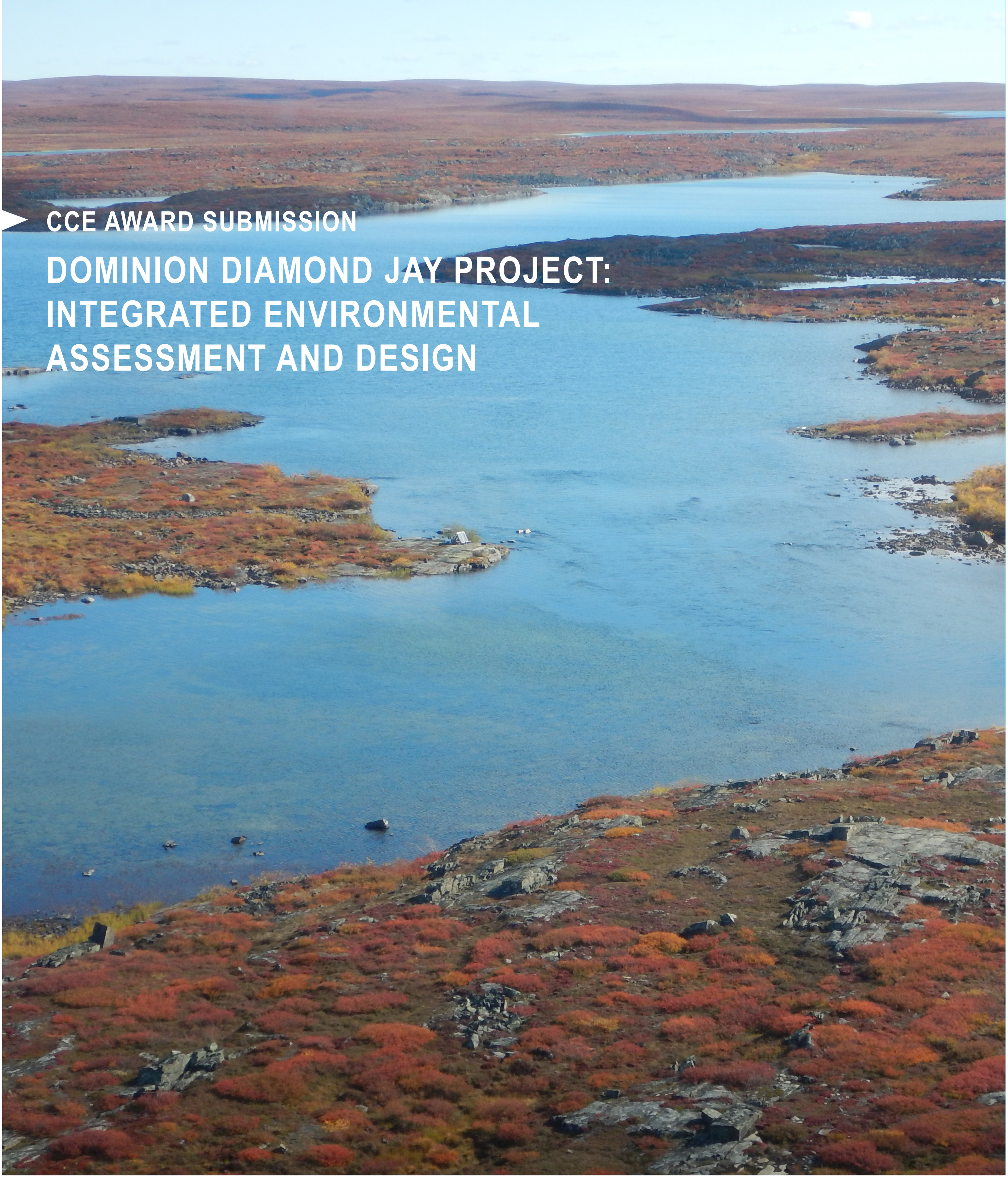
CCE AWARD SUBMISSION

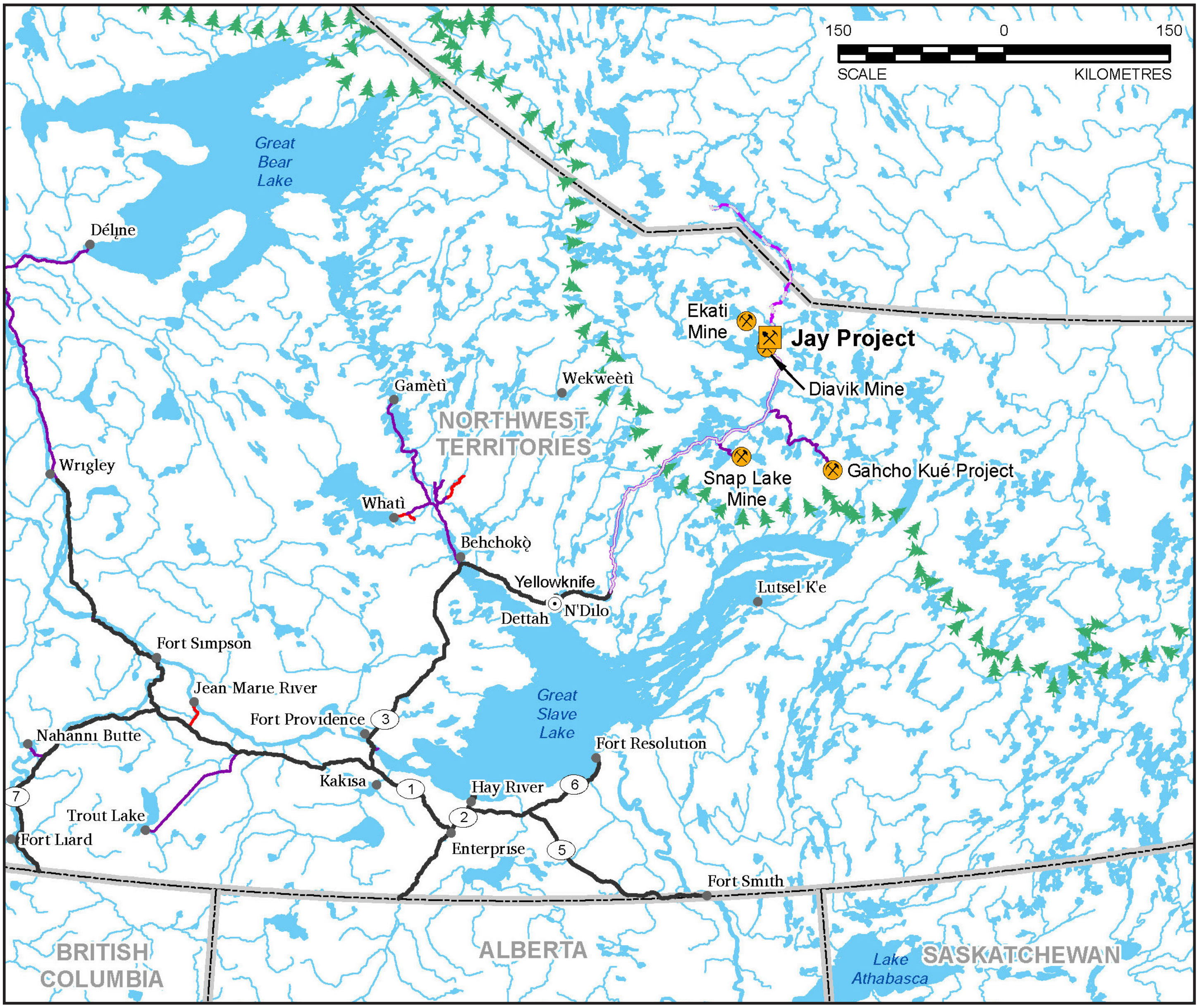
DOMINION DIAMOND JAY PROJECT: INTEGRATED ENVIRONMENTAL ASSESSMENT AND DESIGN



PROJECT SUMMARY

Dominion Diamond (Dominion) purchased the Ekati Mine in 2013, it was scheduled to close in six years, because continued operations were believed to be uneconomic.

