Ottawa River Regulation Planning Board

Commission de planification de la régularisation de la rivière des Outaouais

# Limits to the Regulation of the Ottawa River

## 2019 Spring Flood Overview

Ottawa River Regulation Secretariat
Michael Sarich
Manon Lalonde

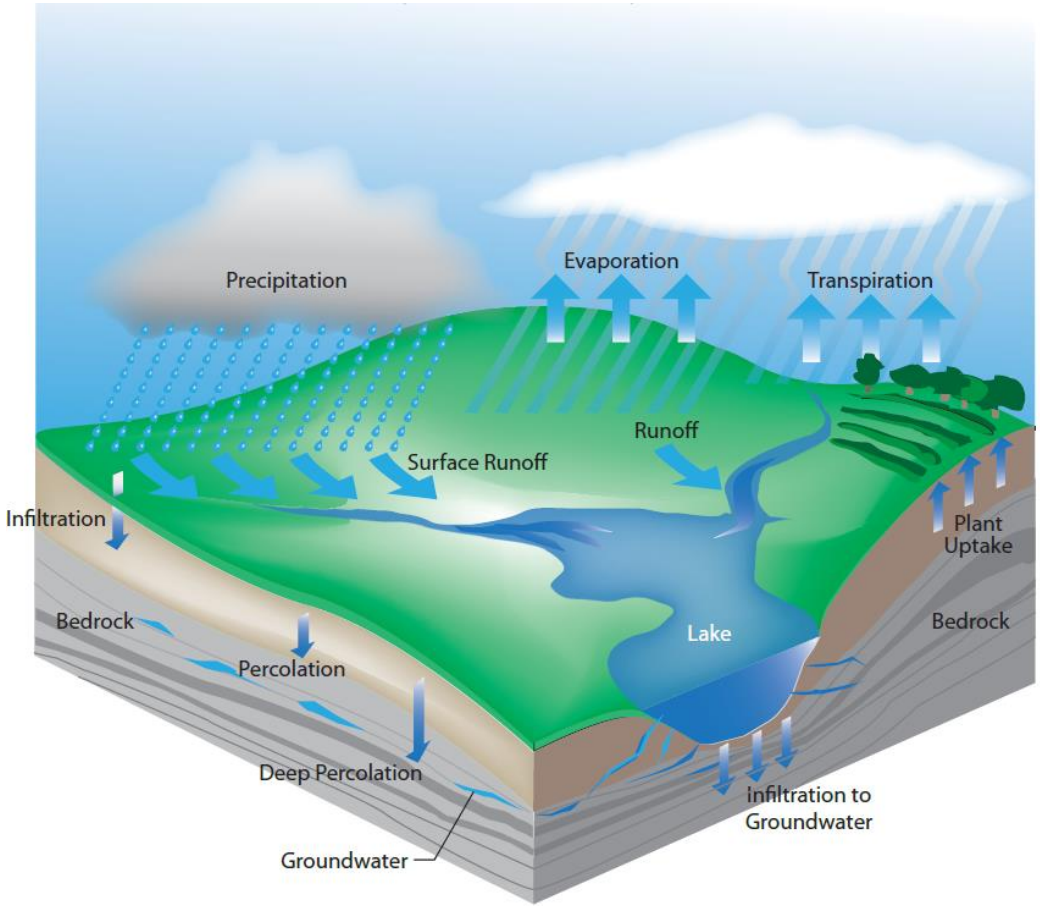
# Ottawa River Watershed


SPRING FLOODS VARY

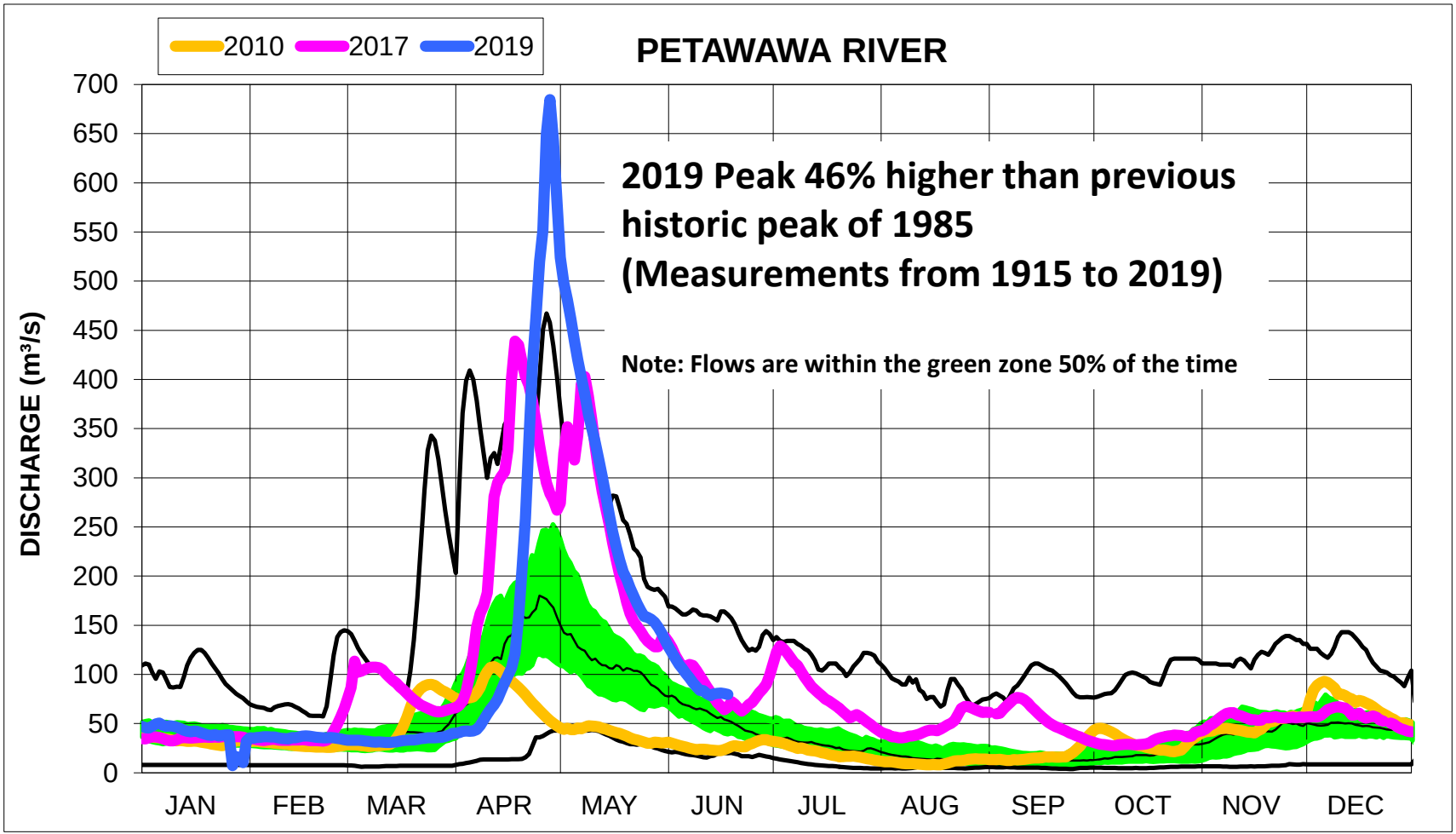
1950-2018:
Maximum daily flow at Carillon dam varied between 3,635 and 9,094 $m^3/s$

In 2019:
Maximum daily flow on April 30th
9,217 $m^3/s$

# The Water Cycle

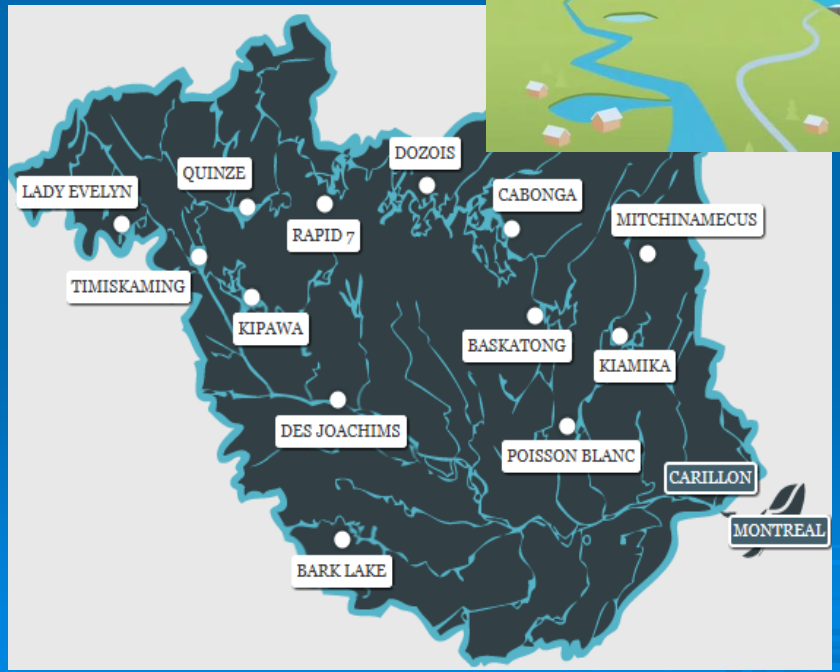


# Natural Variability



# What about Flow Regulation?

*13 Large Reservoirs*




- Reservoirs: large bodies of water that are used to:
  - Release water during winter
  - Retain water in the spring
- Flow regulation
  - Increase flows during winter
  - Reduce flows during spring
- 1983 Agreement
  - Integrated management

The 1983 Canada-Ontario Quebec Agreement established:

- Ottawa River Regulation Planning Board
- Ottawa River Regulating Committee
- Ottawa River Regulation Secretariat

- ***Main role*** : to ensure that the flow from the principal reservoirs of the Ottawa River Basin are managed on an integrated basis : minimize impacts – floods & droughts
- ***Secondary role*** : to ensure hydrological forecasts are made available to the public and government agencies for preparation of flood related messages

# How is the Planning Board structured?


- Administrative and general policy function


- Operational unit


- Executive unit : supports the Regulating Committee and Planning Board

* Ontario Ministry of Natural Resources and Forestry is an Associate Member

# Planning Board Members

## Quebec

Ministère de l'Environnement, et de la Lutte contre les changements climatiques (MELCC)

Hydro-Québec

## Canada

Public Services and Procurement Canada

Canadian Coast Guard

Environment and Climate Change Canada (ECCC)

## Ontario

Ministry of Natural Resources and Forestry (MNRF)

Ontario Power Generation

- Planning Board reports to three parties that signed the 1983 Agreement
  - Ministers of MELCC, ECCC and MNRF

# Mandate include Liaison with the International Lake Ontario – St. Lawrence River Board (ILO-SLRB)

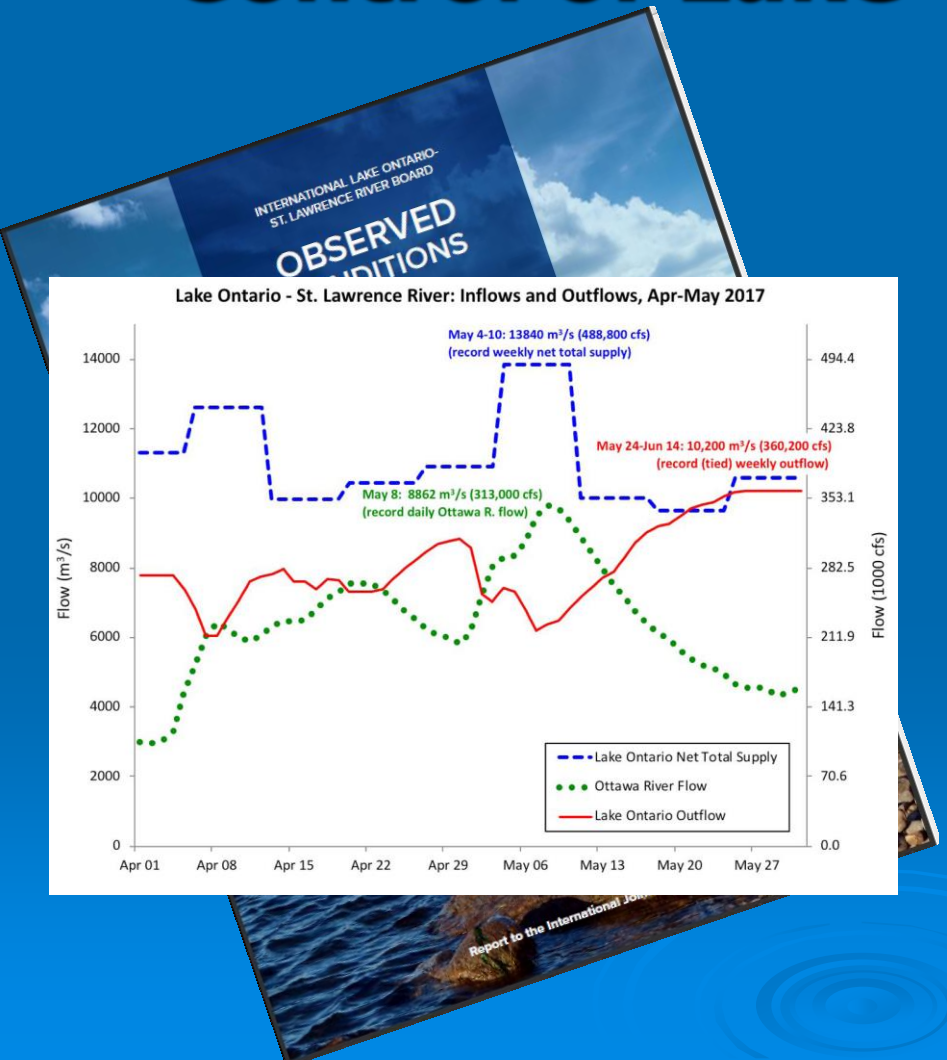
Figure credit: GSC Network

- During spring freshet:
  - Ottawa River has considerable effect on the flows of the St. Lawrence and Montreal archipelago
  - Ottawa River forecasts are used as input for the management of Lake Ontario outflow into the St. Lawrence (based on Plan 2014)

- ILO- SLRB reports to the IJC
  - 6 members (3 Canada, 3 USA)

https://ijc.org/en/loslrb

# Control of Lake Ontario Outflows




## Minimizing impacts of floods

- Lake Ontario outflow is reduced when Ottawa River flows are high – in accordance with ILO-SLRB operational rules
- Lake Ontario outflows have no impact on the Ottawa River
  - Integrated management of the Ottawa River basin reservoirs is solely focused on the Ottawa River for the spring freshet period
- Reducing Lake Ontario outflow when Ottawa River flows are high was done prior to Plan 2014

# Operators of the Principal Reservoirs

**Operators of the 13 largest reservoirs under the 1983 agreement:**

Hydro Québec

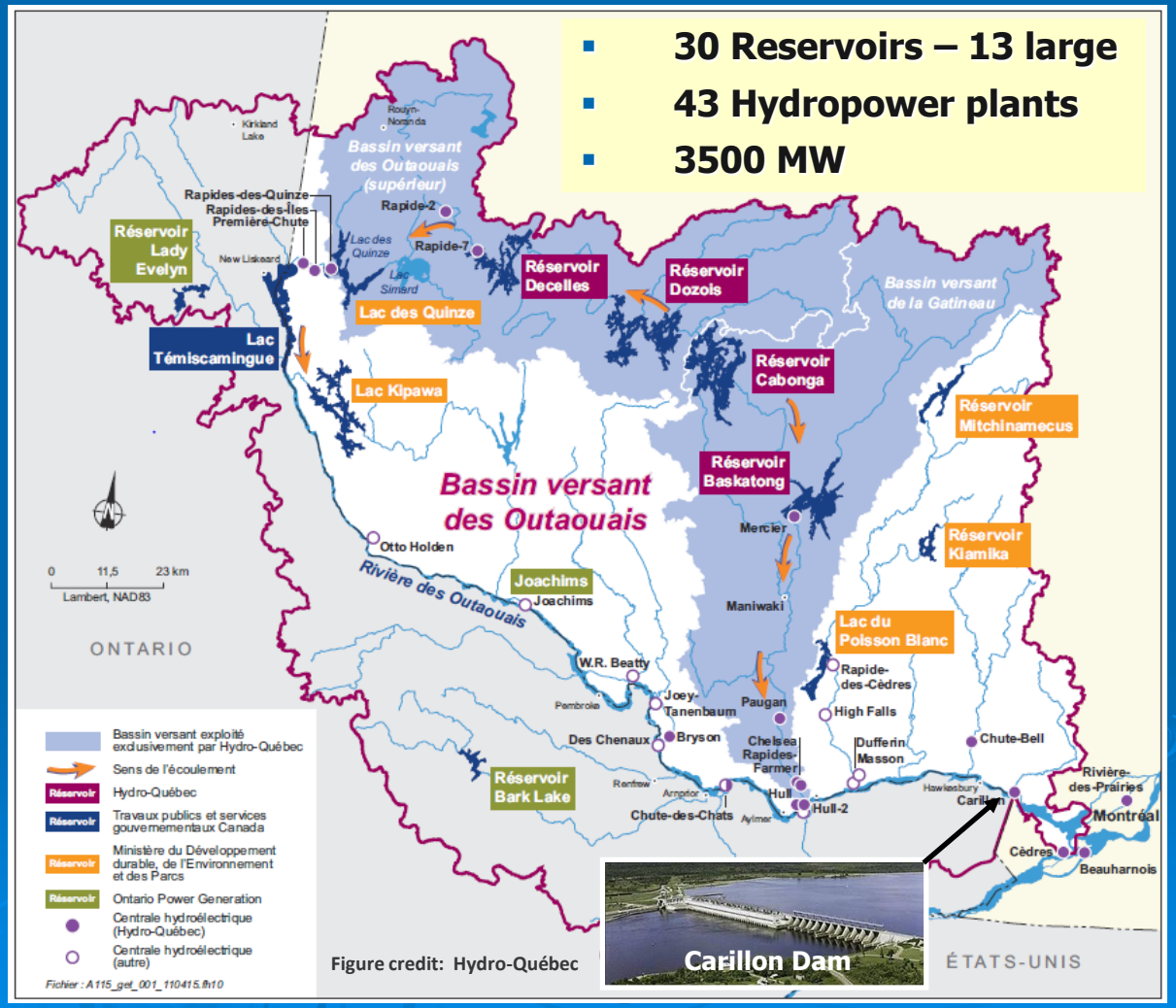
Québec

ONTARIO POWER GENERATION

Gouvernement du Canada

**Ontario Ministry of Natural Resources and Forestry is an Associate Member on the Regulating Committee**

- Contributes hydrometeorological information
- Disseminates flood forecast information in Ontario



