Study on Flooding in Lake Champlain and the Richelieu River

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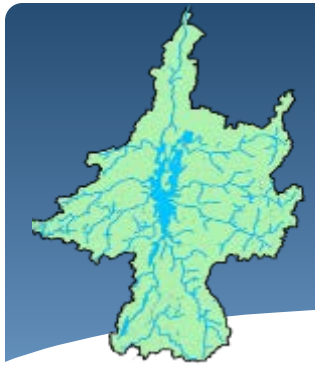
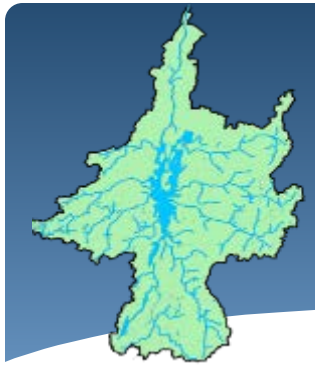
May 20, 2020



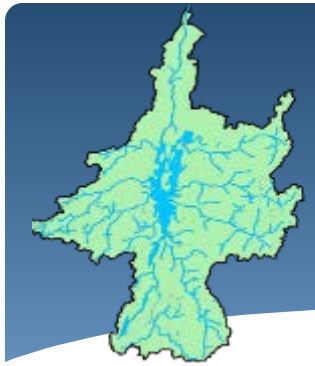
Presentation Outline

- Study Objectives
- Flooding in the Region
- LCRR Study Methodology
- Mitigation Measures Selection Criteria
- Importance of the Saint-Jean Shoal
- Possible Structural and Non-Structural Alternatives
- Consultations in Quebec
- Key Messages
- Q&As



Study Objectives

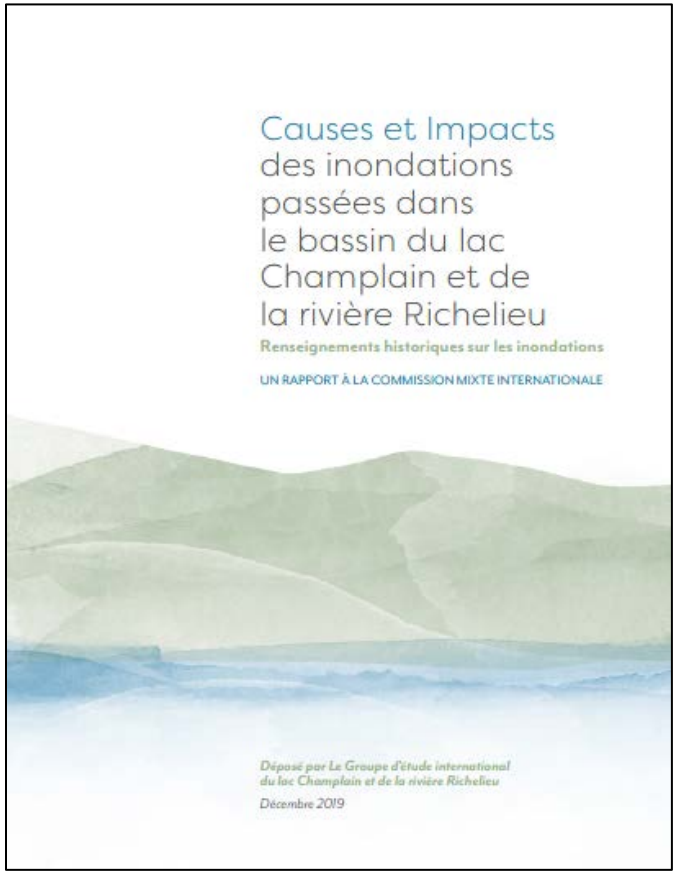
- Determine the causes and impact of Lake Champlain and Richelieu River flooding
- Propose acceptable, viable structural and non-structural mitigation solutions for a range of expected water inflows under various climate conditions
- Develop and make recommendations for implementing a system to forecast floods and to map flood zones in real time



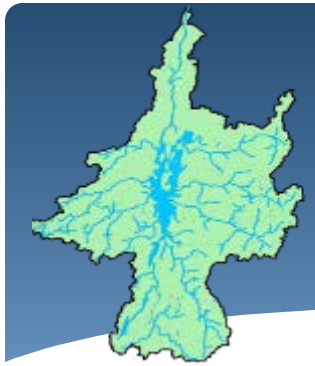
Causes of 2011 Flooding

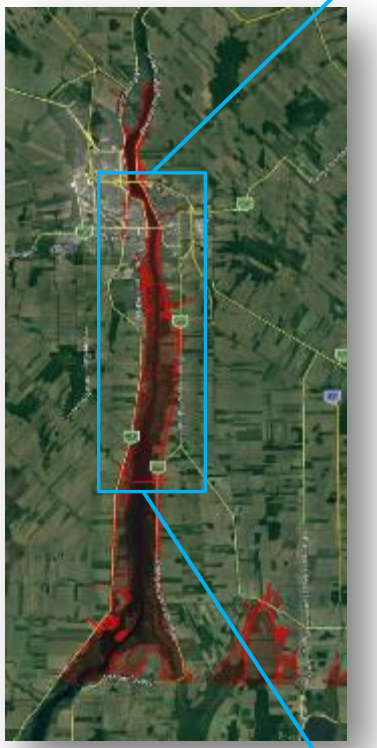
- Heavy rains, large snow pack, sudden thaw, etc.
- Urban development, expansion of impermeable surface areas, conversion of wetlands to other uses, building of transport infrastructure in and along rivers, etc.

Chain of Events	Lake Champlain Basin
Winter 2011	Second snowiest winter in the mountains
April 2011	Record snowfall of more than 200 mm – triple the norm
Nothing unusual at present; minor flood threshold reached Late April - early May: sudden rise in temperatures, very heavy rainfall, and rapid snow melt causing high water inflows and major flooding	
May 2011	A record 125 to 255 mm, 180-280 mm in the mountains
Spring 2011	A record of more than 510 mm in Burlington, VT