To avoid closing the mine, Dominion retained Golder Associates to conduct the Jay Project. The Project required integrated Environmental Assessment, Design and Construction knowledge to meet an aggressive schedule. Golder formed a dedicated team focusing on innovative approaches to avoid closure and continue to provide socio-economic benefits to Northern Canada.



Location plan for the Jay Project and Ekati Diamond Mine

INNOVATION

The Jay Project (the project) comprises development of an open pit to mine the Jay kimberlite pipe located below Lac du Sauvage (Northwest Territories), in a watershed adjacent to the Ekati Mine. The pipe is located below up to 10 m of overburden, 35 m below the lake surface, and will require the excavation of a 370 m deep open pit with a top diameter of 960 m (Dominion Diamond 2015). The surrounding dike, over 14 m high and over 5 km long with a volume of 5,000,000 m3, is a leading concept of the project, and its largest capital expense. Because the dike will follow topographic highs of the bedrock below the lake, it will not extend to the 35 m water depth at the pipe.

Project effects on Caribou are a vital consideration of Northern environmental assessments

The project's cost constraints required Golder Associates (Golder) to apply innovative dike design and construction methods. Estimated capital costs were dramatically reduced by modifying and extending the dike construction design that Golder had recently developed and successfully applied in Nunavut (Esford et al. 2013). The design "requires common construction equipment. Construction includes placing a broad rockfill shell along the dike alignment (no dredging), excavation of the central portion of the rockfill, advance of a zoned core into the excavation from the crest of the dike, densification of the core, slurry wall construction along a centreline to create a cut-off wall, and grouting of the contact between the bedrock and the cut-off wall" (Dominion Diamond 2013).

The key aspects of this innovation were that the project dikes incorporated a variable design, governed by the depth to bedrock at any point along the dike. Optimizing the design and alignment of the dikes was a critical task of the project. The dikes required extensive drilling and geophysics programs, under very tight timelines and harsh winter conditions. This innovation was the key factor in demonstrating that the project could be constructed in an economic manner.