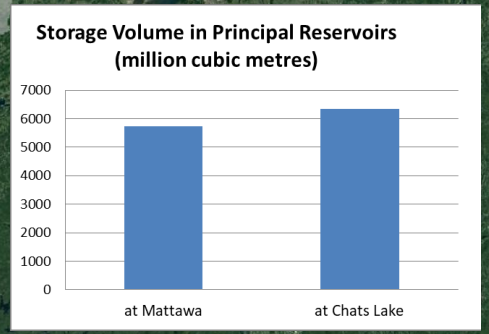
# Ottawa River Watershed

• Mattawa

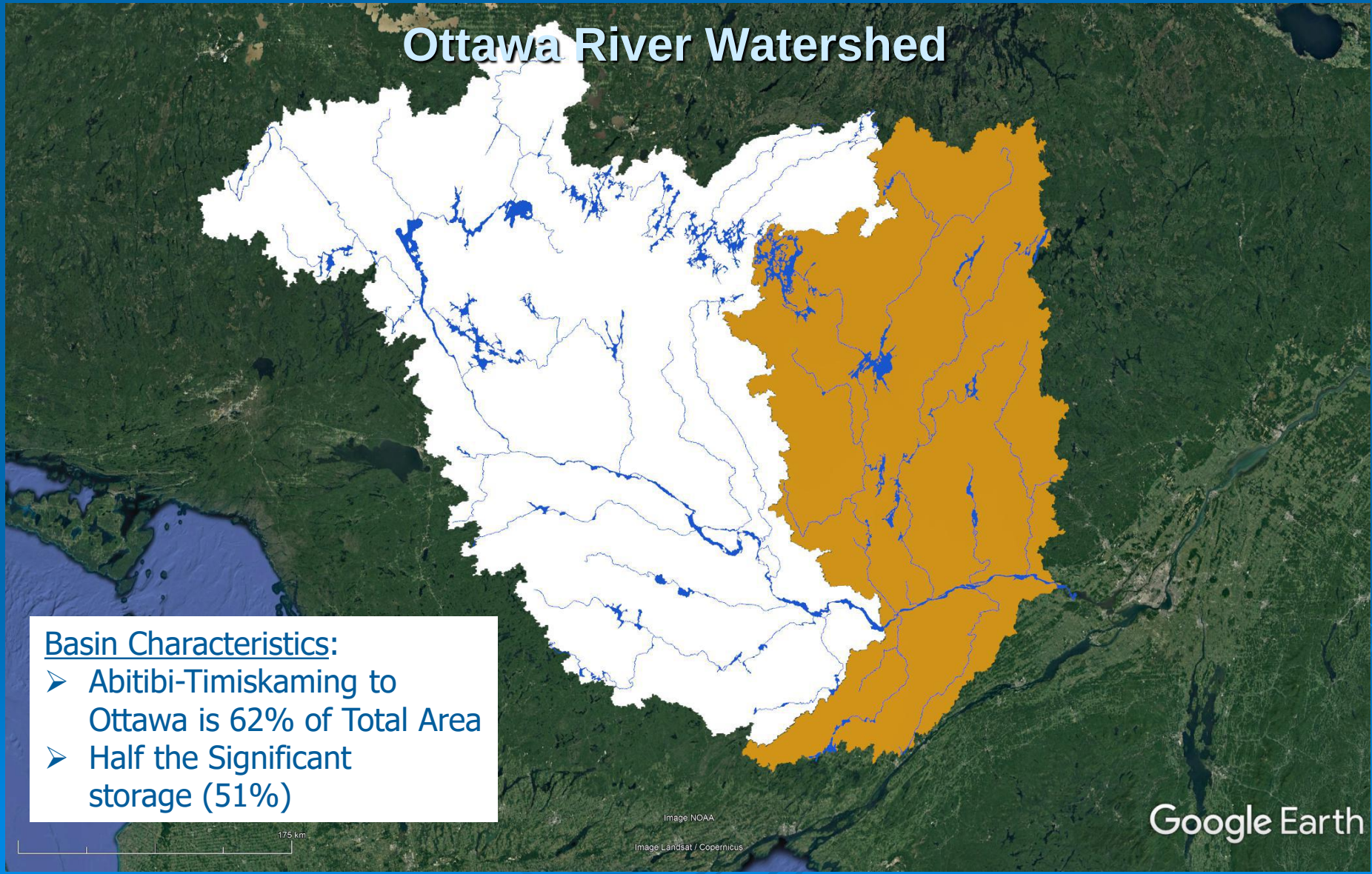
• Arnprior

Basin Characteristics:

- Most large reservoirs located in the northern portion
- Over 60% of the basin has no significant storage (is uncontrolled)



# Ottawa River Watershed




Basin Characteristics:

- Abitibi-Timiskaming to Ottawa is 62% of Total Area
- Half the Significant storage (51%)

# Types of Structures

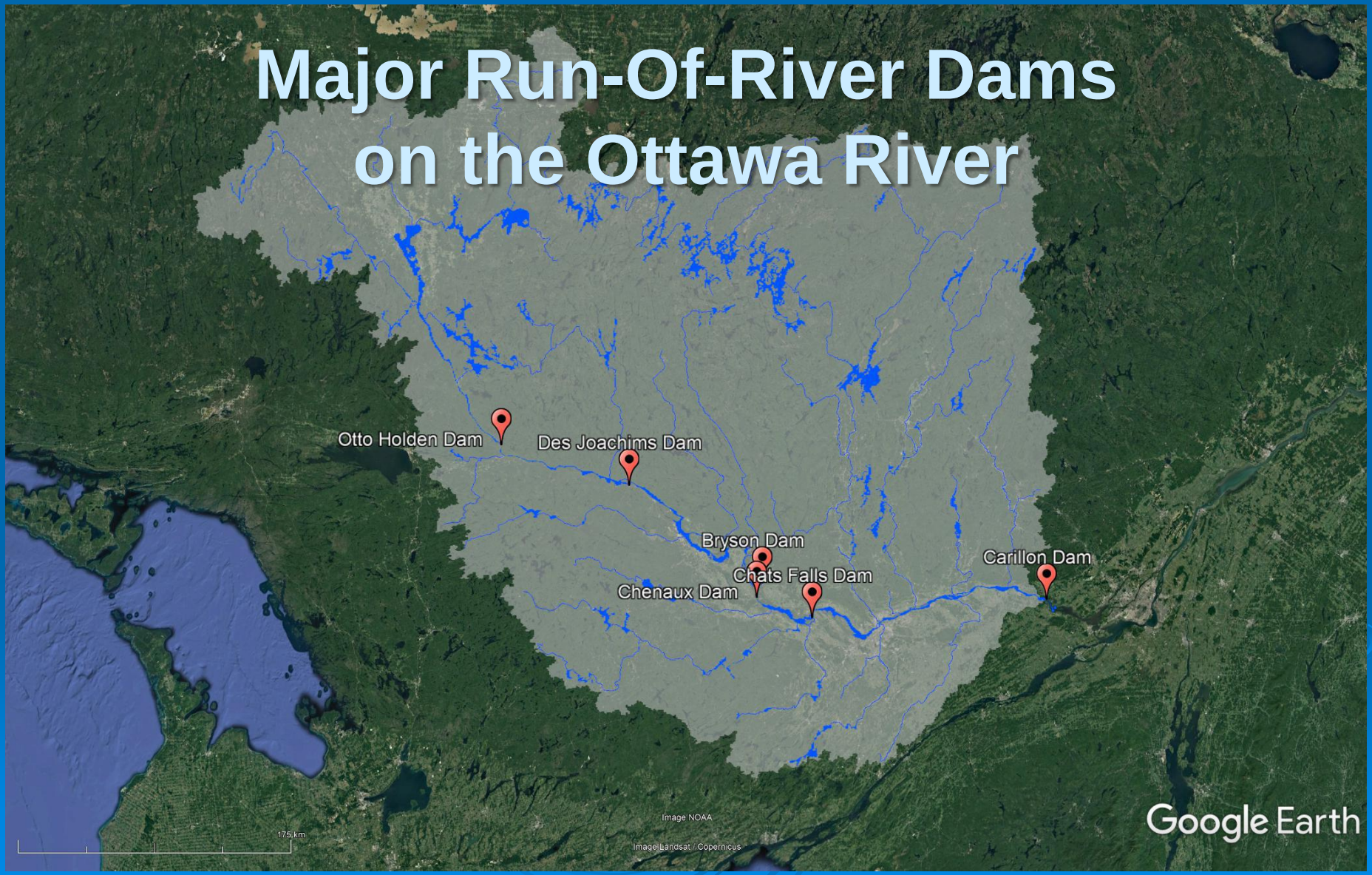
*Run-Of-River Dams*

**Limited capacity to store spring runoff**
***(Carillon, Chats Falls, Chenaux, Bryson, Des Joachims, Otto Holden)***

*Reservoir Dams*

**Capacity to store a portion of the spring runoff**
***(Baskatong, Dozois, Des Quinze, Timiskaming, etc.)***

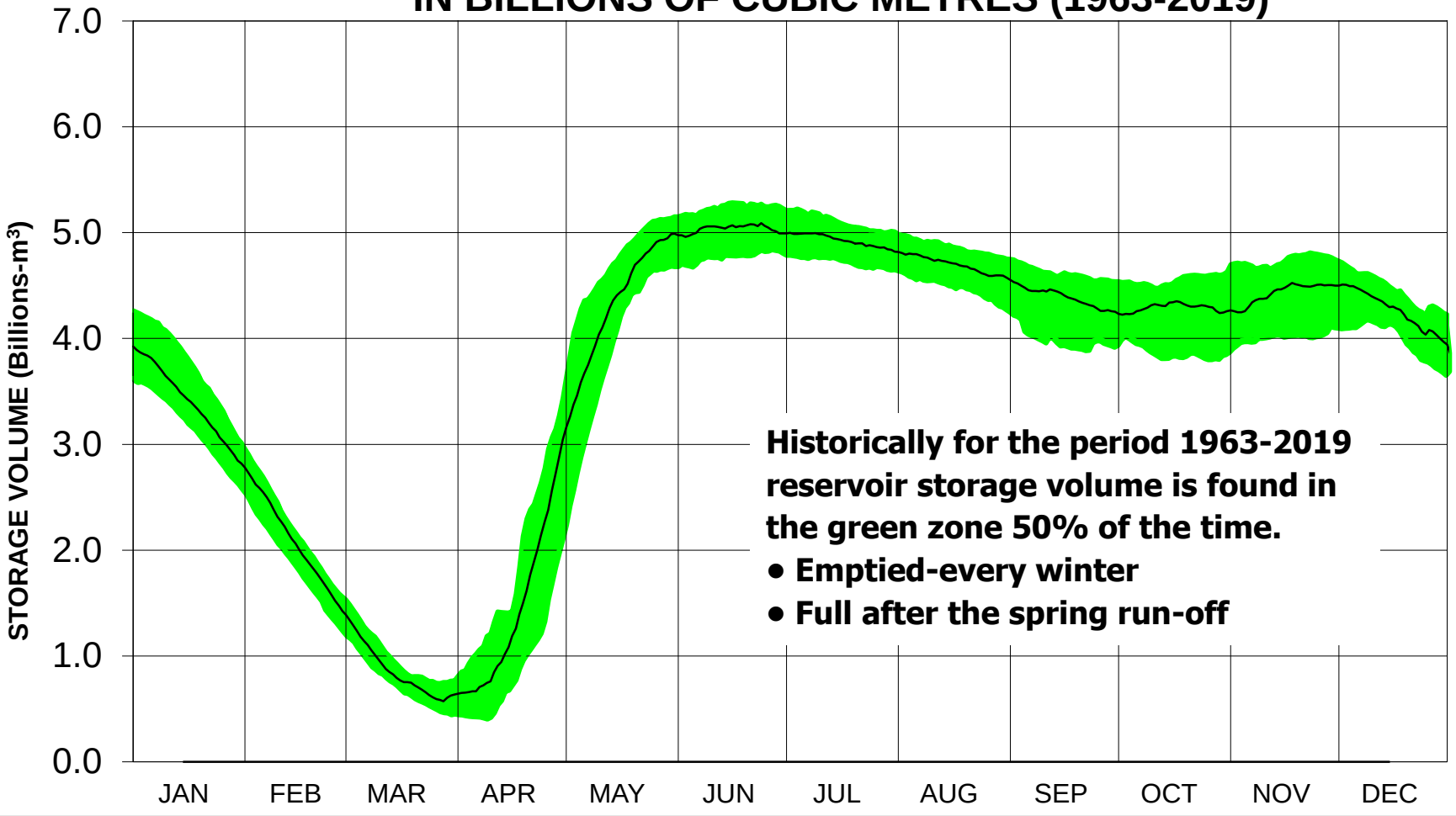
# Major Run-Of-River Dams on the Ottawa River



# Reservoir Management Annual Cycle

| Winter | Spring | Summer | Fall |
| --- | --- | --- | --- |
| Winter drawdown and preparation for the spring freshet | Refill and retention of water to reduce downstream flow | Summer level management and drought mitigation | Operations for fall flood control and reservoir refill |

# WATER STORED IN ABITIBI-TIMISKAMING RESERVOIRS IN BILLIONS OF CUBIC METRES (1963-2019)



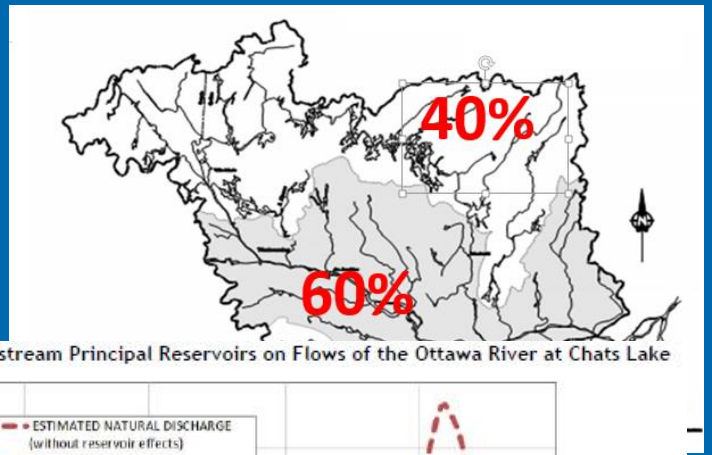
# Limits of Flow Regulation

## Flooding occurs when:

- Spring runoff greatly exceeds the size of reservoirs
- There is significant spring runoff in areas where there are no reservoirs

## Flooding extent and duration :

- Is always reduced
- Eliminated  in many years

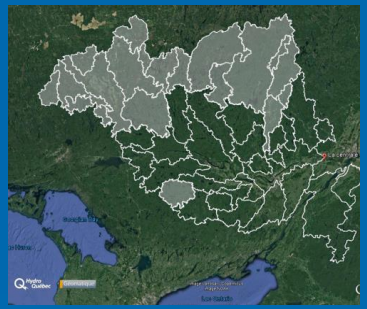


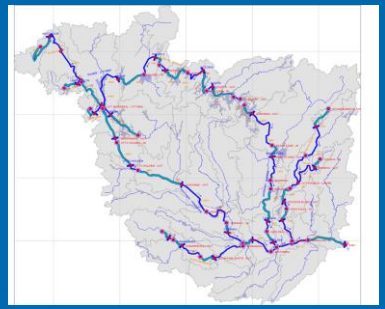
# Daily work of the Regulating Committee

