Upgrade Project

To meet the world’s growing concerns for surface and subsurface sustainability, your facilities must be designed and built with solutions that incorporate economic, scientific, regulatory, and health and safety measures. We partner with you from the ground up.

Successful projects mean working with a multi-disciplinary engineering firm that provides complete design services from concept through to detailed design, construction management, commissioning, and operations. Our earth sciences practice is a key contributor to our global teams, providing the foundation upon which our designs are based. A list of our earth science contributions to some of our key projects are listed below.

Mining

Jansen Potash Project BHP Billiton

Saskatchewan, Canada

Executed in a fully digital environment which linked data from engineering through to construction and commissioning, Hatch’s civil engineering and geotechnical teams were responsible for the earthworks designs of all site areas, encompassing the production of deliverables and construction support.

Mary River Baffinland Iron Mines Corporation

Nunavut, Canada

Hatch services included geotechnical site investigations (ore dock, rail alignment, bridges, arch-plate culverts, ore stockpile, buildings, and mine process structures) in a permafrost environment. Assessments of ice-poor and ice-rich soils and thermal analyses were carried out for foundation design, waste rock stockpile

design, and design of geomembrane lined embankment dams at the mine site. Hatch also provided a cost estimate and support for the mine expansion construction.

Tasiast Expansion Project Tasiast Mauritanie Ltd. SA

Mauritania, West Africa

Hatch provided initial studies and then EPCM services to design and construct facilities to support existing operations and potential future expansion. The civil site development team was involved in the design of earthworks, grading, drainage, stormwater management, firewater ponds, sanitary sewers, roads, water supply pipeline, landfill design, bid evaluation and design build contractor’s work review. The project received the Kinross Safety Award.

Energy

Fargo Moorhead Flood Risk Management

North Dakota, USA

Hatch led a team of consultants tasked with developing a channel that would convey flood waters around the city of Fargo to mitigate damage to the city’s infrastructure. In addition to oversight of channel design optimization, Hatch conducted geotechnical analyses for the channel and embankments and provided design input into the drain and river inlets and bridges.

Muskoka River Watershed Floodplain Mapping

Ontario, Canada

Following severe flood events in the Muskoka River watershed, Hatch was tasked to develop floodplain inundation maps for all major water bodies and options to reduce flood waters in high priority areas. Services included baseline topographic mapping, hydraulic analyses, hydraulic modelling, and production of flood plain maps for select areas throughout the district.

Waba Dam Rehabilitation Confidential client

Ontario, Canada

Hatch conducted geotechnical investigations and assessment of the soft clay foundation to define material properties including in-house laboratory testing and 2D finite element hydrodynamic modeling to predict the complex consolidation, spreading, and settlement behavior of the soil in order to inform the rehabilitation design of the dam.

Infrastructure

Hall Road Upgrade Project

Victoria, Australia

Hatch produced a detailed design which included civil road works, structural plans and utility relocations. The design ensured a constructible outcome and requirements to meet the annual exceedance probability for flood immunity. Hatch’s design yielded water surface elevation to protect the proposed road and adjacent private properties.

Niagara Tunnel Project Ontario Power Generation

Ontario, Canada

Hatch provided Owner’s Representative services, including technical and management oversight for concept design, to procurement phase, to the construction and commissioning phase on this multiple award-winning project. Responsibilities included geotechnical investigations and design development engineering to refine the design of the relocated ice accelerating wall.

ONxpress Transportation Partners Metrolinx GO Rail Expansion

Ontario, Canada

As the largest transportation investment in Canada, this program will redefine the GO Transit rail network into a system delivering two-way, all-day service. A member of the engineering joint venture for ONxpress Transportation Partners, Hatch is providing geotechnical and hydrogeology investigations as well as civil, hydrotechnical (drainage) and geospatial (GIS) services.



About Hatch

Whatever our clients envision, our engineers can design and build. With over six decades of business and technical experience in the mining, energy, and infrastructure sectors, we know your business and understand that your challenges are changing rapidly.

We respond quickly with solutions that are smarter, more efficient, and innovative. “We draw upon our global network of 10,000 professionals with experience in 150 countries to challenge the status quo and create positive change for our clients, our employees, and the communities we serve.”

[hatch.com](https://www.hatch.com)