Beyond the Forecast: Communicating Flood Risk in the Toronto Region

FEWS User Days – November 2020

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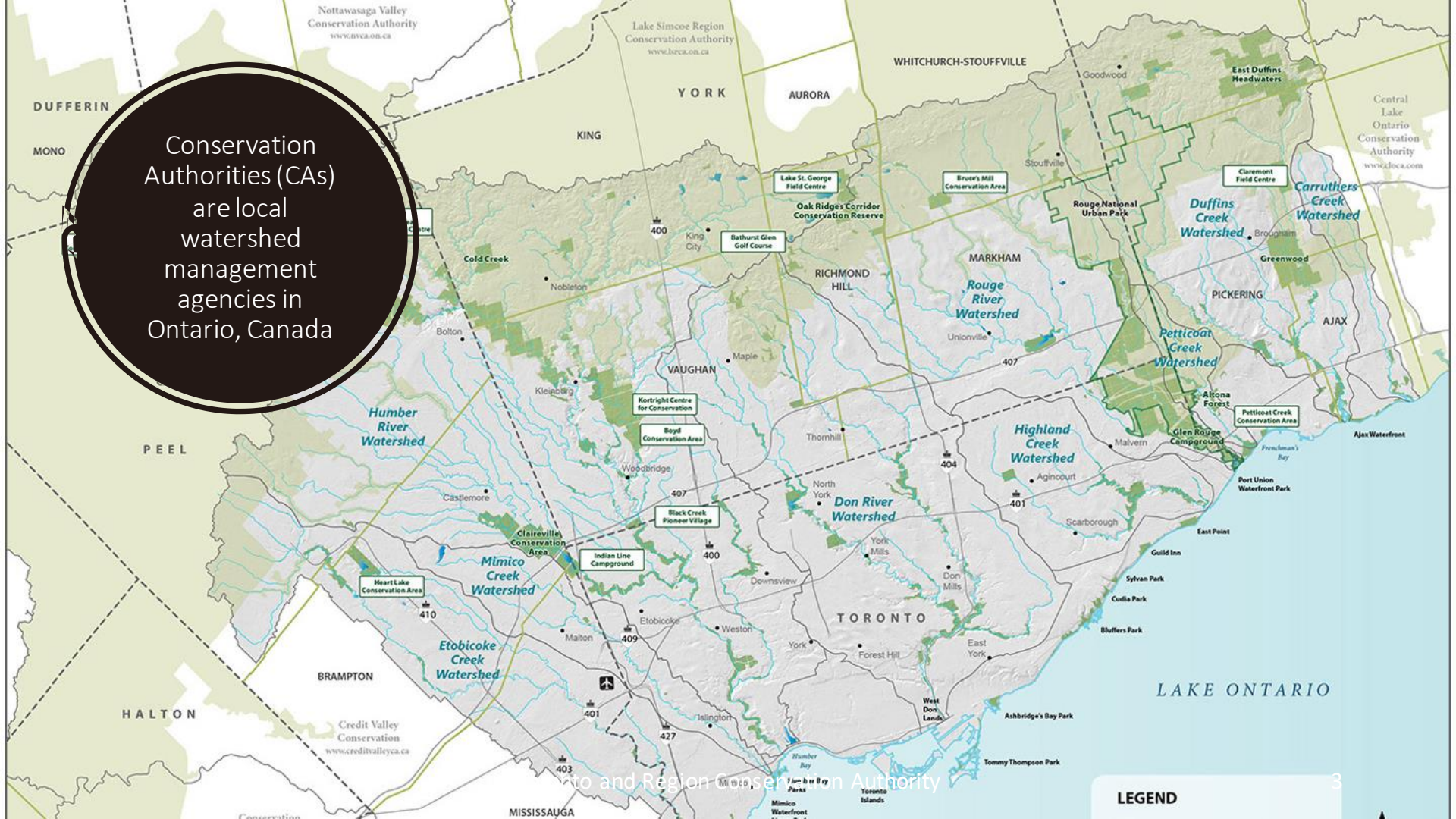
Presentation Outline

- Conservation Authorities and integrated flood risk management
- The differences between risk communication and crisis communication
- Where forecasting and FEWS fit in
- Priming audiences to make crisis communication effective


Conservation Authorities (CAs) are local watershed management agencies in Ontario, Canada
Nottawasaga Valley Conservation Authority
www.nvca.on.ca
Lake Simcoe Region Conservation Authority
www.lsrca.on.ca
Central Lake Ontario Conservation Authority
www.cloca.com
Credit Valley Conservation
www.creditvalleyca.ca
DUFFERIN
MONO
YORK
KING
AURORA
WHITCHURCH-STOUFFVILLE
PEEL
BRAMPTON
HALTON
MISSISSAUGA
VAUGHAN
RICHMOND HILL
MARKHAM
PICKERING
AJAX
TORONTO
LAKE ONTARIO
Humber River Watershed
Mimico Creek Watershed
Etobicoke Creek Watershed
Don River Watershed
Rouge River Watershed
Duffins Creek Watershed
Carruthers Creek Watershed
Petticoat Creek Watershed
Highland Creek Watershed
Oak Ridges Corridor Conservation Reserve
Rouge National Urban Park
East Duffins Headwaters
Lake St. George Field Centre
Bruce's Mill Conservation Area
Claremont Field Centre
Bathurst Glen Golf Course
Kortright Centre for Conservation
Boyd Conservation Area
Black Creek Pioneer Village
Claireville Conservation Area
Indian Line Campground
Heart Lake Conservation Area
Petticoat Creek Conservation Area
Glen Rouge Campground
Altona Forest
Ajax Waterfront
Port Union Waterfront Park
East Point
Guild Inn
Sylvan Park
Cudia Park
Bluffers Park
Ashbridge's Bay Park
Tommy Thompson Park
Toronto Islands
Mimico Waterfront Parks
West Don Lands
Cold Creek
Nobleton
Bolton
Kleinburg
Maple
Woodbridge
Castlemore
Thornhill
Unionville
Stouffville
Goodwood
Broughdale
Greenwood
Malvern
Agincourt
North York
York Mills
Don Mills
Scarborough
Downsview
Etobicoke
Weston
Malton
York
Forest Hill
East York
Islington
King City
400
401
403
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410
427
LEGEND