- Collect all information relevant to flow forecasting (Secretariat)

- Run flow models

  (Hydro-Québec and Secretariat)





- Assess forecast conditions(weather, inflows and levels/flow rates) and optimize holding back to spring runoff in reservoirs to reduce flows downstream to maximize flood alleviation (Regulating Committee)

- Disseminate river conditions forecast to responsible authorities and the public (Secretariat and MNRF – Surface Water Monitoring Centre)

# Communicating the Coming Flood Risk

1. Always to Responsible Government Agencies first
   - ON - MNRF, Surface Water Monitoring Centre
   - QC – Sécurité civile, COG
   - Municipalities (Courtesy Calls)
2. Traditional Media
   - Television, Radio and Newspapers
3. Website
   - Record internet usage
   - Twitter

# 1 - Flood-related Messages

- Look for local conservation authorities and MNRF district office flood-related messages

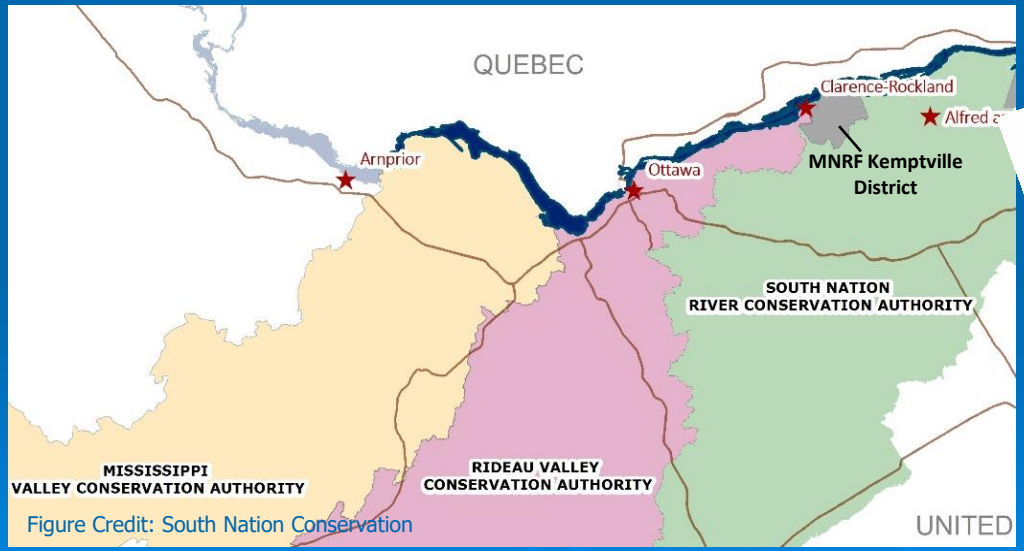
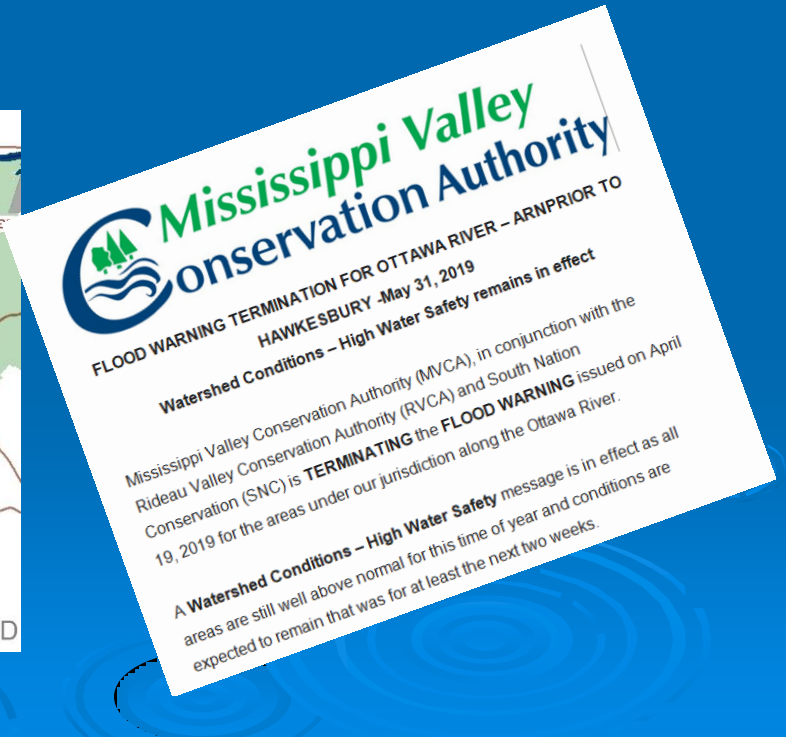



Figure Credit: South Nation Conservation

https://www.ontario.ca/law-and-safety/flood-forecasting-and-warning-program



Mississippi Valley Conservation Authority

**FLOOD WARNING TERMINATION FOR OTTAWA RIVER – ARNPRIOR TO HAWKESBURY -May 31, 2019**

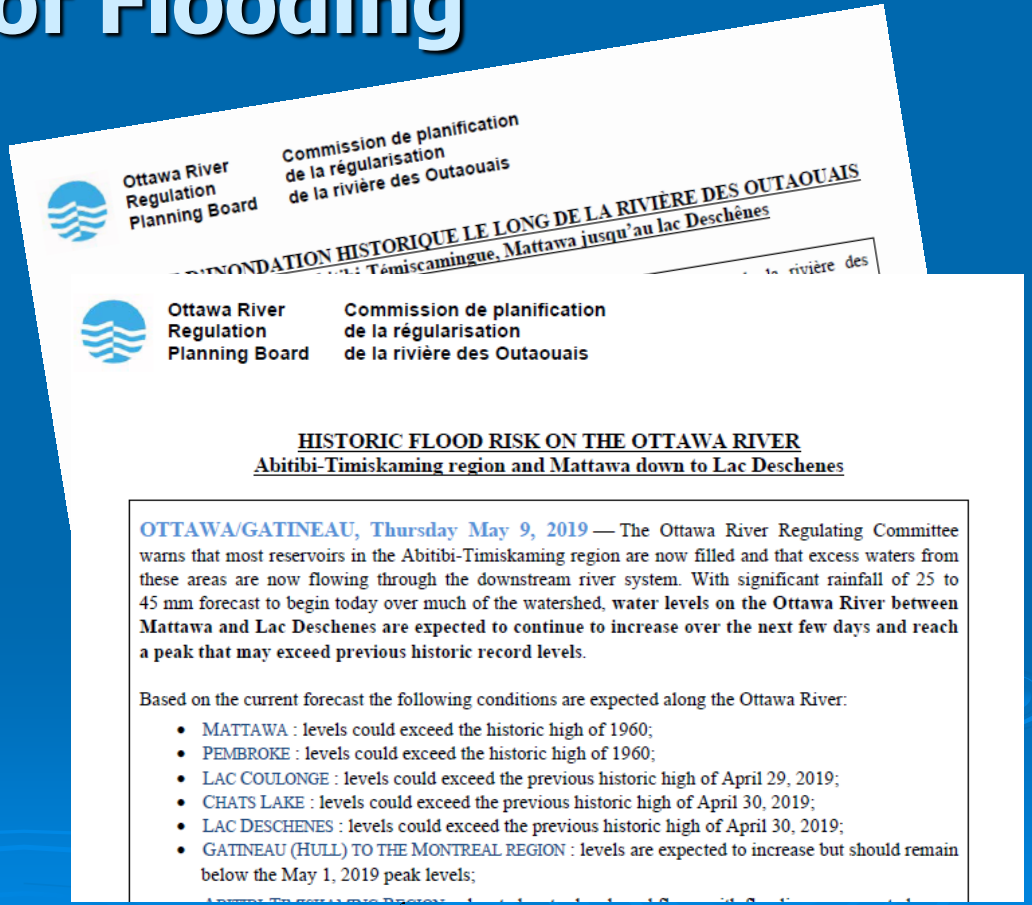
**Watershed Conditions – High Water Safety remains in effect**

Mississippi Valley Conservation Authority (MVCA), in conjunction with the Rideau Valley Conservation Authority (RVCA) and South Nation Conservation (SNC) is **TERMINATING** the **FLOOD WARNING** issued on April 19, 2019 for the areas under our jurisdiction along the Ottawa River.

A **Watershed Conditions – High Water Safety** message is in effect as all areas are still well above normal for this time of year and conditions are expected to remain that was for at least the next two weeks.

# 2 – Keeping the Public Informed of the Risk of Flooding

- **6 Press Releases in 2019**
  - **11 April– Start of the spring freshet**
  - **First peak – warning of the risk of flooding:**
    - **16 April– levels similar to the first peak of 2017**
    - **18 April– levels similar to the peak of 2017**
    - **25 April– level possibly exceeding those of 2017**
  - **Second peak–two notices:**
    - **3 May– Levels are high with potential for further increases**
    - **9 May- Historic flooding from Mattawa down to Lac Deschenes**



Ottawa River Regulation Planning Board
Commission de planification de la régularisation de la rivière des Outaouais

INONDATION HISTORIQUE LE LONG DE LA RIVIÈRE DES OUTAOUAIS
Témiscamingue, Mattawa jusqu'au lac Deschênes

Ottawa River Regulation Planning Board
Commission de planification de la régularisation de la rivière des Outaouais

**HISTORIC FLOOD RISK ON THE OTTAWA RIVER**
**Abitibi-Timiskaming region and Mattawa down to Lac Deschenes**

OTTAWA/GATINEAU, Thursday May 9, 2019 — The Ottawa River Regulating Committee warns that most reservoirs in the Abitibi-Timiskaming region are now filled and that excess waters from these areas are now flowing through the downstream river system. With significant rainfall of 25 to 45 mm forecast to begin today over much of the watershed, **water levels on the Ottawa River between Mattawa and Lac Deschenes are expected to continue to increase over the next few days and reach a peak that may exceed previous historic record levels.**

Based on the current forecast the following conditions are expected along the Ottawa River:

- MATTAWA : levels could exceed the historic high of 1960;
- PEMBROKE : levels could exceed the historic high of 1960;
- LAC COULONGE : levels could exceed the previous historic high of April 29, 2019;
- CHATS LAKE : levels could exceed the previous historic high of April 30, 2019;
- LAC DESCHENES : levels could exceed the previous historic high of April 30, 2019;
- GATINEAU (HULL) TO THE MONTREAL REGION : levels are expected to increase but should remain below the May 1, 2019 peak levels;

ottawariver.ca / rivieredesoutaouais.ca

# 3 – Follow us on Twitter – twitter.com/ORRPB

**ORRPB** @ORRPB · May 9

Historic flood risk on the Ottawa River between Mattawa and Lac Deschesnes/Britannia and Abitibi-Timiskaming region. Read the full press release by the Ottawa River Regulating Committee at ottawariver.ca/current-press-... #ONFlood #OttawaRiverLevel

13 4

**ORRPB** @ORRPB · May 3

Levels could rise rapidly between Mattawa and Lac Coulong
flood levels experienced earlier last month. Read the full Pres
Ottawa River Regulating Committee at ottawariver.ca/current-
#OttawaRiverLevel

10 6

**ORRPB** @ORRPB · May 3

Ongoing flood risk on the Ottawa River in all areas over the coming tv
Levels to remain high for the period. Read the full Press release by the
River Regulating Committee at ottawariver.ca/current-press-... #ONFloo
#OttawaRiverLevel

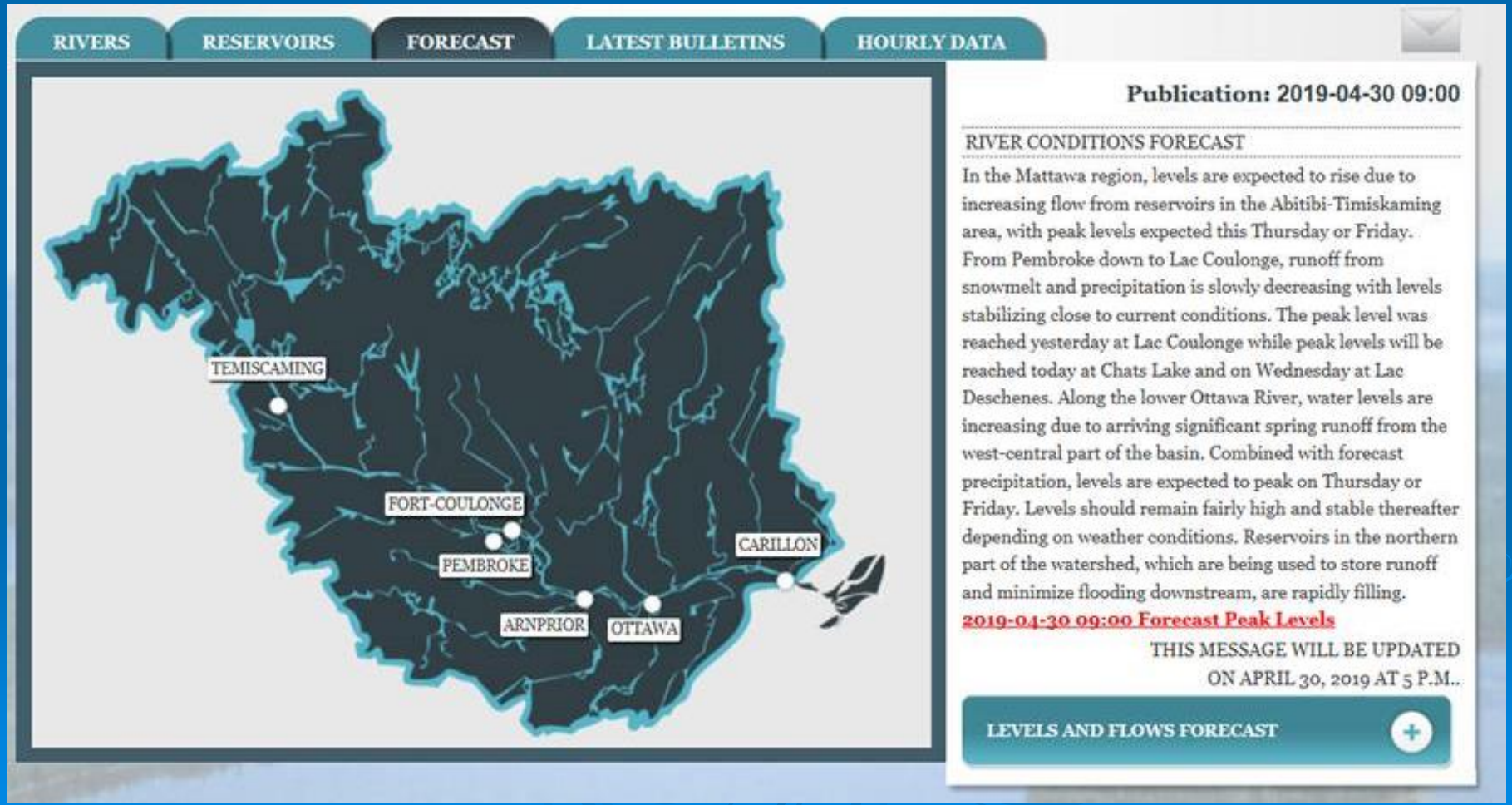
8 1

**ORRPB** @ORRPB · May 2

Questions about dams answered by Senior Water Resources Engineer Michael Sarich. Hear the interview by Robyn Bresnahan at cbc.ca/listen/live-ra... #ONFlood #OttawaRiverLevel


We tweet everytime a Press release is issued …and more

# 3 - Daily updating of Website



# 3 - Forecast Peak Flood Levels

*Utilized in the case of exceptional flooding*

- *Used for the first time in 2017*
- *Used once again in 2019*
- *Published over 50 times in 2019*

