Ponts
JACQUES CARTIER +
CHAMPLAIN
Bridges
Canada

Parsons
Tetra Tech
Amec Foster Wheeler

Deconstruction of the Existing Champlain Bridge

Targeted Environmental Analysis

Summary

April 2019
Contract No 62555

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(2017-2022)

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The Targeted Environmental Analysis (TEA) for the deconstruction of the original Champlain Bridge is part of the same initiative as the 2013 Environmental Assessment (EA 2013) carried out by Transport Canada. EA 2013pertained to both the construction of the New Bridge and the deconstruction of the original bridge. The federal crown corporation The Jacques Cartier and Champlain Bridges Incorporated is the project developer for the deconstruction of the original bridge.

This TEA assesses the effects of the other possible deconstruction methods and determines whether the mitigation measures and the objectives stated in the 2013 EA are still appropriate. It also suggests new measures and objectives, as well as improvements to the current ones (if required) based on best practices in 2019 and the lessons learned from the construction of the New Bridge. Furthermore, the TEA will provide the information needed to obtain the permits required under the Fisheries Act and the Navigation Protection Act, respectively issued by Fisheries and Oceans Canada (DFO) and Transport Canada (TC).

Since the project will be carried out using a design-build delivery method, the project description presented below is only tentative and presents the work methods that may be used by the contractor for deconstruction. The impacts are assessed based on these various options and mitigation measures are proposed to limit the environmental effects of the works. The contract binding contractor will include these mitigation measures in the form of performance objectives to be met during the design and execution of the works.

This preliminary report was prepared so that the responsible authorities (DFO and TC) can carry out a preliminary assessment. It will also serve as a tool during consultations that will be held in spring 2019. Following the comments by the responsible authorities, the public and the aboriginal communities involved, a final version of this report will be prepared. The responsible authorities will then have the relevant information to confirm that EA 2013, pertaining to the entire project — including the deconstruction of the Existing Champlain Bridge— is still applicable and valid given that mitigation measures will be proposed or modified.

Why is a targeted environmental analysis needed?

From a legislation enforcement standpoint, the 2013 Environmental Assessment (EA 2013) included the deconstruction of the original Champlain Bridge. However, to obtain certainpermits, namely from the DFO (under the Fisheries Act for serious harm to fish) and from TC (Navigation Protection Act), an update to EA 2013 is recommended. Since Infrastructure Canada had already conducted a targeted environmental analysis (TEA) in 2015 for the New Bridge project when updating fish habitat encroachment areas. Subsequent to consultations with the Canadian Environmental Assessment Agency (CEAA) and the responsible authorities (DFO and TC), JCCBI decided to use the same approach. This will allow JCCBI to ensure that best practices in the area of environmental protection are used for the deconstruction project, given the context where sustainable development has become a priority for governments and society.

This approach will also enable JCCBI to benefit from the lessons learned during the construction of the New Bridge and to optimize environmental protection measures, namely by considering existing data gathered through various studies since 2013 and the acquisition of additional data on the project and on the environment specifically for the needs of the project. The project components remain the same (deconstruction); however, JCCBI broadened the reviewed environmental components to add enhanced and updated mitigation measures for all the elements likely to be affected, where applicable.

What parts of the bridge have to be deconstructed?

The bridge consists of three sections (5, 6 and 7). Sections 5 and 7 consist of concrete spans consisting of seven prefabricated girders with a middle slab. Section 6 consists of steel trusses, the longest of which crosses over the Seaway. The bridge deck sits on reinforced-concrete piers. The materials that will result from the deconstruction consist of 250,000 tonnes of concrete, 25,000 tonnes of steel and 12,000 tonnes of asphalt.

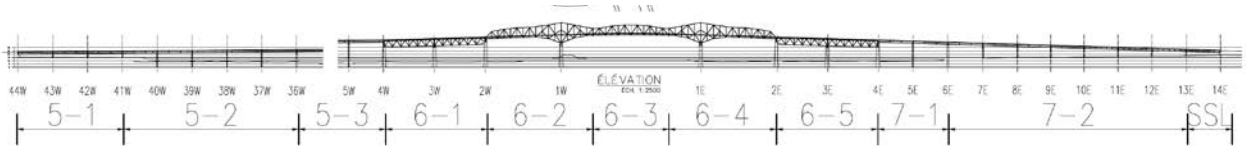


Figure 1 – Champlain Bridge – Areas

What method will be used for the deconstruction of the original Champlain Bridge?