Integrated Flood Risk Management

PREVENTION & MITIGATION

Limiting exposure to risk:
- Implementing TRCA's regulations and policies

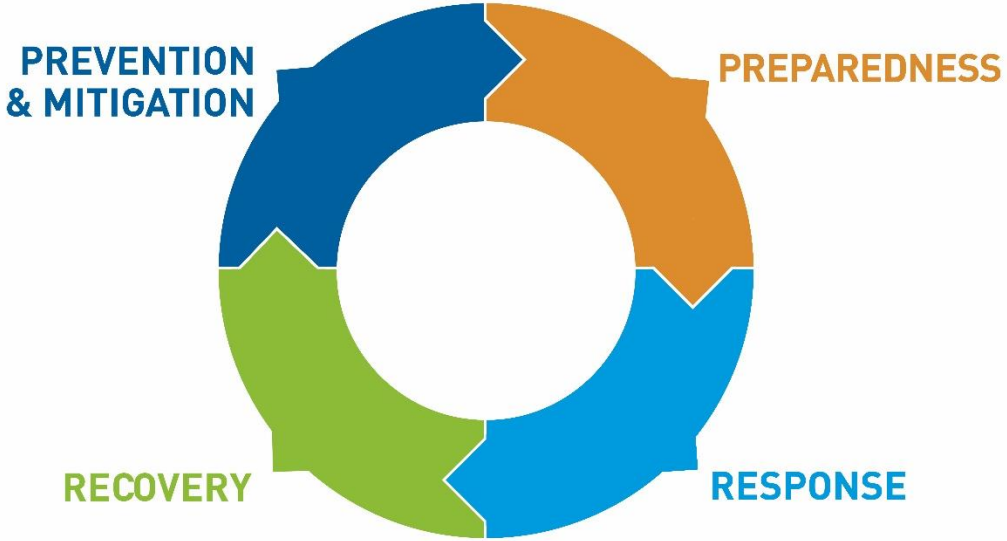
Reducing risk:
- Operating a flood forecasting and warning program
- Maintaining flood control infrastructure
- Creating a flood protection strategy for vulnerable areas
- Implementing remedial works projects

Understanding the risks:
- Climate, geology, watershed response and potential for climate change

Documenting the risks:
- Floodplain mapping, identification of flood vulerable areas

RECOVERY

- Flood event documentation and lessons learned
- Storm analysis



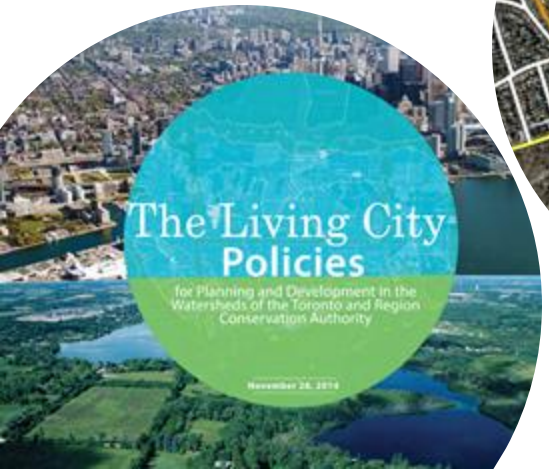
PREPAREDNESS

- TRCA's Flood Contingency Plan
- Emergency Plans
- Emergency Operations Centre
- Training
- Public Education

RESPONSE

- Provide Flood Forecasting and Warning (issuing flood messages)
- Operate flood control infrastructure
- Communicate information and advice
- Data management

Prevention and Mitigation



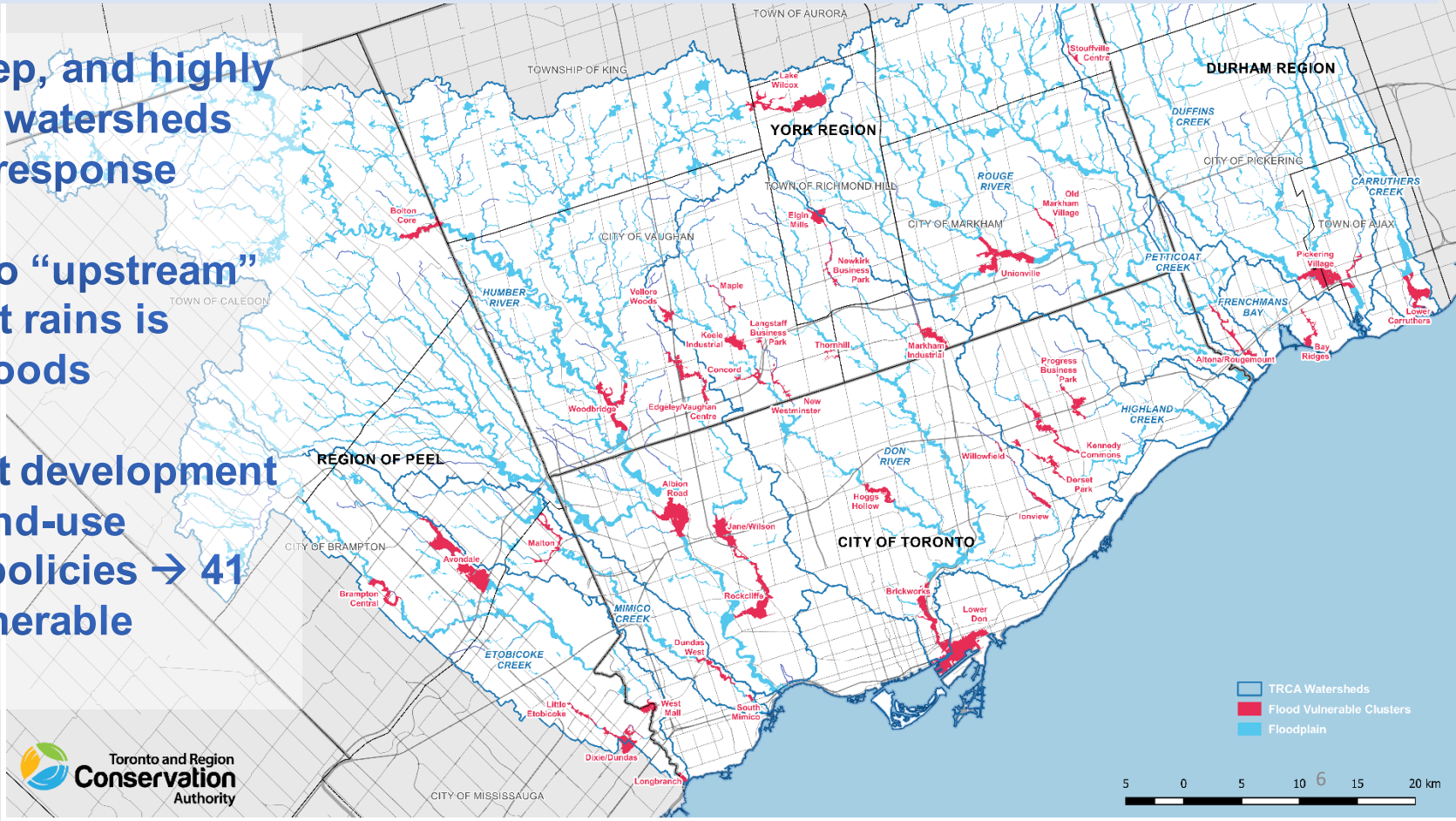
- Floodplain mapping and the engineering studies that support it
  - Hydrology
  - Hydraulics
- Flood Risk Assessment
- **Land Use Management**
  - **Stormwater Management**
  - **Land-Use and Development Regulation**
- Flood Control Infrastructure
  - e.g. G. Ross Lord Dam
- Capital works for flood protection
  - e.g. Port Lands Flood Protection