Look for 'Lac Deschenes / Britannia' for info relevant to Constance Bay

**OTTAWA RIVER REGULATING COMMITTEE (ORRC)**
**OTTAWA RIVER**
**FORECAST PEAK FLOOD LEVELS**
2019-04-23 09:00
**(Next update 2019-04-23 17:00)**

| | | CURRENT LEVEL | | FORECAST PEAK LEVEL | | |
|---|---|---|---|---|---|---|
| | 2017 PEAK (m)*** | DATE-TIME | LEVEL (m) ** | DATE | LEVEL (m) ** | CHANGE (cm) * |
| MATTAWA | 153.96 | 2019-04-23 08:00 | 152.73 | 2019-05-01 | 154.00 | 127 |
| PEMBROKE | 113.03 | 2019-04-23 05:00 | 112.68 | 2019-04-27 | 113.20 | 52 |
| LAC COULONGE | 108.52 | 2019-04-23 06:45 | 107.60 | 2019-04-28 | 108.50 | 90 |
| LAC CHATS | 75.95 | 2019-04-23 08:00 | 75.33 | 2019-04-27 | 75.80 | 47 |
| LAC DESCHENES/BRITANNIA | 60.44 | 2019-04-23 08:00 | 59.83 | 2019-04-28 | 60.30 | 47 |
| GATINEAU/HULL MARINA | 45.20 | 2019-04-23 06:45 | 44.20 | 2019-04-29 | 44.60 | 40 |
| THURSO | 43.69 | 2019-04-23 06:45 | 43.02 | 2019-04-29 | 43.30 | 28 |
| GRENVILLE/HAWKESBURY | 42.81 | 2019-04-23 06:45 | 42.30 | 2019-04-29 | 42.50 | 20 |
| MANIWAKI | 166.10 | 2019-04-23 06:45 | 164.33 | 2019-04-28 | 165.00 | 67 |

# 3 - Increased Forecasting

## 2017 : 3-day forecast at 4 locations

| SITES (PUBLICATION: 2017-04-27 15:31) | | OBSERVATIONS DATE/TIME | OBSERVATIONS VALUE | FORECAST 2017-04-27 | FORECAST 2017-04-28 | FORECAST 2017-04-29 |
|---|---|---|---|---|---|---|
| Ottawa River at Temiscaming | Flow ($m^3/s$) | | | 1400 | 1500 | 1500 |
| Ottawa River at Pembroke | Level (m) | 2017-04-27, 8 A.M. | 112.44 | 112.44 | 112.45 | 112.60 |
| Ottawa River at Britannia | Level (m) | 2017-04-27, 8 A.M. | 59.64 | 59.64 | 59.64 | 59.64 |
| | Flow ($m^3/s$) | 2017-04-27, 8 A.M. | 3650 | 3650 | 3650 | 3650 |
| Ottawa River at Carillon | Flow ($m^3/s$) | 2017-04-27, 8 A.M. | 5684 | 5600 | 5600 | 5650 |

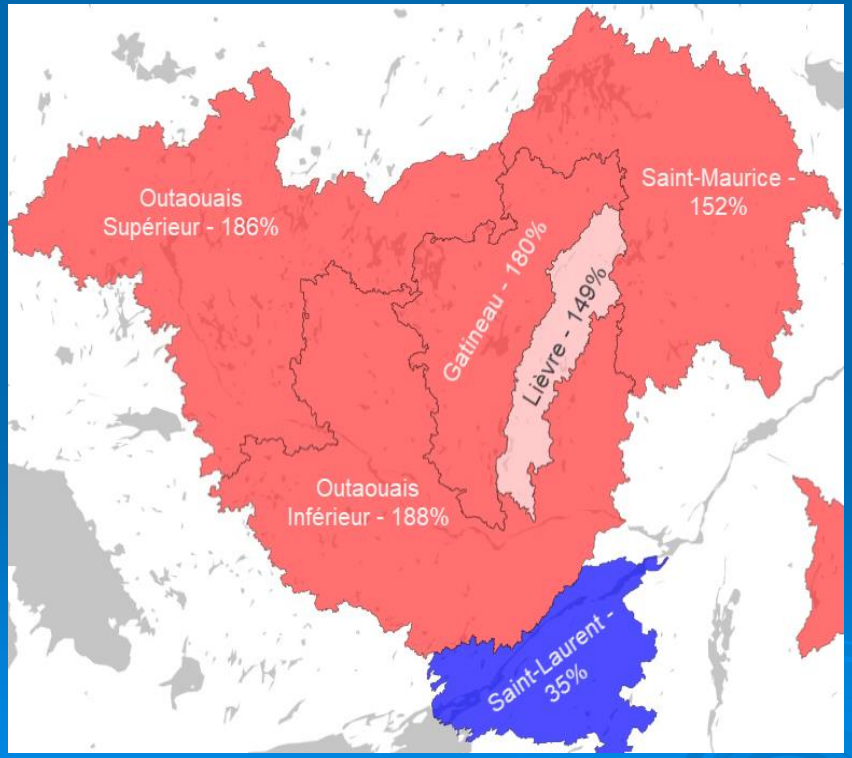
## 2019 : 4-day forecast at 6 locations

| (PUBLICATION: 2019-05-06 18:22) | | DATE/TIME | VALUE | 2019-05-06 | 2019-05-07 | 2019-05-08 | 2019-05-09 |
|---|---|---|---|---|---|---|---|
| Ottawa River at Temiscaming | Flow ($m^3/s$) | | | 2600 | 2800 | 2900 | 2900 |
| Ottawa River at Pembroke | Level (m) | 2019-05-06, 8 A.M. | 113.33 | 113.35 | 113.50 | 113.55 | 113.60 |
| Lake Coulonge at Fort-Coulonge | Level (m) | 2019-05-06, 8 A.M. | 108.74 | 108.78 | 108.85 | 108.95 | 109.05 |
| Chats Lake at Arnprior | Level (m) | 2019-05-06, 8 A.M. | 75.99 | 76.00 | 76.00 | 76.03 | 76.05 |
| Lake Deschenes at Britannia | Level (m) | 2019-05-06, 8 A.M. | 60.45 | 60.40 | 60.38 | 60.40 | 60.45 |
| (Ottawa) | Flow ($m^3/s$) | 2019-05-06, 8 A.M. | 5393 | 5350 | 5250 | 5300 | 5350 |
| Ottawa River at Carillon | Flow ($m^3/s$) | 2019-05-06, 8 A.M. | 8150 | 8100 | 7900 | 7850 | 7850 |

# Events of 2019

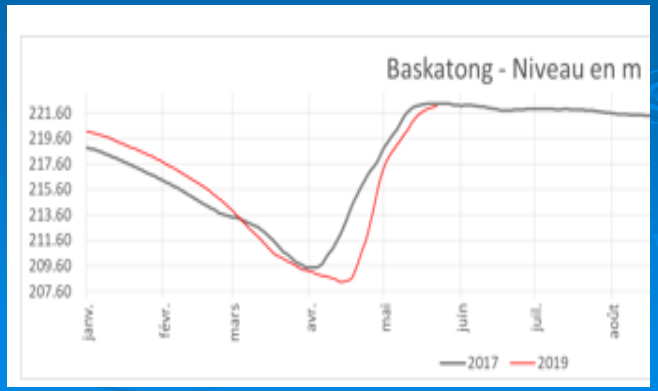
# Winter 2019 – Freshet Preparation

## Snow on the Ground April 1st % of Average

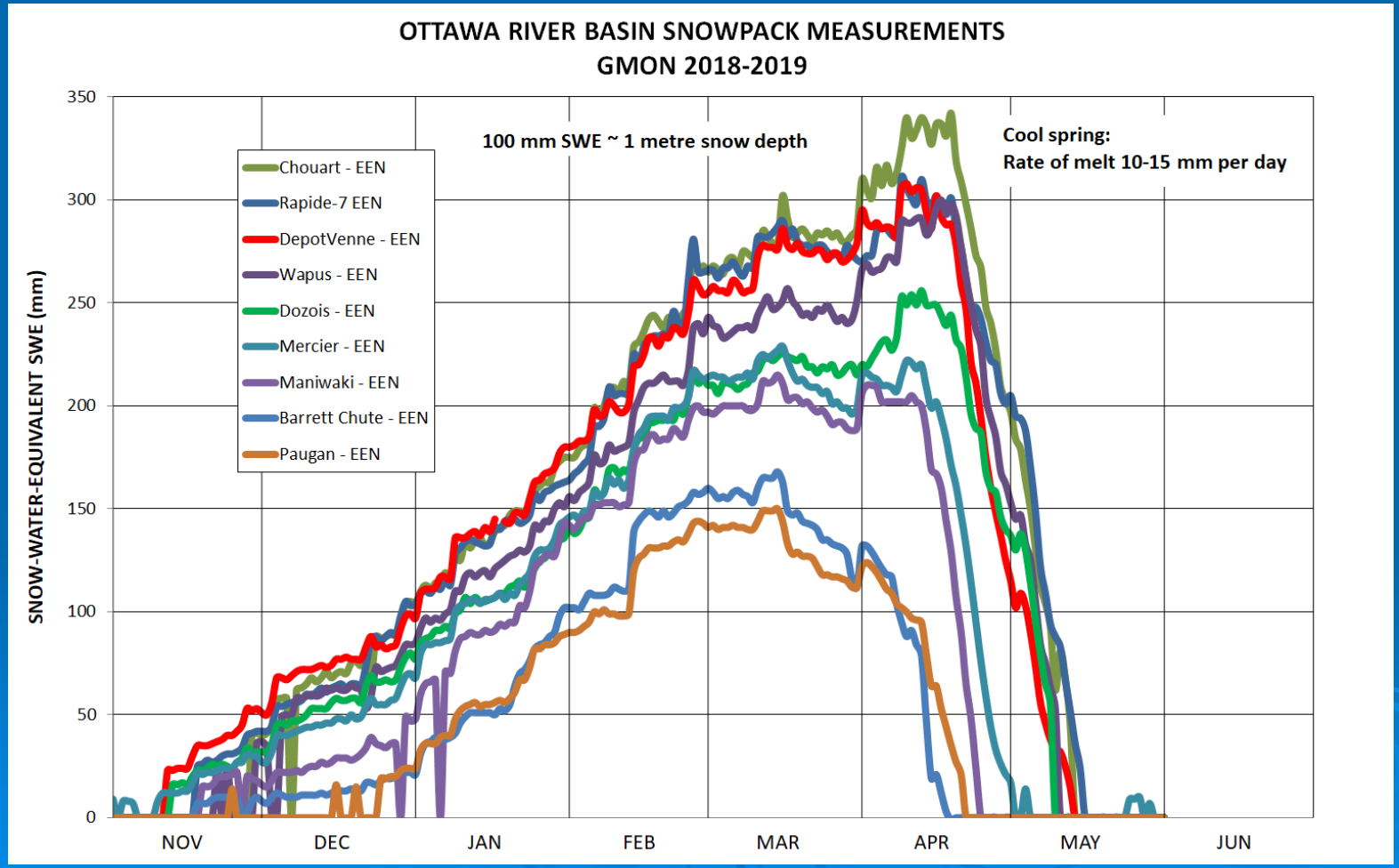



## Snowpack measurements

## Drawdown of reservoirs



# Winter 2019 – Freshet Preparation

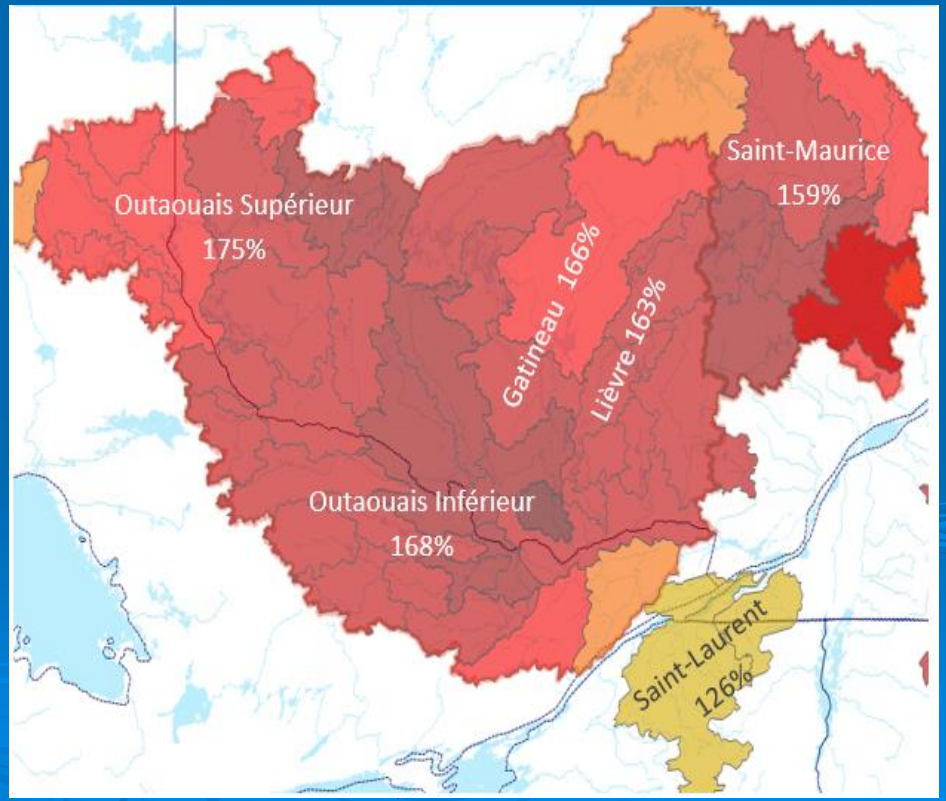


# Spring Freshet 2019

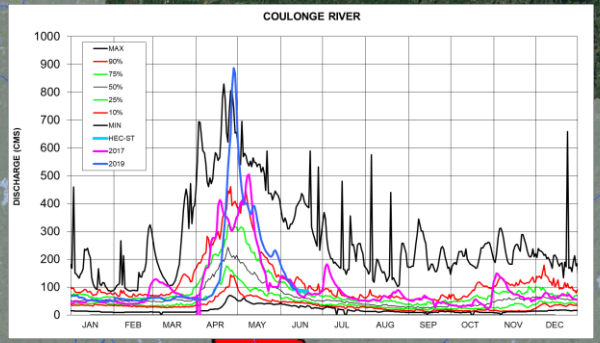
Excess precipitation over the whole basin

- Precipitation forecasts limited over 1 week in advance
- Historic tributary peaks!

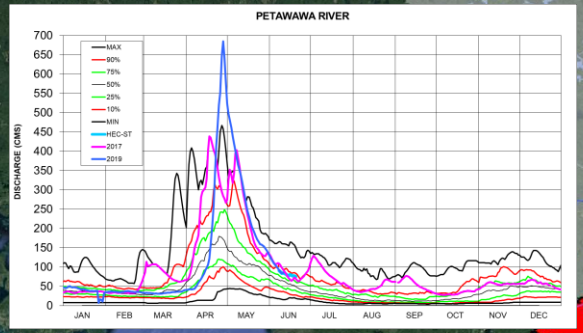
**Total Precipitation from April 1st to May 27th**
**% of Normal**