Extent of 2011 Flooding at St-Jean-sur-Richelieu

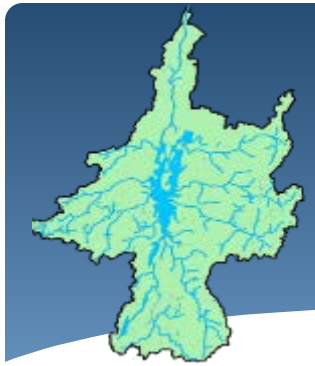




Richelieu River at SJSR

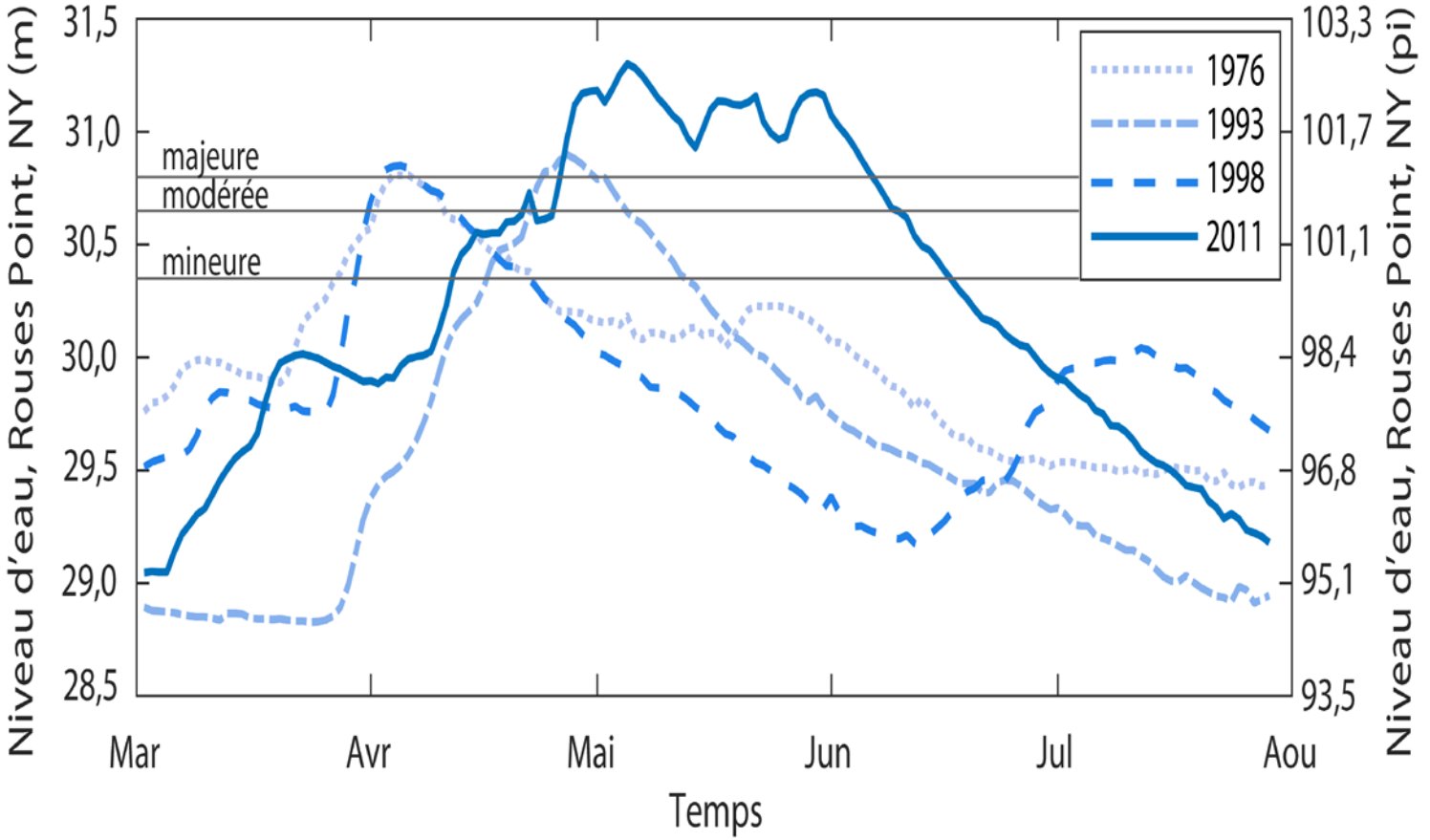
80% of the damage was in Canada, most of it in Saint-Jean-sur-Richelieu.

Major urban flood zone

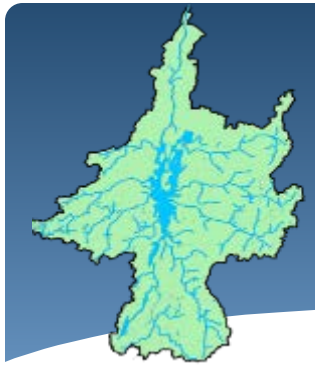


A Rare Event?

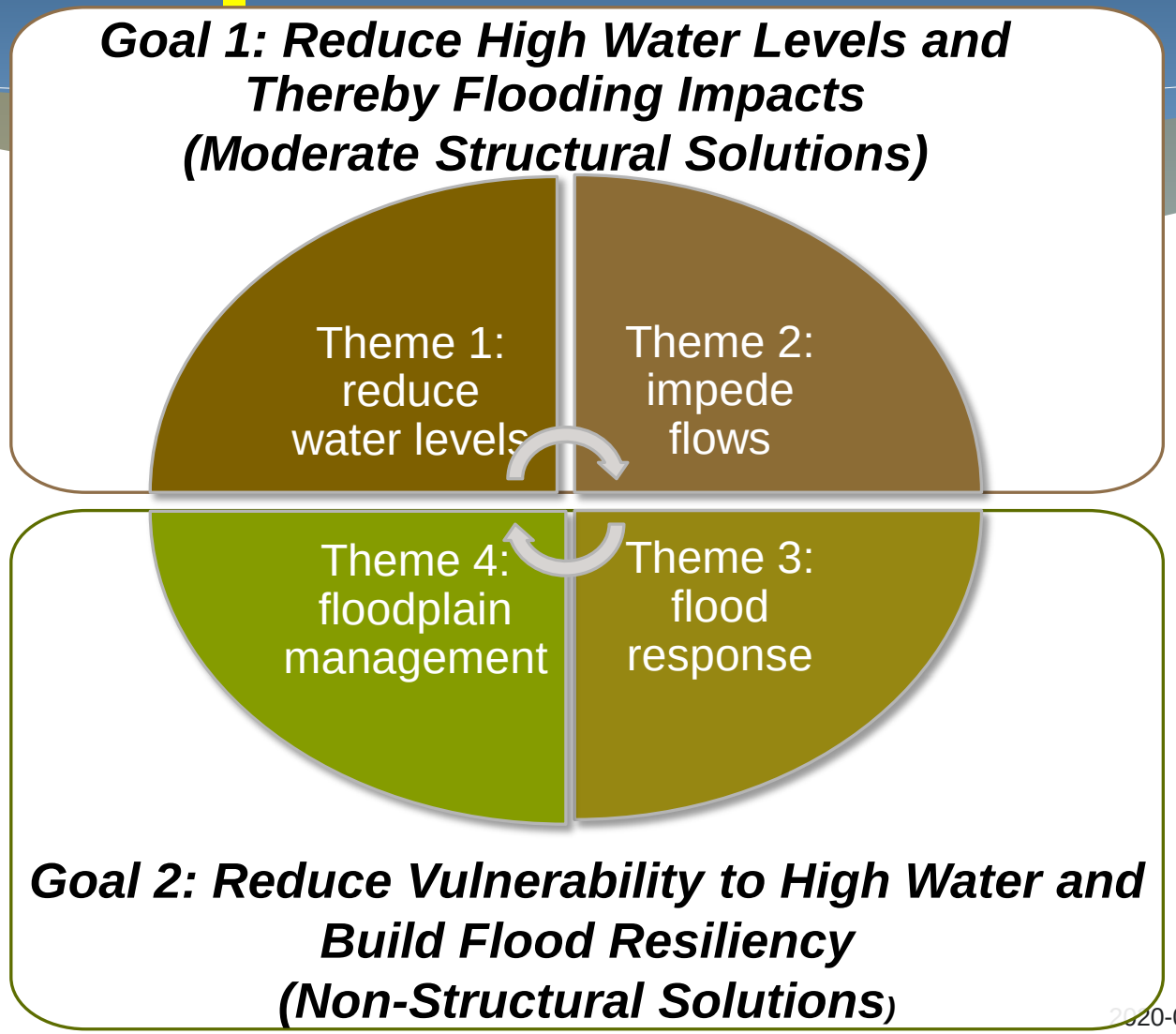
- The LCRR basin has a long history of flooding.
- The 2011 flood event was the worst and longest on record.