Our highly urbanized watersheds

Small, steep, and highly urbanized watersheds → Flashy response

There is no "upstream" → Where it rains is where it floods

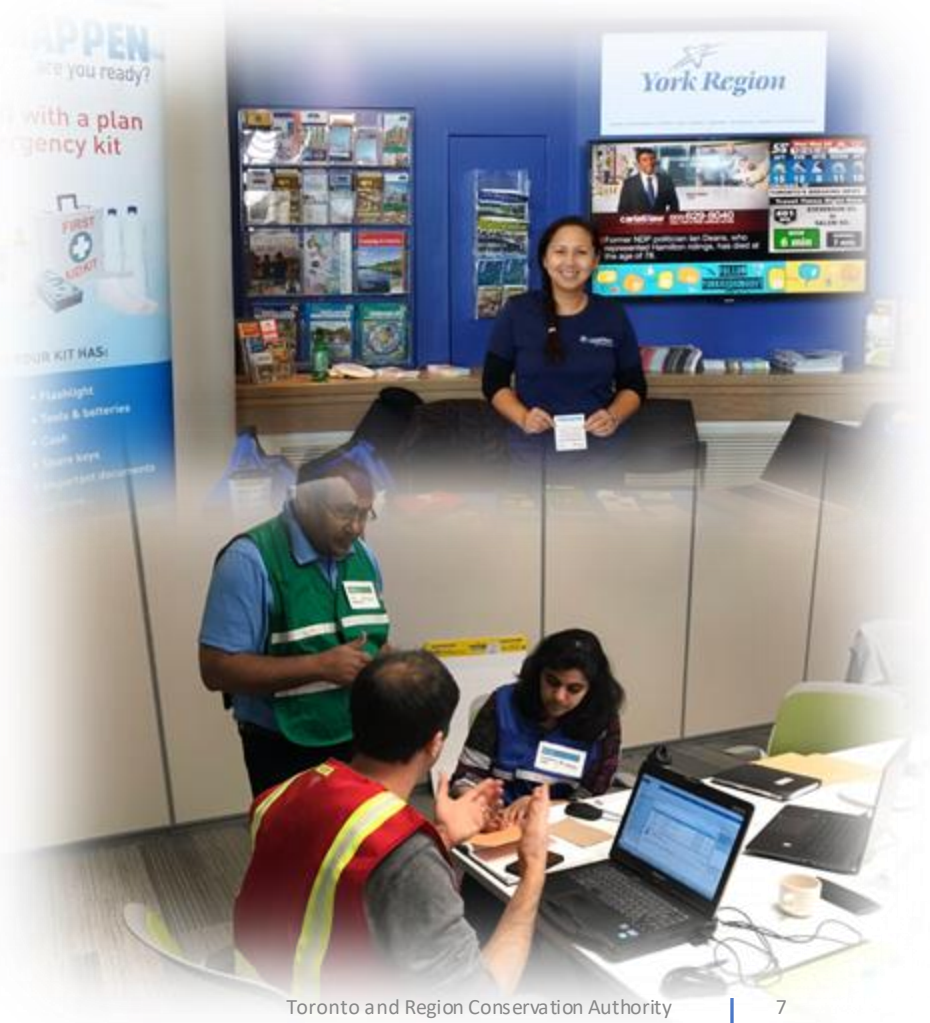
Significant development prior to land-use planning policies → 41 Flood Vulnerable Clusters

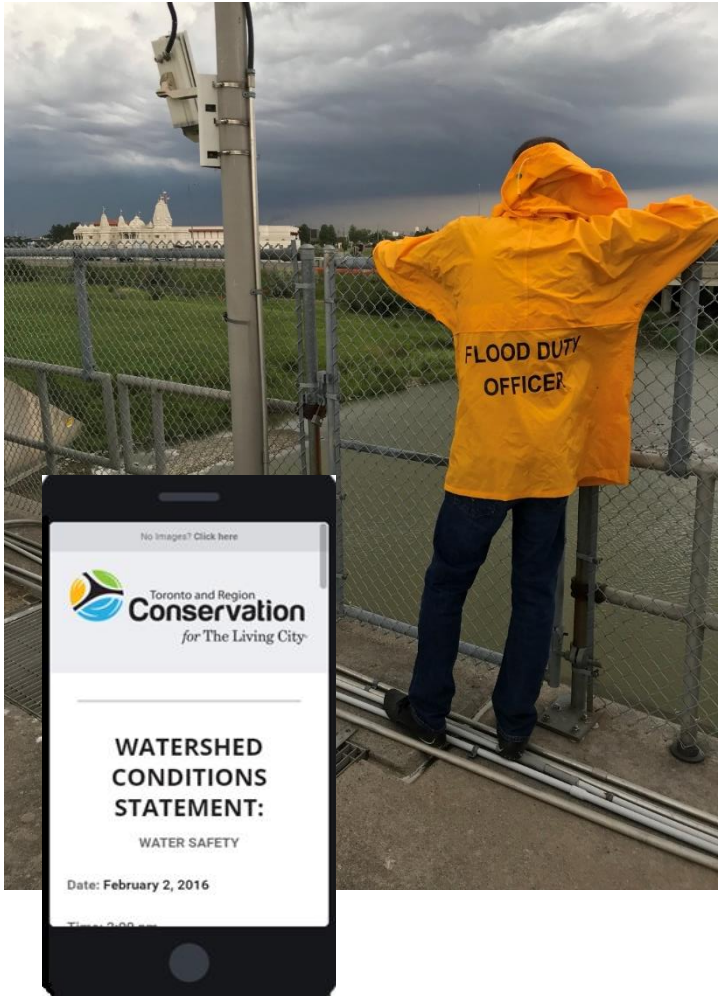


Toronto and Region Conservation Authority

Preparedness

- Emergency Management Planning
  - Flood Contingency Plan
  - Municipal emergency plans
  - IMS structure
- Training
  - Flood Duty Officer training
  - IMS training
  - Partnership with municipalities
- Public Education
  - Emergency Preparedness Week
  - Flood preparedness curriculum partnership with Education
  - Flood Risk Outreach Strategy
  - Floodplain information on the web





