

Improving Flood Risk Evaluation through Cross-Sector Sharing of Richer Data



SUMMARY

Large-scale flood risk models used by Canada's insurance sector currently use low-resolution topographic data as inputs, and also give limited consideration to flood mitigation infrastructure or defense measures that have been implemented by Canadian municipalities.

In a comparative study undertaken by Canadian Water Network and the Insurance Bureau of Canada, incorporating higher resolution topographic data and flood defense measures in these models created a clearer picture that can significantly reduce the level of uncertainty in the resultant flood hazard maps.

When comparing the two types of data inputs (i.e. topographic and flood defense measures), the greatest improvement resulted from the incorporation of higher resolution topographic data from a reliable origin, such as LiDAR-based technologies.

A comparison of different topographic data resolutions used in the models found that there is a "goldilocks" level of 5-metre grid spacing, providing the optimal resolution to evaluate municipal flooding from intense rainfall events.

At a national meeting with municipalities of the Canadian Municipal Water Consortium, the insurance industry, international modelling firms, the federal government and other groups from the public sector, six opportunities were generated to advance sharing and improved use of data and insights in flood risk management.

INTRODUCTION

Flooding has caused significant damage to communities in Canada over the past two decades. Over this period, property claims have increased, and now represent 36.8% of all insurance claims for the Canadian insurance sector, with the largest percentage of property claims resulting from floods. Flooding — both fluvial (riverine) and pluvial (from intense rainfall events) — is a national-scale issue that is posing significant challenges to multiple sectors, including municipalities, the insurance sector, the federal government and the general public.

Each sector has a role to play in dealing with this challenge:

- Municipalities are actively investing in infrastructure and programs that increase flood resiliency.
- The federal government supports communities that are impacted by flooding through disaster mitigation and other funding programs.
- The insurance sector strives to accurately price risk so that it can offer products to consumers and municipalities that protect against losses from flooding.
- As homeowners improve their understanding of flood risk and the costs involved, they are taking action to manage this risk by protecting their own property.



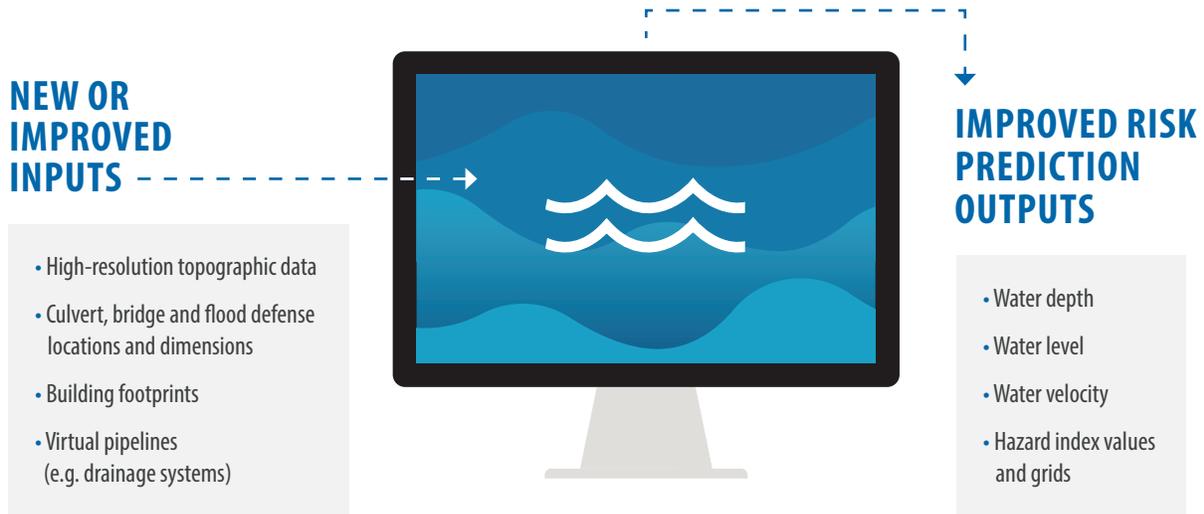
Flooding is a challenge that requires truly collaborative cross-sectoral solutions. Currently, there is a fragmented and incomplete understanding of flood risk and its implications for communities across Canada. In response, Canadian Water Network (CWN), together with the Insurance Bureau of Canada (IBC), convened a meeting in April 2018 with representatives from Canadian municipalities, the insurance industry and upper-level governments (see Appendix). The intent of this meeting was to better understand what actions each sector was taking with regard to flood risk management. One of the key insights that resulted from this discussion was a recognition that the standard for modelling flood risk across Canada could be strengthened to improve decision-making for all groups. Currently, large-scale flood risk models rely largely on low-resolution (typically 30-metre) topographical data of mixed quality, and give limited consideration to flood reduction controls such as storm sewers, dikes and dry ponds. To evaluate whether this was limiting risk predictions and negatively impacting management decisions, CWN and IBC began a pilot project in August 2018 to examine how results for pluvial hazard maps derived from large-scale risk models are different — and to what degree — when richer datasets are used. Natural Resources Canada supplied the high-quality topographical data used in the pilot project.

