Publics Services and Procurement Canada

Timiskaming Dam-Bridge of Quebec Replacement Project (Quebec)

Environmental Impact Statement
PART E – Other effects
Chapter 16 Effects of the Environment on the Project

TETRA TECH

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PUBLIC SERVICES AND PROCUREMENT CANADA

Environmental Impact Statement
Timiskaming Dam-Bridge of Quebec Replacement Project (Quebec)

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TETRA TECH

REVISIONS

Revision nº	Description	Date	By
00	Preliminary Report - Version for comments	March 2022	JR
01	Final Draft – Version for comments	June 2022	JR
02	EIS – Version for the Impact Assessment Agency Review	September 2022	JR
03	EIS – Second Version for the Impact Assessment Agency Review	February 2023	JR

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PART E - OTHER EFFECTS

16 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This chapter describes how local conditions and natural hazards could affect the Project and result in impacts on the environment. The effects of climate change on the lifetime of the Project will also be addressed. In general, these potential risks were taken into account in the dam design. Risks that could not be incorporated into the design are monitored over time, and an emergency plan is in place to address them.

16.1 PROJECTED CLIMATE CHANGE

Ouranos (2015) has modelled future climate change scenarios for various parameters based on a moderate emissions scenario (assumes that GHG emissions will stabilize by the end of the century) and a high emissions scenario (assumes that GHG emissions will increase through to the end of the century). The data are presented by horizon period, using 1981–2010 as a reference period, a 2050 horizon (2041–2070), and a 2080 horizon (2071–2100). Since the lifespan of the dam is 75 years (until 2103), only the data for the 2080 horizon (2071–2100) have been presented (Table 16.1). The Project is located in the southern sector, based on the analysis framework used by Ouranos researchers (2015).

Temperature and precipitation are the main parameters that can influence the Project environment, e.g. changes in flows related to climate change. The main findings presented by the Ouranos report in this regard are as follows:

- Temperatures show an upward trend for the 1950–2011 observation period across all regions in Quebec. Upward trends of between 1°C and 3°C in mean annual temperatures were observed in all regions over this same period;
- Mean temperature trends are consistent with the minimum and maximum temperature trends. Since 1960, there has been an increase in the minimum and maximum temperatures;
- For the 2071–2100 horizon, there will be an increase of about 5°C–6°C in daily maximum temperatures and a warming of about 5°C in daily maximum temperatures in winter (Table 16.1);
- Daily minimum temperatures will be higher (and therefore, warmer) by about 5°C–6°C annually and by up to 9°C in winter. The number of days when the temperature will be lower than -25°C will also decrease from 30 to 5 days, based on the high emissions scenario for the 2071–2100 horizon.

With respect to precipitation, which can affect hydraulic conditions in the river, Ouranos projects the following trends for the 2071–2100 horizon (Table 16.1):

- During the 1981–2010 period, the largest amount of liquid precipitation (rain) occurred in summer (294 mm) with less in the fall (221 mm). For the 2071–2100 horizon, summer precipitation remains more or less stable (296 mm), but autumn rainfall will increase slightly (264 mm). A more pronounced increase in spring rainfall (200 mm) has been noted, which indirectly results in less snow precipitation due to projected increases in temperatures during this period;
- Annual snowfall is expected to decline, decreasing from 242 mm for 1981–2010 to 201 mm for 2071–2100. The sharpest declines will be in spring and autumn.

Table 16.1 General Temperature Indices for the Abitibi-Témiscamingue Region (Southern Region)