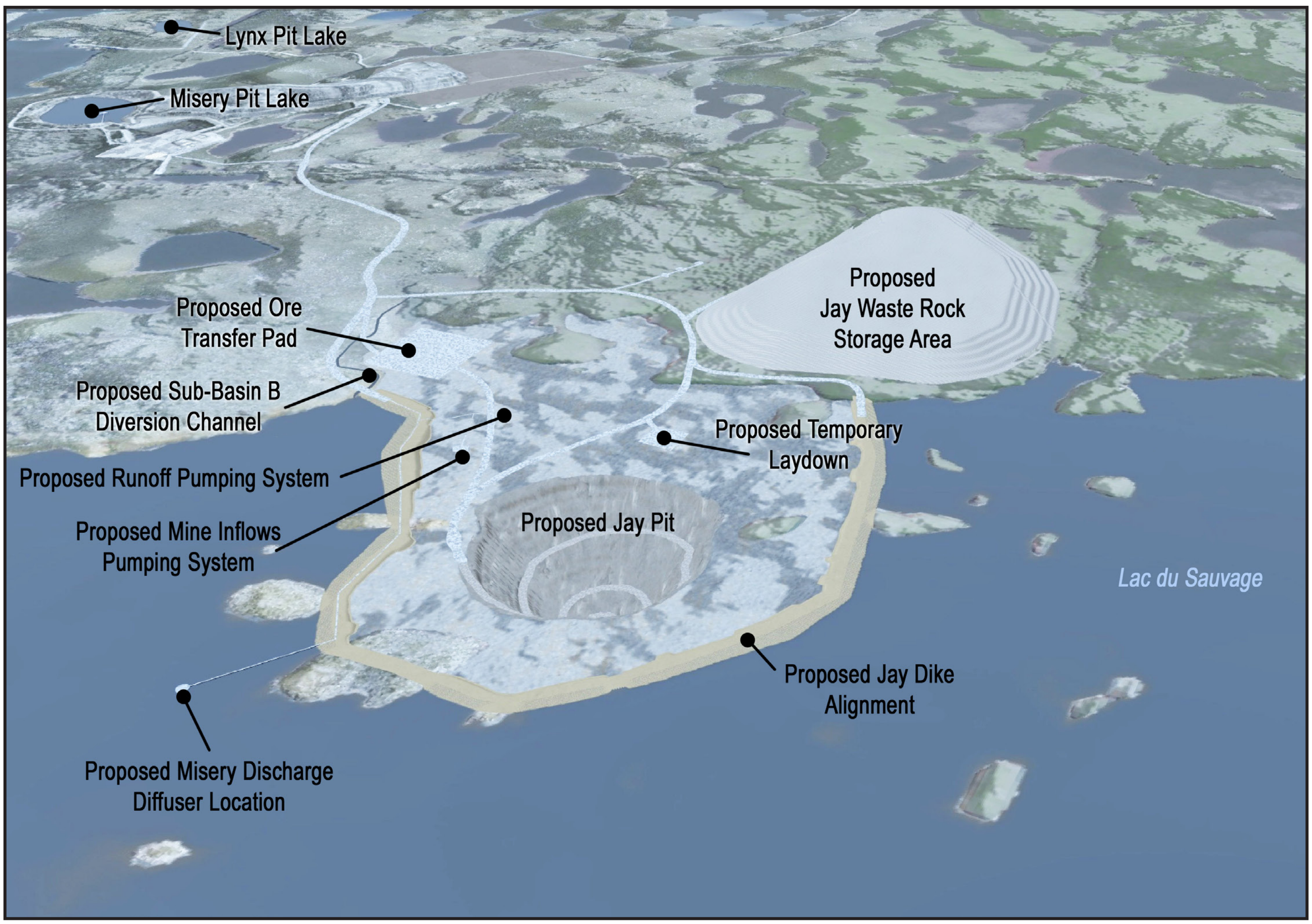
The project will need to manage significant volumes of highly saline water, which will flow into the mine pit when it penetrates below permafrost. Golder developed an innovative water management plan to meet regulatory requirements and to protect the sensitive natural water bodies at the project. The water management plan involved sequestering denser saline water below a fresh water cap in other mined-out pits at the project site, a method described by Golder personnel in Herrell et al. (2015).