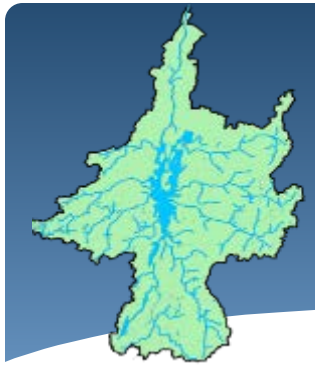


LCRR Study Methodology



- The study explores a wide range of flood mitigation solutions.
- The initial focus was on Theme 1.
- A basin-wide analysis is underway for Theme 2.
- Expert workshops are currently exploring solutions for themes 3 and 4
- Recommendations will combine measures associated with the four themes

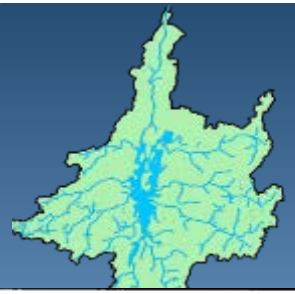


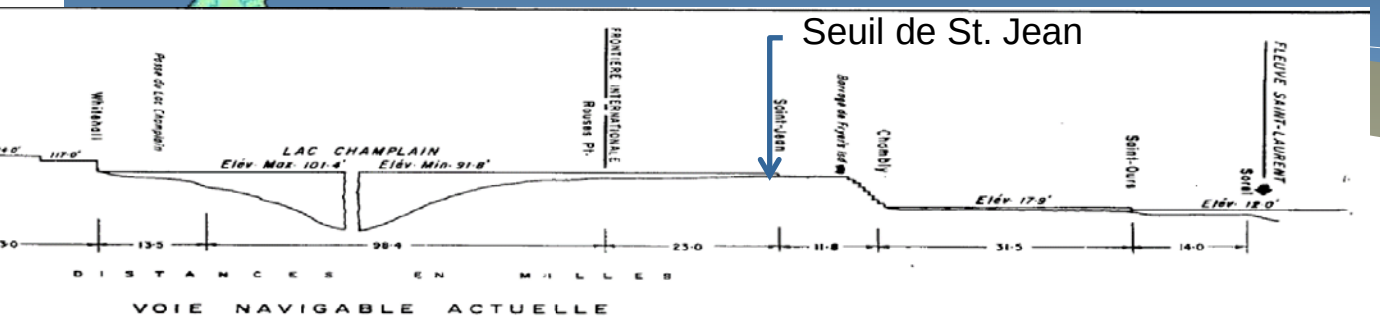


Mitigation Measures Selection Criteria

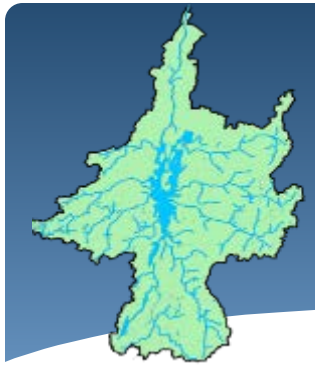
#	Criteria
1	Included in the study's scope and mandate
2	Achievable/feasible
3	Technically viable
4	Economically viable
5	Fair and equitable
6	Environmental issues
7	Climate change resilience

Importance of the Saint-Jean Shoal





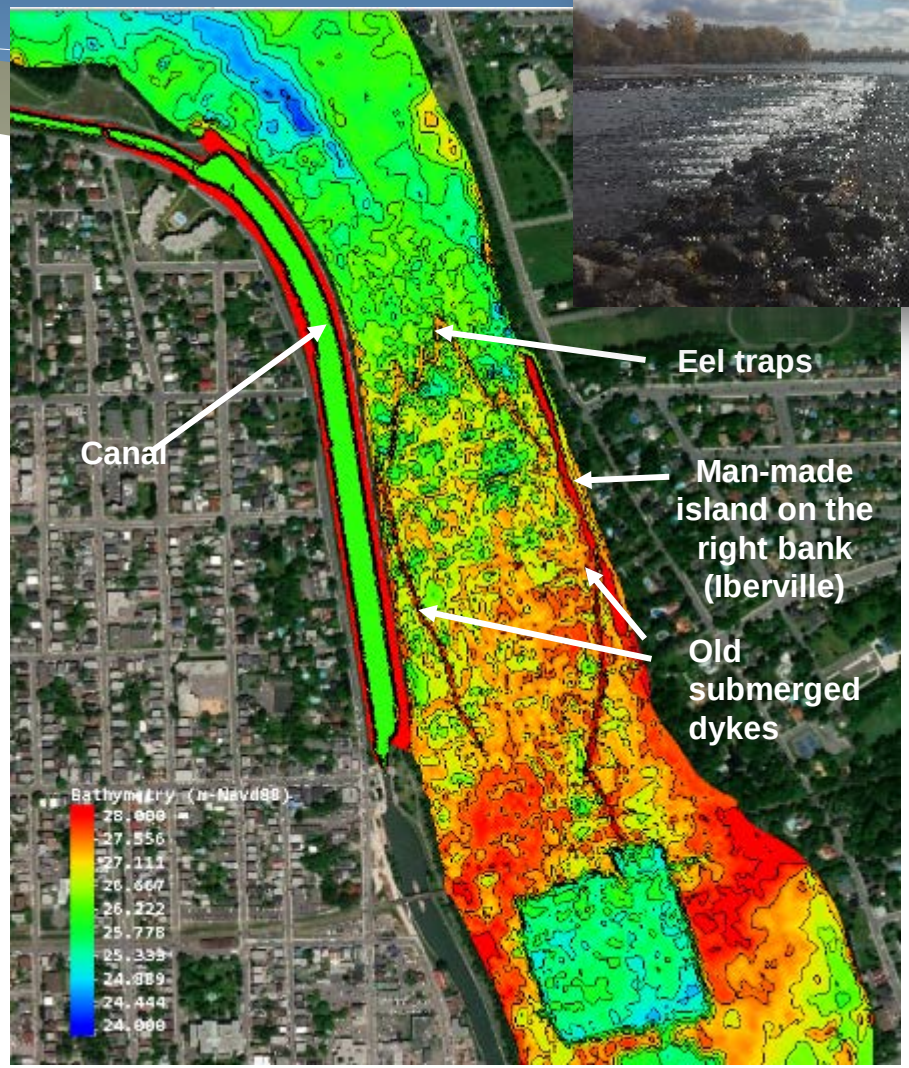
The Saint-Jean Shoal is the hydraulic control for Lake Champlain and the upper Richelieu River and “naturally” regulates water levels upstream.

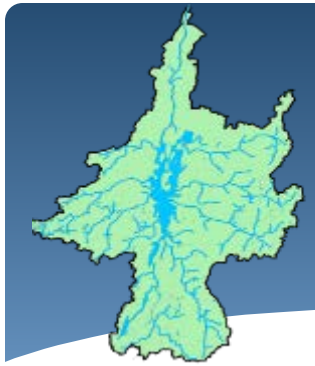


Human Activity

Human activity has affected water flow and levels:

- Eel traps (1850)
- Submerged dykes for old mills (1860)
- Man-made islands, Iberville (1800)
- Bridges and bridge piers
- Chambly Canal widening, early 1970s



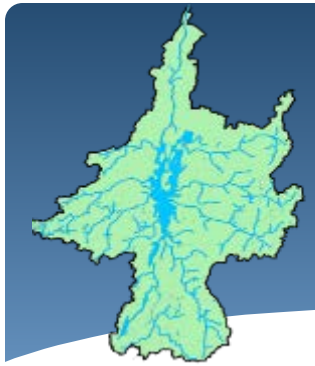


Theme 1: Possible Structural and Non-Structural Alternatives

- Dredging at Saint-Jean shoal to remove obsolete man-made structures
- Diversion through Chambly Canal
- Implementing the aforementioned alternative and dredging certain man-made structures
- Setting up a fixed crest weir upstream from Saint-Jean-sur-Richelieu*
- Setting up an inflatable weir at the above location**
- Setting up an inflatable weir at Saint-Jean Shoal**