There are several possible methods for deconstructing the various parts of the original bridge. The 2013 Environmental Assessment stated that the concrete spans and piers would be sawed and the steel spans deconstructed. These elements would then be recovered using barges, transported to land, cut into smaller pieces that can be transported by truck, and taken to landfill, recovery or reuse sites.

In 2017, the Consortium of Parsons, Tetra Tech, Amec Foster Wheeler (PTA) studied the various possible deconstruction methods based on the different types of bridge structures and access options (on land, jetty, by water using barges). These methods were reviewed in the TEA. Unlaunching could be used for the concrete deck,[1] but conventional options (hydraulic and pneumatic hammers, shear-type concrete breaker (jaws)) or a crane are also possible. For the steel deck, the cantilever or dehoisting methods are an option, depending on the deck section, but the reverse construction method could also be used. For the piers (pier caps, pier shafts and footings), conventional methods using cofferdams and sawing are possible, depending on the bridge sections involved. JCCBI prohibits the use of controlled explosion[1]. However, use of this method for the footings is discussed and assessed in the TEA.

[1] Unlaunching: Launching is an operation that consists in horizontally sliding a bridge element under construction over the future piers and have it placed in its final position with the launching gantry. Unlauching is the reverse operation used to deconstruct the bridge.
Dehoisting: this operation consists in using cables to lower a complete bridge section onto barges or to the ground. Removing this section must not compromise the stability of the remaining structure. This operation is usually performed on the suspended span of a cantilever bridge.
Reverse erection: The same steps are used as when erecting the structure, but in reverse in order to deconstruct it.
Controlled explosion (instead of blasting): Explosives are placed at strategic locations of the element to be demolished in order to control the explosion, for the purpose of protecting the surrounding area (for the safety of people and property as well as of the environment).

Summary of possible deconstruction scenarios

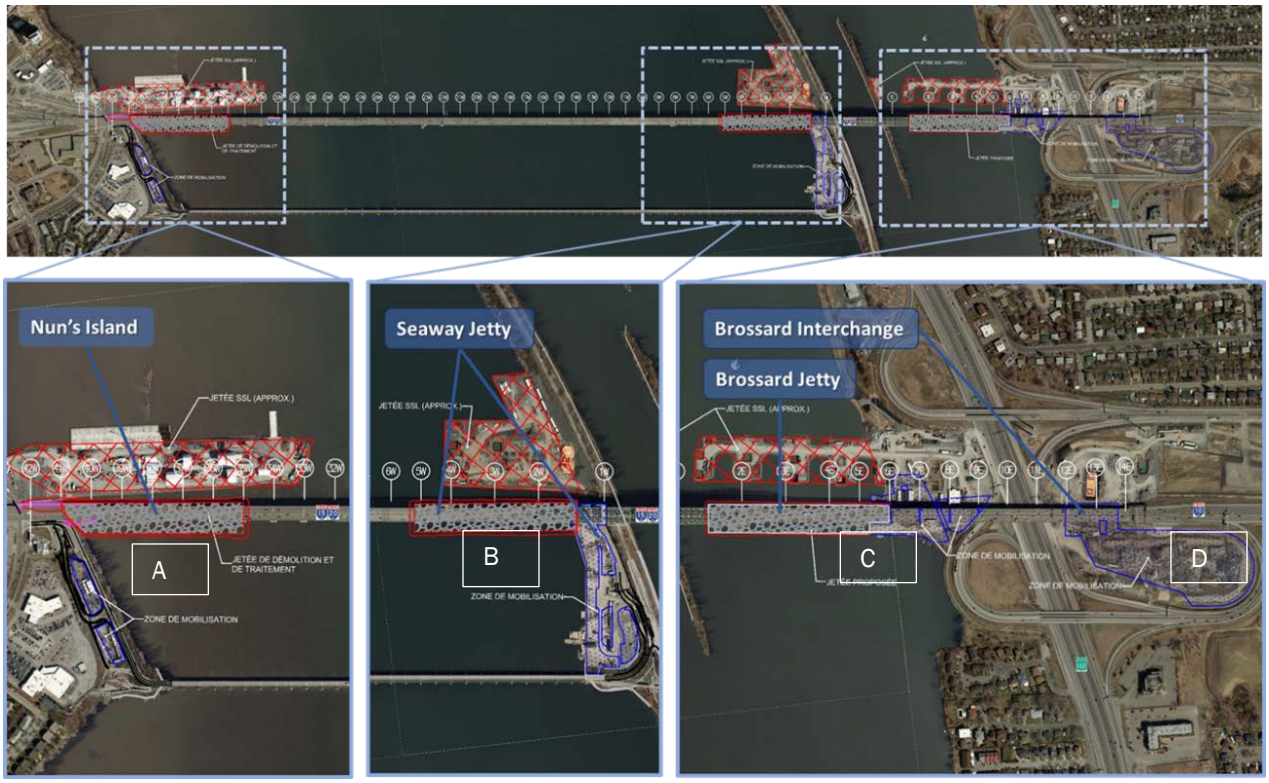
AREA	CONCRETE DECK			STEEL DECK			PIER CAPS AND PIER SHAFTS		FOOTINGS		
	Standard	Unlaunching	Crane	Reverse erection	Cranes	Hoisting	Standard	Sawing	Standard	Standard with cofferdam	Controlled explosion*
5-1											
5-2											
5-3											X
6-1				X							
6-2				X					X (pier 1W)		
6-3				X							
6-4				X							
6-5				X							
7-1	X (in case of a jetty)						X (in case of a jetty)		X (in case of a jetty)		X
7-2											