Flood Response

Conservation Authorities

- **Monitor** watershed and weather conditions and operate a **flood forecasting and warning system**
- **Issue** Flood Messages
- **Operate** Conservation Authority dams and flood control structures
- Provide **technical advice** to municipalities
- Maintain communications with municipalities and other agencies

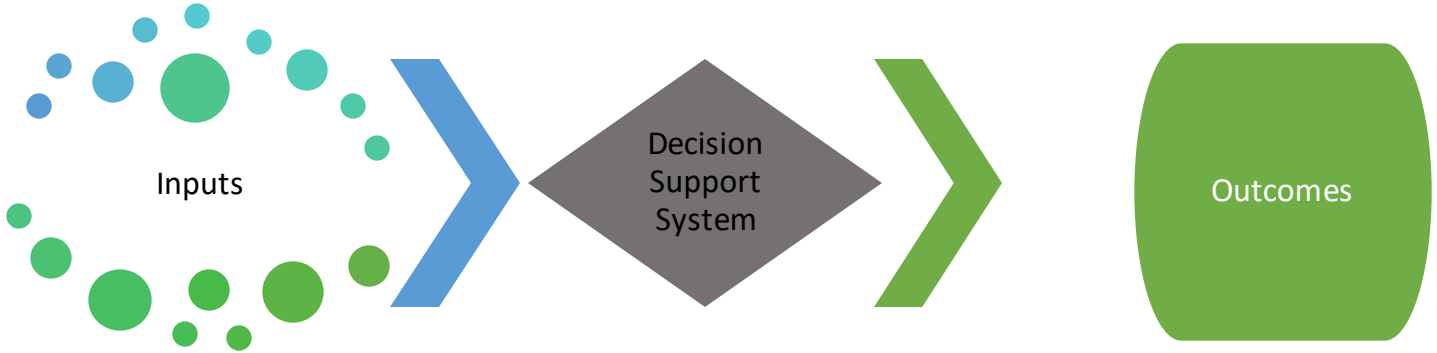
Municipalities

- **Notify** appropriate municipal officials, departments and agencies.
- Determine the appropriate response and **deploy municipal resources** to protect life and property.
- If required, **declare a flood emergency** and implement their emergency response plan.
- **Request provincial assistance** if needed

Recovery

- Impact Tracking
- Post-event analysis
- Data collection
- Lessons learned

Where FEWS/Decision Support Systems come in



- Current streamflow / WL / SWE
- Received Precipitation
- Forecast Precipitation
- Radar
- Forecast Temperature
- Thunderstorm parameters

- Brings together the inputs
- Supports the analysis and the decision
- Documents the decisions

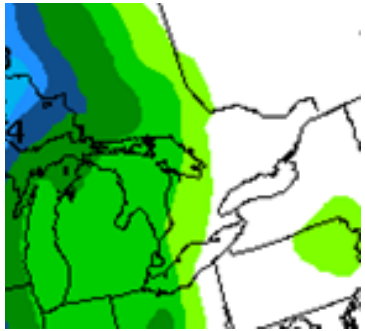
- Is there a threat of flooding?
- What level message do we issue?
- What info do we need to provide to municipal partners?
- Dam operations (TRCA only has two dams and they are exclusively for flood control (reservoirs are empty until filled by a storm)

Distilling data into key messages

Inputs

Decision Support System

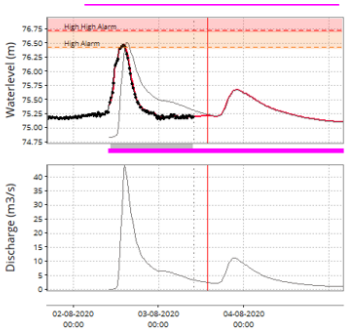
Outputs

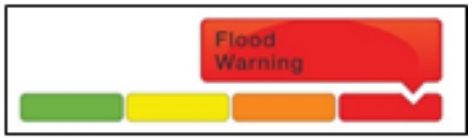


ANTECEDENT MOISTURE CONDITIONS
for September 2020

PE Value for month	1.88	
Total Precipitation:	*108.29*	mm

DAY	PRECIPITATION (mm)	S	*RUNOFF (mm)*
		20.45	
1	21.2	10.39	***9.27***
2	23.9	4.09	***15.72***
3	37.0	1.88	***32.91***
4	0.4	3.36	***0.00***
5	0.0	5.18	***0.00***
6	11.1	3.06	***7.10***
7	0.3	4.64	***0.00***
8	1.2	5.32	***0.00***
9	0.9	6.26	***0.00***
10	0.2	7.94	***0.00***





TRCA Flood Message Types

High flows, unsafe banks, melting ice or other factors that could be dangerous for recreational users such as anglers, canoeists, hikers, children, pets, etc. Flooding is not expected.

Early notice of the potential for flooding based on weather forecasts calling for heavy rain, snow melt, high wind or other conditions that could lead to high runoff, cause ice jams, lakeshore flooding or erosion.

Flooding is possible in specific watercourses or municipalities. Municipalities, emergency services and individual landowners in flood-prone areas should prepare.

Flooding is imminent or already occurring in specific watercourses or municipalities.

A notice that critical high Lake Ontario levels and/or waves are imminent and/or occurring, which could result in shoreline flooding and/or erosion

We can't change the weather, but we continue to work towards reducing the threat to public safety