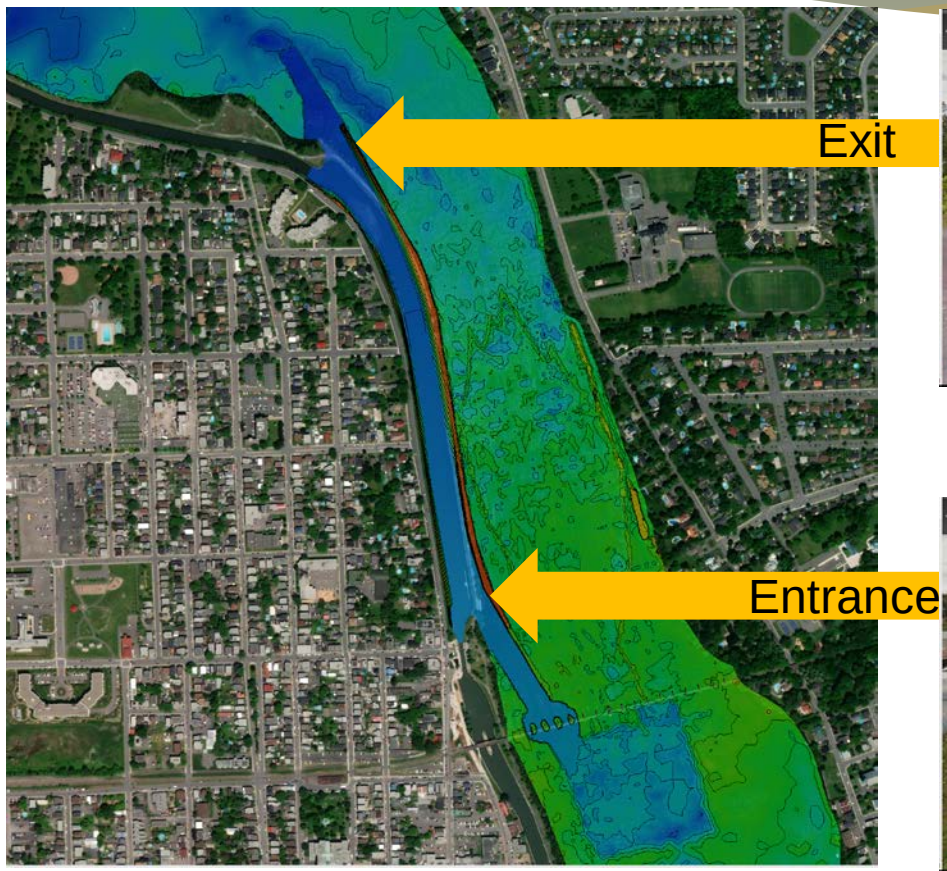
*Stress the importance of not exacerbating low levels

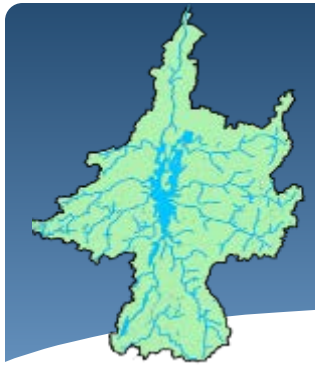
**Extensive dredging



Diversion Through Chambly Canal

- Used only during a flood – no impact otherwise
- For flooding like that of 2011, a diversion would greatly reduce water levels (-33 cm at SJSR, -15 cm at Lake Champlain) and save many buildings
- The LCRR Study is working with Parks Canada on this option





Impact of Diversion for an Event Similar to 2011

Water inflows observed in 2011

Management plan:

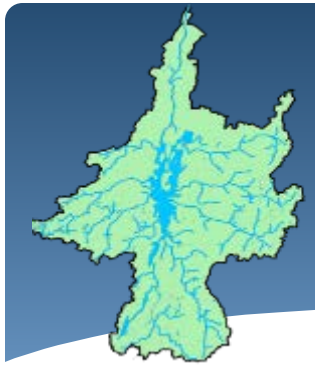
Opening gates to 30.05 m and closing to 29.89 m (NAVD 88)

Quarter-monthly data

2011 flooding at SJSR

2011 flooding at SJSR With water diverted through canal

Fixed or Movable Crest Weir Upstream from Saint-Jean-sur-Richelieu



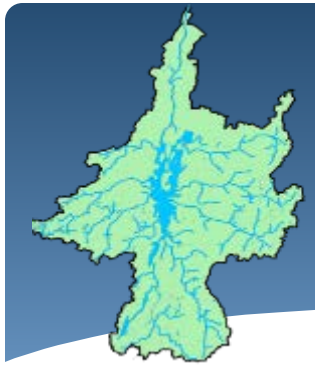
Advantages:

- Would protect against flooding
- Would protect against low lake levels
- Esthetically, can be hidden in normal circumstances

Disadvantages:

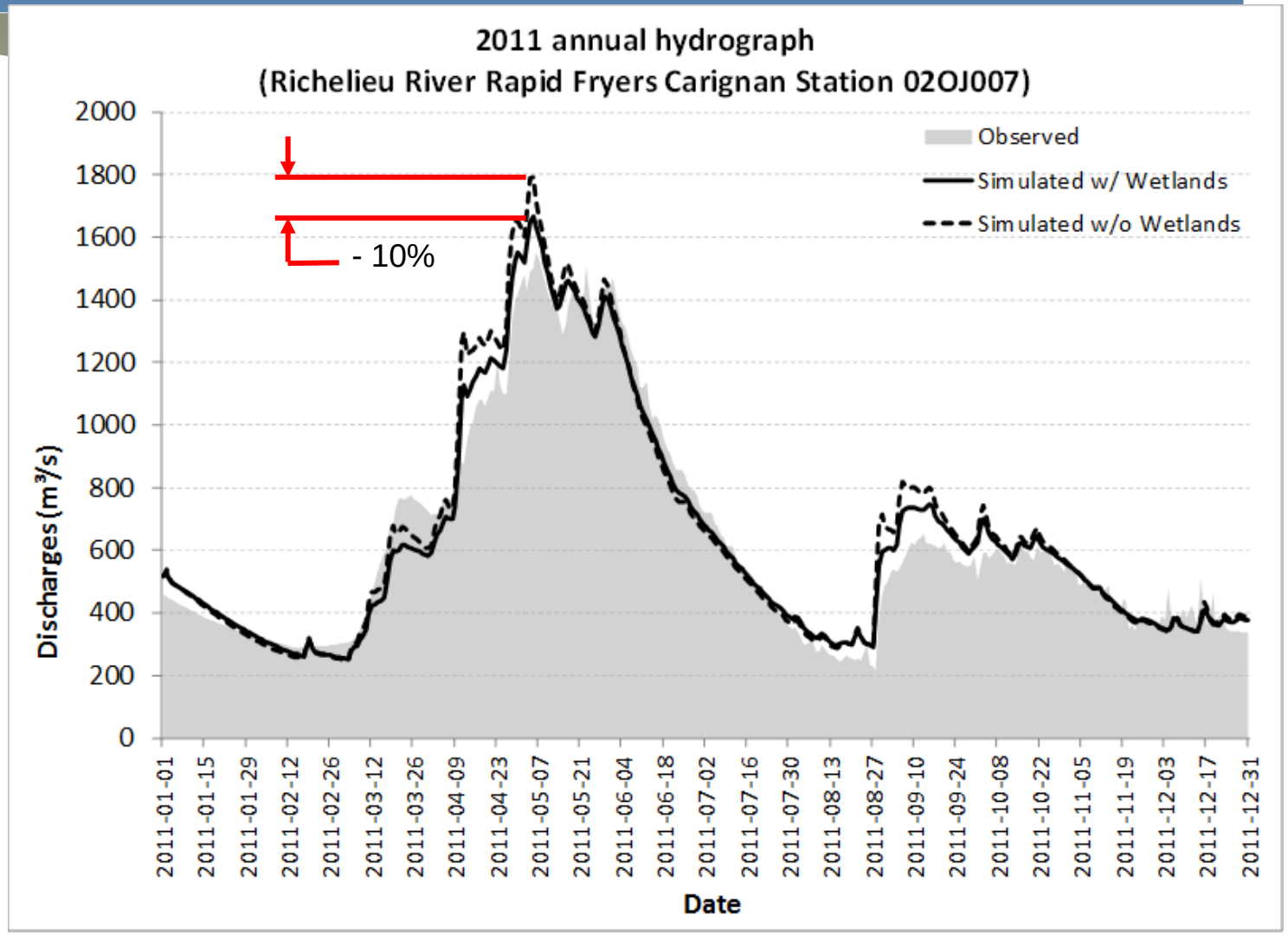
- Expensive
- Canal must be extended and another lock put in
- Less water upstream of crest
- Extensive dredging