		1981–2010 period	2071–2100 Period		Trend
			Moderate emissions scenario	High emissions scenario	
Mean daily maximum temperatures (°C)	Annually	7.9	10.8 (9.2 to 11.7)	13.4 (11.5 to 14.5)	↑
	Winter	-7.9	-5.0 (-6.2 to -3.9)	-2.6 (-4.0 to -1.0)	↑
	Spring	7.9	10.2 (8.9 to 11.6)	11.9 (11.0 to 13.8)	↑
	Summer	22.6	25.6 (24.4 to 26.3)	28.6 (26.6 to 30.2)	↑
	Fall	8.7	11.7 (9.9 to 12.5)	14.2 (12.5 to 15.7)	↑
Mean daily minimum temperatures (°C)	Annually	-3.7	-0.8 (-1.5 to 0.7)	2.5 (1.1 to 3.7)	↑
	Winter	-20.0	-15.5 (-16.6 to -13.7)	-11.1 (-12.4 to -9.1)	↑
	Spring	-5.1	-2.3 (-3.1 to -0.9)	0.3 (-0.7 to -1.6)	↑
	Summer	9.9	12.5 (11.5 to 13.6)	15.4 (13.8 to 17.1)	↑
	Fall	-0.1	2.9 (1.2 to 3.6)	5.5 (3.0 to 6.5)	↑
Number of days < -25°C (days)	Winter	30.2	14.7 (10.4 to 19.6)	5.0 (1.3 to 8.4)	↓
Maximum accumulated precipitation over 5 days (mm)	Annually	61	68 (66 to 72)	71 (68 to 74)	↑
	April to September	59	64 (63 to 69)	67 (63 to 69)	↑
Total liquid precipitation (mm)	Annually	674	760 (718 to 808)	822 (784 to 873)	↑
	Winter	19	34 (29 to 52)	67 (49 to 96)	↑
	Spring	138	177 (159 to 188)	200 (178 to 215)	↑
	Summer	294	301 (276 to 325)	296 (256 to 306)	↑
	Fall	221	254 (230 to 277)	264 (240 to 287)	↑
Total solid precipitation (mm)	Annually	242	226 (213 to 240)	201 (184 to 225)	↓
	Winter	150	157 (152 to 164)	153 (143 to 165)	↑
	Spring	49	38 (35 to 53)	34 (23 to 45)	↓
	Summer	0	0 (0 to 0)	0 (0 to 0)	-
	Fall	42	28 (18 to 32)	14 (6 to 22)	↓

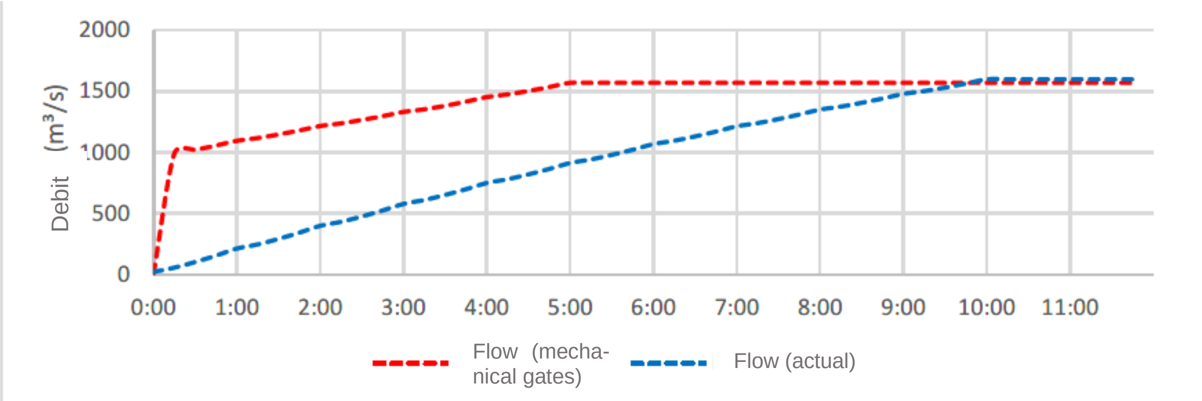
Source: Climate Portraits (ouranos.ca) (French only)

16.2 Local Conditions and Natural Hazards that could Affect the Project and Result in Environmental Effects

16.2.1 Hydraulic Conditions (Heavy Rains, Extreme Flooding, Flow Conditions)

In general, total liquid precipitation will increase, particularly in springtime and, to a lesser degree, in summer. Solid precipitation (snow) remains fairly stable throughout the winter, but there is a slight decline in autumn and spring. The amount of annual snowfall is likely to be lower than at present. Winter, as well as autumn and spring, will be warmer.