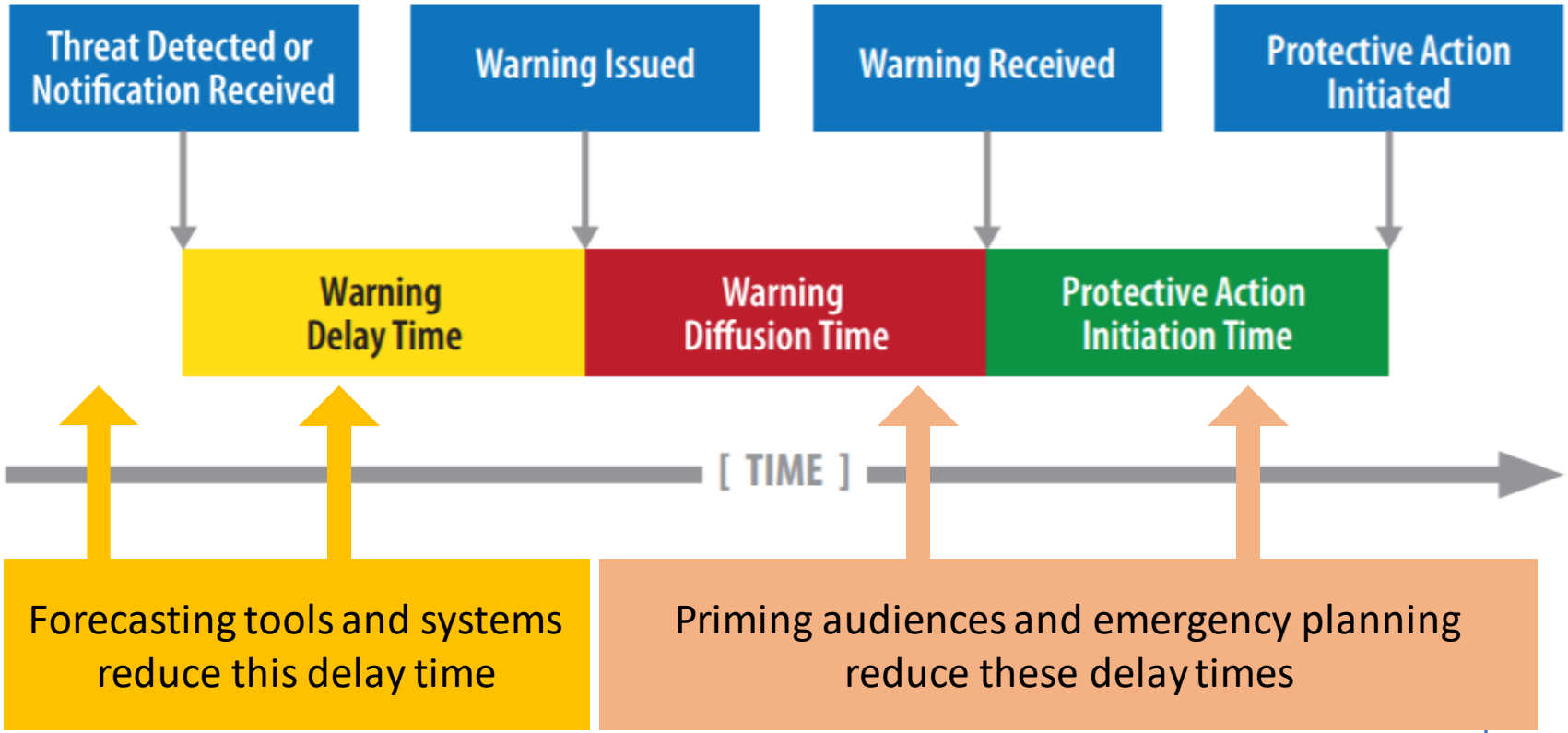
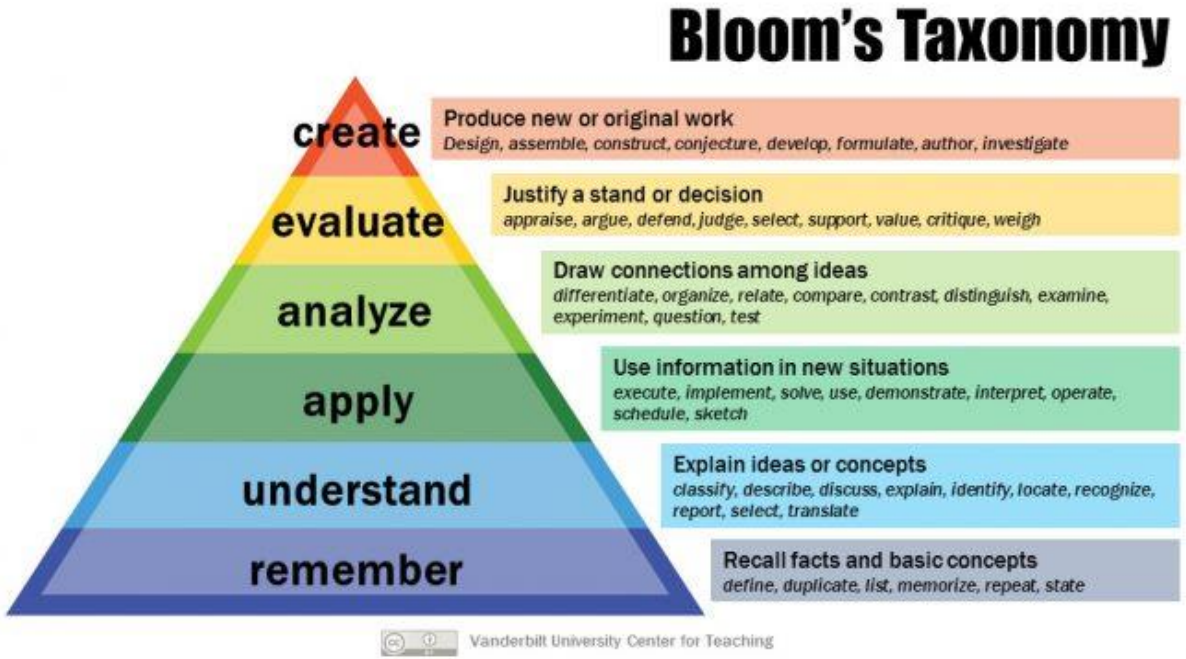
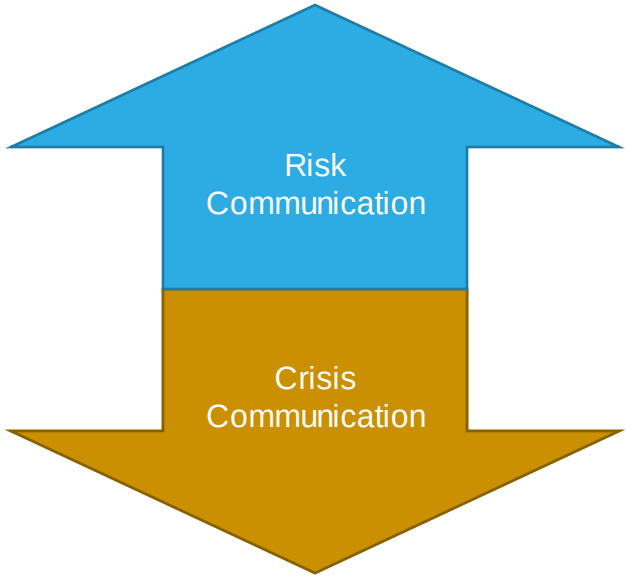


Figure adapted from D. Mileti - *A Guide to Public Alerts and Warnings for Dam and Levee Emergencies*, US Army Corps of Engineers

Risk Communication vs Crisis Communication*





*I first came across the concept of applying Bloom's Taxonomy to risk communication in a presentation by Ronda Oberlin, City of Lansing, MI

Many people inhabiting flood-prone communities are not fully aware of the risks to themselves and their property.