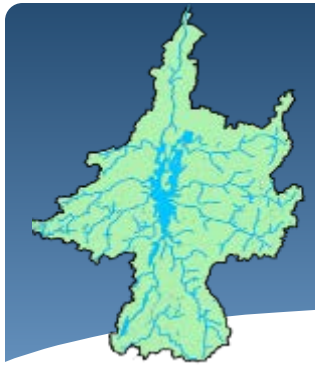
1. Saint-Jean shoal is excavated to 25.8m, a volume of 244,658 m^3
2. A movable crest weir is built
3. Chambly Canal is extended and another lock is built



Theme 2: Enhancing the Natural Regulation Function of Wetlands

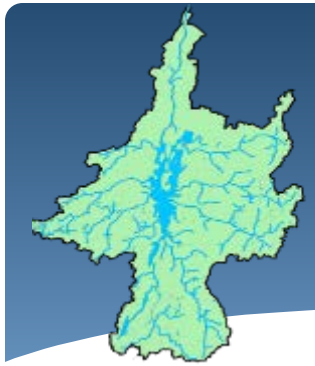
- Strong support from watershed environmental groups, chiefly in the U.S.
- The current in-depth study (INRS-ETE):
  - Has shown there is a slight chance of increasing wetland area to further reduce flooding in the LCRR basin
  - Indicates that LCRR basin wetlands play a key role in natural regulation (-10% of the 2011 maximum flood flow)
  - Highlights the need to preserve existing wetlands and their benefits





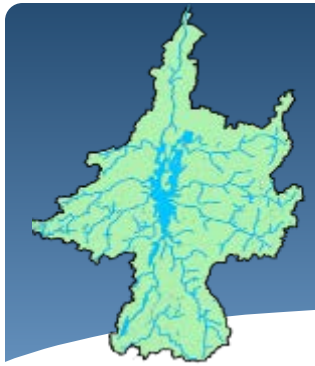
Theme 3: Improve the prediction and intervention capacity

- Developing and making recommendations for implementing, as appropriate, an operational, real-time forecasting and flood inundation mapping system for the basin considering:
  - Sharing and use of prediction products
  - Uncertainty quantification
  - Mapping of inundation zones
- Survey on public risk perception, survey on first respondents, literature review on early warning systems
- Workshop with first respondents and modelers to ensure a proper needs response – delayed due to COVID-19



Theme 4: Improving Flood Plain Management

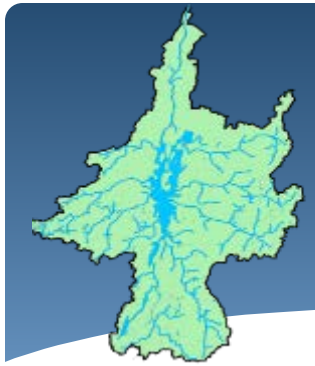
- The study will provide local information and tools (numerical models, database, etc.) to determine flood exposure and vulnerability in various flow and level scenarios.
- These tools can help local stakeholders assess the best way to manage their flood plains.
- The study has also called on U.S. and Canadian experts to suggest flood plain best management practices and offer ideas on:
  - Flood risk mapping
  - Flood plain occupancy and use
  - Flood cost-sharing and insurance programs
- The Study Board will review these ideas and recommend those it considers most promising.



Consultations

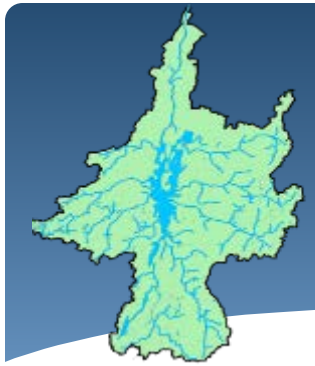
The Study approach has taken an iterative approach

- Provincial inter-departmental group: 10 ministries/departments
- Federal inter-departmental group: 10 ministries/departments
- MNAs: Lemieux, Roberge Education Minister, Samson, Charest Status of Women Minister, IsaBelle, Jolin-Barrette Immigration Minister
- Federal MPs: Bessette, Blanchet, Normandin, Barsalou-Duval, Plamondon
- Senate: Dalphond
- Municipalities: St-Jean, Noyan, Venise-en-Québec, Saint-Paul-de-l'Île-aux-Noix, Sainte-Anne-de-Sabrevois
- MRCs: MRC de Pierre-de-Saurel, MRC de la Vallée du Richelieu, MRC du Haut-Richelieu, MRC Brome-Missisquoi, MRC de Rouville
- Stakeholders: local and regional environmental groups, Chambre de commerce et de l'industrie du Haut Richelieu (Haut-Richelieu Chamber of Commerce and Industry), UPA, etc.
- Network: consortium (Ouranos), OBVs (watershed organizations), universities, Eastern Township and Montérégie first responders, etc.
- First Nations
- Public



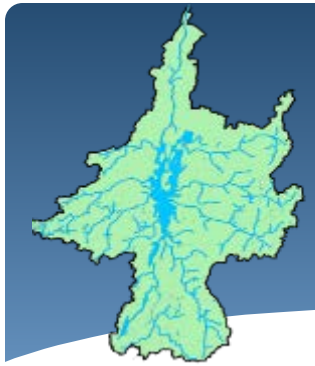
Considerations

- IJC Commissioners are the communication channel of choice for elected officials/senior managers in Quebec, Vermont, and New York State
- The MELCC coordinates Quebec's inter-departmental panel and is the LCRR study's operational gateway to the Quebec government
- Two MELCC staffers (Daniel Leblanc and Richard Turcotte) sit on the Study Board
- The Direction de l'expertise hydrique et atmosphérique (DEHA) does a portion of the HHM's work (Simon Lachance-Cloutier, Dominic Roussel)
- The team tasked with reviewing the Politique de protection des rives du littoral et des plaines inondables/PPRLPI (Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains) is in contact with the IJC (Marie-Claude Théberge and team, Valérie Vendette)



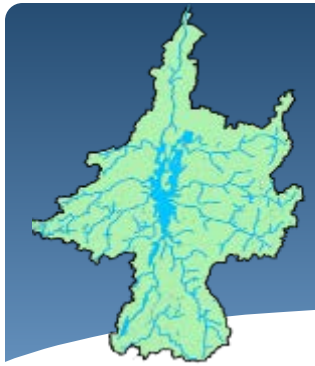
Key Messages

- The study is working on a series of structural and non-structural solutions and presents them for public discussion
- Solutions will take a “whole concept” approach from the four themes
- The study has identified a series of possible structural solutions and wishes to start a dialogue on their social and political acceptability
- A great deal of work is being done to identify non-structural solutions to propose in 2020
- Various levels of government, stakeholders, and the public are being consulted



Next Steps

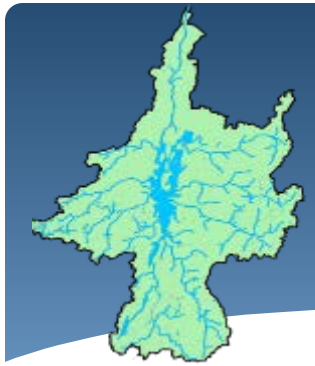
- In coming months, the study will explore options and get initial feedback from partners (you and others) on potential structural solutions.
- The Study Board will keep working on these solutions and use selection criteria to narrow the list of socially or politically acceptable ones.
- Other consultations will be held in 2020 along with public information sessions.
- A more thorough economic, social, and environmental impact assessment will be available in 2020 for all proposed structural solutions.