# Tributary Flooding 2019





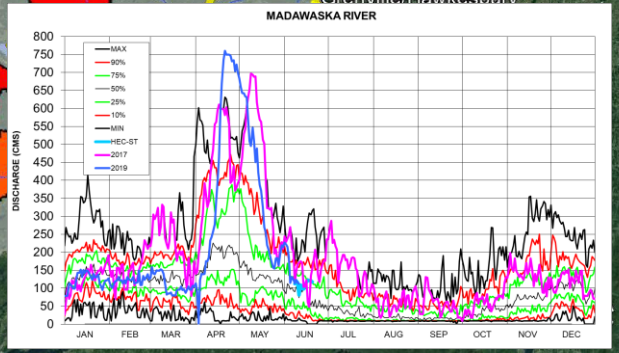



Mattawa

Fort-Coulonge

Pembroke

Grenville/Hawkesbury



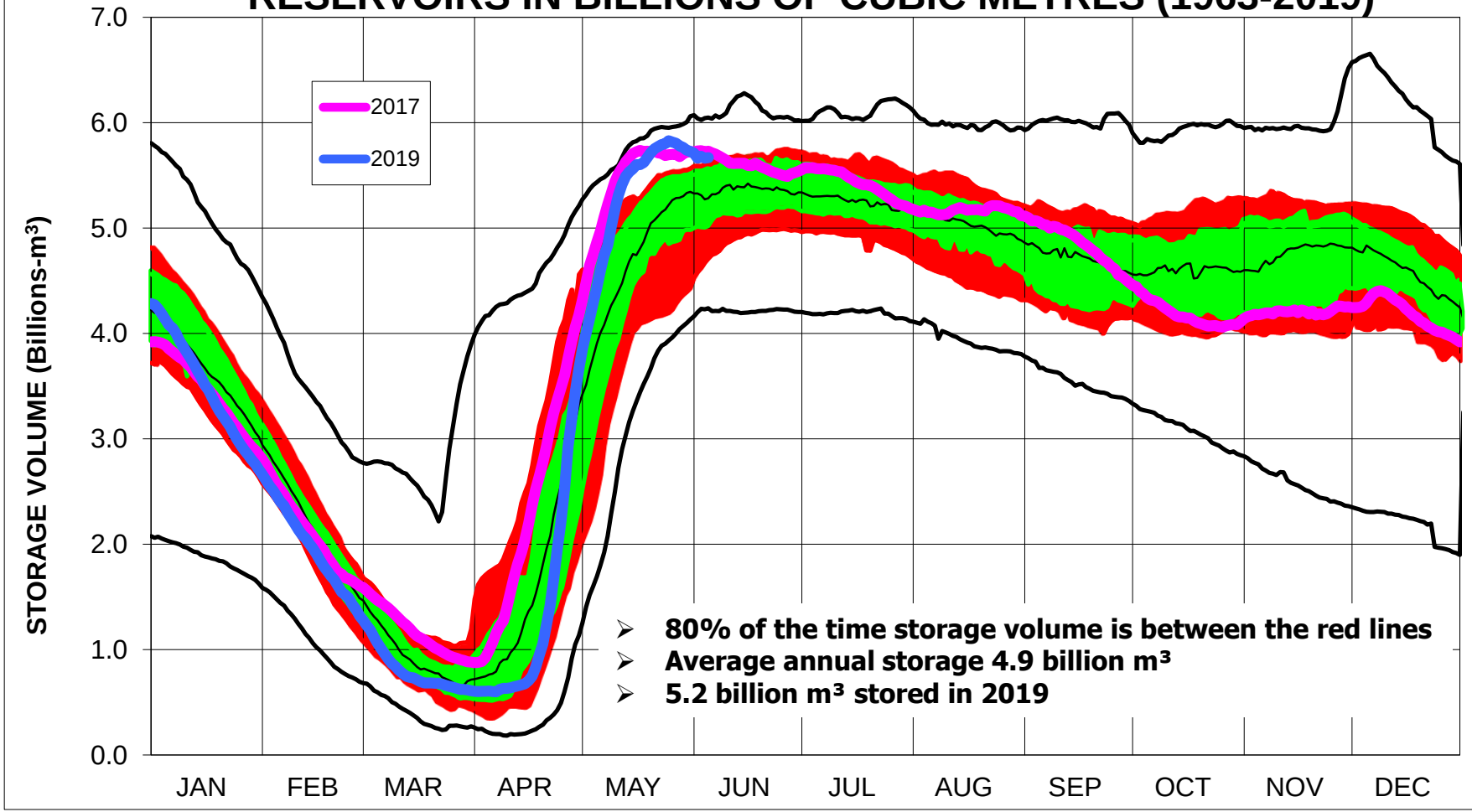

**New historic record peak flows from the uncontrolled mid-basin tributaries**

Image NOAA
Image Landsat / Copernicus

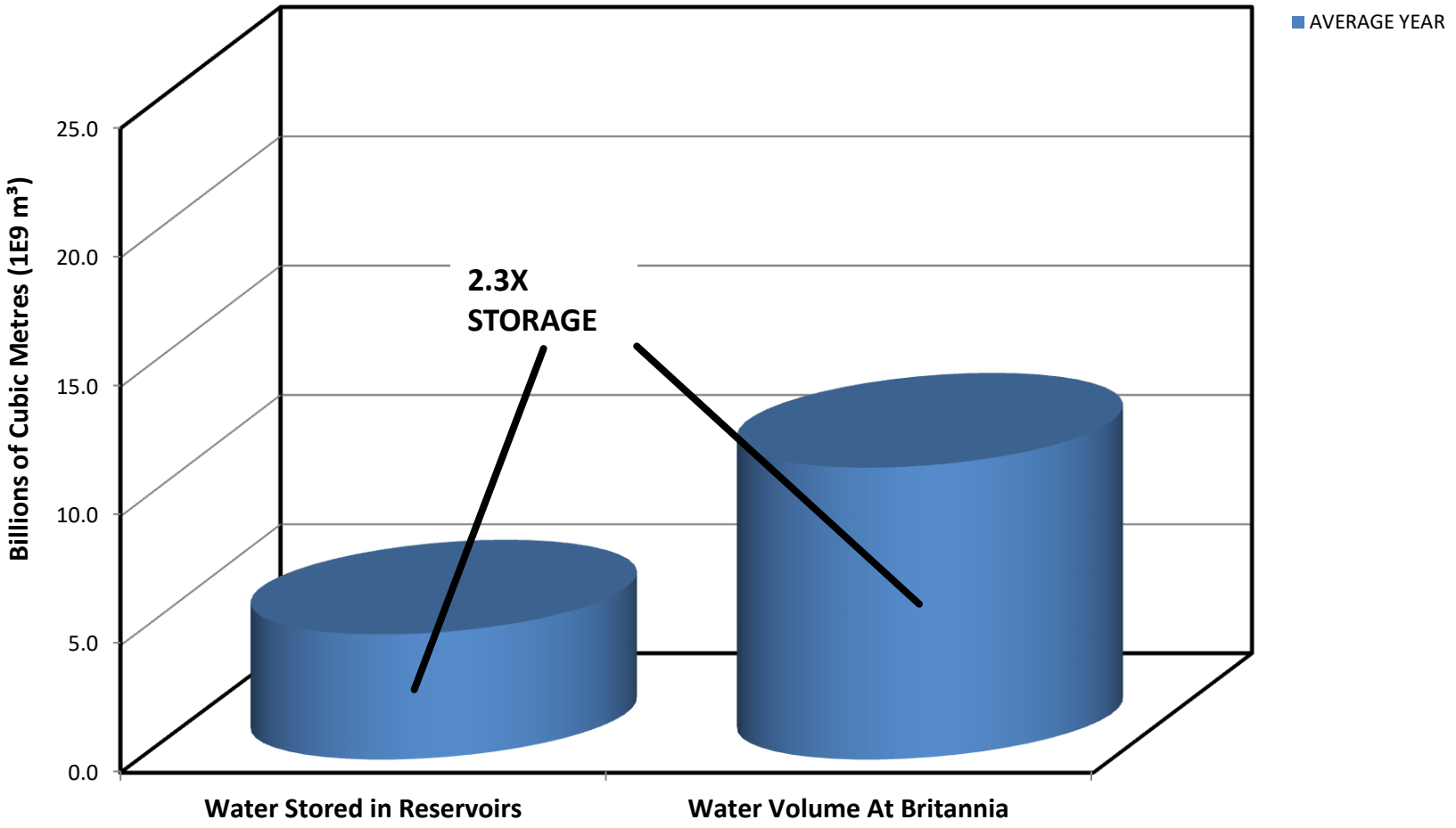
175 km

Earth

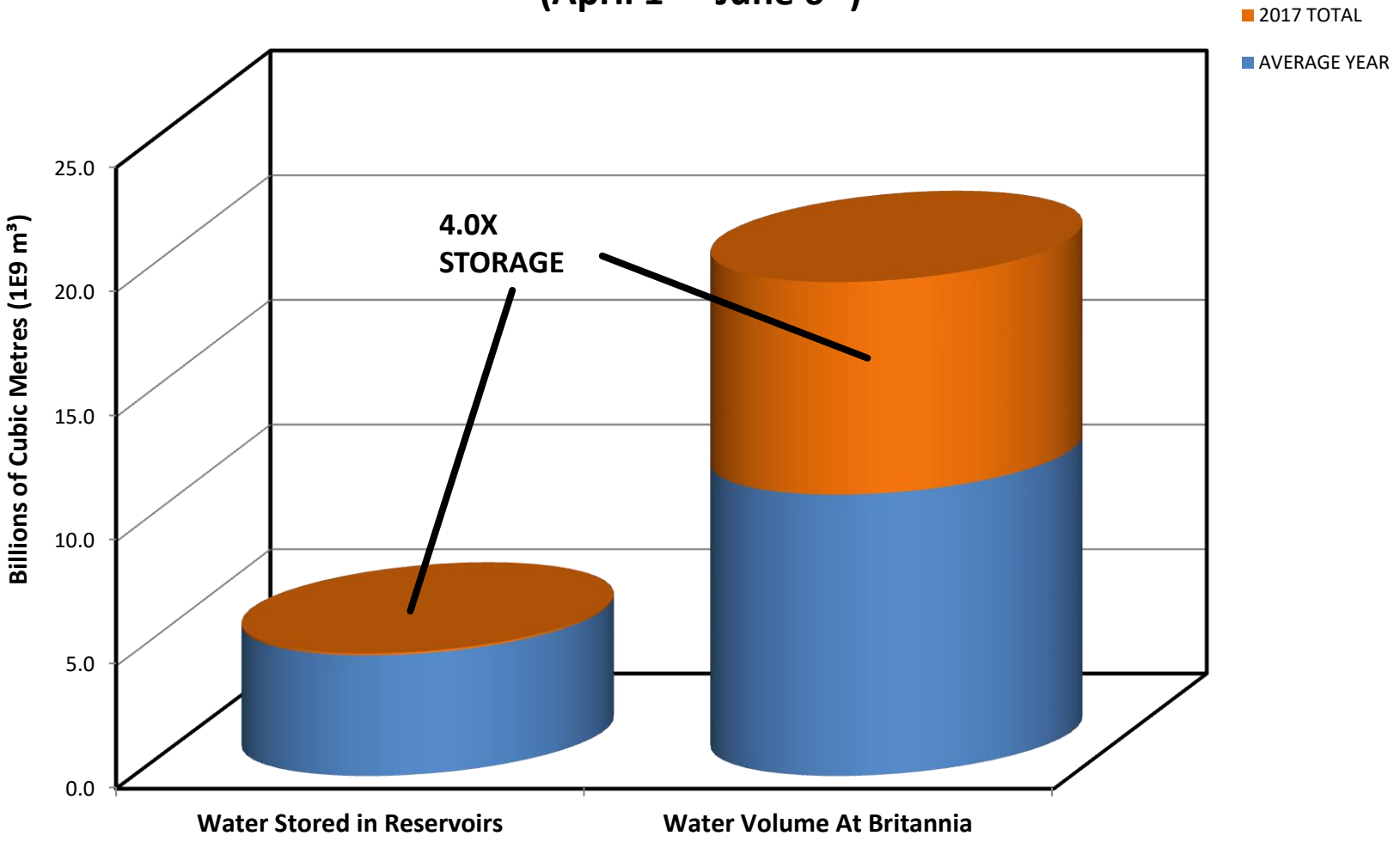
# WATER STORED IN ABITIBI-TIMISKAMING-BARK LAKE RESERVOIRS IN BILLIONS OF CUBIC METRES (1963-2019)

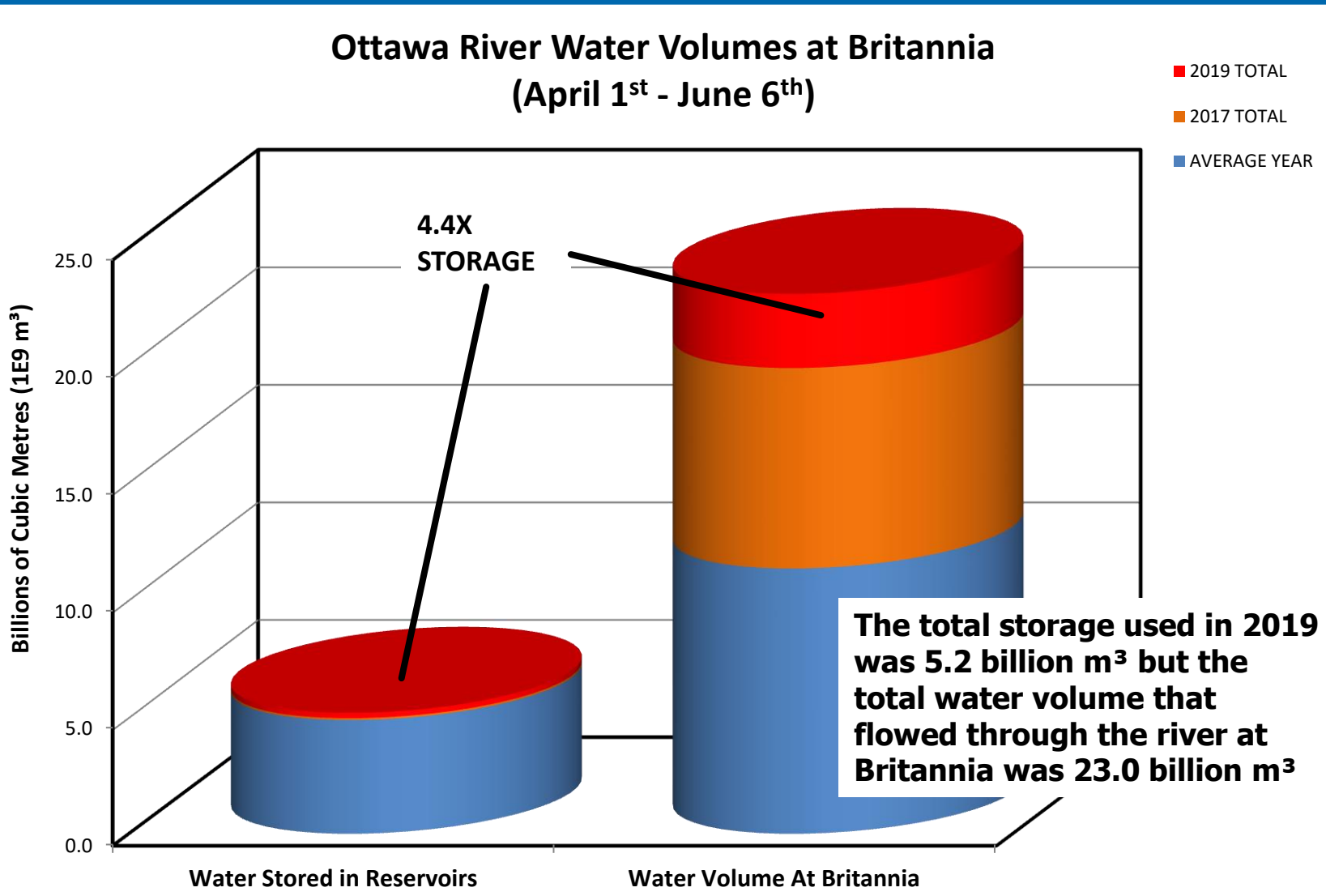


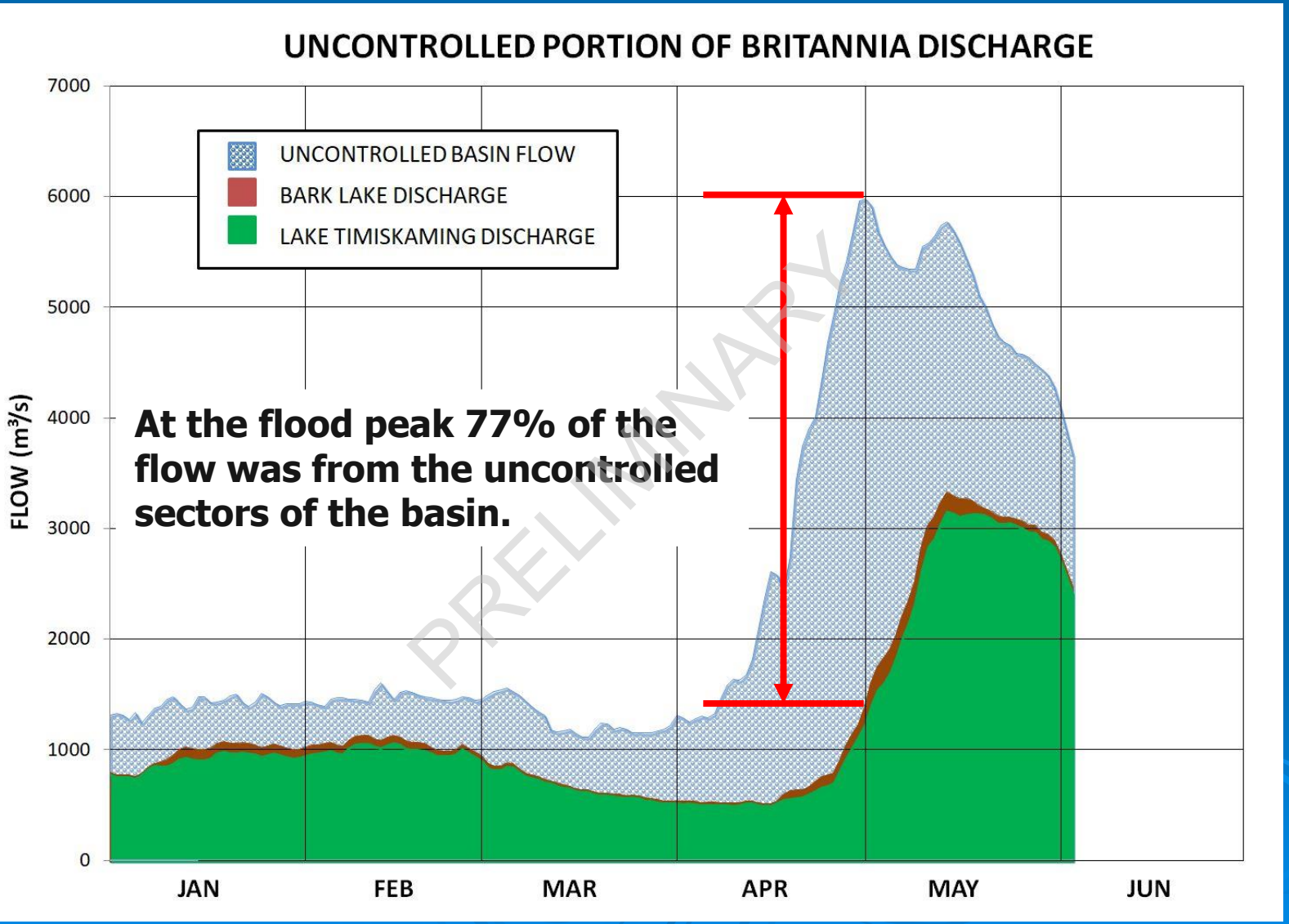
# Ottawa River Water Volumes at Britannia
# (April 1st - June 6th)

