



# Impact of Spring 2019 Flooding in Canada

*Integrating Statistical and Geospatial Information*

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GIS DAY 2019, Nov 13 2019



Delivering insight through data for a better Canada



Statistics  
Canada

Statistique  
Canada

Canada

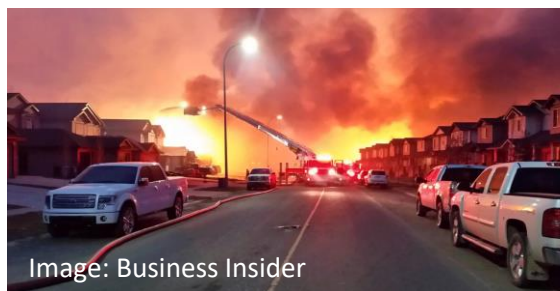
# Need for interdepartmental collaboration – integrating statistical and geospatial information for emergency management

## Benefits to Canadians

- Inform decision makers and the public in a timely manner
- More effective use of resources
- Avoid sending people into harm's way
- Data to measure economic and social impact of disasters

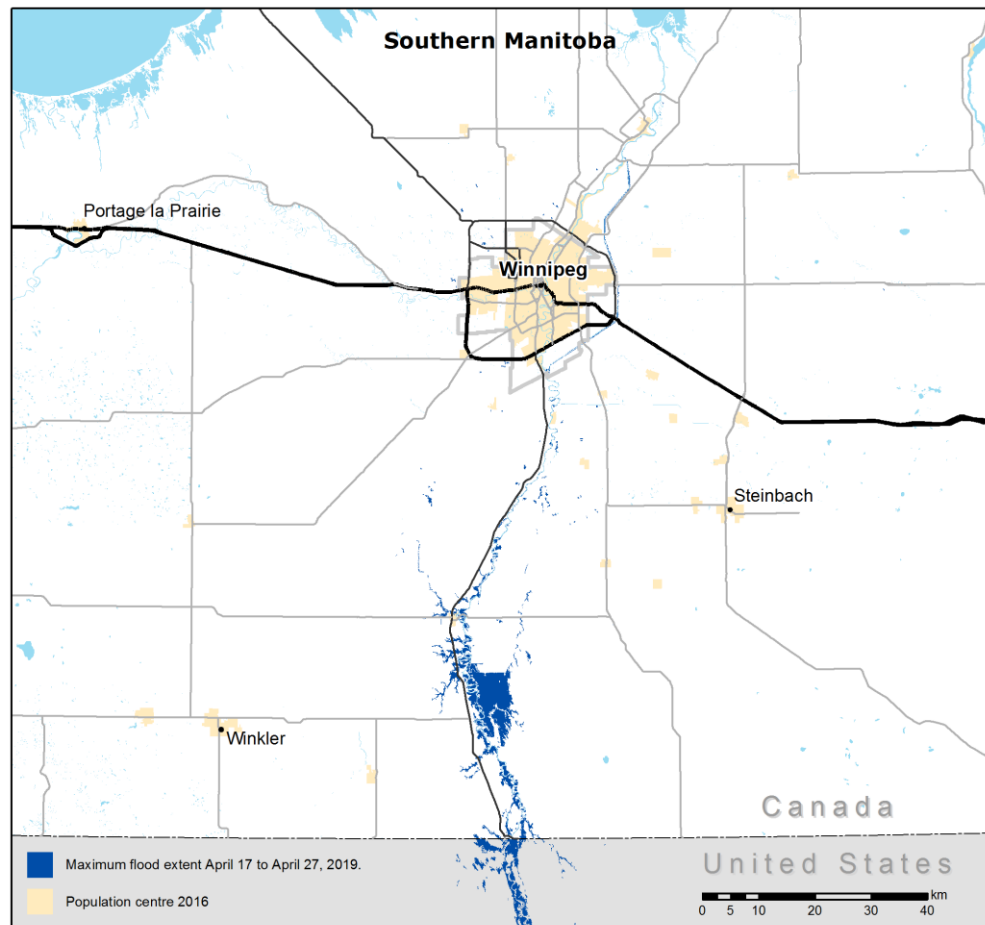
## Benefits to Statistics Canada

- Reduce respondent burden in areas affected
  - Residents attending to more important matters
- Census 2021 behavioural test, May 2019 – areas avoided.
- Census collection, May to July 2021

