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Projet d'aménagement d'un complexe
hydroélectrique sur la rivière Romaine
par Hydro-Québec
Basse-Côte-Nord 6211-03-005

Envoi par courriel

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Objet : Projet d'aménagement d'un complexe hydroélectrique sur la rivière Romaine

Monsieur,

En référence au projet précité, la commission d'examen conjoint, chargée de l'étude de ce dossier, vous soumet des questions d'Alliance Romaine annexées à la présente, pour lesquelles elle compte sur votre collaboration afin que l'information demandée soit rapidement rendue disponible, compte tenu de la deuxième partie de l'audience débutant le 1^{er} décembre 2008.

Nous vous remercions de l'attention que vous porterez à cette demande et vous prions d'agréer, Monsieur, l'expression de nos sentiments les meilleurs.

Monique Gélinas
Coordonnatrice du secrétariat de la commission

**Questions for Hydro-Québec on the proposed Romaine Hydro-Electric Mega-Project
Environmental Hearings, Havre St-Pierre, QC, November 2008**

Résumé de l'étude d'impact sur l'environnement

1. In section 4.1.2, the proponent includes a long profile of the Romaine River (Figure 8). What time of year does the current water level depicted in the profile represent ?

Volume 1

- 2a. In section 9.4.1, the proponent states that it will not be possible to let any water through the « tronçon court-circuité » of Romaine-4 during the first 75 days of reservoir filling. How does the proponent propose to compensate for habitat loss this loss, as it is not included in the tabulation of overall habitat loss ?
- 2b. The proponent explains in section 9.4.2 that they were unable to measure the bathymetry of lotic zones in the « tronçon court-circuité » of Romaine-4, and thus did not include these zones in the calculation of wetted area and habitat loss. However, in section 23.6, the proponent claims that 99 % of this zone's surface area is composed of lotic zones. How does the proponent verify the accuracy of the habitat loss measurements when they only considered 1 % of the reach ?
- 2c. Why hasn't the Proponent figured out a way to maintain ecological flows in the « tronçon court-circuité » of Romaine-3 during the first 125 day stage of reservoir filling, as described in section 10.4.1 ?
- 2d. In section 10.4.1, the proponent claims it was too difficult to obtain bathymetry measurements of lotic zones of the « tronçon court-circuité » of Romaine-3. However, in section 10.4, the proponent itself claims that the majority of this reach is lotic. Why has the proponent not developed methods to overcome this barrier ?
- 2e. How is the proponent going to ensure that flows below KP51.5 remain at 70 m³/s during the second phase of filling the reservoir of Romaine-2 ? There is no explanation in section 11.4.1, nor is there a reference to another section with an explanation.
- 2f. The ecological flow proposed below Romaine-1, during the filling of Romaine-2, described in section 11.4.1, is 70 m³/s. This is only half the ecological flow described in table 12.12 of section 12.4.2.8. What ecological effects does the proponent expect during this period ?
- 2g. During the section phase of the filling of Romaine-2, there will not be any ecological flow. The proponent has calculated in section 11.4.1, that the tributary inputs will be 70 m³/s below Romaine-1. What will the proponent do if the tributary flows during are not enough to ensure a discharge of 70 m³/s ?

- 2h. In section 12.4.2.2, the proponent describes future efforts to regulate flow rates in order to maintain the salmon spawning ground at KP 34.5. With an overall reduction in spawning grounds, and an unlikely increase in salmon populations, (as predicted by the proponent, due to the elimination of northern pike in section 12.4.2.4), does the proponent expect increased competition to reduce the quality of this spawning ground ?
- 2i. Section 12.4.2.3 describes the winter ecological flow below Romaine-1. How does the proponent expect this flow to affect the other plants and animals living in and around the reach ?
- 2j. In section 12.4.2.1, the proponent identifies six fish species that were taken into account when determining the ecological flow. However, the proponent only discusses spring spawners in section 12.4.2.4. How will the ecological flows during the summer, fall and winter affect these 5 species ?
- 2k. According to the Politique de débits réservés écologique pour la protection du poisson et de ses habitats, the proponent must have a compensation plan if ecological flows harm fish species. However, in section 12.4.2.4, the proponent proposes not to compensate for the loss of northern pike. How does the proponent explain the discrepancy between the regulations and its plan ?
- 2l. Section 12.4.2.6 explains that the proponent does not expect accumulation of fine sediments to be problematic in Salmon spawning beds. Does the proponent have plans to monitor the accumulation of fine sediments and reassess the situation if more fine sediment than expected is accumulating ?
- 2m. Logging, road building and other construction projects result in the availability of more fine sediments in a river system. Did the proponent include these artificial fine sediment inputs when predicting that the salmon spawning beds would not be affected in section 12.4.2.6 ? If not, why ?
- 2n. In section 19.1.2, the proponent acknowledges that 70 % of the banks downstream of Romaine-1 are composed of sand, silt or clay. Did the proponent include the increase in fine sediment load due to tributary incision after damming in its prediction that there wouldn't be sedimentation of salmon spawning beds in section 12.4.2.6 ? If not, why ?
- 2o. In section 12.4.2.6, the proponent claims that salmon currently clean out the fine sediments from the spawning beds as they lay their eggs. Has the proponent considered the possibility that too much fine sediment accumulation might render the spawning grounds unusable and prevent salmon from being able to clean out the beds ?