COMPLEXITY

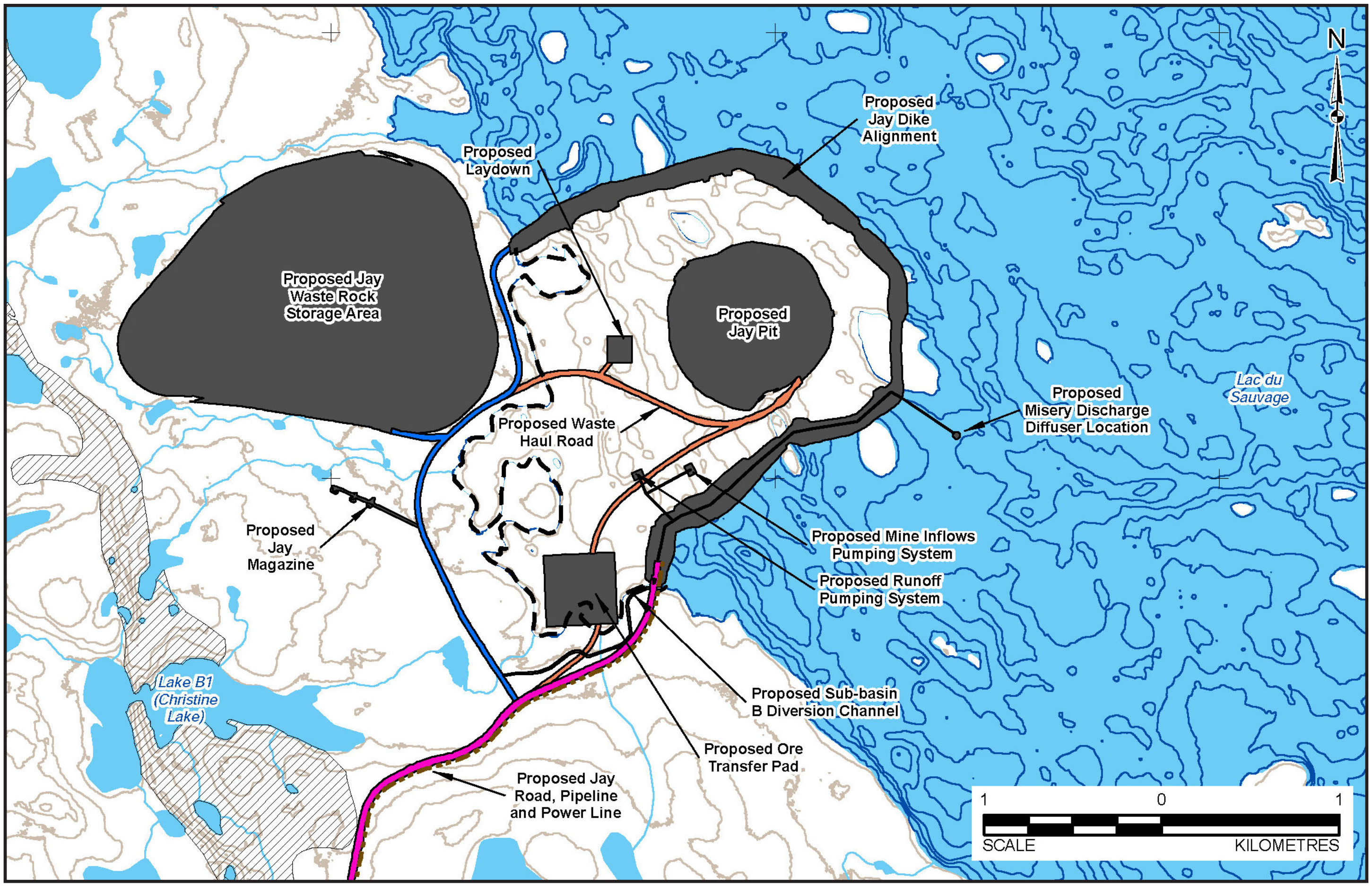
The project is located in a remote, northern setting, in a pristine, sensitive watershed and with the potential to affect the traditional lands of several aboriginal groups. The project required application of innovative engineering design and water management to provide acceptable economic, environmental and social outcomes.

Environmental and engineering field studies were completed under harsh, northern conditions and compressed timelines, with attendant logistical challenges, and sparsity of historical data posed significant challenges. Effective management of the Environmental Assessment (EA) and design components of the project were essential to its success, and required seamless integration of 17 scientific disciplines with the engineering design of mine pits, surface infrastructure, waste and water management, and closure and reclamation components, during which the project team also participated in regulatory, public and Aboriginal consultation. The interdependencies of these tasks were carefully managed to ensure that information needs were effectively identified, scheduled and passed between disciplines. Without this approach, the project could not have met its timelines.

Dike design, as described above, and water management tasks had additional internal complexities. Water management was based on integration of eight water models (Vandenberg et al. 2015), and required that a baseline hydrology model be calibrated within six months of the start of baseline study, something unheard of in the data-sparse north. It also required rapid characterization of saline groundwater from tight rock below permafrost, based on regional experience, literature review and development of a deep sampling well in winter conditions. These were essential inputs to development of effective mitigation design.