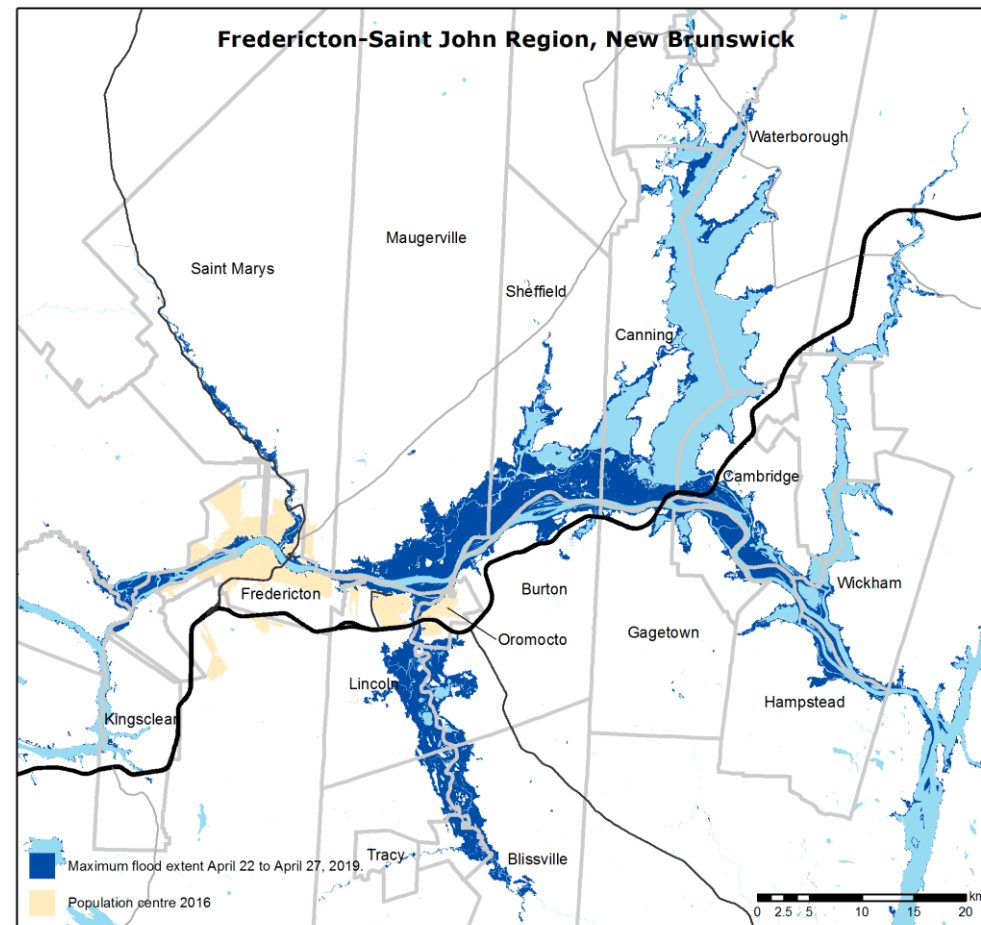


# 2019 spring flooding in Canada – four regions

– Released in Statistics Canada's *The Daily* on May 17, 2019



Source(s): Statistics Canada.  
Flood extent information provided by Emergency Geomatics Services, Natural Resources Canada, 2019