The design of the dam is in accordance with the Canadian Dam Association Dam Safety Guidelines, which specify that the design flood used in design calculations must be 1,000 years plus 1/3 of the maximum probable flood (MPF). The dam design also takes into account climate change. The 1,000-year flood flow is 5,281.8 m^3/s, while the design flow is 6,532.5 m^3/s (see Chapter 9), which will help manage additional flows and intense rainfall events associated with climate change. The use of mechanized gates instead of wooden stop logs (the system currently in use) also provides a better responsiveness to particular events (30 minutes to reach a flow of 1,000 m^3/s instead of 5 hours – see figure below). Note that generators are on site in case of power failure.



16.2.2 Drought

Liquid precipitation in summer will remain fairly similar under the two scenarios prepared by Ouranos. This should allow summer water levels to be maintained at levels close to the current situation using essentially the same management approach—especially since liquid precipitation in spring will increase slightly, which makes it possible to store water during this time to mitigate potential summer droughts.

16.2.3 Ice Jams

The study area is not located in an area that is prone to ice jams. Ice cover is absent just upstream of the dam and only begins to form some 12 km farther upstream. However, the design of the piers takes into account transverse ice loads. Increases in temperature could reduce the extent of the ice cover or its thickness. At present, ice jams do not affect the Project and are not expected to do so in the future.

16.2.4 Landslides, Avalanches, Erosion, Subsidence

The study area is not prone to avalanches or landslides and subsidence. The banks downstream of the dam, where current velocities are higher, are primarily composed of riprap to ensure bank stability and prevent erosion. To date, no signs of erosion have been observed in the immediate vicinity of the dam where construction will take place. The Project also includes stabilizing the banks using erosion-resistant materials. Lastly, a concrete slab has been constructed downstream of the dam to reduce current velocity and limit erosion of the riverbed.

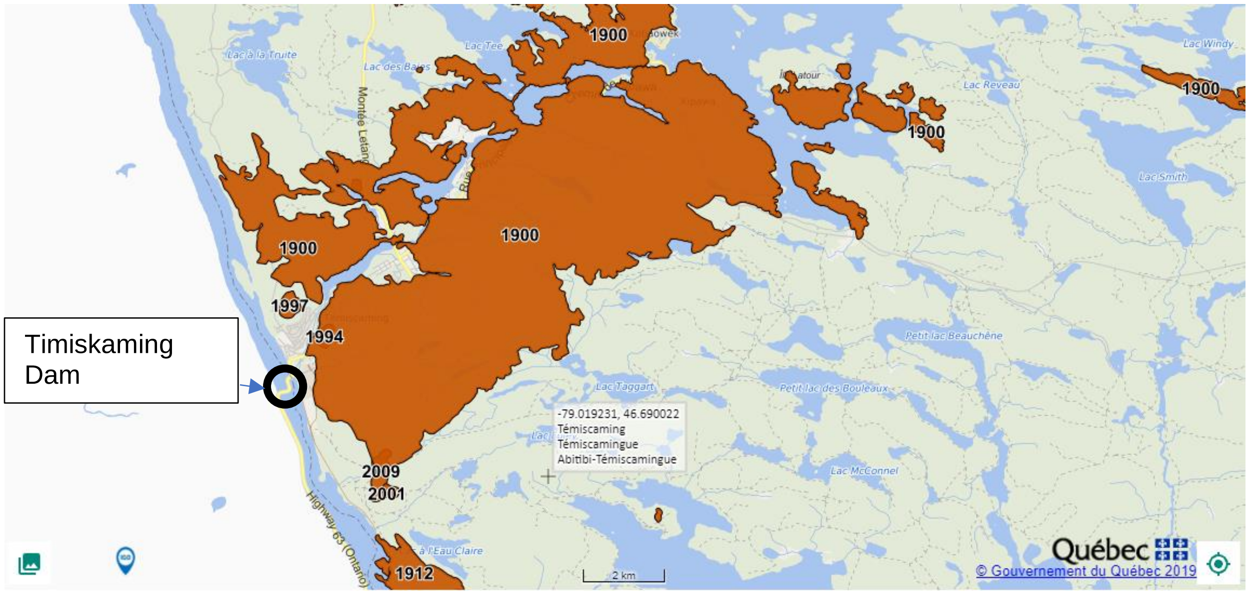
16.2.5 Fire – Forest Fires

Forest fires are relatively rare in the Timiskaming Dam Complex region. The largest forest fire occurred in 1900 in the northeast and affected 5,524 ha. Also in 1900, a second fire just north of the town of Temiscaming affected 568 ha. In 1912, a little to the south, an area of 281 ha burned. More recently, small areas of generally less than 20 ha burned around Temiscaming in 1994, 1997, 2001 and 2009 (Figure 16.1). On the Ontario side, the area does not appear to be prone to forest fires, according to the federal data compilation (Figure 16.2).