Perspective of the Operations on the Site



Jay Project footprint, showing major features of the proposed mine development

SOCIAL ECONOMIC BENEFIT

The Ekati Mine employs approximately 1,400 people, including 600 contractors, of which one-third are Aboriginal and over half are northern residents. It is the largest northern employer of Aboriginal people in the mining industry, and provides significant training and career opportunities. Closure of the mine would result in a significant impact on employment in the Northwest Territories; the project will extend employment by over a decade.

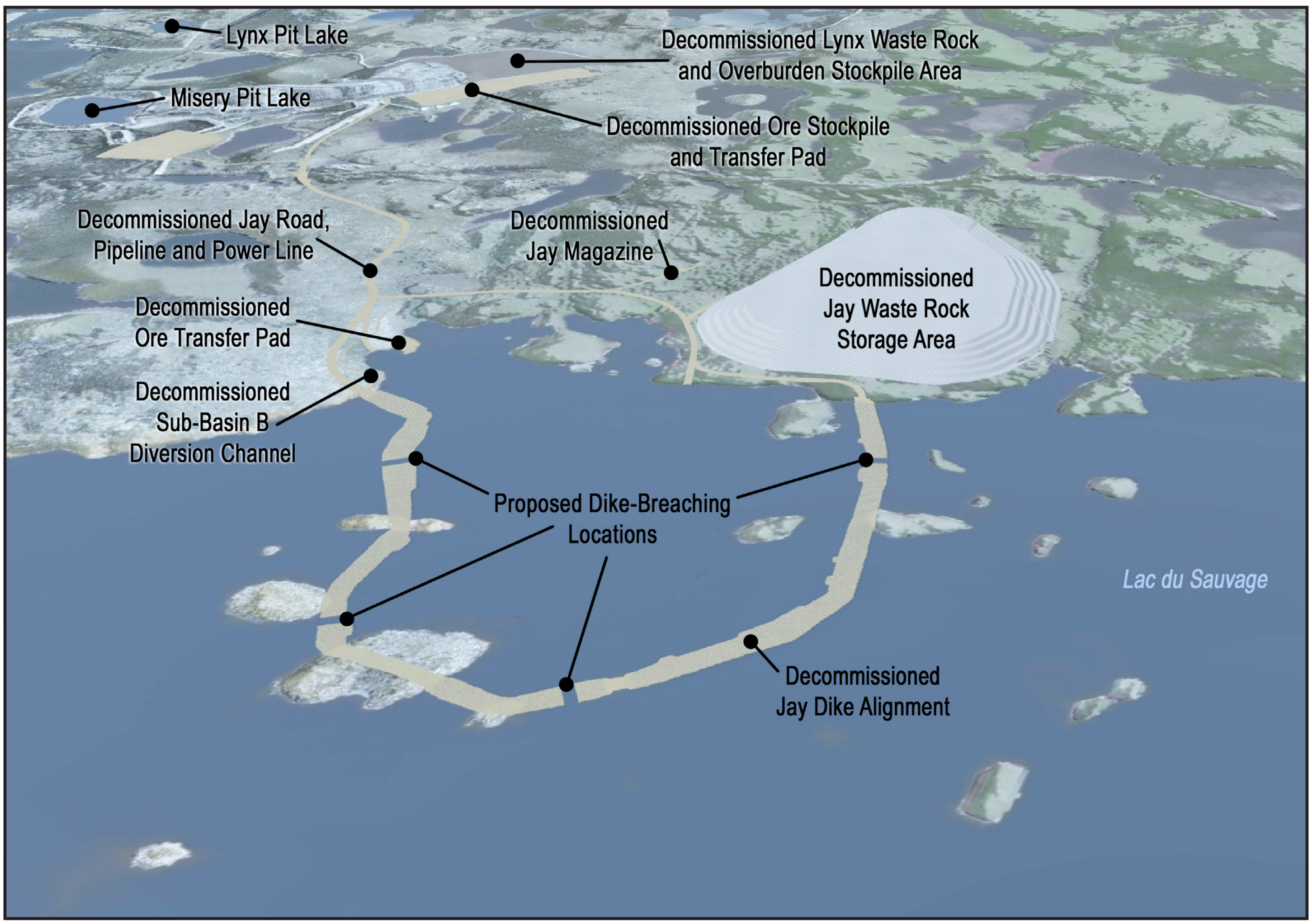
Many Golder staff are residents of Yellowknife, where we have an office of more than 20 people, and this project provided an opportunity to build technical capacity in the North. Dominion Diamond has a stated preference for Northern personnel, and Golder was able to provide qualified scientists and engineers to the project team. These were not limited to field staff. For example, the hydrology component lead was a Yellowknife resident and the hydrological modeling was performed in that office.