* Possible but not allowed by JCCBI

Note :
Black cell: method not suitable for this part of the deconstruction
Blue cell: plausible method
White case: possible method, but less well adapted
Cell marked with an X: possible method, but associated with some constraints

Which sites will be used on land?

Four mobilization sites (A, B, C and D) could be used for deconstruction: one on Nuns' Island, one on the Seaway dike, and two on the Brossard side. At these sites, the materials will be reduced into smaller pieces and then transported by truck or barge to their final disposal site.



Are jetties needed in the water?

Given the shallow water depth under some parts of the bridge, which prevents the barges from using these locations, the contractor may have to build jetties. JCCBI has defined the maximum size of the jetties and mitigation measures will be implemented for the temporary encroachments. Note that the contractor may choose an option other than jetties, such as access by a temporary pier bridge.

The possibility of reusing materials from the New Champlain Bridge jetties is a viable option that is being studied. In a context of sustainable development where cost, the environment and the social component are three aspects to consider in any decision-making, the reuse of materials seems be the preferred option. The reuse of materials allows truck transport mileage to be significantly reduced, which has a major positive impact from an environmental (e.g. reduction in greenhouse gas emissions) and social standpoint (e.g. reduction in transportation-related disturbances for local residents, including dust and noise). The materials originating from the New Bridge jetties would be removed and stored, ideally near the new jetties on JCCBI sites, and would be made available to the contractor responsible for the deconstruction of the bridge. Although reuse of the materials is the preferred option, this solution may not be feasible and the materials may have to come from an external source.

What are the characteristics of the environment in which the project will take place?

Several environmental characterization studies have been conducted since the 2013 Environmental Assessment, and the TEA served to compile relevant information in order to supplement the description of the project's surrounding environment, namely:

- Inventory of biodiversity on JCCBI land;
- Several environmental characterization studies of soil and groundwater;
- Several surveys (air quality, sound environment) in relation to the construction of the New Bridge;
- Bird studies;
- Several bathymetric surveys.

Striped Bass caught in the Champlain Bridge area (AECOM, 2017)

Lake Sturgeon caught in the Champlain Bridge area (AECOM, 2017)

In addition, based on the major concerns that were identified, additional surveys were conducted in 2018, some of which are still under way:

- Sediment characterization;
- Characterization of aquatic habitat (fish habitat, benthic communities, grass beds);
- Contaminants on the structure;
- Bathymetry.