Volume 2

- 3a. Why is the flood regime downstream of Romaine-1 different in section 19.2.3 than in 12.4.2.6? The description in 19.2.3 does not include any floods above 1200 m³/s. Which is the true future regime ?
- 3b. Why hasn't the proponent included a discussion in section 19.2.3 of increased fine sediments downstream of Romaine-1 due to erosion in the tributaries ?

Volume 3

- 4a. On maps 23-11, 23-12, and 23-13, the proponent outlines the regions of the « tronçons court-circuité » where there will be viable fish habitat. These habitats are small and disconnected. How has the proponent determined that these areas will be suitable for fish survival ? Does the proponent expect the ecological flow from Romaine-4, Romaine-3, and Romaine-2 to connect the habitat patches shown on maps 23-11, 23-12, and 23-13 ?
- 4b. In table 23-63 of section 23.2.1, the proponent claims there won't be any surface area losses in the tributaries that feed into the four « tronçons court-circuité ». However, these tributaries no longer have a meaningful connection to the Romaine. How has the proponent ensured that fish can move freely between these tributaries and the Romaine ? If the proponent has not, why is this not described as habitat loss ?

Volume 4

- 5a. Section 26.2.3, volume 4 of the EIA says that the Proponent has not detected the presence of Wolverine or Eastern Wolf (both species have protected status) in the study area. If the presence of these species is verified, what remediation would be taken ?
- 5b. Section 26.1.2.1, volume 4 of the EIA observes that some of the moose populations are higher than expected because of the unique habitat, free of many predators, found at the northern limit of the boreal forest. Has Hydro-Quebec accounted for the changes in habitat that are going to happen from anthropogenic climate change ? And what remediation's might Hydro take to minimize the stresses on the ecosystems ?
- 5c. Section 26.1.2.1, volume 4 of the EIA states that there is only 0.29 moose for every 10km² and 0.37 caribou per 100km² in winter. How will summer populations be affected and what are those summer populations ? This past summer Alliance Romaine witnessed a significantly higher number of moose and caribou in the study areas than the winter observations. What is the size of the summer populations and how will they be affected ?

Volume 5

6. According to section 2.2.2 and 4.2.2 of the guidelines, the environmental impact statement should address the effects on recreation. When asked about how the Romaine would remain a challenging canoe route, the proponent referred to section 35.2.3 of the EIS, which admits that whitewater sections of the river will be lost. In addressing the issue, the proponent states that there are 25 other rivers (according to the FQCK) on the North Shore that can satisfy the needs of canoeists. How many of these rivers are already dammed ?

Volume 7

- 7a. Section 17 is a detailed investigation of the current and future water temperature regimes, with the proponent explaining that water temperature is very important for the timing of fish reproduction. Why didn't the proponent investigate the effects of climate change on water temperature in section 49.2 ?
- 7b. In section [49.1.1.2](#) of the EIS, the proponent recognizes the Boreal Forest as a carbon sink. When responding to questions regarding the loss of this important carbon sink, the proponent states that during a forest's life cycle of 100-150 years, the boreal forest emits as much carbon as it absorbs (as a result of tree death, fire, insect infestation, decomposition etc.). How did the proponent measure the life cycle of the forest in this particular region of Quebec ?

Detailed questions regarding responses to Alliance Romaine's initial concerns :

Greenhouse Gas (GHG) Emissions

Hydro Quebec's response to question P-004; Questions and comments from Environment Canada, CA-163 to CA-165 (in response to P-004)

- 8a Reservoir surface emissions (diffusive and bubbling fluxes) – Methane and CO₂

For example, scientists at the Canadian Government's Freshwater Research Institute have investigated several hydroelectric reservoirs in Northern Canada to produce the first detailed calculations of GHG emissions. At one site it was estimated that annual production of methane was more than 7 grams per square meter of reservoir surface. In another study on flooded peat bog, it was estimated that each year, up to 30 grams of methane and between 450 and 1800 grams of CO₂ were emitted per square meter of reservoir surface.