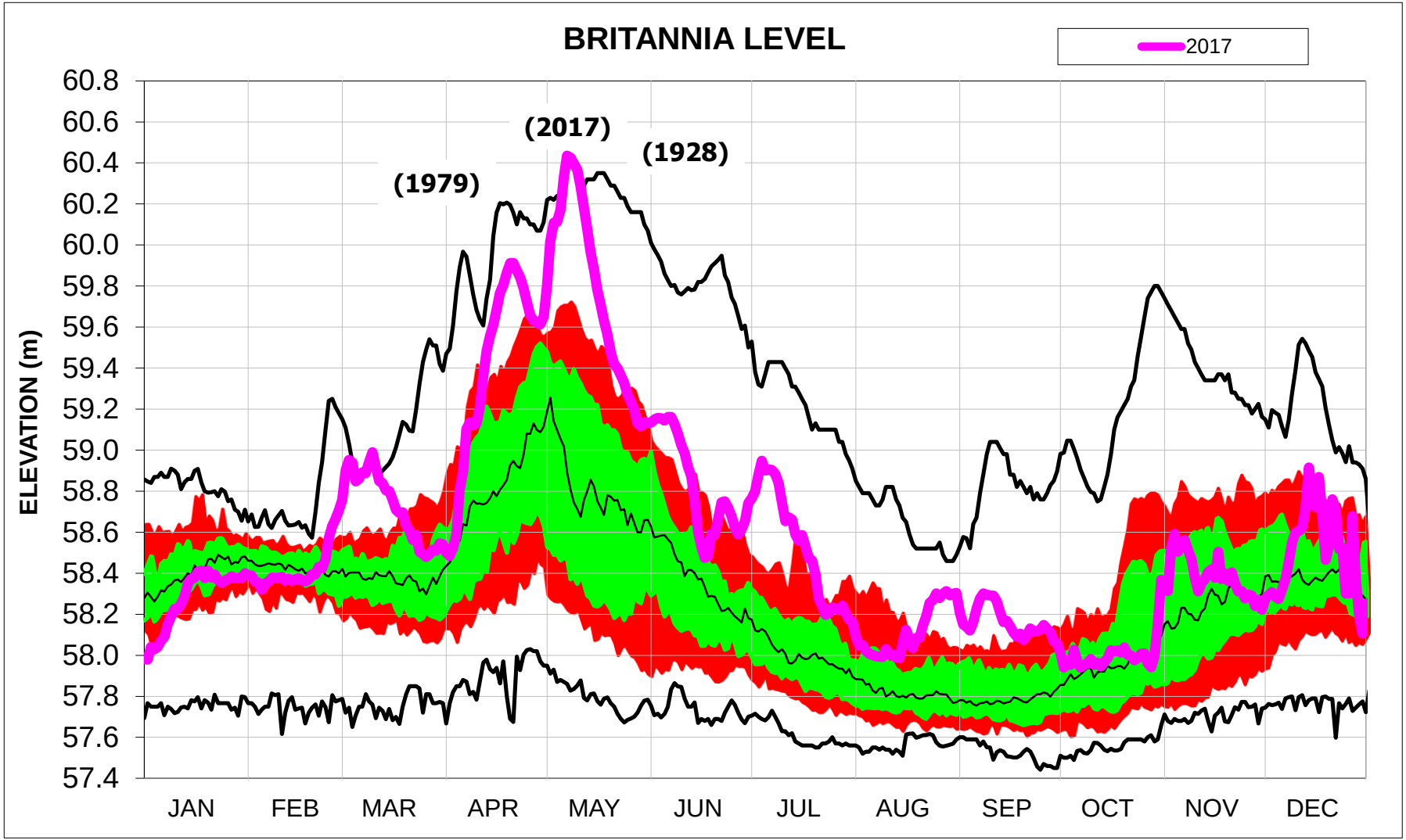


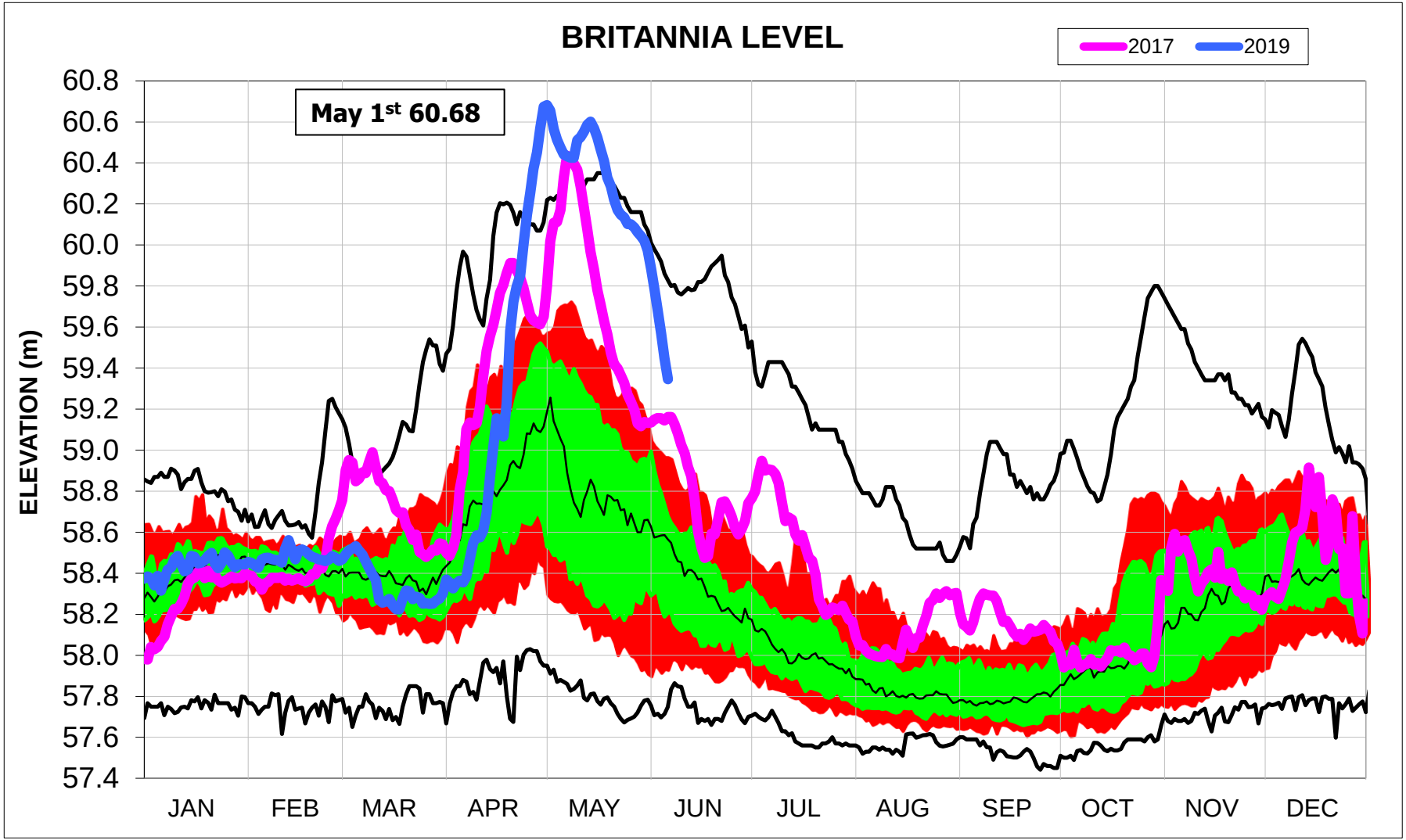
# Ottawa River Water Volumes at Britannia
# (April 1st - June 6th)



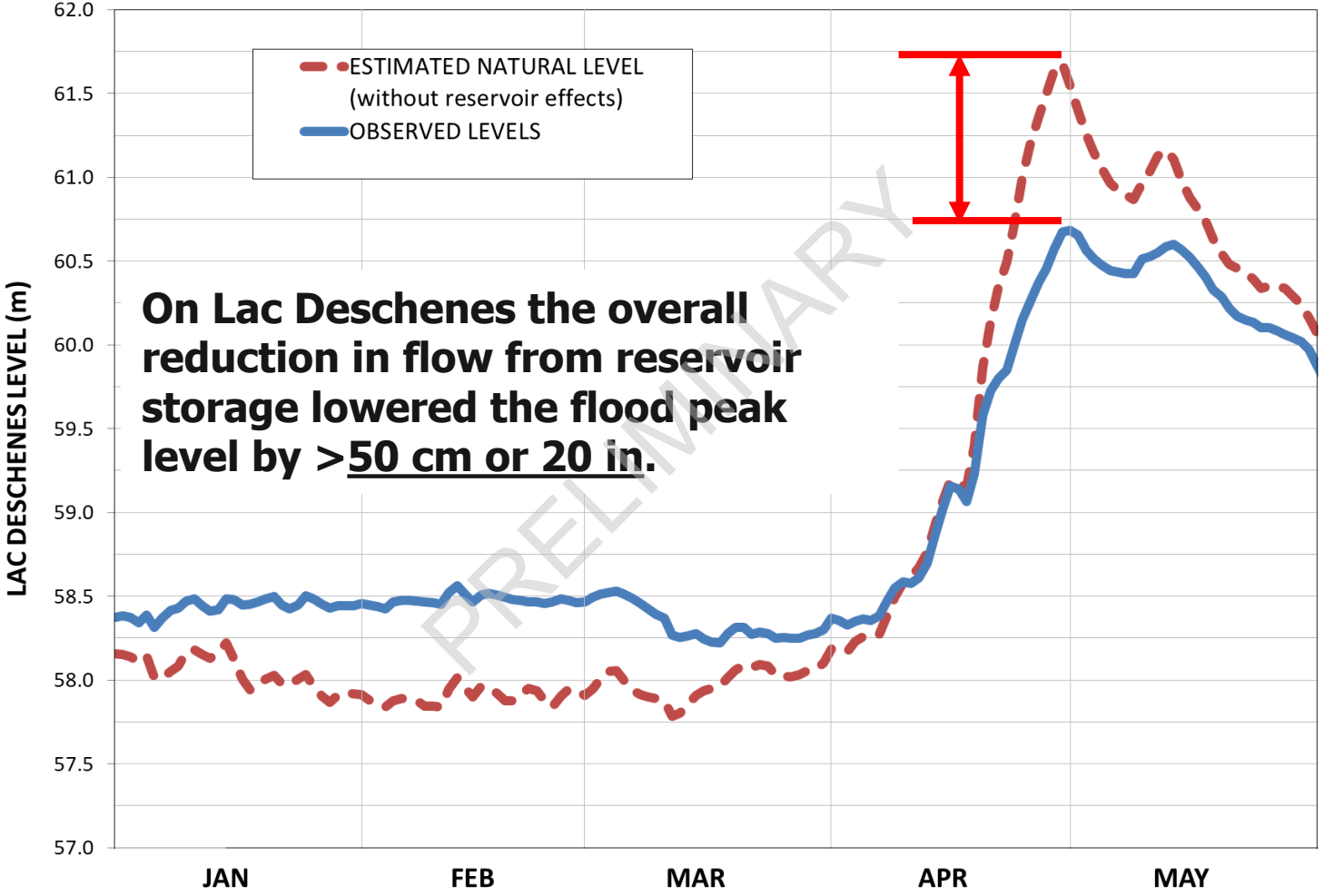

Ottawa River Water Volumes at Britannia
(April 1st - June 6th)
2019 TOTAL
2017 TOTAL
AVERAGE YEAR
4.4X
STORAGE
Billions of Cubic Metres (1E9 m³)
25.0
20.0
15.0
10.0
5.0
0.0
Water Stored in Reservoirs
Water Volume At Britannia
The total storage used in 2019 was 5.2 billion m³ but the total water volume that flowed through the river at Britannia was 23.0 billion m³


UNCONTROLLED PORTION OF BRITANNIA DISCHARGE
UNCONTROLLED BASIN FLOW
BARK LAKE DISCHARGE
LAKE TIMISKAMING DISCHARGE
FLOW (m³/s)
7000
6000
5000
4000
3000
2000
1000
0
JAN
FEB
MAR
APR
MAY
JUN
At the flood peak 77% of the flow was from the uncontrolled sectors of the basin.
PRELIMINARY

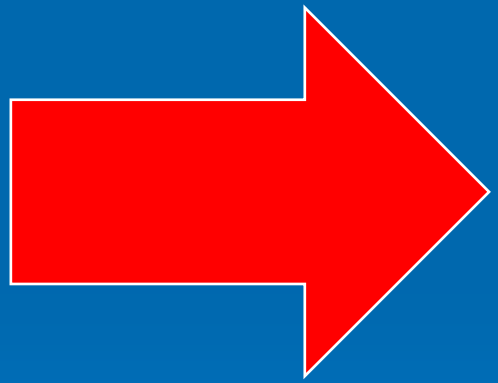

BRITANNIA LEVEL
2017
(2017)
(1928)
(1979)
ELEVATION (m)
60.8
60.6
60.4
60.2
60.0
59.8
59.6
59.4
59.2
59.0
58.8
58.6
58.4
58.2
58.0
57.8
57.6
57.4
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


BRITANNIA LEVEL
2017
2019
May 1st 60.68
ELEVATION (m)
60.8
60.6
60.4
60.2
60.0
59.8
59.6
59.4
59.2
59.0
58.8
58.6
58.4
58.2
58.0
57.8
57.6
57.4
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

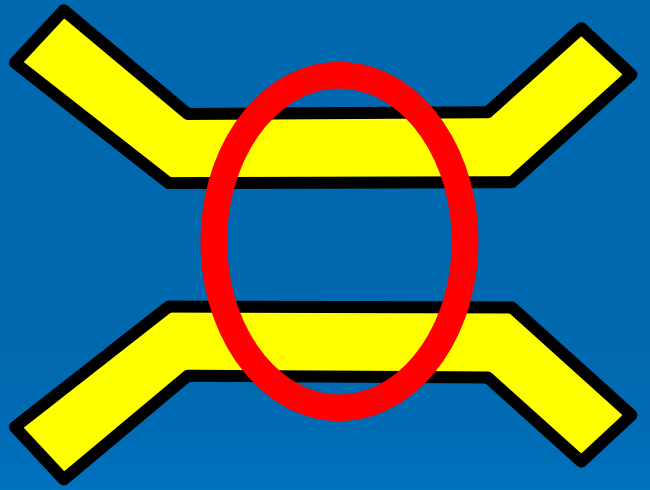
# LAC DESCHENES - OBSERVED LEVELS AND RESERVOIR EFFECTS



# What determines the level in my area?

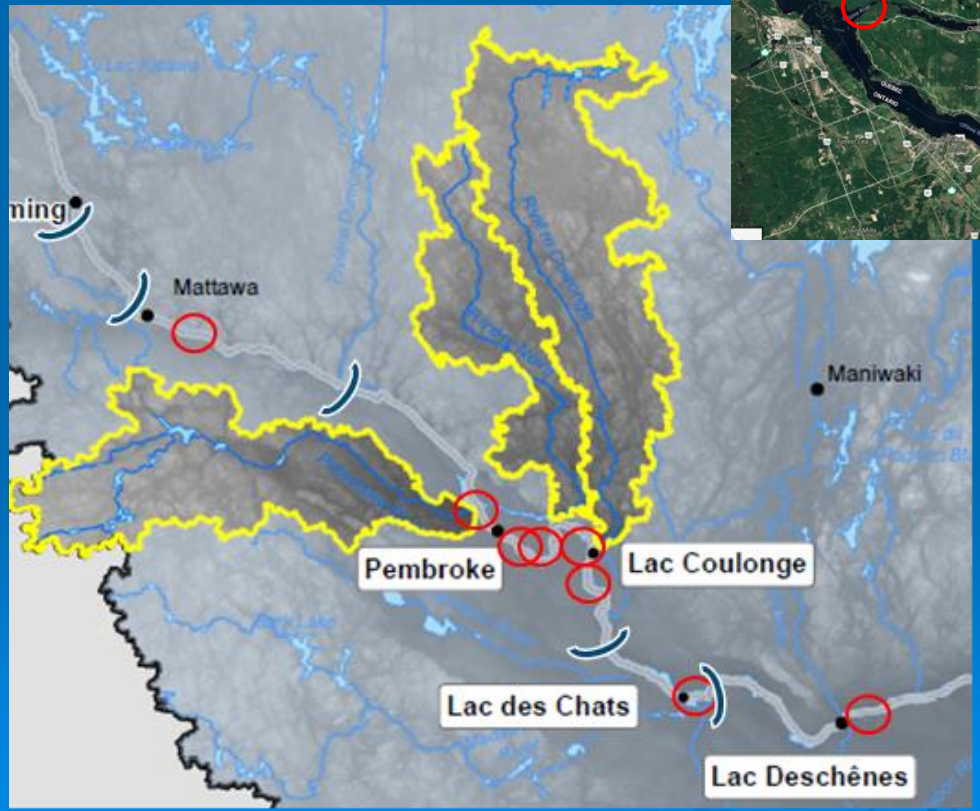


Arriving Upstream Flow

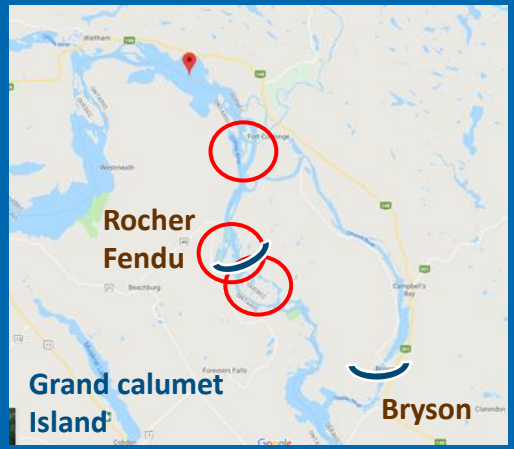


Downstream Constrictions (Control Point)