What do you think?

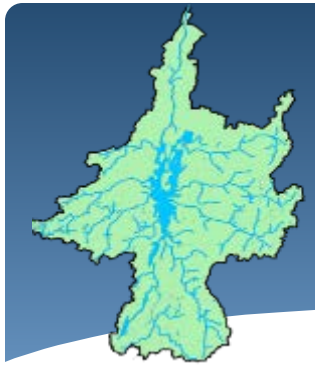
We would like to:

- Learn your views, positions, concerns, challenges, and possible solutions
- Determine their acceptability
- Know if you see opportunities or connections with what you are doing



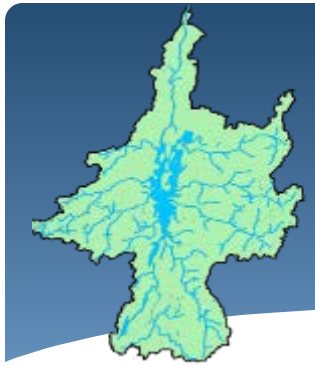
Q&As

- Do you think flooding is still a serious issue in your area? If so, why? If not, why not?



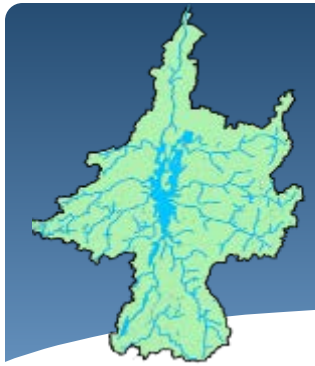
Q&As

- What are your priorities with regard to flooding?



Q&As

- What proposed solution or solutions do you prefer? Do you have questions about any of the solutions presented to you?
  - Theme 1: reduce water levels
  - Theme 2: impede flows
  - Theme 3: flood response
  - Theme 4: floodplain management

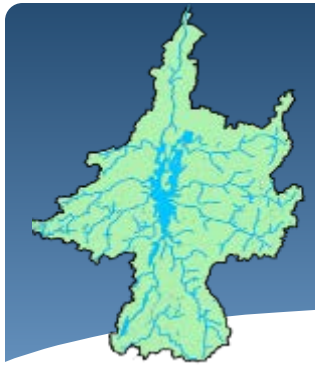


Q&As

- Have stakeholders in your community (mayors, citizens, local businesses) ever talked to you about the Commission's work?
- Could we follow up with you?

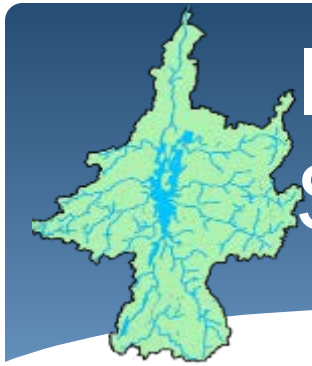
Thank you!

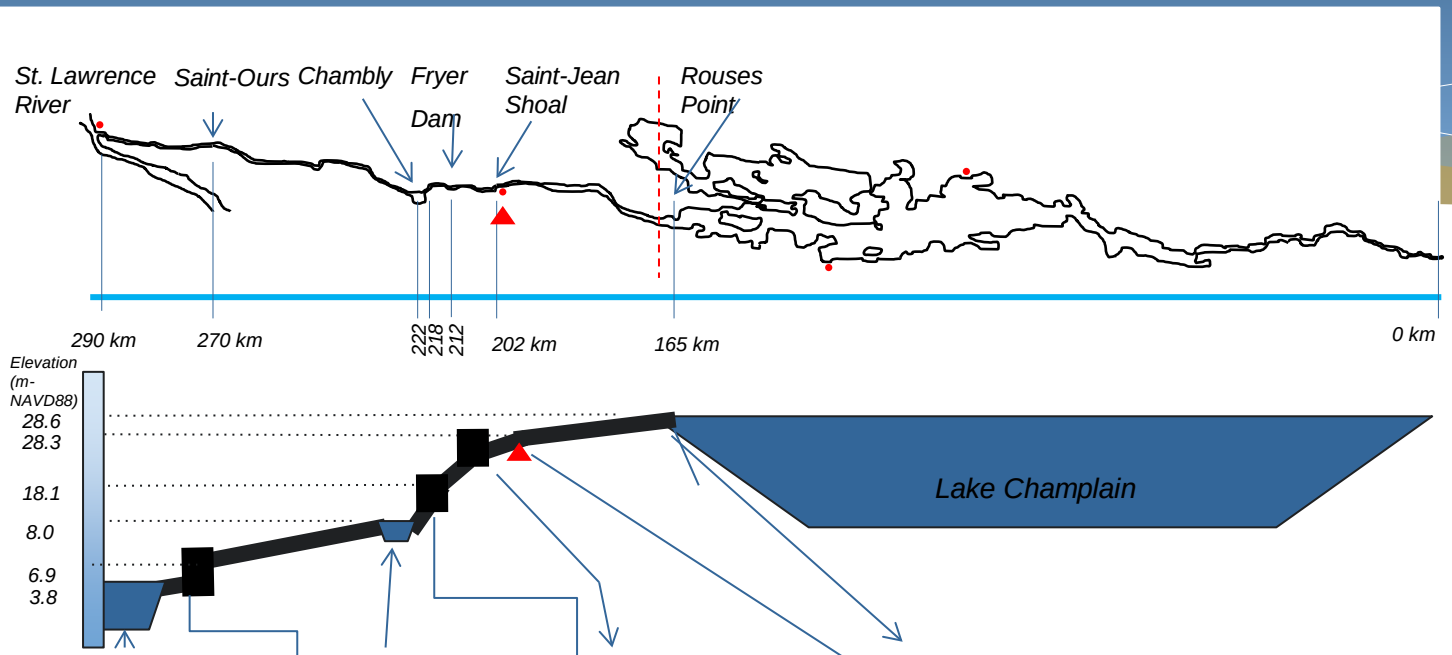
Fisk Point – Isle La Motte, VT;
Lake Champlain Basin
Program