Thistlethwaite et. al., 2017

Limiting exposure to risk:
- Implementing TRCA's regulations and policies

Reducing risk:
- Operating a flood forecasting and warning program
- Maintaining flood control infrastructure
- Creating a flood protection strategy for vulnerable areas
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Understanding the risks:
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Documenting the risks:
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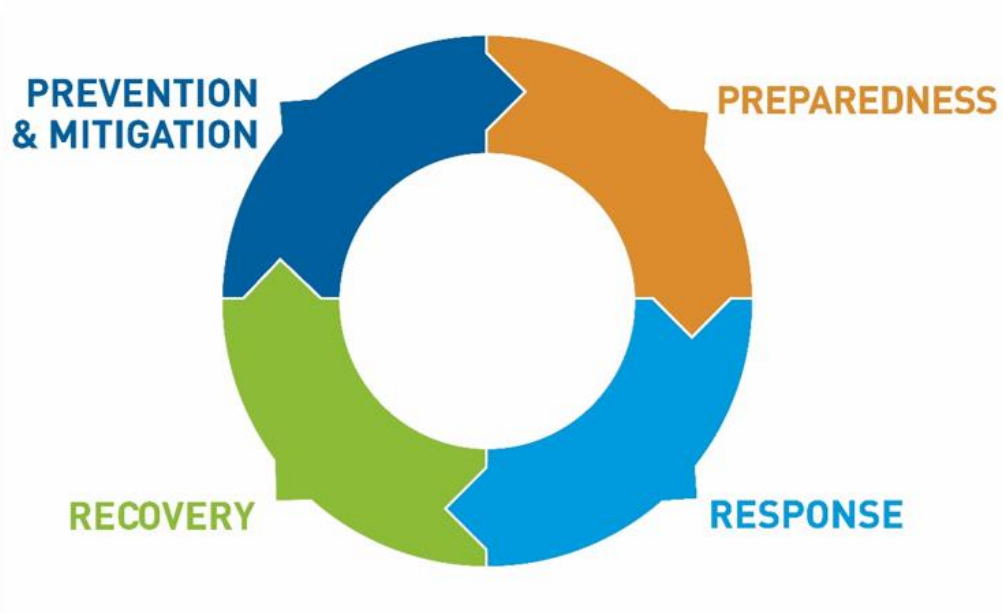
RECOVERY



- TRCA's Flood Contingency Plan
- Emergency Plans
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- Public Education

RESPONSE

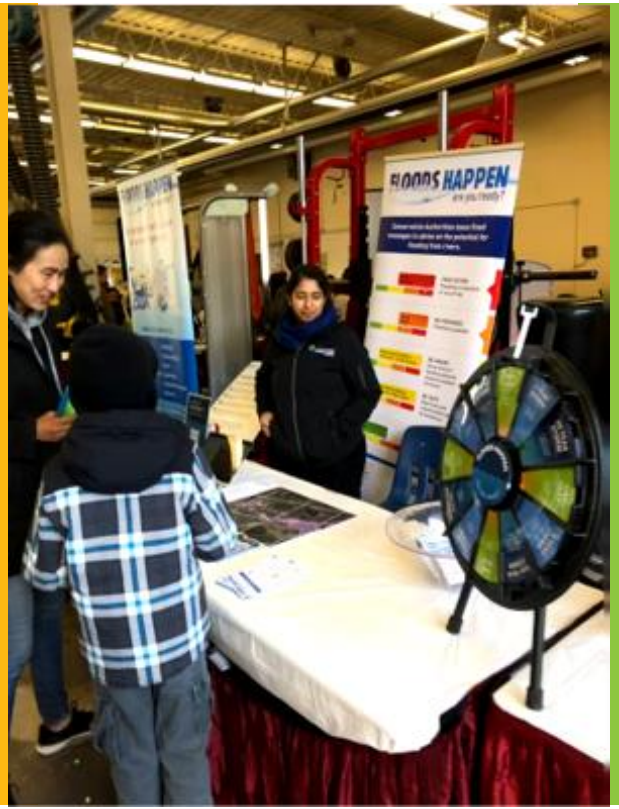
- Provide Flood Forecasting and Warning (issuing flood messages)
- Operate flood control infrastructure
- Communicate information and advice

…but we have many touchpoints with these audiences

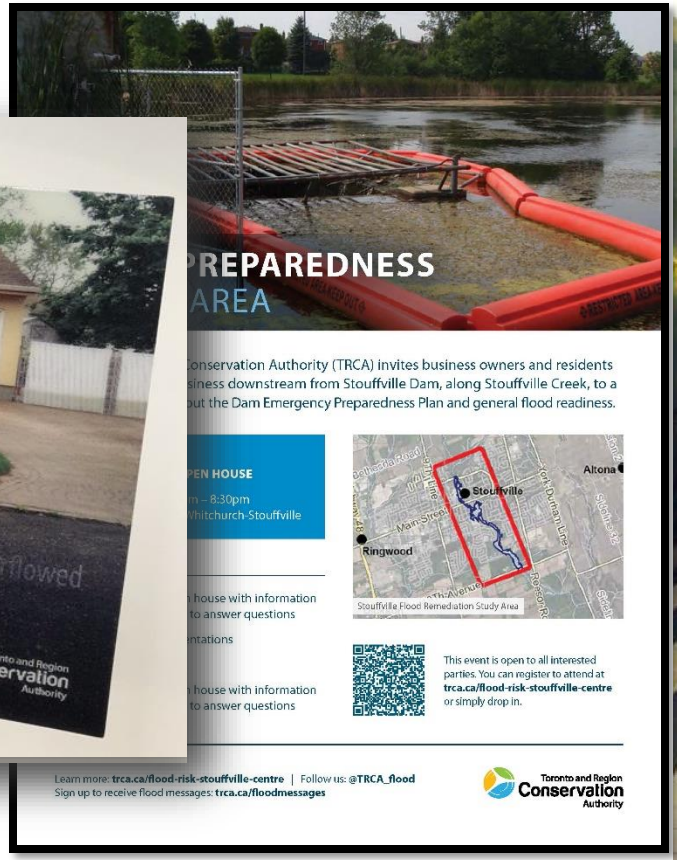
Flood Risk Outreach Program and Site-Specific Flood Response Plans

- Priming our municipal partner emergency management officials
- Priming members of the public who live in flood vulnerable areas