GHG emissions over the 50 year productive life expectancy of a hydro-electric reservoir were calculated. It was estimated that about two thirds of labile carbon in flooded vegetation and soils would decompose over that period; up to 10% of this carbon would be released as methane with the remainder as CO₂. Averaged over the 50 year life expectancy, it was estimated that each square metre of a typical reservoir in Northern Canada will emit between 400 and 700 grams GHGs (CO₂ equivalents) per year – the higher figures corresponding to those reservoirs where peat bog dominates. For the 1200 km² Cedar lake reservoir in Northern Manitoba, it was estimated that GHG emissions over the 50 years could be similar to a coal-fired power station of equivalent capacity.

Can the proponent account for the apparent differences in GHG emissions (methane, CO₂) in the examples they provide for hydro-electric reservoirs in boreal regions of Quebec relative to those in other parts of Northern Canada ?

- 8b. Has the Proponent made estimates of annual GHG emissions from SM3, since impoundment, which could be used as a reference point for the Romaine ?
- 8c. Has the proponent assessed GHG emissions from the Romaine watershed prior to construction ?

References:

1. Pearce F. 1996. Trouble bubbles for hydropower. New Scientist (May issue) <http://www.newscientist.com/article/mg15020283.500-trouble-bubbles-for-hydropower--from-china-to-norway-new-hydroelectric-schemes-are-supposed-to-help-cutemissions-of-greenhouse-gases-but-will-they-itfred-pearceit-investigates.html>
2. R.A. Bodaly, et al. "Experimenting with hydroelectric reservoirs." Environmental Science & Technology 38 (2004): 347A-352.
3. VL St.Louis, CA Kelly, E Duchemin, JWM Rudd and DM Rosenberg.2000 "Reservoir surfaces as sources of greenhouse gases to the atmosphere: A global estimate." BioScience 50: 766-775.
4. VL St.Louis, AD Partridge, CA Kelly and JWM Rudd. "Mineralization rates of peat from eroding peat islands in reservoirs." Biogeochemistry 64 (2003): 97-110.
5. E Duchemin, M Lucotte, VL St.Louis and R Canuel. "Hydroelectric reservoirs as an anthropogenic source of greenhouse gases." World Resource Review 14 (2002): 334-353.
6. CA Kelly, JWM Rudd, VL St.Louis and T Moore. "Turning attention to reservoir surfaces, a neglected area in greenhouse studies." EOS 75 (1994): 332-333.
7. Rudd, J.W.M., R., Harris, C.A. Kelly and R.E. Hecky. 1993. Are hydroelectric reservoirs significant sources of greenhouse gases? Ambio 22(4): 246-248.
8. World Commission on Dams, 2000. Does Hydropower Reduce Greenhouse Gas Emissions? http://www.dams.org/news_events/press357.htm

Temporal variation in Reservoir GHG emissions

9. Does the proponent plan on doing follow up studies on temporal variation in reservoir GHG (CO₂ and methane) emissions ?

GHG emissions (degassing fluxes) from turbines, spillways and associated structures

10. Has the proponent done any studies on degassing fluxes of methane from reservoirs in Quebec to assess their potential contribution to overall emissions ?

Indirect GHG Emissions

11. The United Nations Intergovernmental Panel on Climate Change (IPCC) recommends accounting for direct and indirect GHG emissions attributable to mega projects such as the Romaine complex.

Does the proponent endorse the recommendations of the IPCC ?

Impacts on the productivity of the marine ecosystem - Fisheries, marine birds and mammals (whales) in the zone of the river-mouth and Mingan Archipelago

- 12a) The proponent responds to question **P-005** by indicating that simulations (NPZ modelling?) were used to predict that there would be little influence on primary production by the proposed hydrological alterations to the Romaine. According to DFO experts (**CA-085**), NPZ modelling is used to simulate overall phytoplankton production in relation to physical alterations in the environment. We would therefore like to know if the NPZ model used by the Proponent is capable of **1**) predicting qualitative changes in the species composition of phytoplankton populations (i.e. diatoms relative to non-siliceous species) and, **2**) whether significant reductions in riverine silicate inputs were factored into the model ?

References :

1. Ittekkot et al. 2000. Hydrological alterations and marine biogeochemistry: A silicate issue? *Bioscience* 50:776-782.
2. Treguer et al. 1995. The silica balance in the world ocean: A re-estimate. *Science*. 268:375-379.