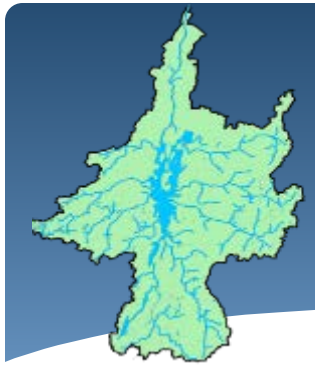


EXTRAS

International Lake Champlain-Richelieu River Study Board

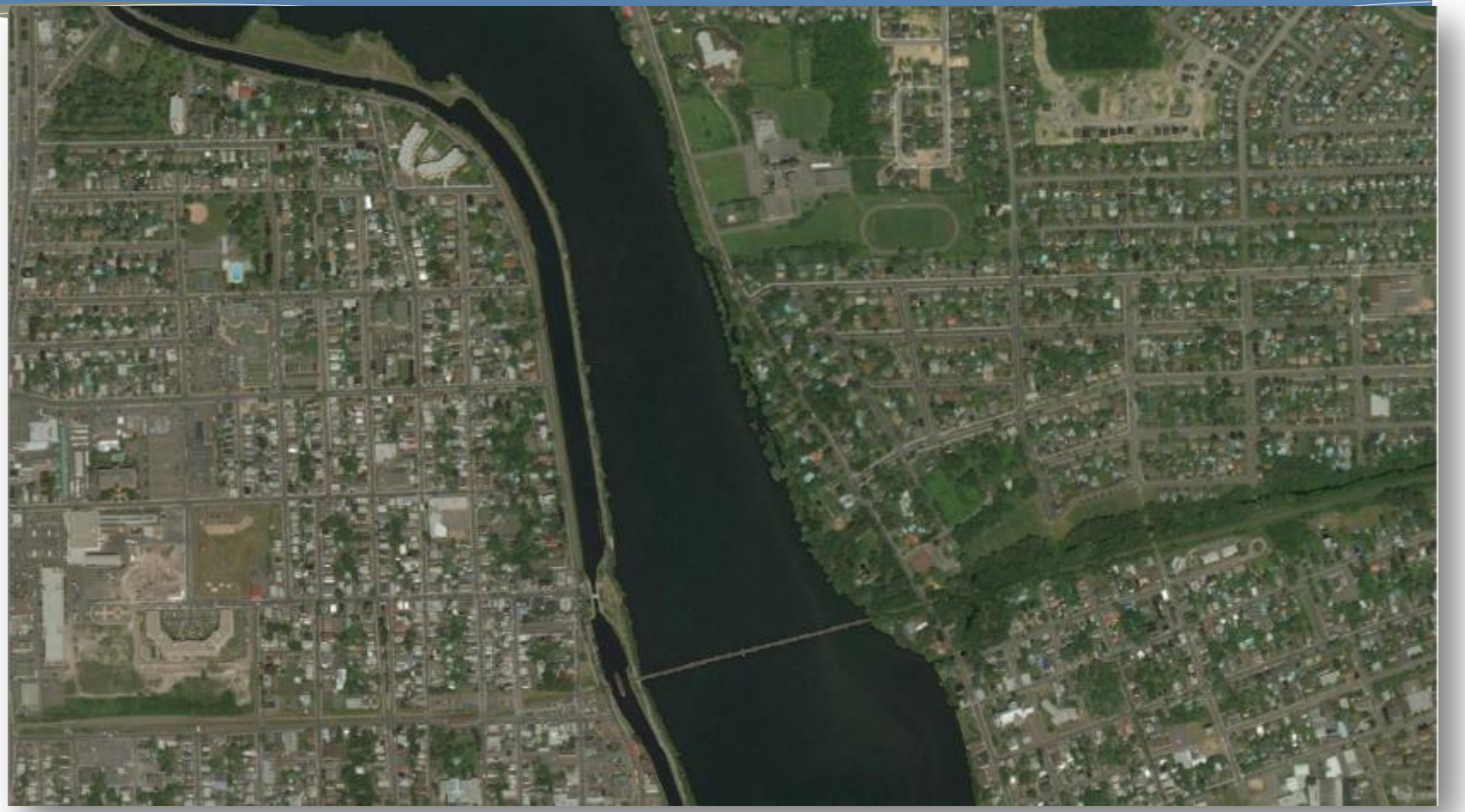




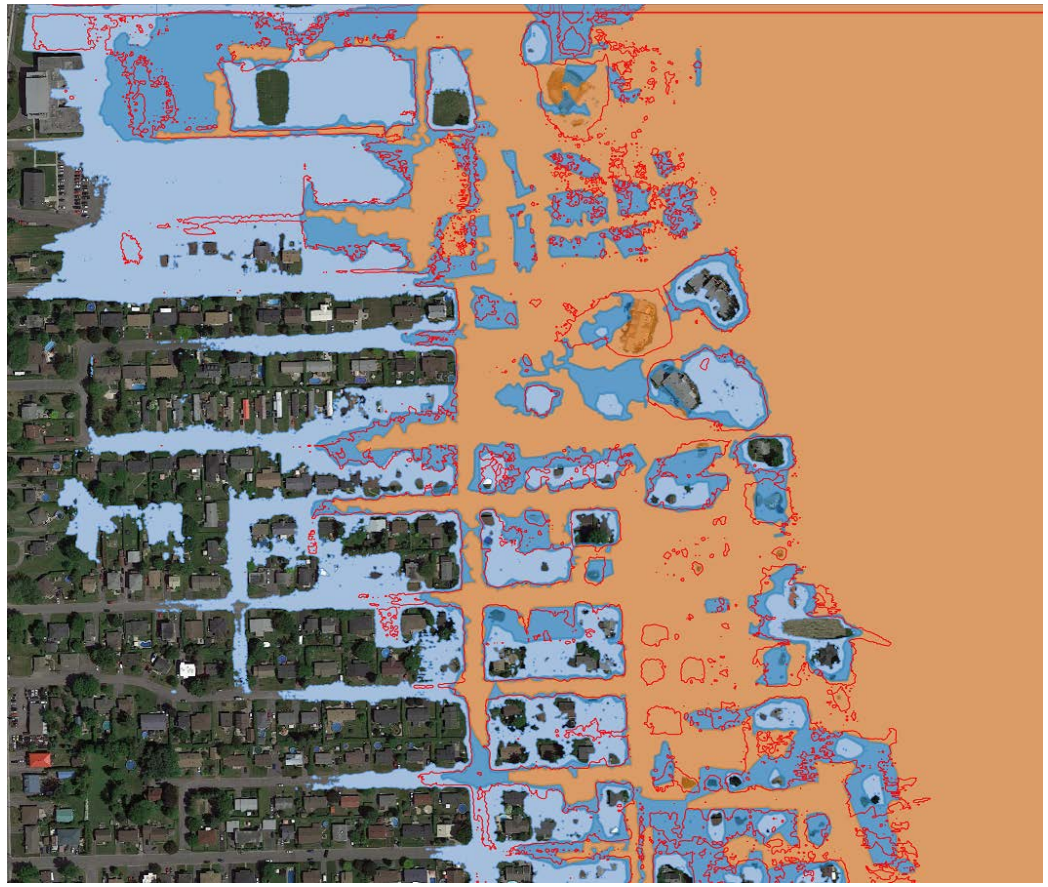


The Chambly Canal Issue

- Widened in the early 1970s
- Raises upstream water levels (10 cm or 4 in) when flows are high
- We are looking at the feasibility of moving more water through the canal