However, the area is not immune to future forest fires. The main impacts of a fire on the Project would be that operators would be unable to access the site for a given period of time and that the opening and closing of the gates could not be adjusted, as these systems are operated manually. Because the dam and the various related components are not very susceptible to damage (the dam being made of concrete, and the other components, of steel or metal), the risk of fires affecting such infrastructure is low.

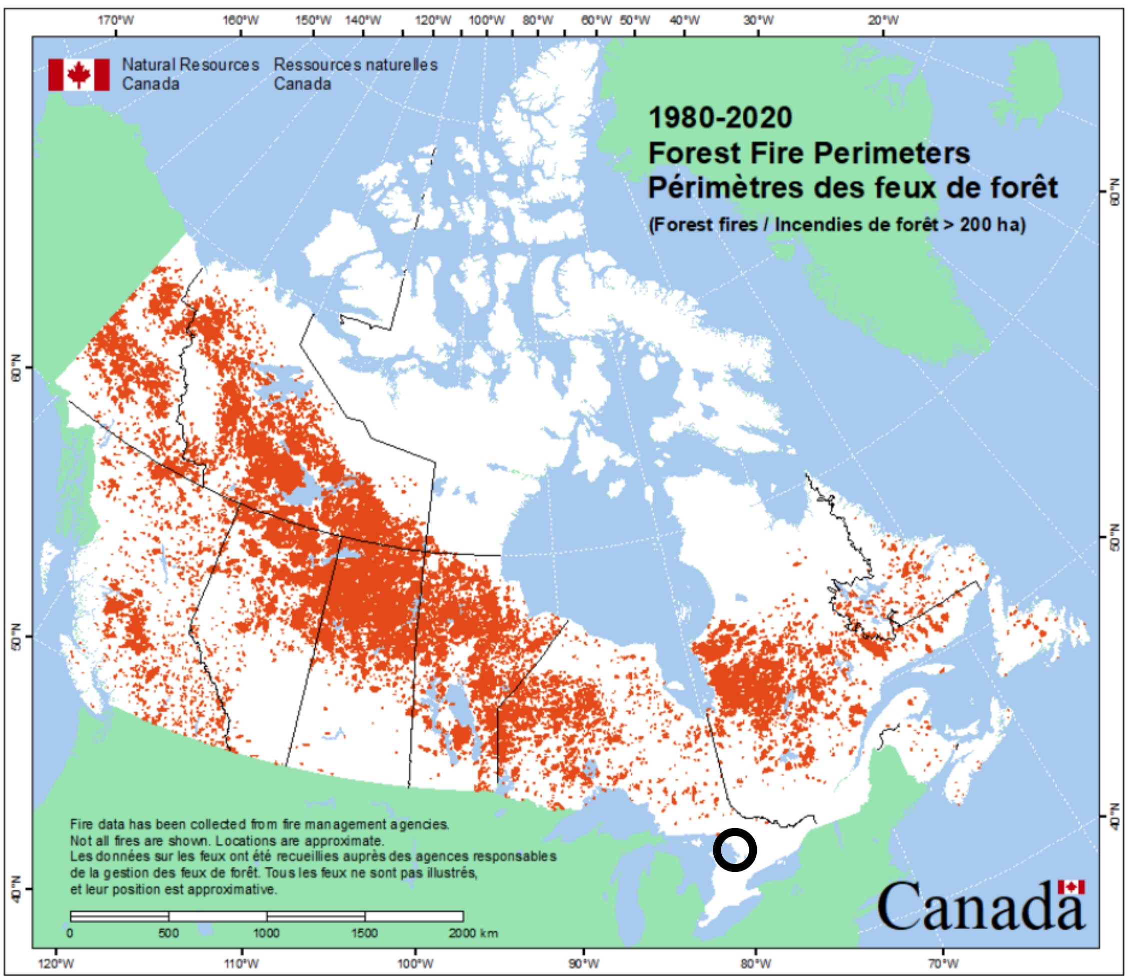
In the event of a fire affecting only the dam’s operating facilities, the emergency response plan (ERP) sets out response procedures for containing the fire so that it will not damage the various types of equipment.