Supplementary Question – Primary Production

- 12b) We are concerned that significant alterations in river flow regime will not only cause an overall reduction of nutrient inputs (mineral and organic - dissolved and particulate) to the river mouth zone in spring but also lead to a loss of buoyancy flux (caused by reduced freshwater inputs) and the stable layer (stratification) that is essential for high primary productivity in the coastal zone. (See also comment **CA-084** by DFO regarding organic matter inputs)

Has the proponent considered the impacts of these factors on primary production (particularly the potential loss of buoyancy flux in spring) in the NPZ simulations ?

Secondary productivity and potential impact on Whales.

Comment CA-085 by DFO

- 12c) In this regard, we refer to comment **CA-085** in which DFO points out that the Proponent's assumption that the megaproject will not affect the zooplankton prey (i.e. **krill**) of Baleen Whales is not valid because the NPZ simulation model can only be used to simulate primary production and cannot be extrapolated to secondary production (zooplankton).

Has the Proponent done alternative follow up studies to assess the impacts of the megaproject on secondary (zooplankton) production and by extension the potential impacts on Whales, Fisheries, animals, and birds? If so, what were the results ?

Impacts on freshwater quality

- 13a. In a Bulletin by Hydro Quebec (1), it was stated that the filling of the nearby River Sainte Marguerite 3 (SM3) Reservoir in about 1998, caused certain metals (unspecified) to become elevated to toxic levels in a down-stream reservoir. This rendered the water unfit to drink. Bottled water was distributed to affected users. Clarke City which drew water from the affected reservoir was connected to a new supply of drinking water in Sept Iles.

Has the Proponent considered measures to mitigate for a potential significant deterioration in freshwater quality following impoundment of the Romaine, similar to that experienced for SM3 ?

- 13b Increased salinity of the drinking water was encountered by the Inuit of Kuujjuaq at the mouth of the Koksoak River following impoundment of the Caniapiscou River in 1982 to fill the Caniapiscou Reservoir.

We are concerned that the large scale hydrological alterations proposed for the Romaine could cause a lowering of the water table at the mouth of the river (see Question 4 below), thereby affecting the quality of the drinking water of Havre St Pierre that is currently pumped from ground water.

Does the Proponent have any contingency plans in the event of such an occurrence ?

References:

1. Construction of the Sainte Marguerite Hydro-Electric Development. 1994 -2000. Environmental Highlights. Hydro-Quebec Bulletin.
2. Freidl and Wuest. 2002. Disrupting biogeochemical cycles - Consequences of damming. Aquatic Science 64: 55-65
3. Rosenburg et al.1997 Large-scale impacts of hydroelectric development. Environ Rev. 5: 27-54

Biodiversity: Potential impacts on the coastal wetland complex at the mouth of the River Romaine

14. The peat / wetland complex at the mouth of the Romaine River has been identified as an area in need protection under Environment Canada's conservation plan to protect the biodiversity of the St. Lawrence. This area is known for its rare biotypes.

Has the proponent considered measures to safeguard the ecological integrity of the wetland complex at the mouth of the Romaine River ?

Reference :

Protecting the biodiversity of the St. Lawrence: Conservation plan. Environment Canada
http://www.qc.ec.gc.ca/faune/biodiv/en/sites/conserv_plan.html

Reservoir Induced Seismicity (earthquakes)

15a Reservoir induced earthquakes occurred after the filling of the Manicougan (Manic 3), Toulnostouc and Sainte Marguerite River (SM3) reservoirs (1). Globally, more than 90 earthquakes have been triggered by the filling of reservoirs. The largest and most damaging earthquake triggered by a reservoir was in 1967 in Koyna, India: the magnitude of the earthquake was a 6.3. Depth of water (> 80 metres) is considered to be the most important factor in reservoir induced earthquakes (2, 3).

In view of the fact that reservoirs proposed for the Romaine exceed 80 metres in depth, what is the probability of the occurrence of an induced earthquake of 6.3 or greater ?

15b Has the proponent made any contingency plans in the event of such an occurrence, particularly with regard to potential effects on the structural integrity of older dams in the region ?

References:

1. Lamontagne, et al. 2006. Reservoir-induced earthquakes at Sainte-Marguerite-3, Quebec, Canada. *Can. J. Earth Sci.* 43: 135–146
 2. Baecher and Keeney 1982. Statistical examination of reservoir-induced seismicity. *Bulletin of the Seismological Society of America.* 72: 553-569
 3. Earthquakes Caused by Dams: 'Reservoir-Triggered/Induced Seismicity' 2008. <http://www.probeinternational.org/files/dam%20triggeredeearthquakes>
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