

### **Authors and title (for reference) :**

PÂQUET, Guy et Richard Lévesque (2001) : Dynamique des berges de La Grande Rivière entre les centrales LG-2-A, Robert-Bourassa et l'embouchure. Rapport synthèse pour la période 1991-1999. Report prepared by Géo-3D inc. for the direction Expertise et Support technique de production, Unité Hydraulique et Environnement, Hydro-Québec. 52 p., 6 figures, 8 tables, 2 photographs and 3 appendices (17 maps).

### **Framework and objectives :**

In order to comply with La Grande-2-A and La Grande 1 authorisation certificates issued in 1987 and 1988, Hydro-Québec had to monitor until 1999 environmental impacts resulting from the implementation of these new equipment. One of the themes under study concentrated on monitoring the evolution of the La Grande River banks between the Robert-Bourassa power plant and the mouth of the river. As opposed to the 1978-1991 reference period, bank monitoring had to be performed by photo-interpretation every second year between 1991 and 1999. Reports pertaining to the bank evolution status had to be produced for each 2-year period, i.e. : 1991-93, 1993-95, 1995-97 and 1997-99. A final report compiling the monitoring data for this period and enabling data comparison with respect to the 1978-1991 reference period also had to be completed.

### **Abstract :**

The current report summarises the content of four progress reports written over the study period, between 1991 and 1999. La Grande River bank erosion monitoring between the Robert-Bourassa power plant and the mouth of the river was performed using photo-interpretation tools every second year between 1991 and 1999. The main impacts due to the LG-2-A and LG-1 power plant construction as well as to the creation of the LG-1 reservoir were identified and quantified over this period. These studies were further instrumental in validating predictions relative to the evolution of bank erosion as reported in pilot studies.

As opposed to what had been foreseen in these studies, the construction of the LG-2-A power plant, which was to enable instantaneous water flow increases from 4 300 to 5 920 m<sup>3</sup>/s grafted from the Robert-Bourassa reservoir, did not cause an 8% increase in volumes of eroded material on the banks of the river, downstream from the Robert-Bourassa and LG-2-A power plants. On the contrary, it resulted in a 60 to 25% reduction in the latter (depending on whether the two major landslides which occurred between 1987 and 1990 are included in the reference period). This can be explained by the fact that the LG-1 reservoir was flooded only one year after the LG-2-A operations start-up, covering for the changes relative to the river flow increases.

According to the same pilot studies, the LG-1 reservoir creation upholding water levels between 30,5 and 32 m, was to bring a reduction of approximately 60% in material eroded from the reservoir banks (upstream from km 37) as compared to the 1978-1991 reference period, causing little change downstream from the LG-1 power plant. The volume of eroded material on the circumference of the LG-1 reservoir reduced from 425 000 m<sup>3</sup>/yr over the 1978-1991 reference period to approximately 100 000 m<sup>3</sup>/yr over the 1993-1999 period, a reduction of approximately 75%. These calculations do not take into account the 1991-93 period since the LG-1 reservoir was not full yet. The reduction in the total volume of eroded material observed after 1993 is mainly due to a very significant reduction in landslide activity. Although the volumes of eroded material have diminished considerably, the length of eroded sections has increased in accordance with initial previsions, augmenting from 75 km in 1993 to 110 km in 1999.

The average values observed over the 1993-1999 period downstream from LG-1 reached approximately 44 000 m<sup>3</sup>/yr, a 20% reduction as compared to previsions in pilot studies. The length of active sections in this area remained stable over the monitoring period, to the exception of a 1-km reduction attributable to the construction of protection structures at the beginning of the 1990's.

According to the results obtained over the 1991-1999 monitoring period, the banks of the La Grande River should continue to evolve. The probability that volumes of eroded material reach levels as important as those recorded during the 1978-1991 reference period are very low. However, the LG-1 reservoir is relatively new and the banks sensitive to erosion have not been affected yet.

**Key words :** La Grande River, monitoring bank erosion, reference period (1978-1991), 1991-1999 period, summary report, reduced or increased erosion, landslide, LG-2-A and LG-1 power plants, upstream from LG-1, downstream from LG-1, LG-1 reservoir, LG-1 and LG-2-A authorisation certificates.

**Distribution list :** Ministère de l'Environnement, James Bay Advisory Committee on the Environment, Review Committee, Cree Regional Authority, Cree communities, Eeyou Corporation, Makivik Corporation, Société de la faune et des parcs du Québec, Société d'énergie de la Baie James, Société de développement de la Baie James, Municipalité de la Baie James, Hunting, Fishing and Trapping Coordinating Committee, Canadian Electrical Association, Environment Canada, Fisheries and Oceans Canada, Unités d'environnement et de relations avec le milieu des divisions d'Hydro-Québec, Documentation centre of Direction Environnement d'Hydro-Québec.

**Version :** final

**Diffusion code :** internal/external

**Date :** December 2001

**Code number at Centre de documentation Environnement d'Hydro-Québec :** HQ-2001-121