Aquatic survey using divers (PTA, 2018)

With respect to the physical environment, the study area contains soil, sediment and groundwater, all contaminated at different depths. The surface water meets provincial and federal criteria for maintaining aquatic life. Some contaminants are present on the structure of the original bridge, and a detailed characterization is under way to confirm and locate the contaminated areas and propose adequate management methods. Air quality remains a major issue related to the project, due to the anticipated emissions associated with the large quantity of materials to be handled during deconstruction. The detailed characterization of the contaminants found on the structure will allow the issues associated with the management of these materials and contaminants during the works to be properly identified. The ice study was updated to determine whether an effect was noted in relation to climate change; however, no trends have been identified.

With respect to the biological environment, the St. Lawrence (Lesser and Greater La Prairie basins) is a habitat with a rich biodiversity. Several status wildlife and plant species, including the Brown Snake and Peregrine Falcon, are found in it. There is a major Cliff Swallow colony on the Champlain Bridge, in addition to the Couvée Islands migratory bird sanctuary, which will have to be protected during the works. Lastly, fish habitats qualified as sensitive are found and temporary encroachments associated with the presence of jetties will have to be compensated by one or more mitigation projects.

Cliff Swallow using the beams for nesting

With respect to the human environment, several areas sensitive to increases in noise levels are found near the work sites, and this aspect is a major issue for local residents. There is a major network of bicycle paths around the project. There are no known archaeological sites in the deconstruction work area. The Aboriginal community of Kahnawake is located a dozen kilometres southwest of the original bridge. There is no commercial fishing in the study area; however, there may be recreational fishing over the waterway in general. Regarding commercial shipping, the section of the St. Lawrence in the study area is not suitable for commercial shipping, with the exception of the Seaway, which plays a key role in the North American transportation network.

What are the main environmental issues related to the project?

The project involving the deconstruction of the original Champlain Bridge is located in an urban area and in the busiest highway corridor in Canada; these aspects will have to be taken into account in the planning and execution of the deconstruction work. The work area on land is limited however certain residents situated nearby might be negatively affected by the deconstruction. Inconveniences related to deconstruction work will therefore have to be minimized in terms of noise, dust and traffic.

Given the rich aquatic ecosystem, water quality should be protected and temporary encroachments on the riverbed minimized. The bridge and surrounding area are used by several bird species, and the Cliff Swallow colony nesting on the original bridge is an issue that will be studied closely and will involve compensatory measures favouring their relocation. The Couvée Islands are part of the Migratory Bird Sanctuary and must be protected; no encroachment will be tolerated in this area. Lastly, the project is located at a site where several other projects have been, are or will be carried out, and the cumulative effects are an issue that must be carefully considered.

The main issues are as follows:

- Quality of life (noise, dust, traffic);
- Water quality and fish habitat;
- Migratory birds and protected habitats (Migratory Bird Sanctuary);
- Cumulative effects.

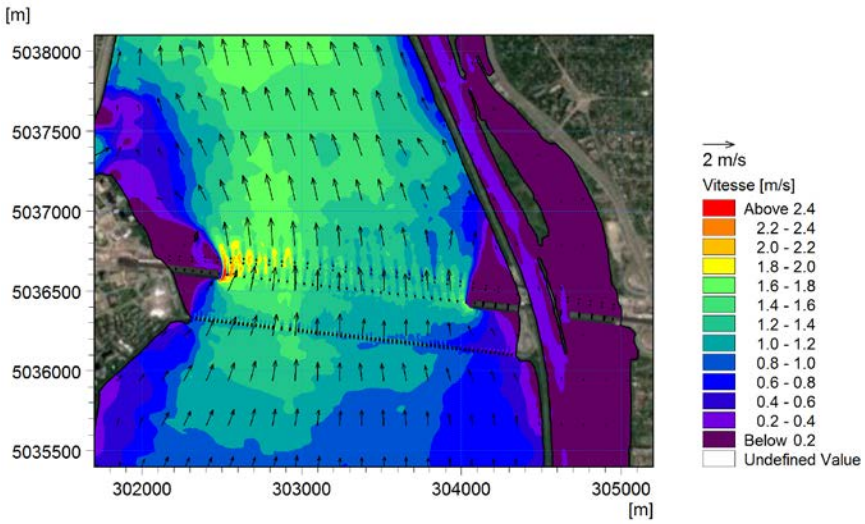
To identify the potential effects of the project, the interrelationships between the different project phases and the environmental components have been determined. For each effect, the significance of the effect was assessed using three parameters: intensity, duration and extent. Detailed analyses were undertaken for some complex effects (hydraulic conditions, traffic, sound environment, air quality, greenhouse gases, quality of life). Mitigation measures were identified to reduce the significance of the effects and ensure that residential effects are insignificant under the *Canadian Environmental Assessment Act,* S.C. 1992, c. 37 (CEAA). The mitigation measures presented in the 2013 Environmental Assessment were reviewed, adapted and enhanced to specifically reflect the deconstruction-related impacts based on the possible methods, and consider 2019 best practices as well as the lessons learned during the construction of the New Champlain Bridge.