# Natural River Narrowing's Restrict the Passage of Water

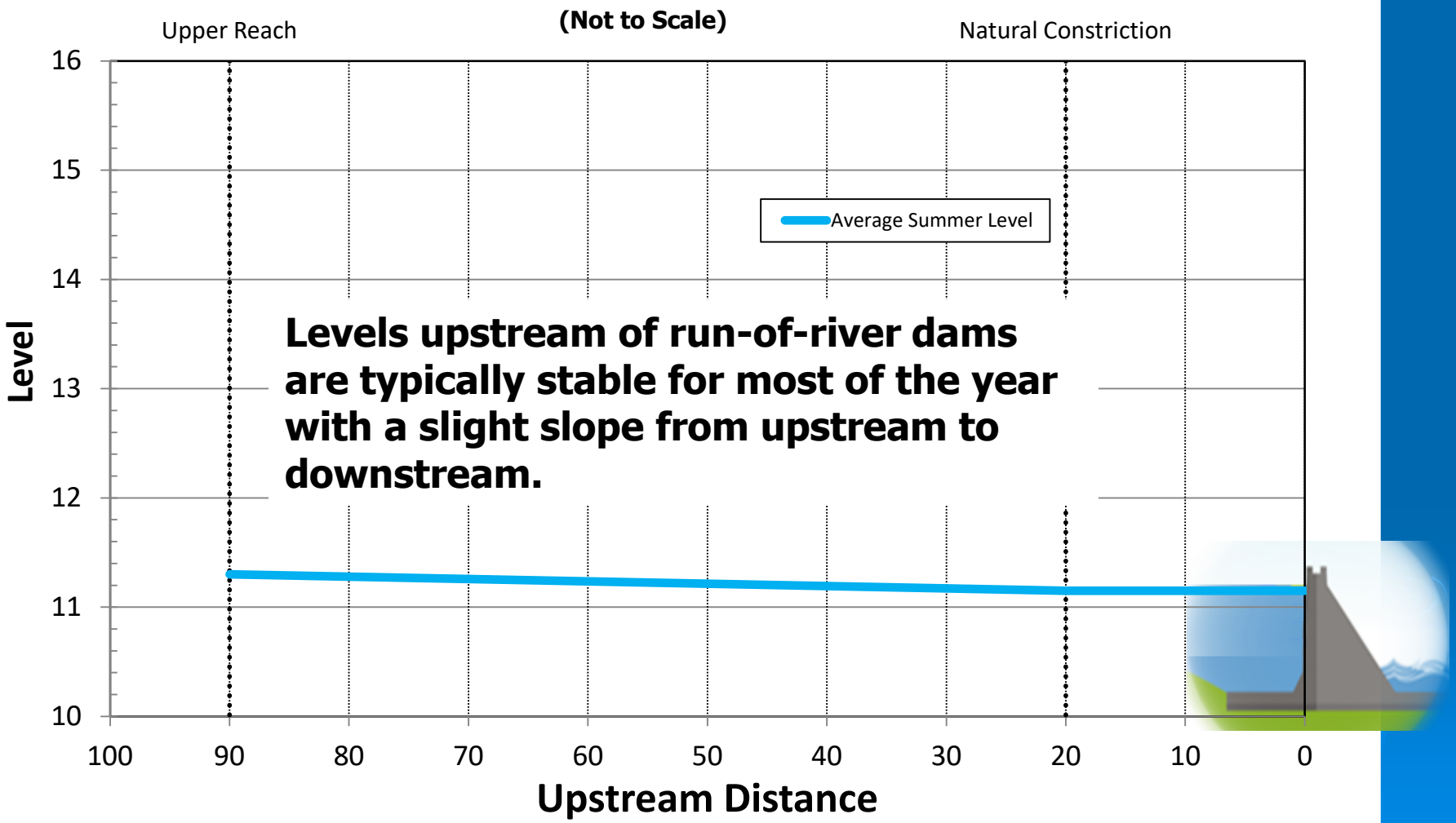







- Narrowing's cause water to back up (similar to a funnel)
- Before river flows become high, run-of-river dam's lower their level above the dam and conditions return to a near natural state

# Upstream Water Level Profile



# Upstream Water Level Profile

**(Not to Scale)**

Upper Reach

Natural Constriction

Average Summer Level

Average Peak Level

2017-2019

Backwater Effect

*Potential effect*

**During flooding run-of-river dams lower levels directly upstream to ensure they do not create a backwater effect worsening upstream flooding.**

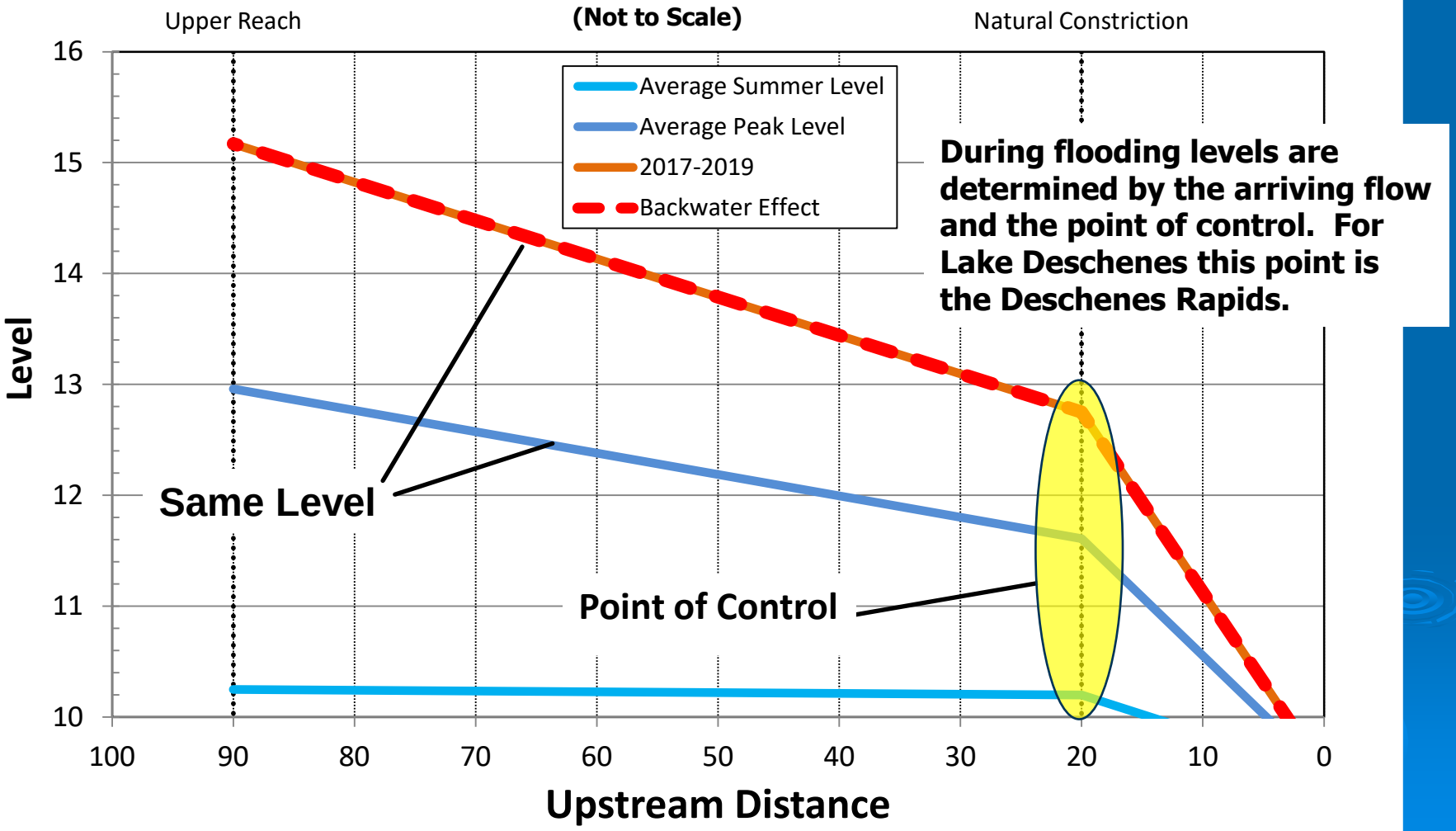
**Level**

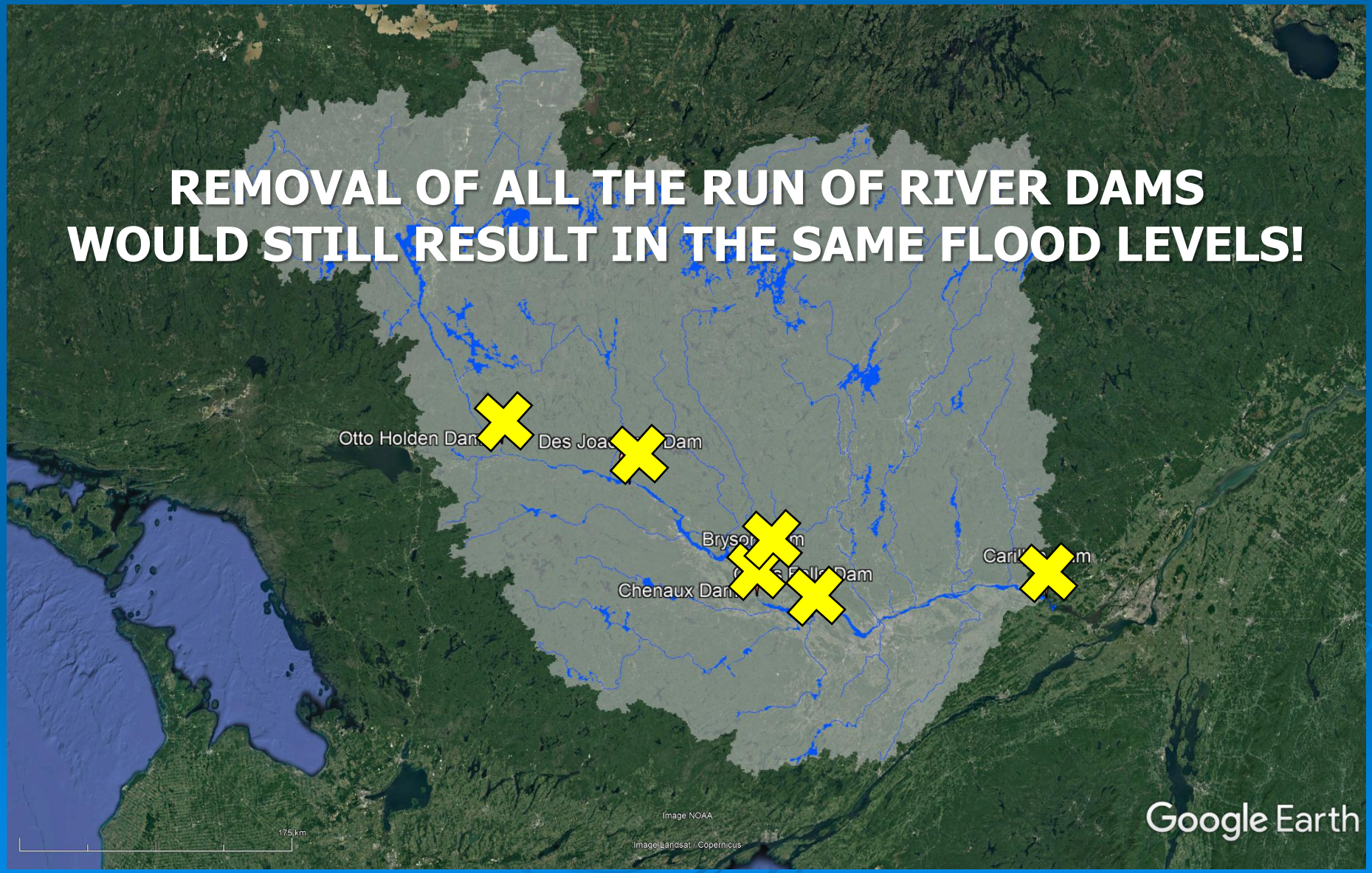
16
15
14
13
12
11
10

100 90 80 70 60 50 40 30 20 10 0

**Upstream Distance**

# Upstream Water Level Profile




REMOVAL OF ALL THE RUN OF RIVER DAMS
WOULD STILL RESULT IN THE SAME FLOOD LEVELS!
Otto Holden Dam
Des Joa Dam
Bryso m
Chenaux Dam
Cari m
175 km
Image NOAA
Image Landsat / Copernicus
Google Earth

# Lake Deschenes – Natural Lake

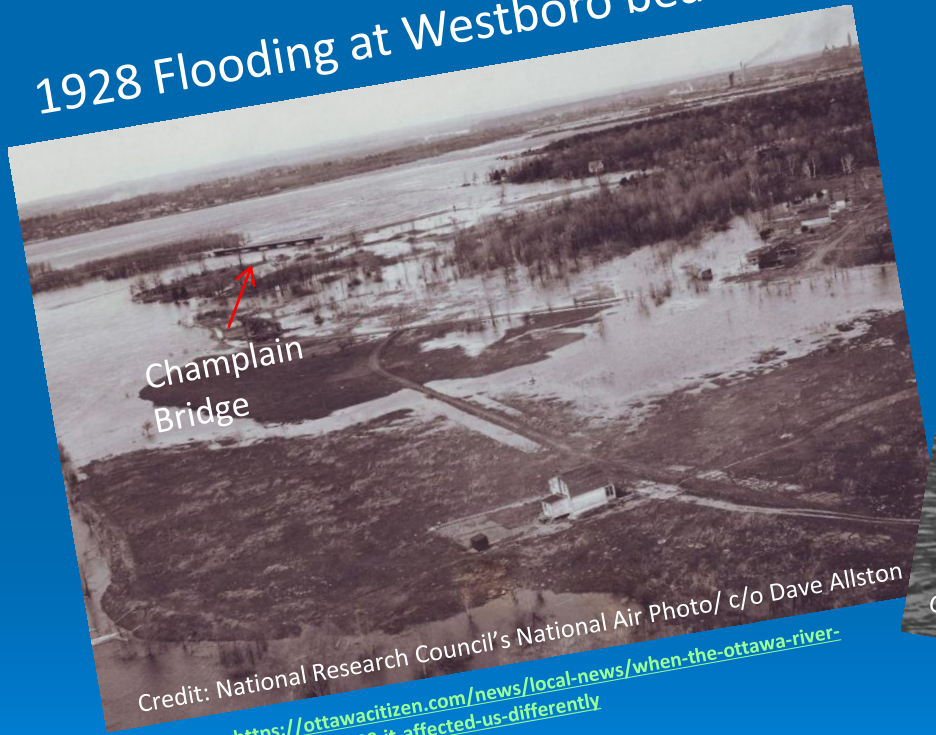
- Water levels are determined by
  - the upstream river flow rate
  - the natural river narrowing at Deschenes rapids
- Ring Dam at Chaudière Falls - Does not affect lake levels
  - during normal or flood conditions
- Carillon Dam - Affects water levels up to Hull
  - during normal conditions
  - but not during flood conditions (given operational levels are lowered)
- Conditions downstream (Hull, Carillon, Great Lakes) – *No effect on Lake Deschenes levels*

# Exceptional Spring Flooding

- Historic flooding from Pembroke down to Montreal
  - Record levels recorded at Pembroke, Westmeath/Lac Coulonge, Chats Lake, Britannia beach, Mattawa highest since 1960
  - Level in Gatineau/Hull similar to 2017
    - Highest since start of recording in 1964
  - Flow rate  at Carillon dam similar to 2017
    - Probably the highest flow in recorded history (1880's->)
- Exceptional floods occurred in 20's, 50's, 70's, 2017 and 2019
  - Other exceptional floods are to be expected in the future

# Floods of the past

1928 Flooding at Westboro beach




Credit: National Research Council's National Air Photo/ c/o Dave Allston

https://ottawacitizen.com/news/local-news/when-the-ottawa-river-flooded-in-1928-it-affected-us-differently

1947 Flooding in Hull

Credit: Bibliothèque et Archives nationales du Québec

**Flooding on the Ottawa River occurred before dams were built**

# Risks of Living in the Floodplain

Should be called the 1% flood!