Figure 16.1 Historical Forest Fires in Quebec in the Timiskaming Dam region



Source : [Forest fires - Forêt ouverte - Données Québec (donneesquebec.ca, French only)]

Figure 16.2 Historical Forest Fires in Canada



Source: [Canadian Wildland Fire Information System | Canadian National Fire Database (CNFDB) (nrcan.gc.ca)]

16.2.6 Seismic Events

The dam is located in an area of high seismic activity. The design values outlined in the *National Building Code of Canada 2015* for earthquakes have been used to design the dam structures to ensure that the dam is able to withstand potential earthquakes in the region.

Should there be a seismic event greater than what is addressed by the code, a dam failure could occur. This would be similar to any other breach resulting in dam failure, producing a "wave of water" that could cause downstream flooding. An emergency response plan is currently in place for such situations (see Chapter 15). However, the small difference in water level between the upstream and downstream areas during most of the year minimizes the impact of such a situation.

16.3 Effects of Climate Change on the Project

16.3.1 During Construction

During Phase 1 of construction (July to December of Year 1, six months), it is expected that all flows will pass through the Ontario dam, while the Quebec dam will be completely closed by a rockfill cofferdam. The Ontario dam is capable of managing flows of up to 1,940 m^3/s. Construction is scheduled to begin during lower-energy flow conditions in the river (outside of the freshet period), which limits the risks of exceeding the flow that can pass through the dam on the Ontario side. During this time, it would also be possible to store part of the flow in the lake, within expected water levels, as required. An emergency plan will be prepared by the contractor (and submitted to PSPC for approval) to determine the actions to be taken in the event that the Quebec dam needs to be opened during Phase 1 to manage exceptional flows. This plan must make it possible to respond within 24 to 48 hours. It must include evacuation of the construction site (removal of all materials and equipment), withdrawing of the cofferdam, and the reopening of the Quebec dam. The emergency plan will also be supervised by PSPC based on the hydrological forecasts and recommendations from the Ottawa River Regulation Planning Board.

During Phases 2 and 3, it is expected that flows will pass through the Ontario dam and the half of the Quebec dam that will have had its underwater structures completed. The other half of the Quebec dam will be closed by a sheet pile cofferdam. Phases 2 and 3 will span the entirety of Year 2 (January to December). The flow that can pass through the two open sections of the Ontario and Quebec dams is around 2,733 m^3/s. The same measure as in Phase 1 (an emergency plan that can be implemented by the contractor within 24 to 48 hours) will also be put in place.

During Phase 4, the situation will be similar as in Phase 1, as the new dam will be closed and used as a cofferdam. Phase 4 will take place from January to October of Year 3. In January and February, testing will be conducted to ensure that the gates function properly, and the dam will be fully operational in time for the spring freshet. The contractor will resume work around mid-July, after the spawning period and the freshet have passed, to demolish the existing dam and it's during this last period that the Quebec dam will be closed. The demolition should be completed by October. Nonetheless, an emergency plan will also be in place to address exceptional situations.

16.3.2 During Operation (75 years)

During the period of operation, climate change is likely to cause a slight increase in maximum accumulated precipitation over 5 days (Table 16.1). Total annual liquid precipitation will also increase, with the greatest increases anticipated in spring and autumn. The design of the dam discharge capacity takes into account climate change, and the dam can continue being managed to maintain forecast water levels in Lake Timiskaming and limit downstream flooding.

16.3.3 Upon Project Closure

The dam is not scheduled to be dismantled at the end of its useful life in 75 years. At that time, the situation will be assessed, and the required environmental studies will be carried out using the latest climate data.