To do so, JCCBI held workshops together with experts from Infrastructure Canada, DFO and TC to review all the mitigation measures and performance criteria that were implemented for the construction of the New Bridge, and thus benefit from their experience to increase the environmental protection related to the deconstruction project. To properly refine the mitigation measures, the project impacts were reviewed based on the worst-case scenario, i.e. the scenario using work methods that would potentially generate the greatest impacts.

The section on cumulative effects was also updated to reflect the recent projects that will be carried out at the same time as the deconstruction of the bridge.

The main effects on the physical environment components deal with air quality, soil, groundwater and surface water. The presence of slightly contaminated soil, sediment and groundwater will result in measures having to be implemented to prevent the spread of contaminants into the environment. A traceability system will be implemented to ensure sound management of contaminated soil and groundwater as well as for the large quantities of deconstruction-related materials. Since a large part of the deconstruction work will take place in or near water, several mitigation measures will be required to limit the dispersion of suspended matter and contaminants in the water. Water quality will be monitored for the duration of the work to ensure compliance with the requirements in the TEA.

Simulations of hydraulic conditions were conducted to check the impact of the potential jetties. Lastly, the presence of contaminants on the bridge will require that several measures be implemented to minimize the effects. In terms of air quality, measures will be taken to reduce greenhouse gas (GHG) emissions. GHGs emitted during the works will be compensated and discussions are under way on the compensation of these emissions regarding the type of carbon credit purchase or independent projects. In short, it is deemed that through the application of the proposed mitigation measures, the effects of the project on the physical environment will be made insignificant.

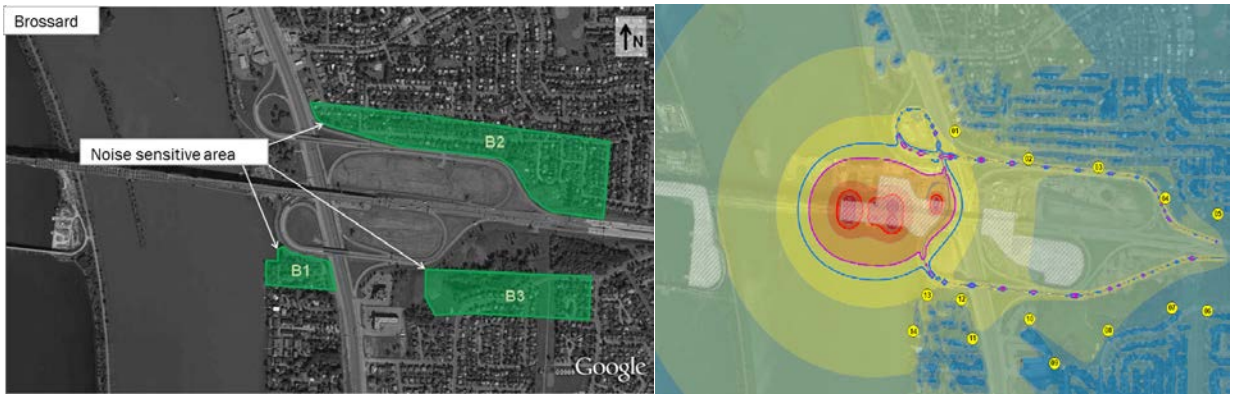


Hydraulic simulation conducted for the detailed assessment of project-related effects – Velocity fields for the flow rate for a 1:100-year flood (13,260 m³/s) – With jetties