The project EA included a significant component of traditional knowledge, including gathering of local and traditional knowledge to determine potential effects of the project on culture and traditional land use, and to develop appropriate mitigation measures, including integration of traditional knowledge into project planning and design, monitoring plans, and closure and reclamation. Aboriginal groups engaged in this process included the Yellowknives Dene First Nation, Łutselk'e Dene First Nation, North Slave Métis Alliance, Tłįchǫ Government, Kitikmeot Inuit Association, Deninu K'ue First Nation, Fort Resolution Métis Council, and residents of the seasonal communities of Umingmaktok and Bathurst Inlet.

ENVIRONMENTAL BENEFITS

The EA design schedule constraints required that Golder apply innovative environmental baseline, assessment and mitigation methods. These included applying water modeling approaches which advanced those previously applied by Golder at the Gahcho Kué Diamond Mine in the Northwest Territories. Development of mitigation measures to reduce or eliminate adverse environmental effects is a key feature of the EA process, which was accomplished by Golder integrating the engineering and environmental team. Key mitigation measures included:

- A water management plan to effectively manage saline pit inflows, to minimize use of fresh water by recycling, and to limit the effects of diked area drawdown and backflooding on natural water bodies.
- Identifying key mitigation measures associated with Caribou protection, including limiting disturbance to migration pathways, vehicle interactions, sensory disturbance and direct loss or fragmentation of habitat.
- Identifying key mitigation measures associated with fish and fish habitat protection, including limiting changes to lake and stream water levels and flow velocities and direct loss or fragmentation of habitat. Unavoidable losses were the subject of offsetting plans, developed by Golder in consultation with regulators and Aboriginal communities, and are presently planned to include restoration of an extirpated population of sportfish in a northern watershed.
- Intensive field studies and baseline syntheses prepared as part of the project are now a part of the public record and represent advancement in the state of knowledge of physical and biological characteristics of the Lac du Sauvage watershed and downstream water bodies.



