

# EAGLE GOLD

## TRANSMISSION CONNECTION

The ATCO logo is located in the bottom right corner of the image. It consists of the letters "ATCO" in a bold, white, sans-serif font, with a yellow horizontal bar underneath the letters.

### Nominee Engineer

### Sam Saeiarasi, M. Sc., P. Eng., Supervising Engineer

Sam has managed many major infrastructure projects over his 28-year career as a civil engineer, spanning bridge and interchange projects, utilities and transmission line realignments and new line installations. He completes civil and structural design specifications and provides construction oversight for ATCO's powerline and substation developments. Sam has expertise in site grading and earthwork design for substations, power plants and access roads that includes side slope assessment, erosion control, environmental impact studies, substation site selection and transmission line routing.

### Supporting Team

Imran Khan, M. Eng., P. Eng.; Vanna Cheung, P. Eng.; Tam Ho, P. Eng.

### Clients

Victoria Gold Corporation & Yukon Energy Corporation

### Contractors

Cobalt Construction (earthworks), Midnight Sun Drilling Inc. (foundations), Tetra Tech (NELPCo engineering service provider for geotechnical investigations and site support)

## PROJECT OVERVIEW

The Eagle Gold Transmission Connection project involved building the S258 McQuesten Substation and connecting multiple transmission lines into the facility — including existing 69 kV line L250, a 33 km single-circuit 138 kV line from S249 Mayo Substation and the 69 kV L251 Eagle Gold feeder — to supply Victoria Gold's Eagle Gold mining project. Employing up to 400 people, Eagle Gold is the most advanced mining project in the region and on track to be the largest gold mine in the Yukon.

ATCO was engaged to design, procure for and construct the McQuesten Substation and 69 kV in-out line L250. Our flexibility, commitment to engineering excellence and the attention to total lifecycle requirements afforded by our unique perspective as an owner of electricity assets allowed us to deliver

the civil scope on time, on budget and with the required quality, despite a mid-project pivot to mitigate serious civil issues with the original substation site.

### The Original Location's Design

ATCO completed the preliminary civil design for the original substation location in 2016. We based the design on a 2015 geotechnical report completed primarily for site selection. Approximately 40 km from Mayo, the original substation location (Location 1) was the preferred of three sites evaluated, given the relatively dry and firm ground with no permafrost.

The 2015 geotechnical investigation was confined to the previously cleared transmission line right of way, adjacent to the substation site. Therefore, when Victoria Gold retained ATCO for the

detailed design in 2017, we requested a detailed geotechnical investigation of Location 1; Tetra Tech drilled three new boreholes, one in the cleared right of way and two at the substation location. The substation boreholes revealed permafrost to a depth of 4 m, with approximately 2 m of ice-rich content (30 – 40%).

The presence of permafrost heavily impacted the design. The site grading and foundation designs both had to be revised, leading to following challenges.

- The significant depth of ice-rich permafrost required an average of 2 m to be excavated for pad and road construction and associated ditch work, significantly increasing the volume of unsuitable material.
- The new design required an intensive maintenance program of ditch



cleaning and pad repair, as sloughing of permafrost in the ditch and cracking in the pads from settlement were likely to occur.

- As schedule constraints prevented advance brushing that would have allowed the permafrost to thaw, site-specific soil management and brushing plans were required. They included hand-cutting trees and providing a drainage system for the material stockpile.
- The changed foundation design used rock socket piles rather than the original shallow concrete footings to prevent differential settlement.

### Environmental Challenges

The construction team found birds nesting and highly wet ground conditions at the proposed location for the stockpile of unsuitable material. The unsuitable material comprised mainly non-ice-rich with some ice-rich material that would melt in warmer temperatures (most excavated ice-rich material was to be hauled from site to a disposal location). To keep from disturbing the birds, prevent flooding and ensure proper disposal, a new stockpile location was required — which would also require additional brushing disturbing more vegetation.

### Melting Soil & Seepage

Contractors excavated test holes at various pad and road locations to confirm the organic cover and soil conditions prior to stripping. Most of the visual inspection aligned with the geotechnical report; however, when excavating holes for the transmission line bypass in the previously cleared area (which had no ice-rich permafrost), the holes showed a large quantity of melting ice and water seepage. ATCO and the contractor identified these soil conditions as a major concern for excavating and handling ice-rich material.

### Proposed Site Relocation

After analyzing the execution challenges and potential cost and schedule impacts, ATCO proposed a new site at an old open pit 200 m west of the original site.

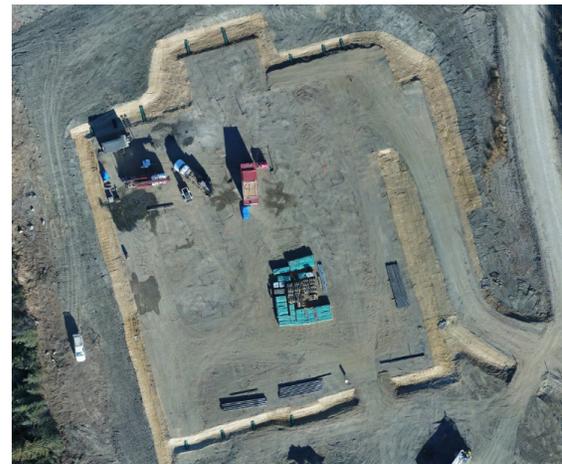
ATCO's civil engineering and construction teams played a significant role in finding and selecting the new site, performing a detailed assessment both on and off site that compared the cost, schedule and quality risks of relocation. We completed a preliminary site layout within days and field-confirmed it to support the geotechnical investigation and Yukon Energy's application for regulatory approval and permitting.

To ensure that the project still met the planned energization date, the engineering site grading design was completed within two weeks of receiving the client's approval. We worked in parallel on activities such as collecting and analyzing survey data, providing regulatory support, geotechnical scoping and providing onsite support. We also redesigned the foundations for the new site and completed the design package in a highly condensed timeline.

ATCO's engineering team then worked closely with construction teams during execution, making design changes to address ad-hoc challenges as required.



*Original location (Location 1)*



*New site after earthworks completed*

## THE ATCO DIFFERENCE

**Attending to the smallest design and construction details allowed us to identify cost, schedule and quality risks associated with ice-rich permafrost at the original site. We addressed these challenges by helping to locate, obtain approvals for and complete the design for a new site in a matter of weeks by working extended hours and coordinating directly with each project stakeholder.**

**Our attention and flexibility realized significant maintenance and execution cost savings and provided a better-quality product — on time and on budget. Using an existing open pit also helped minimize the project's environmental impacts, reducing the brushing and tree cutting that would have been required to stockpile material on the original site.**