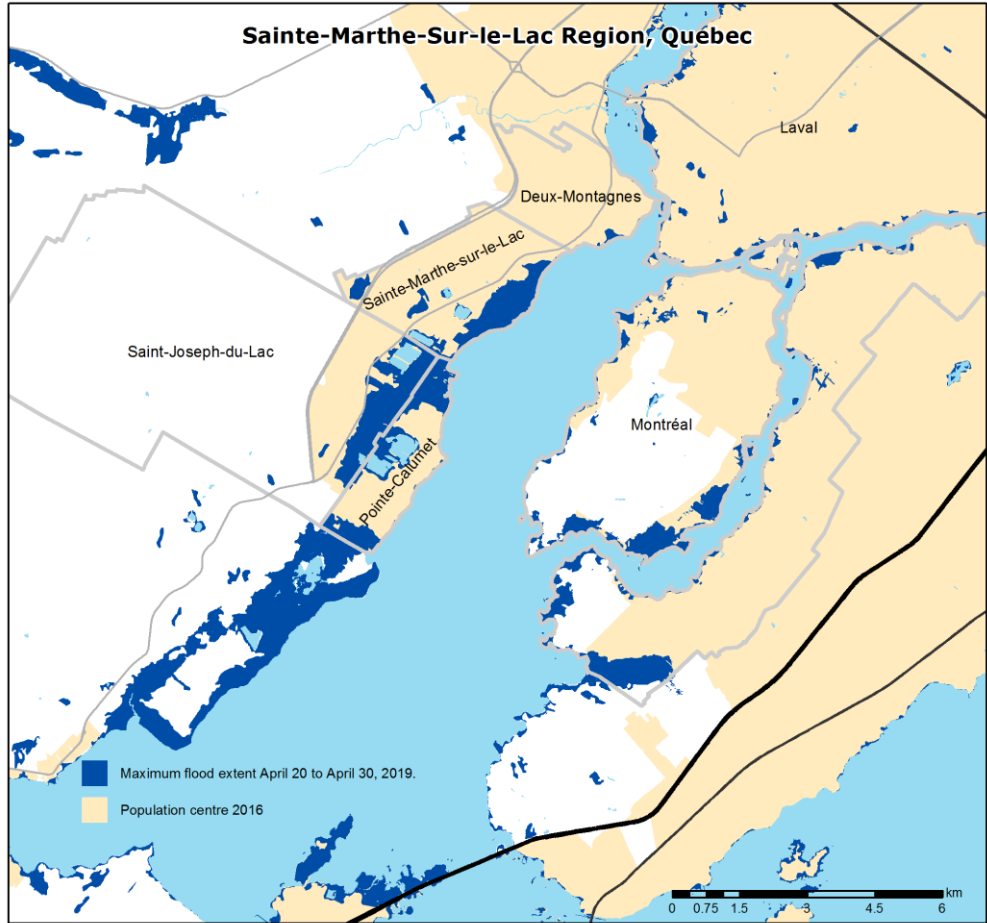


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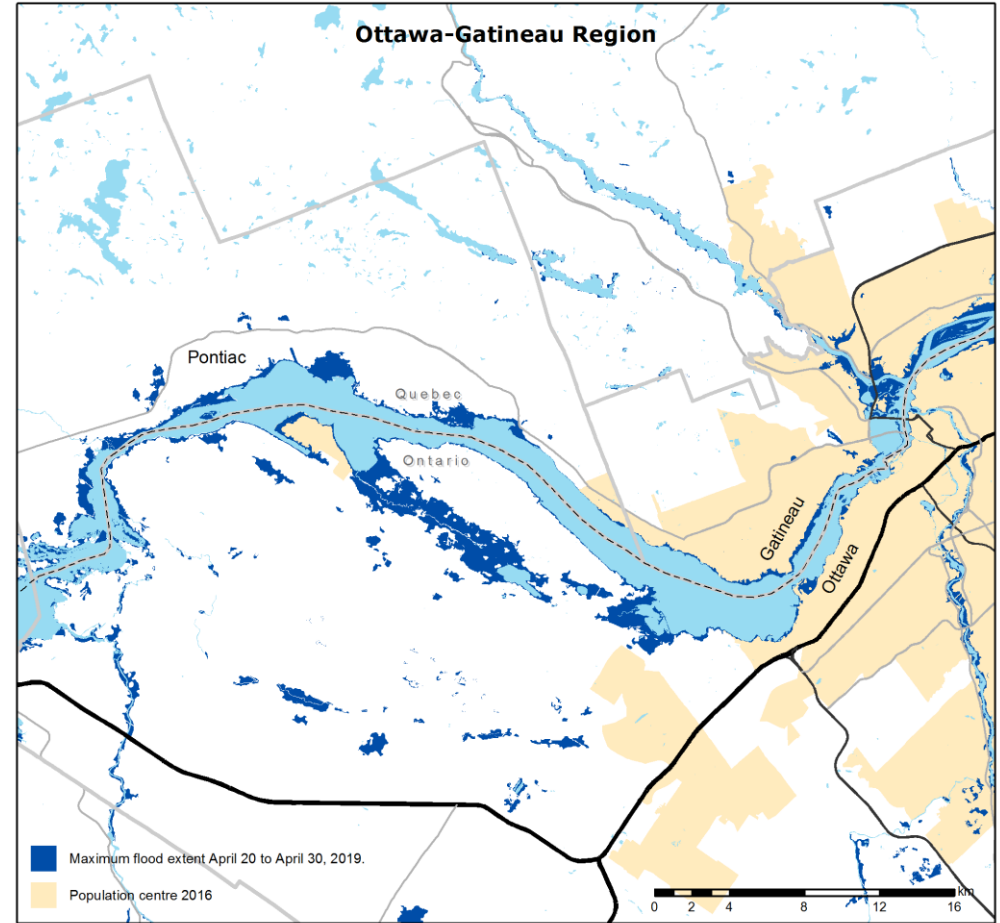


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# Cooperation and information sharing among federal departments

## Key Departments:

- Public Safety Canada: Government Operations Centre (GOC) – critical role in coordinating Federal-Provincial efforts/needs
- Natural Resources Canada (NRCan): Emergency Geomatics Service – critical role in interpreting remotely sensed information and products
- Agriculture and Agri-Food Canada (AAFC) – critical role in providing crop land coverage/classification
- Statistics Canada – critical role in integrating statistical data and geospatial information, and producing timely data on the flood events in several regions across Canada

## What information did Statistics Canada leverage and derive?

- Annual Crop Inventory Classification - Agriculture and Agri-Food Canada (AAFC)
- Census of Canada, standard geographies (CSDs and DAs), road network and the Address and Business Registers
- Dwellings, farmland, roads, business characteristics related to the natural disasters of the four regions

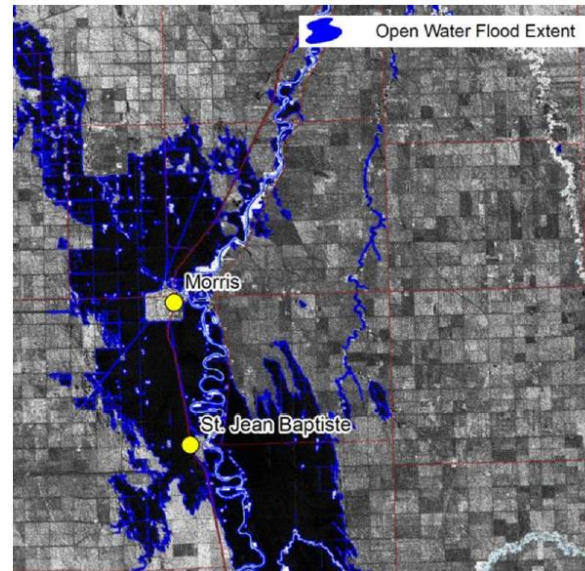
## Data Sources/Processing – Natural Resources Canada EGS Flood Product