## Risk over a 50-yr Period

Over a 50-year period, there's 40% chance of getting a 100-yr flood event at least once

## 100-yr Flood

Is actually a 1% flood, meaning that on any given year, there is a 1% chance of having a flood of this magnitude

# Limitations of Regulation

- Size of reservoirs smaller than spring runoff, large portion of the watershed uncontrolled
- Flooding cannot be prevented
- Peak of the flood is substantially reduced
- Amount of precipitation, rate of snowmelt and natural stream characteristics are main factors in flood levels
- Meteorological factors are known only a few days ahead

# Dam Mismanagement?

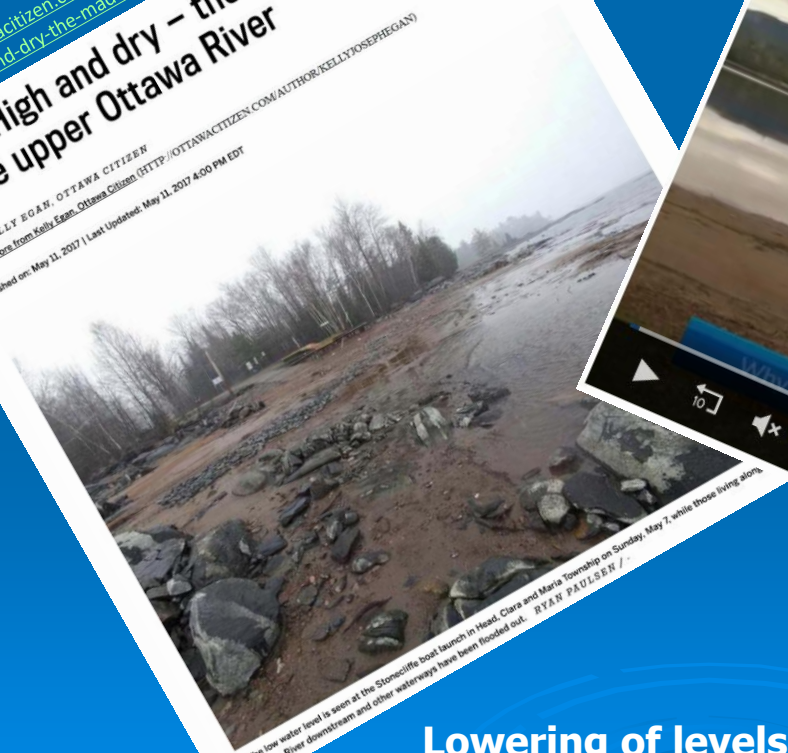
https://ottawacitizen.com/news/local-news/egan-high-and-dry-the-maddening-story-of-the-upper-ottawa-river

## Egan: High and dry – the maddening story of the upper Ottawa River

KELLY EGAN, OTTAWA CITIZEN

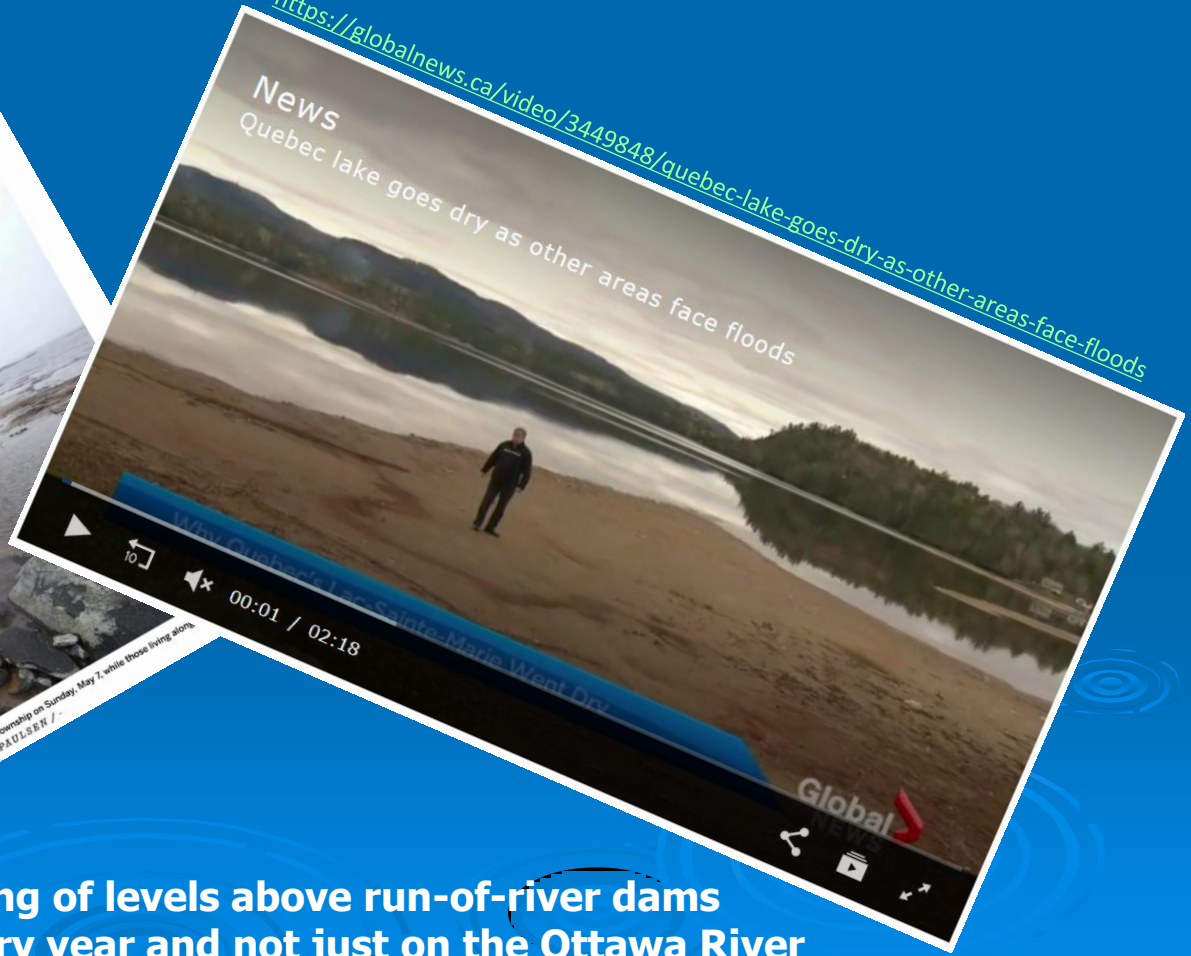
More from Kelly Egan, Ottawa Citizen (HTTP://OTTAWACITIZEN.COM/AUTHOR/KELLYJOSEPHEGAN)

Published on: May 11, 2017 | Last Updated: May 11, 2017 4:00 PM EDT

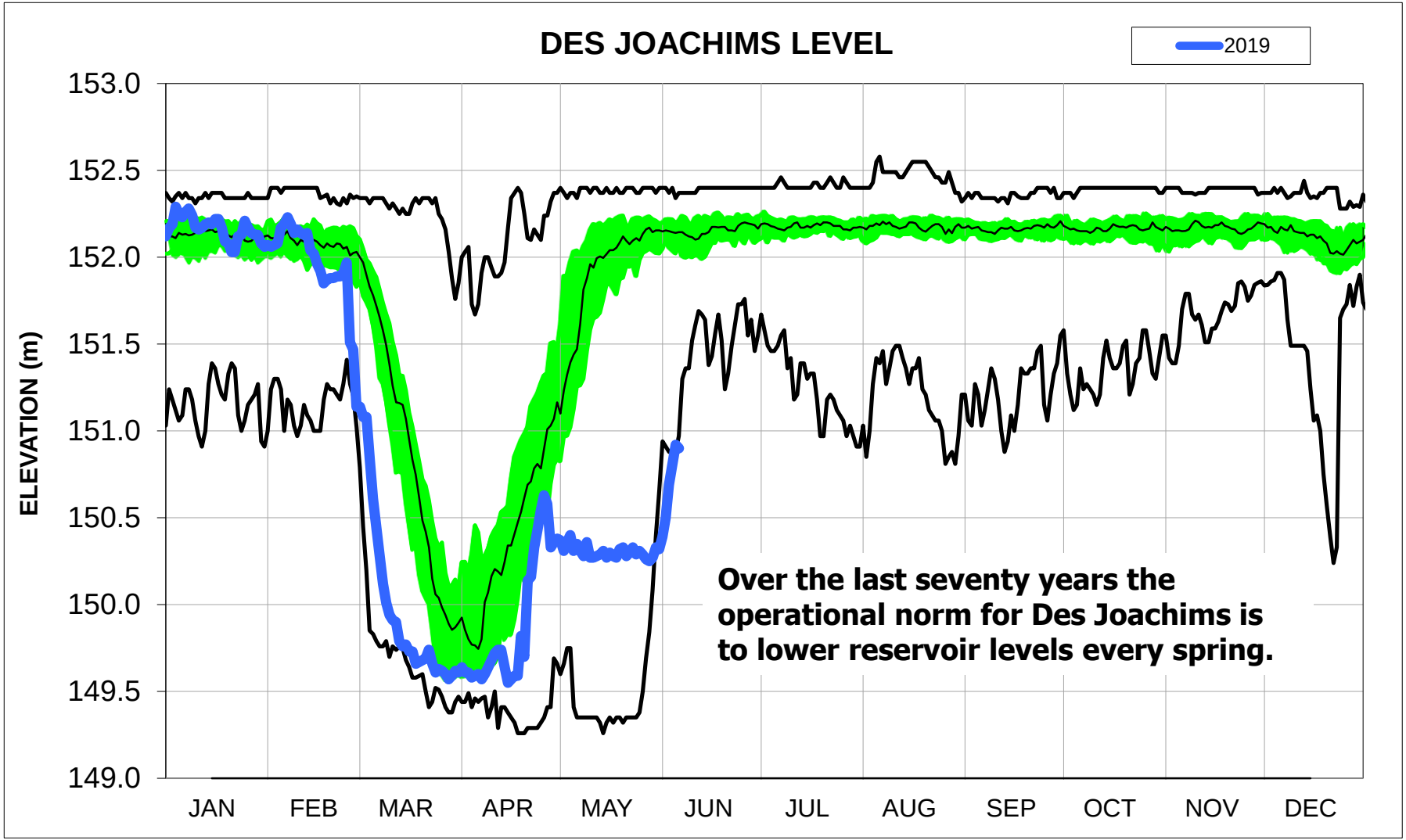


The low water level is seen at the Stonecliffe boat launch in Head, Clare and Maria Township on Sunday, May 7, while those living along Ottawa River downstream and other waterways have been flooded out. RYAN PAULSEN /...

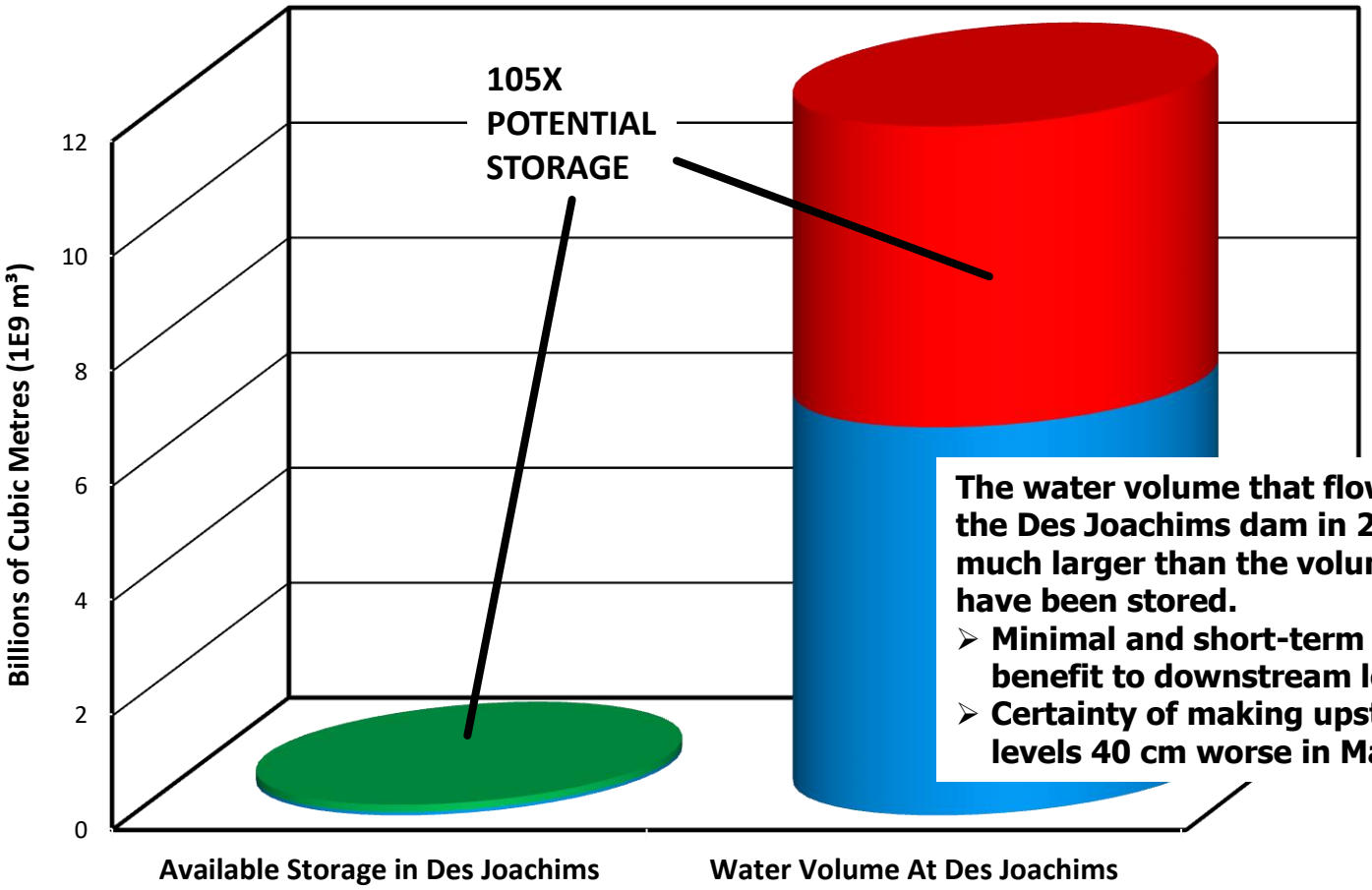
https://globalnews.ca/video/3449848/quebec-lake-goes-dry-as-other-areas-face-floods




**Lowering of levels above run-of-river dams is done every year and not just on the Ottawa River**


DES JOACHIMS LEVEL
2019
153.0
152.5
152.0
151.5
151.0
150.5
150.0
149.5
149.0
ELEVATION (m)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Over the last seventy years the operational norm for Des Joachims is to lower reservoir levels every spring.

# Ottawa River Water Flow Regulation During the Spring Freshet (April 1st-June 6th)




**The water volume that flowed through the Des Joachims dam in 2019 was much larger than the volume that could have been stored.**

- **Minimal and short-term possible benefit to downstream locations**
- **Certainty of making upstream flood levels 40 cm worse in Mattawa**

# Information

Current Water levels
Toll free number 24 hours per day

| Ottawa-Gatineau | | Outside |
|---|---|---|
| **613-995-3443** | *English* | **1 800 778-1246** |
| **613-995-3455** | *French* | **1 800 778-1243** |

Flow forecasts during freshet

Web Site: **http://www.ottawariver.ca**

Twitter @ORRPB

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Ottawa, Ontario
**Email : secretariat@ottawariver.ca**