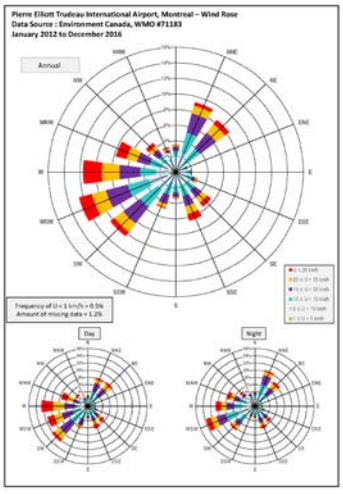
There are anticipated effects on fish habitat, migratory birds and species at risk during deconstruction work. The creation of jetties may disrupt wetlands along the St. Lawrence. Measures will have to be implemented to limit these losses and a compensation project for wetland ecological functions will need to be developed. The project may seriously harm fish habitat. A compensation program for any encroachment in fish habitat is required to mitigate these effects. The search for compensation projects is under way and it involves two types of initiatives. First, there are structures in slow-moving water that can be used by fish, birds and herpetofauna. These types of developments will compensate for the loss of wetland and riverside environments as well as fish habitats in slow-moving water. Second, there will be structures in fast-flowing water to compensate for the habitats of this type of fish affected by the works.

Migratory bird nesting grounds may be disrupted during the works. Restriction periods will be in force to minimize disruptions on birds and fish. To reduce impacts on at-risk species, the Peregrine Falcon nesting site will have to be moved to the New Bridge, while St. Lawrence currents near the jetties must not prevent the migration of the American Eel and other fish species. Fishways will be integrated into the jetties, in keeping with enhanced criteria to ensure they are efficient. Species with a provincial status are also found. Special measures will have to be taken to mitigate effects on the Brown Snake, Lake Sturgeon, American Shad, Chain Pickerel and Rosyface Shiner. Considering the mitigation measures and compensation projects, the environmental effects on the biological environment are deemed insignificant.

Quality of life is mainly affected by three project impacts: sound environment, air quality (dust and contaminants), and traffic (mobility). To properly assess the potential effects on the sound environment, modelling was conducted using specialized software to estimate the levels of noise generated by the work and its impact on sensitive environments. This in-depth assessment enabled the issues to be properly defined and the proposed mitigation measures optimized. It also enabled the definition of a noise management program that will be implemented at the start of the work to ensure compliance with requirements.



To properly assess the effects on air quality, detailed analyses were done on two components: dust emissions generated by the work, and the potential release of contaminants present on the structure. These analyses enabled the proposal of new mitigation measures and the proper definition of an ambient air quality monitoring program.



In terms of mobility, although the daily number of trucks is low compared to total vehicular traffic on these roads, the detailed studies have shown that the fact that the trucks are driving at a reduced speed may increase congestion, especially if they are on the roads during peak hours. A trucking management plan will be developed for traffic management in the areas next to the project, for trucks that are mobilized for the construction phase. Measures that may be included in the plan are: travel outside of peak hours (e.g. between 10 a.m. and 3 p.m. or between 7 p.m. and 5 a.m.), avoiding local roads, and using predetermined routes that avoid residential neighbourhoods.

Truck routes on Nuns' Island, south sector

Routes on Nuns' Island for trucks coming from the South Shore

Some recreational activities may be disrupted, but measures will be put in place to ensure the safety of users and minimize inconveniences. The environmental effects on the human environment have been deemed insignificant and are managed by appropriate mitigation measures.

A Good Neighbourhood Committee or two will be set up to monitor the efficiency of the mitigation measures on quality of life.

The assessment of the project's cumulative effects and environmental effects also showed that the project had no major residual effects. Given that other projects that will be taking place in the area, the contractor will have to prepare a traffic management plan, jointly with JCCBI, that will consider other work sites simultaneously operating in the area. Similarly, the contractor will have to update the noise study with its deconstruction scenario and timetables, while taking the other work sites into account.