- Satellite imagery
  - Optical
  - Radar
- Image Classification

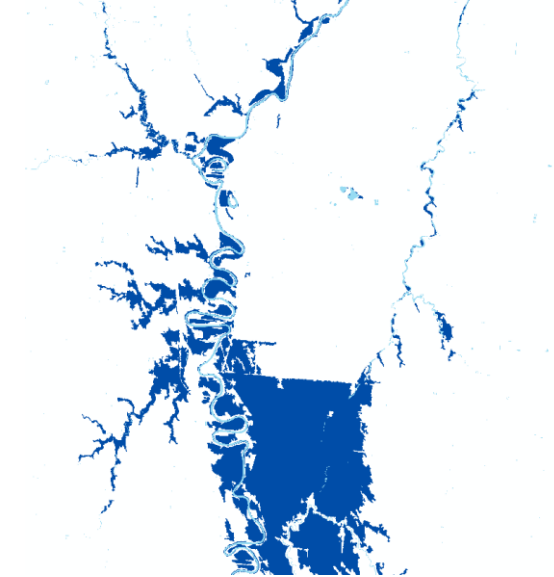
### Flooding in Manitoba



### Radar image



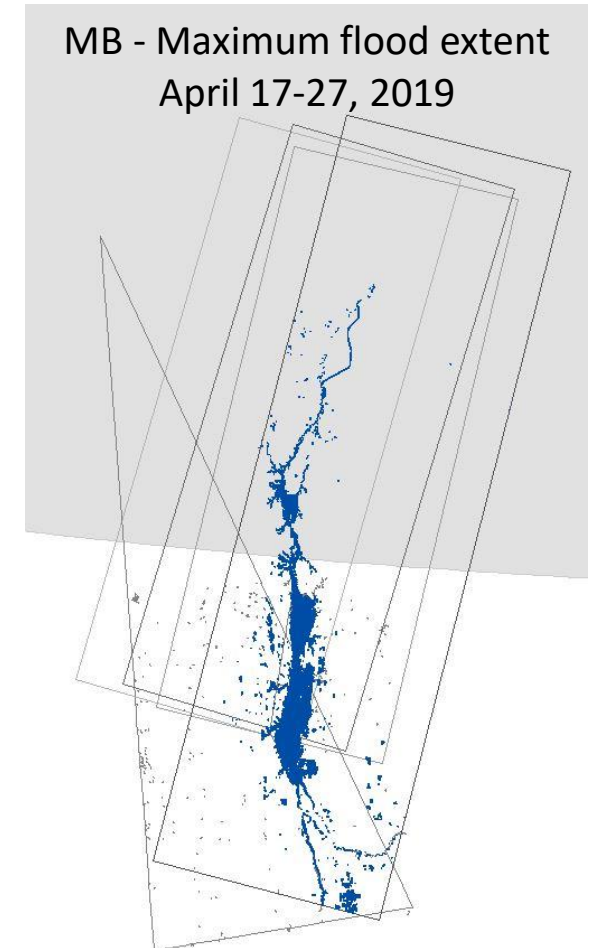
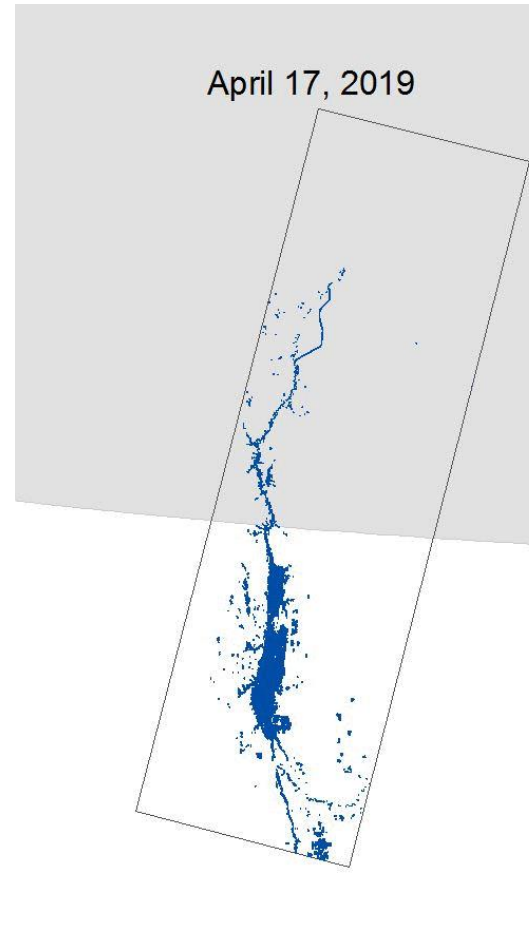
### Flood extent polygon layer



Source: [ftp://ftp.neodf.nrcan.gc.ca/EGS/2015/Flood\\_Products/ProductInterpretationGuide/Guide\\_OpenWaterFloodExtent.pdf](ftp://ftp.neodf.nrcan.gc.ca/EGS/2015/Flood_Products/ProductInterpretationGuide/Guide_OpenWaterFloodExtent.pdf)

