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Site C Temporary Civil Works

Knight Piésold

Knight Piésold served as lead designer for the main civil works contractor, Peace River Hydro Partners, on BC Hydro's 1,230-MW Site C Clean Energy Project. The team designed and monitored critical temporary works that enabled safe river diversion and dam construction. This mandate addressed large cofferdams, seepage cut-off systems, slope stabilization and site-wide water management to enable the construction of the permanent dam, generating station and spillways.

The firm's real-time monitoring enabled adaptive engineering under challenging conditions. Commissioned in 2025, the project now provides electricity for 450,000 homes annually.

Temporary or permanent?

Site C is a hydroelectric facility on the Peace River in northeastern British Columbia, developed by BC Hydro to provide long-term, reliable, renewable energy. Knight Piésold designed many civil works, including diversion cofferdams, relocated surplus excavation material (RSEM) areas, a 4.5-km till conveyor corridor, site-wide water management systems, haul roads, mechanically stabilized earth walls, temporary excavations and slope stabilization.

The firm treated these temporary works as critical infrastructure. Six large diversion cofferdams, up to 35 m high and extending approximately 4 km in total, were designed using zoned earthfill embankments combined with multiple seepage cut-off technologies. Cement-bentonite slurry walls and bedrock-socketed interlocking steel pipe piles were integrated to address highly variable alluvial and bedrock conditions in



the major river setting.

System selection and detailing balanced hydraulic performance, constructability and sequencing constraints, resulting in resilient temporary works that performed reliably throughout construction and under extreme conditions.

Knight Piésold also developed and implemented comprehensive performance monitoring systems for the cofferdams, foundations, slopes and excavations, including vibrating wire piezometers, inclinometers and survey prisms. Live data acquisition and clearly defined trigger thresholds provided real-time insight into pore pressures, deformation and seepage behaviour.

"Innovative geotechnical methods for a huge project." - Jury

This instrumentation-driven approach allowed proactive adjustments to be made to the project's dewatering strategies, stabilization measures and construction sequencing, enhancing safety and reliability while

maintaining progress.

Environmental and geotechnical innovation was demonstrated through management of unprecedented volumes of potentially acid-generating (PAG) shale. Knight Piésold's RSEM areas integrated starter dykes, low-permeability containment and adaptive water management and treatment strategies, balancing long-term environmental protection with construction efficiency.

Site C has advanced best practices in construction-stage engineering, instrumentation-driven design and integrated delivery for large hydroelectric and major civil infrastructure projects. The methodologies and lessons learned are directly transferable to future hydroelectric developments, mining operations and other major infrastructure projects worldwide.

Ensuring reliability

As one of Canada's largest infrastructure projects ever, Site C presented extraordinary complexity due to its scale, location and risk profile. The project required safely di-

verting a major river while enabling deep excavations under highly variable flows, extreme weather events and tight seasonal construction windows.

Central to the project were the six large diversion cofferdams that diverted the Peace River and enabled the construction of the permanent works. These cofferdams incorporated zoned earthfill embankments with multiple seepage cut-off technologies, including cement-bentonite slurry walls and interlocking steel pipe piles socketed into bedrock, which were designed to perform reliably during high flows, intense rainfall and rapid runoff changes.

Subsurface conditions were exceptionally challenging. Variable alluvial deposits over bedrock, weak bedding planes and localized slope instability required extensive investigation, conservative design criteria and continuous reassessment as excavation progressed. Unanticipated ground conditions encountered during diversion tunnel, tailrace and cofferdam interface excavations necessitated the rapid redesign and implementation of stabilization measures, including anchors, dowels, shotcrete, mesh and pile walls, often within constrained footprints adjacent to the active cofferdams.

Knight Piésold designed the RSEM areas to safely contain more than 12 million m³ of PAG shale, integrating low-permeability liners, starter dykes, staged placement and water collection and treatment systems for long-term environmental protection.

Many of the project's complexities were addressed through integrated geotechnical, hydraulic and environmental engineering, supported by real-time monitoring. Designs were refined as conditions were exposed, balancing safety, constructability and the project schedule. This process proved highly effective, maintaining stable, dry working conditions throughout construction.

Earning social trust

The Site C Clean Energy Project delivers significant long-term social and economic benefits to British Columbia. Commissioned in 2025, it provides approximately 5,100 GWh of renewable electricity annually, supporting energy security, economic



Six large cofferdams diverted the Peace River and enabled the construction of the permanent works.

growth and electrification.

During construction, the project supported thousands of jobs and generated substantial economic activity in northeastern B.C. Engineering, construction, environmental monitoring and support services created employment opportunities for local and Indigenous workers and businesses.

Knight Piésold's engineering contributions enabled safe and efficient construction, reducing risk of delays or failures that could have further increased costs to the public.

Managing environmental impact

Knight Piésold's environmental approach emphasized active protection of the Peace River ecosystem. Early in the project, the team completed sediment transport and fluvial geomorphology studies to support environmental assessments and regulatory approvals, establishing technical foundations for downstream impact management.

During construction, the firm designed comprehensive site-wide water management infrastructure to control river flows, groundwater, construction runoff and extreme weather events. These systems protected downstream water quality and

aquatic habitat while meeting stringent regulatory requirements throughout the site's multi-year construction period.

To ensure effective oversight, two of Knight Piésold's environmental professionals were seconded full-time to establish and manage the contractor's environmental department. This multidisciplinary team implemented compliance monitoring, habitat protection measures and reporting protocols to maintained commitments throughout construction.

Indigenous participation was also actively incorporated into environmental stewardship. Indigenous personnel were hired and trained in water quality sampling, amphibian salvage, daily environmental reporting and ecosystem monitoring. More than 100 known Indigenous archaeological sites within the work area were protected through co-ordinated inspection protocols, with construction halted whenever artifacts were encountered until specialized assessment could be completed.

Ultimately, the project's environmental legacy is the provision of clean, renewable electricity, displacing fossil fuel generation and supporting British Columbia's climate objectives for generations. **CCE**

Site C Temporary Civil Works

Award-winning firm (lead designer): Knight Piésold (Egbert Scherman, P.Eng.; Craig Nistor, P.Geo.; Cory Vos, P.Eng.; Warren Dowd, P.Eng.; Benoit Otis, P.Eng.; Carlo Capucuo, P.Eng.; Owen Payne, P.Eng.; Josh Baranesky, P.Eng.; Salina Yong, P.Eng.).

Owner: BC Hydro

Other key players: Peace River Hydro Partners (client), McElhanney Engineering (geometric design of roads), Delve Underground (design of temporary adits, grout tunnels and access tunnels).