Risk communication takes many forms

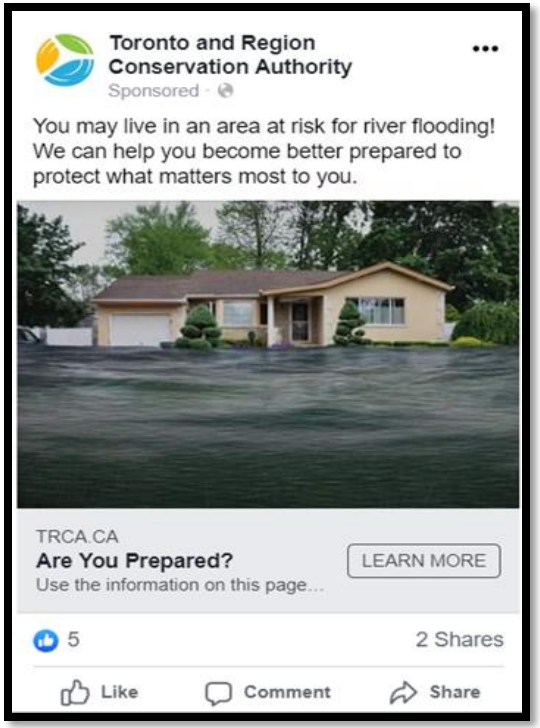


Advertisements



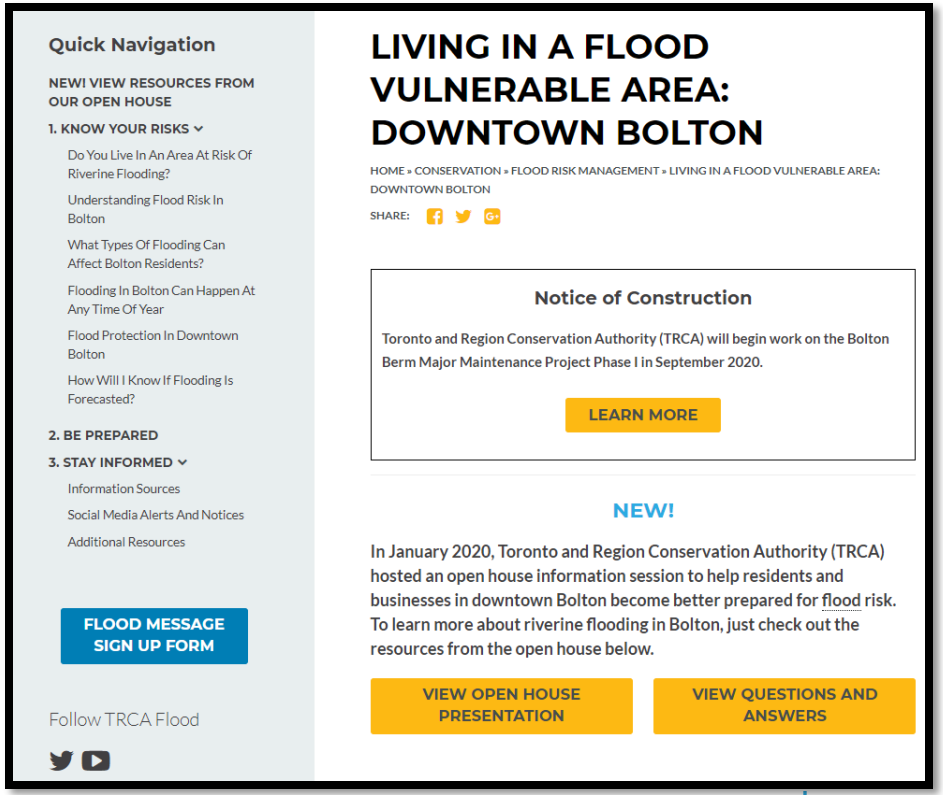
Advertisements

Geotargeted Social Media Campaigns



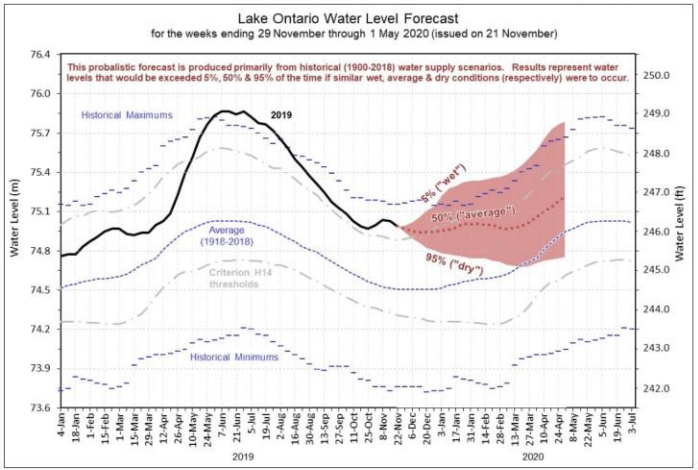
Public Open Houses

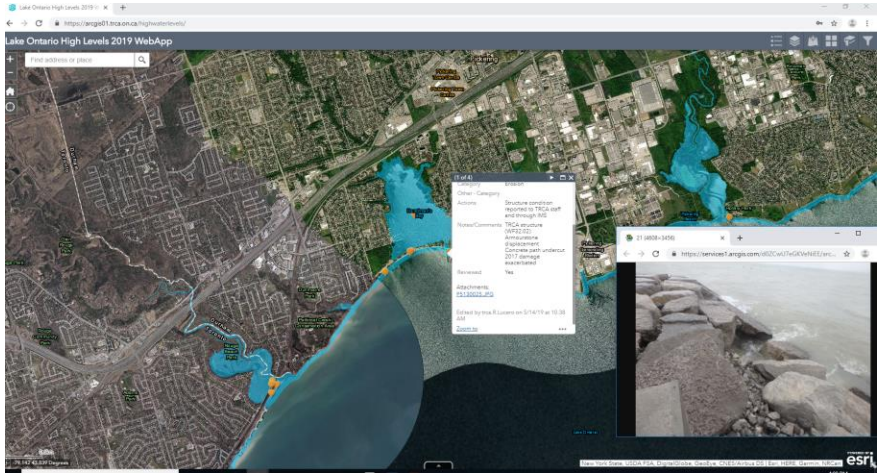
Digital flood handbooks

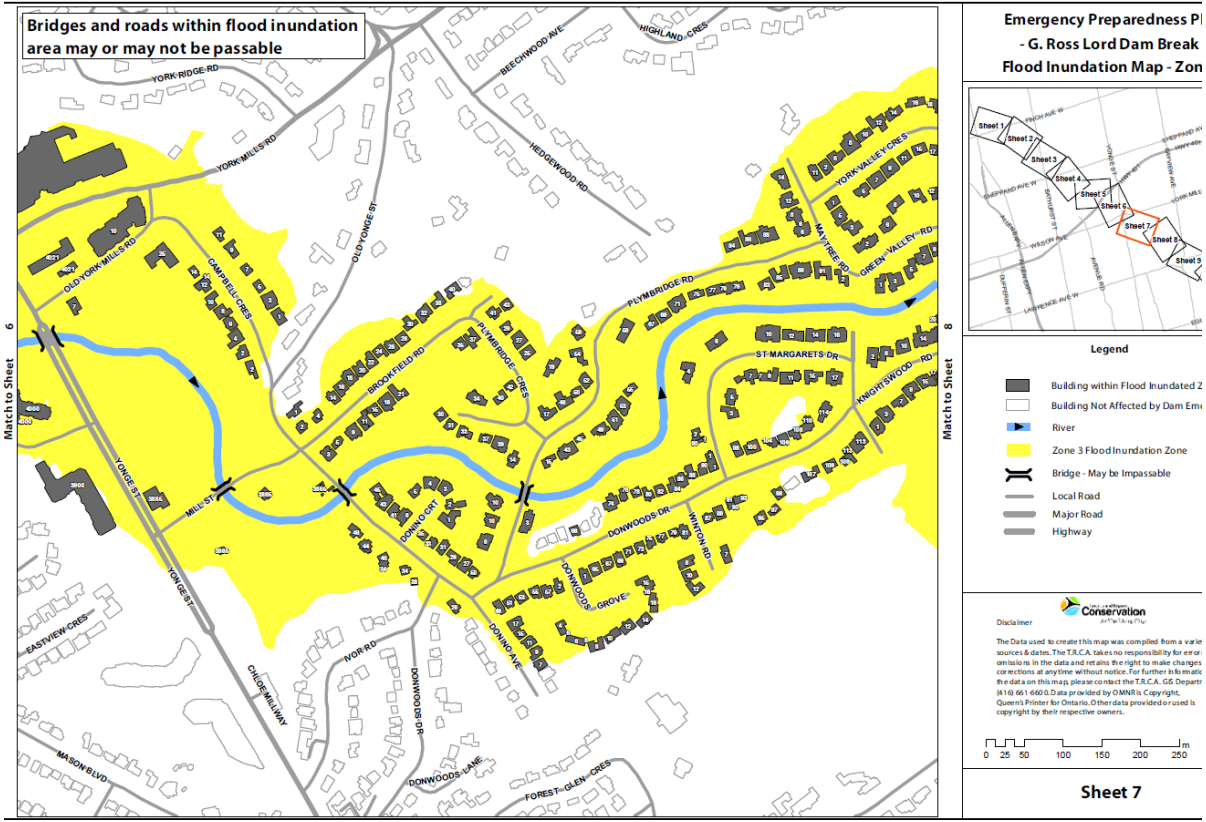


For our first responders, a map is better than a hydrograph, and a list of addresses is even better

Many audiences want a binary answer, some can cope with uncertainty



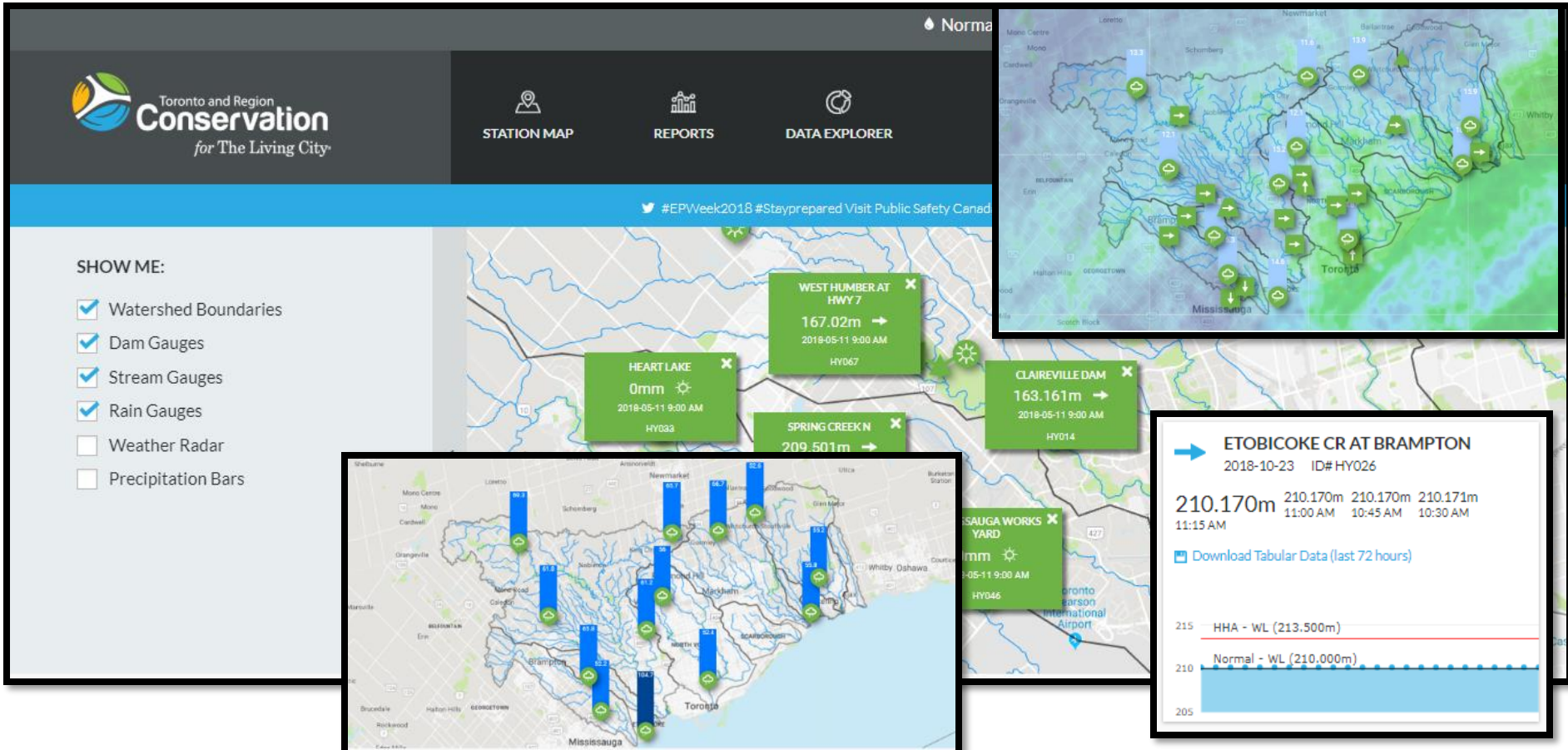




10 scenarios reduced to three zones – precision will be lost in favour of simplicity

For the sophisticated user, share the data, exchange the data

trcagauging.ca



Parting thoughts – what we are working on now..

- Warning messages and pro-active communication with audiences should reference a shared vocabulary/understanding – has that been established?
- Consider the outputs you need for your (various) flood warning audiences to include in your decision support system (FEWS) workflows
- While warning messages may be one-directional, how can public feedback be incorporated into situational awareness tools?

Thank you!

Questions?

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Toronto and Region Conservation Authority