## Data Sources/Processing – Natural Resources Canada EGS Flood Product

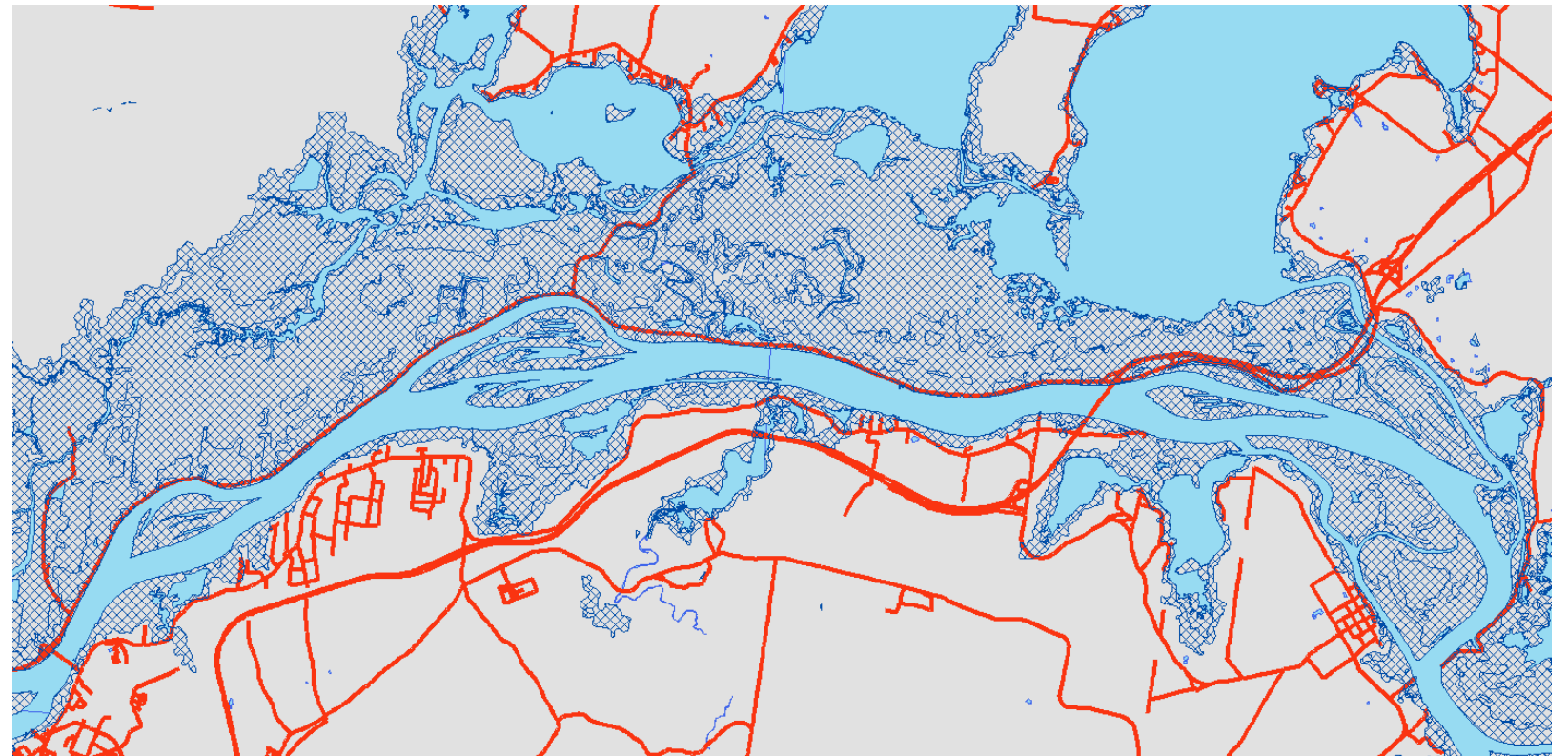
- Floods
  - Dynamic
  - Water recedes in one area, rises in another
  - Multiple peaks
- Flood extent polygon layers
  - Snap shots in time
- Merge all to obtain the maximum flood extent
  - MB – April 17-27, 5 extents
  - ON, QC – April 20-30, 19 extents
  - NB – April 22-27, 5 extents





