



# La Grande Hydroelectric Development Geotechnical Conditions and Designs

## Geographical location

North of the 53<sup>rd</sup> parallel in northern Québec

## When it began or was completed

All dams and dikes were constructed between 1973 and 1996.

## Why a Canadian geotechnical achievement?

The La Grande hydroelectric development, Phases 1 and 2, were ambitious engineering projects in a vast, remote territory, in a harsh northern climate. Hundreds of dikes and dams were designed and constructed with various types of cross sections; from rockfill zoned dams to homogeneous dikes. The following two examples demonstrate the complexity and variety of foundation conditions encountered and solutions applied.

La Grande-2 was the first site to be developed. The main dam, 2836 m long and 160 m high, is a rockfill dam with an upstream inclined earth core on a bedrock foundation. The Duncan D-20 zoned sand and gravel dike is 6052 m long and founded on deep alluvial complex soil formations. The foundation required five different types of treatment: core in a trench, rock grouting under the core, impervious upstream blanket, diaphragm wall and heavy slurry trenches.

The La Grande-1 North dike is located in a 70 m deep valley filled with thick clay topped by a thin layer of sand; both resting on a basal till deposit. Ancient slides and flows, soil liquefaction potential and sensitive clays were all identified prior to construction. Built in two phases, the North dike was designed and constructed with four cross sections: on rock with grouting, on till with a trench, on clay with large berms and on silty sand with a cement-bentonite cut-off wall.

During La Grande hydroelectric development, Hydro-Québec and its consultants conducted extensive research on, among other topics, filters, frost penetration, till suffusion and water-air flow modelling.

## Submitted by

Hydro-Québec

## Key References

Société d'énergie de la Baie James. 1987.  
**La Grande Rivière Hydroelectric Complex—Phase One Development.**  
Montréal, Québec, 496 p.

Société d'énergie de la Baie James. 1996.  
**La Grande Rivière Hydroelectric Complex—Phase Two Development..**  
Montréal, Québec, 427 p.

## Photographs (Archives d-Hydro-Québec)



La Grande-2 main dam and spillway.



La Grande-1 main dam (Archives d'Hydro-Québec).