Impact of Diversion for an Event Similar to 2011



Event similar to 2011

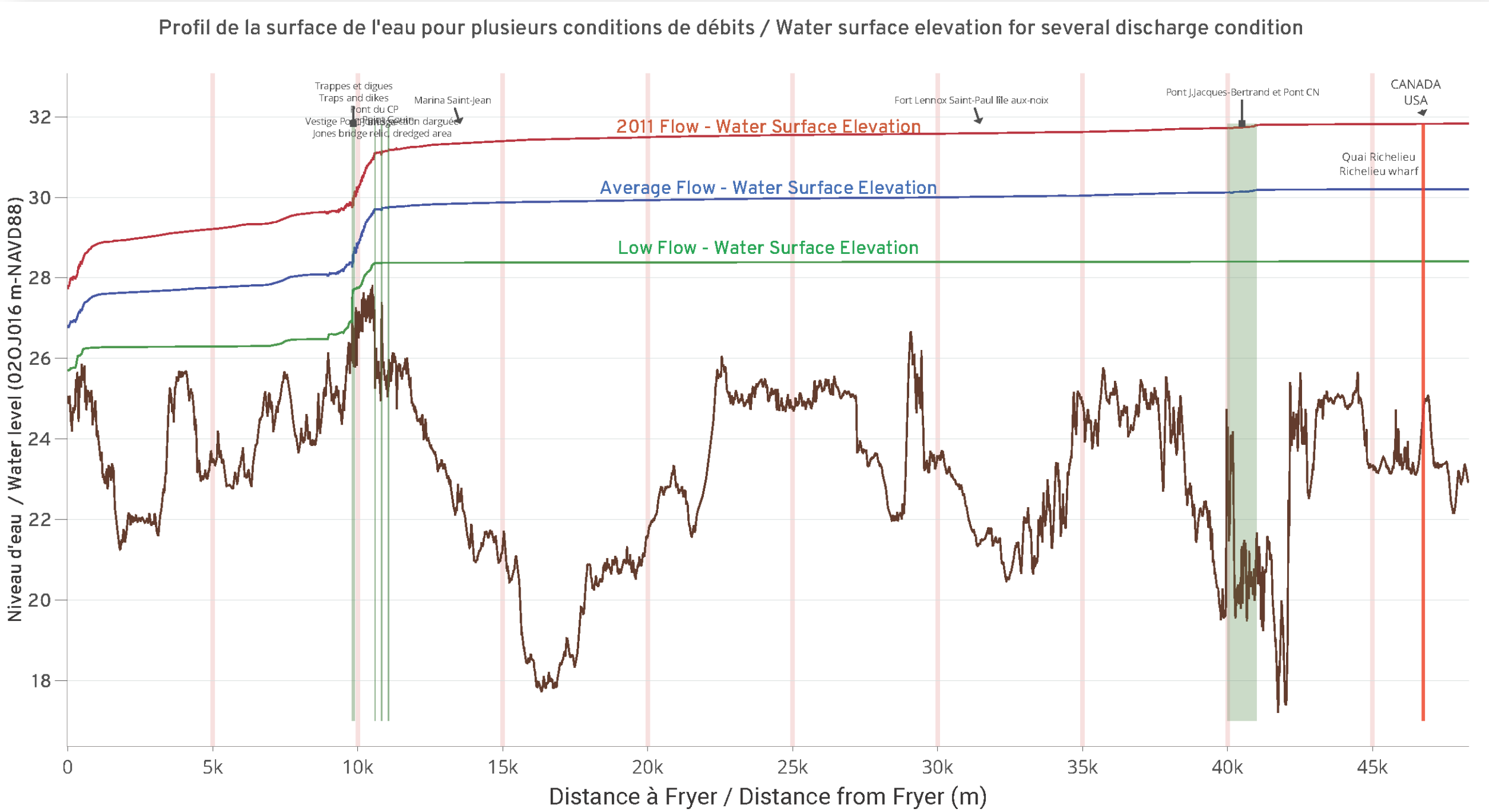
100-year* recurrence interval estimated by MELCC

20-year* recurrence interval estimated by MELCC

Event similar to 2011 with water diverted through Chambly Canal

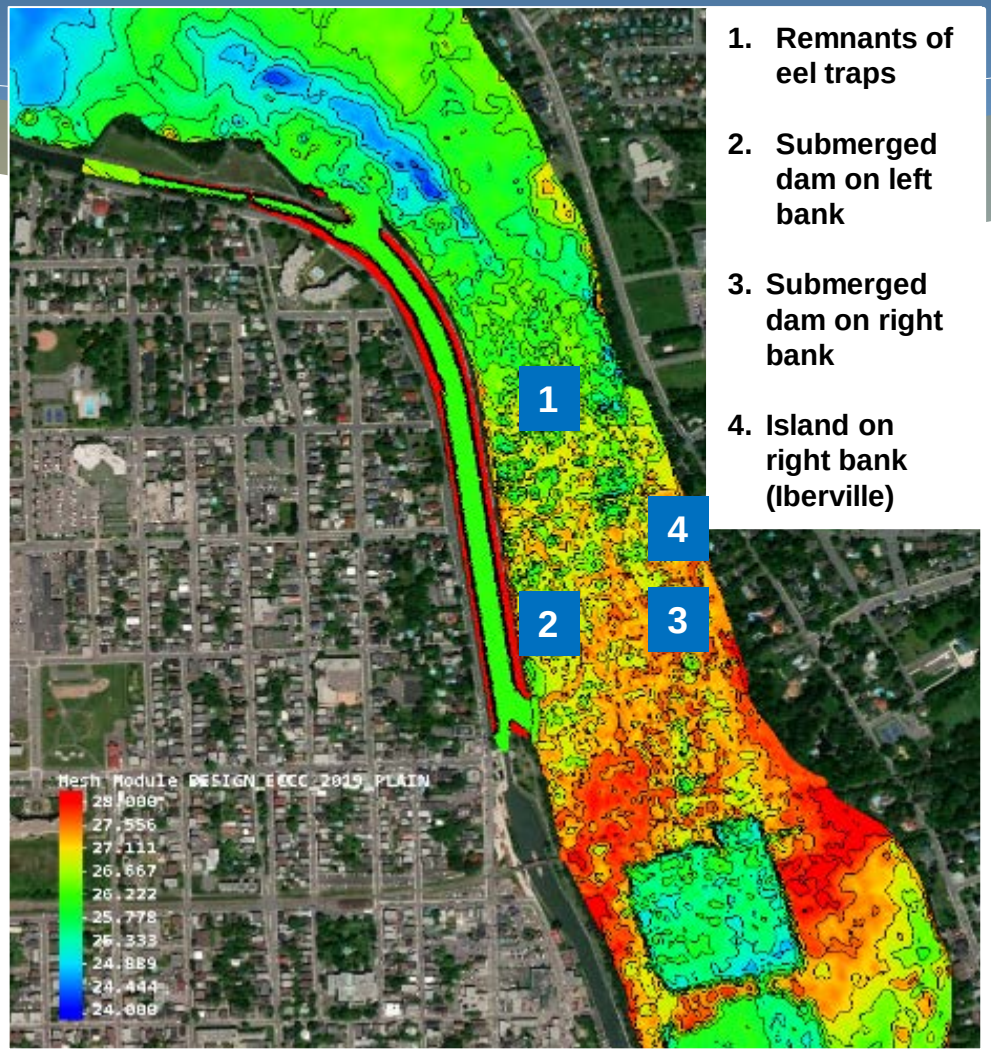
MELCC estimates that SJSR's 100-year recurrence interval is 30.54 m* (the level reached in 2011 was 30.68 m, at SJSR marina)

* *Recurrence interval calculated for 1972 – 2000 period*


Profil de la surface de l'eau pour plusieurs conditions de débits / Water surface elevation for several discharge condition
Trappes et digues
Traps and dikes
Pont du CP
Vestige Pont Jones
Jones bridge relic
Marina Saint-Jean
Fort Lennox Saint-Paul île aux-noix
Pont J.Jacques-Bertrand et Pont CN
CANADA
USA
Quai Richelieu
Richelieu wharf
2011 Flow - Water Surface Elevation
Average Flow - Water Surface Elevation
Low Flow - Water Surface Elevation
Niveau d'eau / Water level (02OJ016 m-NAVD88)
32
30
28
26
24
22
20
18
0
5k
10k
15k
20k
25k
30k
35k
40k
45k
Distance à Fryer / Distance from Fryer (m)

Alternative/Solution Examples: Eliminating Interventions

- Early 1970s Chambly Canal widening caused water levels to rise by some 15 cm.
- Removing structures (1-4) would reduce water levels by some 9 cm and we can calculate the number of houses it would save.



1. Remnants of eel traps
2. Submerged dam on left bank
3. Submerged dam on right bank
4. Island on right bank (Iberville)