## Data Sources/Processing – Statistics Canada

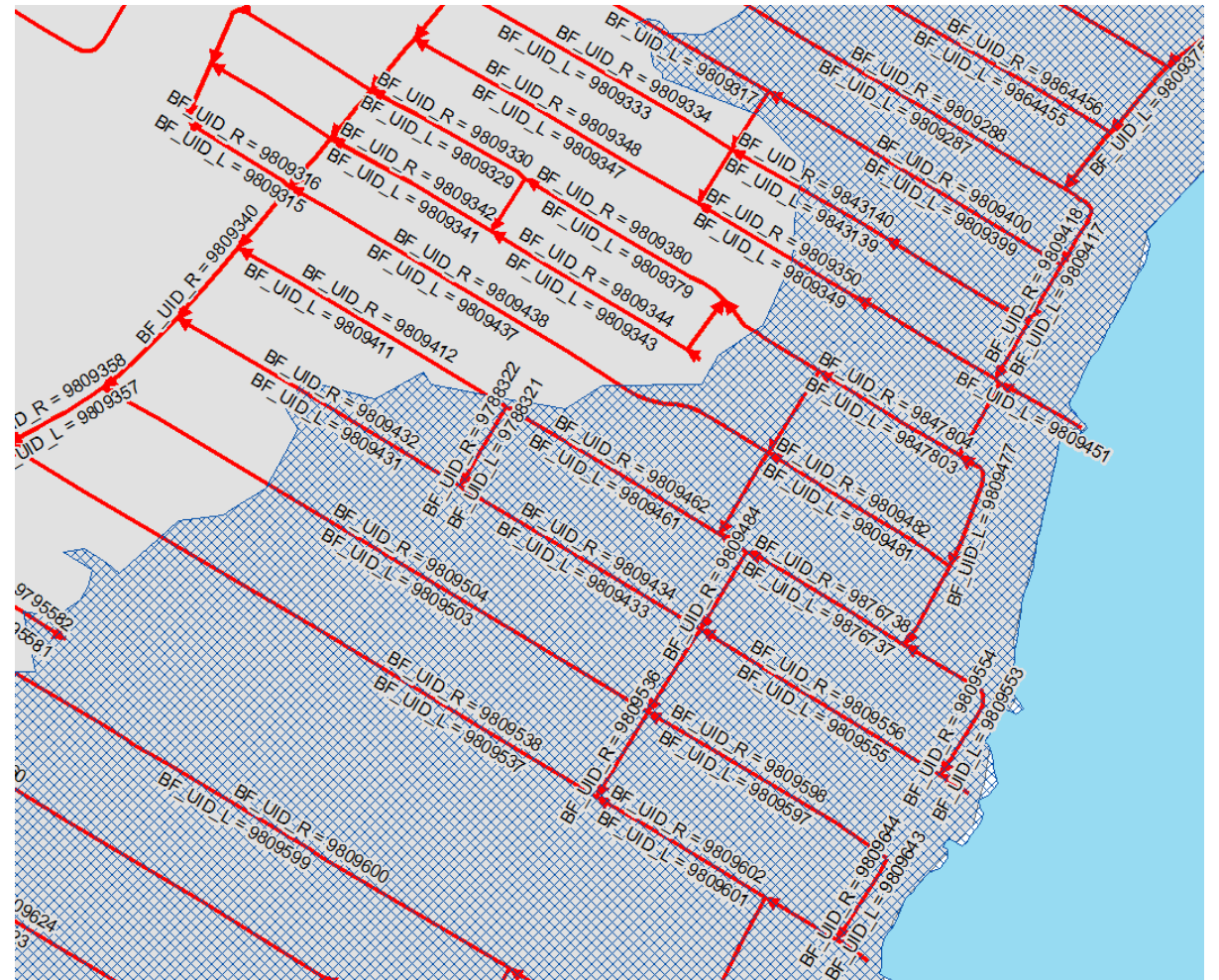
- Road network – Spatial Data Infrastructure
  - Intersection of maximum flood extent and road segments
  - Affected roads (total length)
  - Affected block faces (for affected dwelling estimates)





## Data Sources/Processing - Statistics Canada

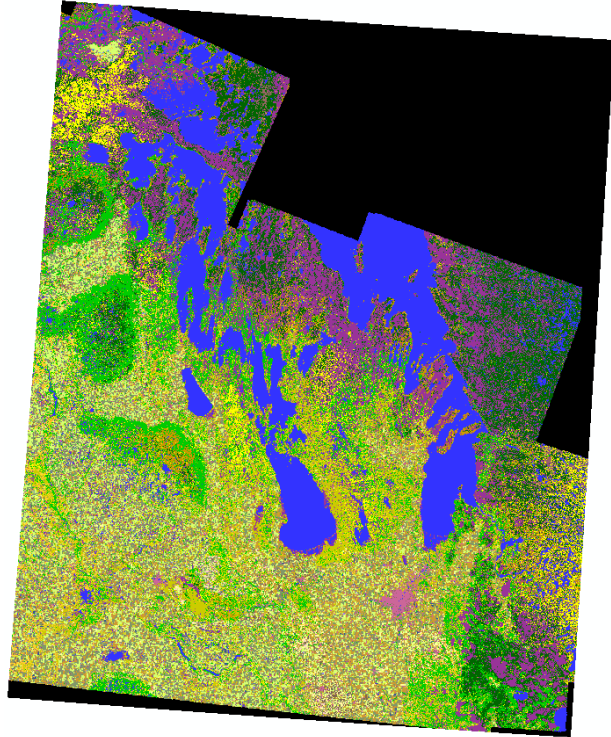
- Dwelling Universe Frame (DUF) – Address Register
  - Dwellings are coded to block faces
  - Number of dwellings summed for each affected block face
    - Within region
    - Within Census Subdivision (CSD)