How will JCCBI make sure that all of these measures are applied?

About 200 separate mitigation measures have been proposed to mitigate the various effects on the environmental components. To ensure compliance with these environmental requirements, JCCBI shall require the selected contractor to implement an environmental management plan based on ISO 14001:2015. This system will enable monitoring and tracking of the mitigation measures and performance objectives established from the TEA, and will provide accountability. System audits will be conducted regularly by JCCBI.

What will the monitoring and follow-up program that is implemented consist of?

A monitoring program will be implemented by the contractor and audited by JCCBI, and will involve several components, including water quality (compliance with suspended matter criteria), sound environment (compliance with criteria for different times of day), and air quality (compliance with standards for various parameters). If these criteria and standards are not met, the contractor shall be required to implement additional mitigation measures or modify his work methods. The contract shall contain several incentive measures, including penalties. The monitoring program will also cover fish (passage through fishways) as well as other wildlife species, including the birds found on the original bridge. Lastly, JCCBI will simultaneously start up a monitoring program involving the successful outcome of compensation projects for fish habitat and wetlands, the displacement of the Brown Snake and the creation of hibernacula, Peregrine Falcon and Cliff Swallow nests, the state of the habitat around the temporary structures, and vegetation recovery in the areas that will have been restored.

How will temporary encroachments be compensated?

Based on the worst-case scenario, temporary encroachments in fish habitat have been estimated at 6.5 ha, whereas about 0,1 ha of wetlands will be affected. The habitats affected are located mainly in slow-moving water. The approach used for the search for compensation projects involves two types of structures. First, slow-moving water developments will include a wetlands section to compensate for the loss of wetland and riverside environments as well as fish habitats in slow-moving water.

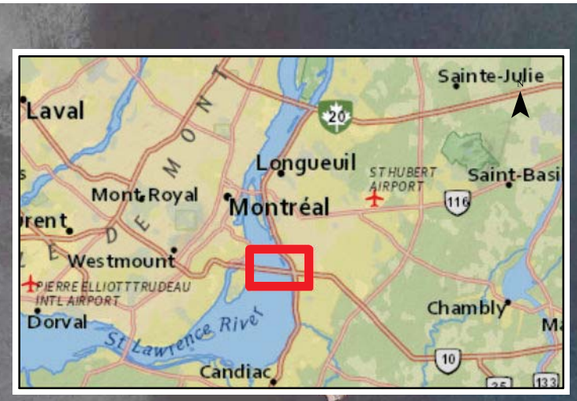
Example of a compensation project in calm water
Photo credit : Infrastructure Canada

These structures can then be used by both fish and herpetofauna. Second, there will be structures in fast-flowing water to compensate for the habitats of this type of fish affected by the works. A few projects have been identified and more detailed surveys are under way. JCCBI will be responsible for building and monitoring these structures.

Among potential projects, JCCBI is proposing to partially dismantle the dock of the ice control structure (belonging to JCCBI). This is a net habitat gain by removing backfill in the immediate area of the original Champlain Bridge (Greater La Prairie Basin). Based on flow conditions that will be present once the dock has been dismantled, this project will enable fast-water habitats to be restored (> 0.3 m/s). Hydraulic simulations are under way and the results will be included in the final version of the TEA. The surface area covered by this initiative is roughly 1 ha. However, its dismantlement is only feasible after the end of deconstruction work on the original Champlain Bridge, since this area is part of the mobilization zones that can be used by the contractor.

How will the community benefit?

In keeping with JCCBI's values, several initiatives are being considered from a sustainable development perspective, including materials reclamation and traceability, development of assets (shoreline development for recreational and commemorative purposes), Envision recognition (measurement system for improving the sustainability of infrastructure projects consisting of five facets: quality of life, project management, resources, ecology and environmental footprint), as well as a research and development program pertaining to certain materials or elements that have been removed from the original bridge.



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(XX) Piers and abutments to be dismantled

Mobilization area

Deconstruction area

Potential jetty

DECONSTRUCTION OF EXISTING
CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

Location of work area

March 2019

Coordinate system: NAD83 MTM 8

Base map: Here Map

Parsons
Tetra Tech
Amec Foster Wheeler

Map 1

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