Perspective of the Post-Closure Site

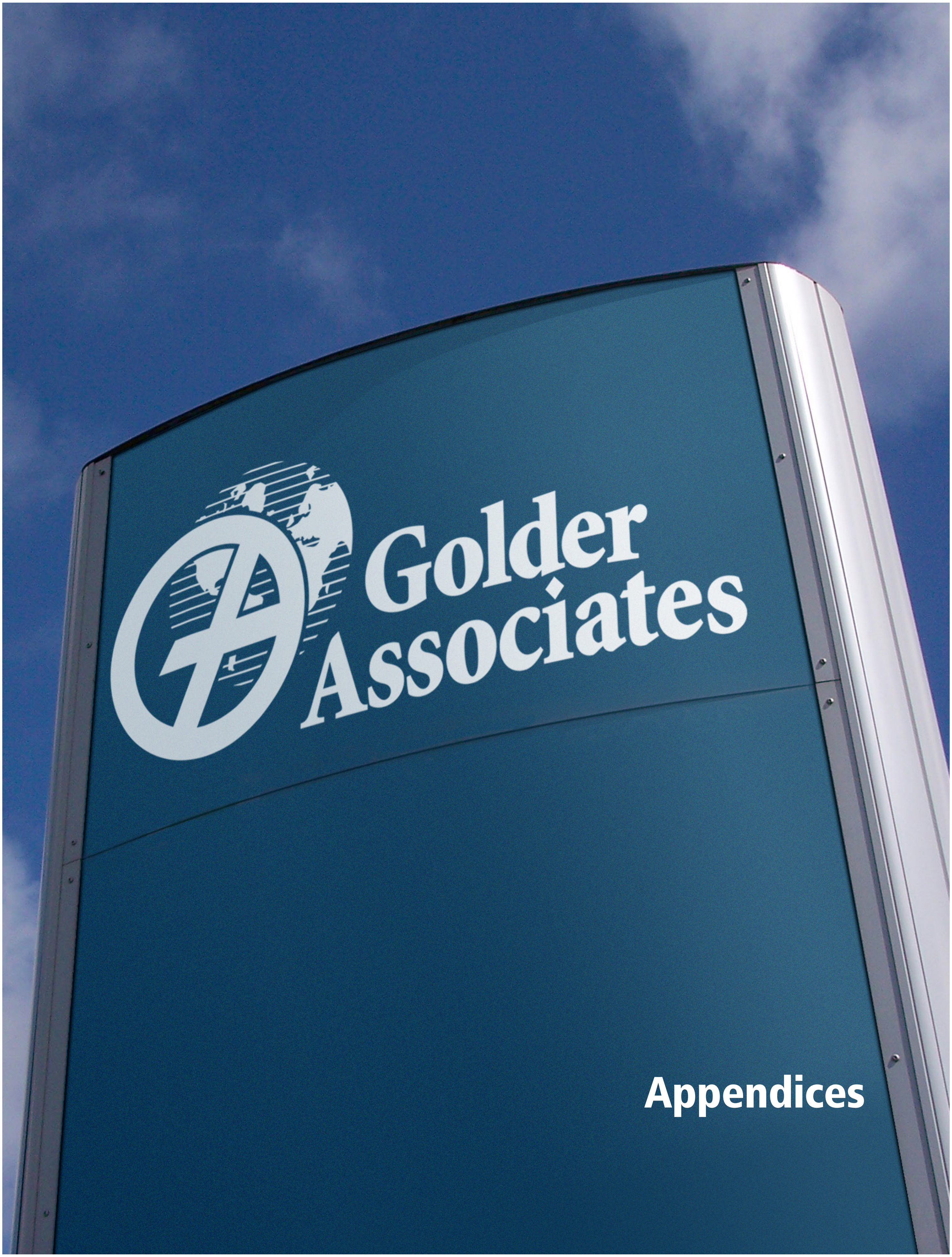
MEETING THE CLIENT'S NEEDS

The delivery of the EA and design of the project was both challenging and rewarding for Golder. By forming a highly qualified, experienced and integrated project team, managing the project and associated risks in an effective manner, and applying innovative methods to both phases of the project, Golder was able to meet the client's strict schedule and economic needs.

At the start of the project, Dominion Diamond indicated that a previous expansion study estimated that the project would be uneconomic, and the Ekati Mine would close. This was primarily due to the cost of diking to allow open pit mining. Though the project value is confidential, Golder's application of innovative engineering concepts and methods reduced initial budget estimates to less than 50% of the previous value, and Dominion Diamond decided to proceed.

The aggressive schedule for the project required the submission of an EA within 16 months of commencing baseline studies. Golder was able to meet this timeline through solid project management execution.

Golder applied an integrated water modeling process, incorporating eight models, including an innovative water balance model, developed by Golder for application to lake-dominated northern watersheds. Modeling and assessment results were passed between environmental disciplines as soon as they were available, before reporting commenced. Engineering and environmental teams collaborated continuously as the project and environmental mitigation details evolved. We believe that the project timeline would not have been achievable without the collaboration of a high-functioning, integrated engineering and environment team.



Appendices

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