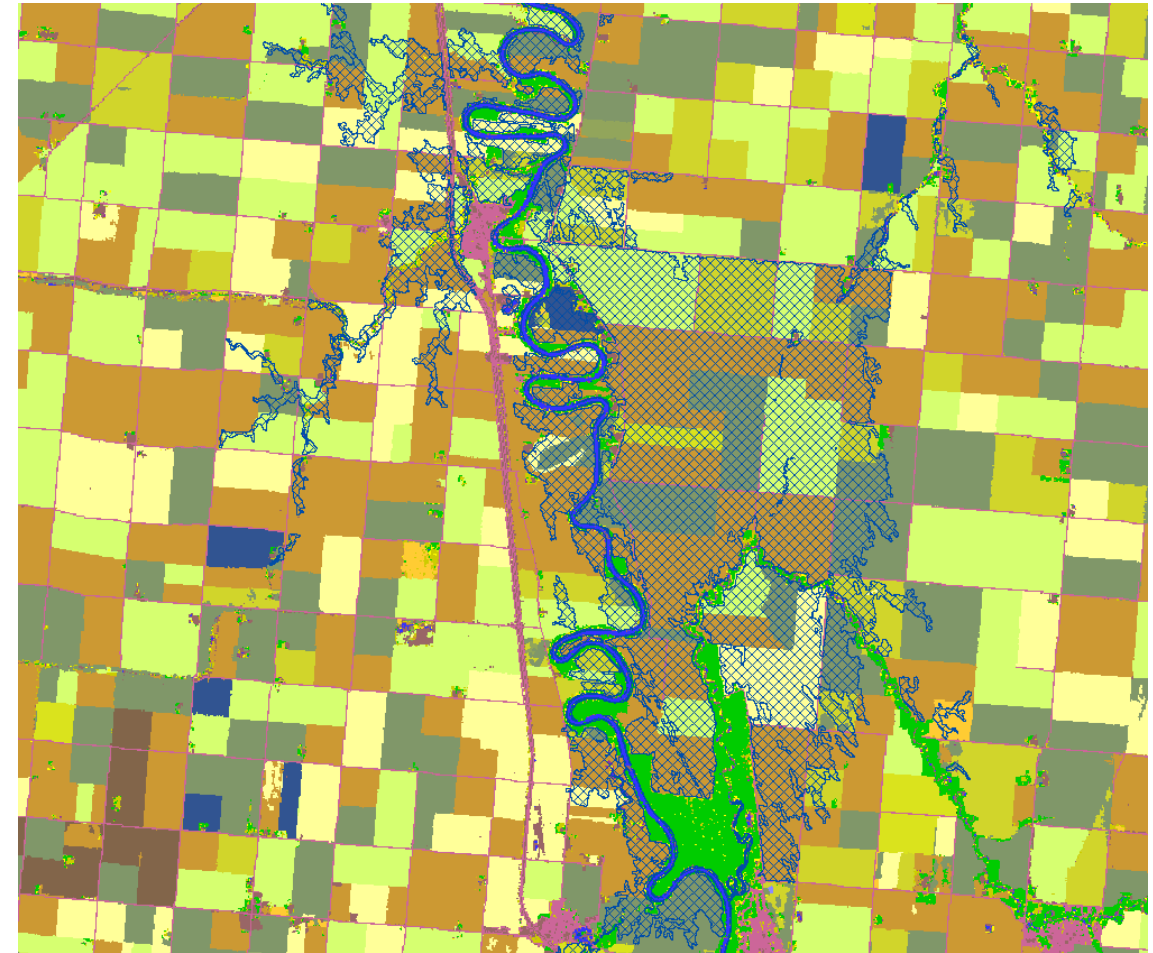
## Data Sources/Processing – Agriculture and Agri-Food Canada

- Estimation of affected agricultural land

Agriculture and Agri-Food Canada (AAFC)  
Annual Crop Inventory Classification



- 1-20-Water
- 2-30-Barren
- 3-34-Urban
- 4-35-Greenhouses
- 5-50-Shrubland
- 6-80-Wetland
- 7-110-Grassland
- 8-120-199-Agriculture
- 9-200-Forest
- 9.1-210-Coniferous
- 9.2-220-Broadleaf
- 9.3-230-Mixedwood





## Results – Released in *The Daily* on May 17, 2019

Table 1. Spring 2019 flooding: Selected data by affected region

	Dwellings flooded or at risk	Flooded area	Flooded farmland	Roads flooded or at risk
	number	square kilometres	square kilometres	kilometres
<b>Total</b>	<b>17,494</b>	<b>609</b>	<b>153</b>	<b>462</b>
South-central Manitoba (Red River Valley)	150	124	114	70
Fredericton–Saint John Region (Saint John River)	5,501	383	34	238
Ottawa–Gatineau region (Ottawa River)	5,996	91	6	101
Ottawa (Ontario)	2,196	42	1	39
Gatineau (Quebec)	3,800	49	5	62
Sainte-Marthe-sur-le-Lac region (St. Lawrence River)	5,847	10	0	53

**Source(s):** Special tabulations.



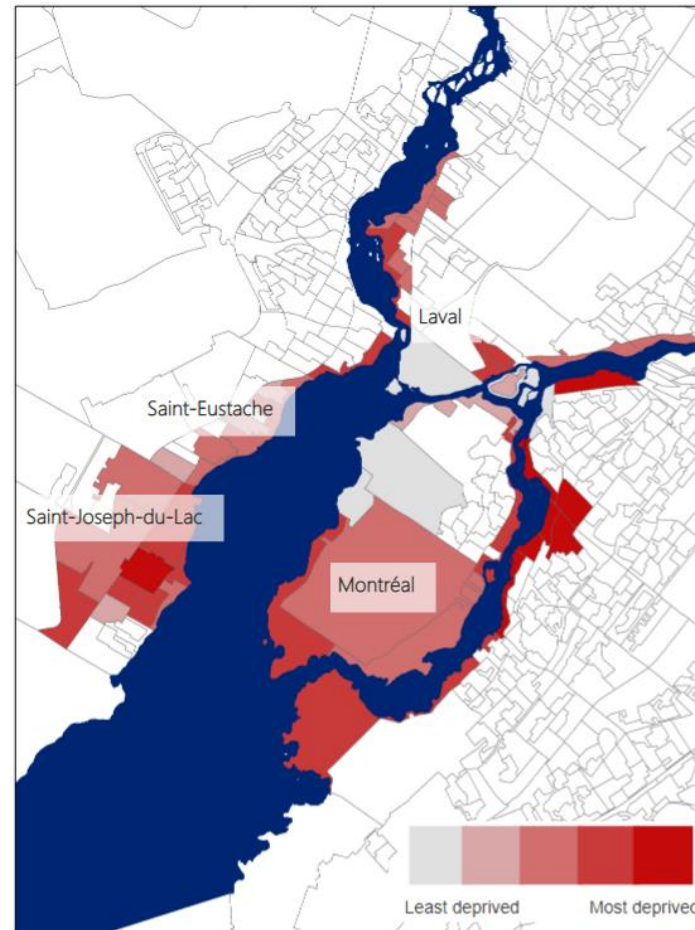
## Results – Released in *The Daily* on May 24, 2019

Table 1. Spring 2019 flooding: Business location counts by affected region and Employment Size

	Business locations without employees	Business Locations with 1-4 Employees	Business Locations with 5+ Employees	Total
<b>Total</b>	<b>3,202</b>	<b>359</b>	<b>224</b>	<b>3,785</b>
Fredericton-Saint John Region (Saint John River)	646	102	82	830
Ottawa-Gatineau Region (Ottawa River)	1,289	103	95	1,487
Ottawa (Ontario)	335	48	18	401
Gatineau (Québec)	954	55	77	1,086
Sainte-Marthe-Sur-le-Lac Region (St. Lawrence River)	1,267	154	47	1,468

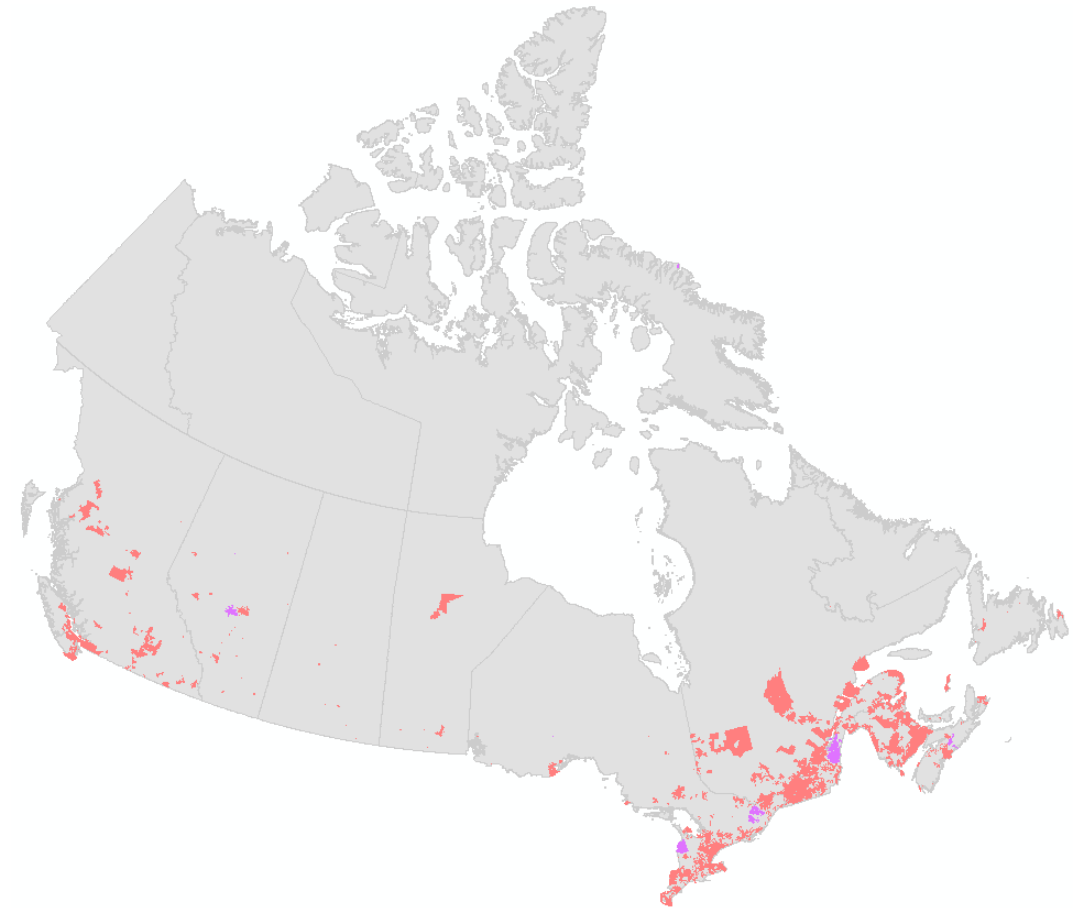
**Source:** Business Register, Statistics Canada

## Residential instability in flood-affected dissemination areas in Sainte-Marthe-sur-le-Lac, Quebec (West Montréal–St. Lawrence River)



## Impact on Statistics Canada's programs during disasters: *Census 2021 behavioural test, May 2019*

- Question: were there any dwellings potentially impacted by flooding in the Behavioural Test areas?
- Identified 500+ dwellings and removed from the sample
- Impact
  - Reduced respondent burden
    - Stopped sending census materials
    - Stopped non-response follow-up
  - More efficient use of resources





# Questions?

Impact of spring flooding in Canada 2019

<https://www150.statcan.gc.ca/n1/daily-quotidien/190517/dq190517a-eng.htm>

<https://www150.statcan.gc.ca/n1/daily-quotidien/190524/dq190524b-eng.htm>

<https://www150.statcan.gc.ca/n1/daily-quotidien/190614/dq190614a-eng.htm>

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