The pilot project had three objectives:

- 1** To assess the potential for enhancing flood risk evaluation when higher quality topographical data and municipal flood mitigation measures are incorporated in flood risk models.
- 2** To determine what data type, resolution and format is most effective for improving model certainty.
- 3** To investigate mechanisms for sharing relevant and current data across public and private sectors.

PROJECT INSIGHTS

Two flood risk modelling firms were selected through a competitive process to evaluate the flood risk of five Canadian cities (EPCOR - Edmonton, Halifax, Regina, Tecumseh, Windsor) when higher resolution topographic data and municipal flood defense data is incorporated into their existing flood risk models. The modelling firms assessed how the results compared to maps derived using current lower resolution datasets. The project focused specifically on pluvial flooding (i.e. flooding from intense rainfall) because of its significance for insurance and municipal investments and decisions, as well as the relatively poor understanding of the risk it presents when compared to other types of flooding in Canada, such as riverine or coastal flooding.



The results from both modelling firms generally showed that **the use of any of the richer datasets** — either topographic or flood defense data — **is likely to improve risk characterization** beyond what is presently available to insurers. The most significant improvement resulted from incorporating higher resolution topographic data from a reliable origin, such as LiDAR-based technologies.

In terms of the resolution or spacing of the topographic grid (i.e. the size of the grid cells used to represent a geographic area in a model), the current standard of a 30-metre grid typically used for regional mapping and modelling was found to be too coarse to effectively fully represent the results of pluvial flooding, but is useful as an initial screen of where pluvial flooding could be a risk and requires more detailed assessments. During the pilot, 2-metre spacing provided much greater detail and improved the predictability of the results. However, topographic grid spacing also has a significant impact on model run time. A dense dataset is likely too costly and impractical to produce national-scale pluvial flood maps. A 5-metre grid spacing reduces processing time, with minimal reduction in output quality as compared to finer grid spacing. However, it may be advantageous to use 2-metre grid spacing in certain key areas, such as dense urban centres.

When it comes to addressing flooding in cities, drainage systems such as storm sewers can also significantly change the risk picture beyond considerations of basic topography. Incorporating such features into pluvial flood risk models can play an important role in improving model accuracy, particularly in urban areas and for small storm return periods such as a 1-in-5 year storm. In addition to incorporating these features more explicitly, it is recommended that pluvial models be linked with or checked against proper hydraulic models for urban drainage systems to increase model accuracy. Further investigation is needed to determine alternative methods for representing building effects, because grid spacing may compromise the ability to directly use building footprint data. In general, any decision to represent buildings in pluvial flood risk models will likely only be relevant if modelling is undertaken at finer topographic grid spacing (i.e. less than 10-metre spacing).



OPPORTUNITIES TO ADVANCE RISK MANAGEMENT THROUGH CROSS-SECTOR COLLABORATION

CWN, in partnership with IBC, convened a second cross-sector meeting in May 2019 (see Appendix) to collectively discuss the results of the pilot project and determine the next steps forward to better enable and accelerate knowledge sharing on this issue. Discussion focused on potential mechanisms that would improve the future access and sharing of relevant data across sectors. There was strong agreement among the participants that richer data is critical to improving flood risk evaluation in Canada and that new sharing mechanisms will allow decision makers to more effectively leverage the existing and evolving knowledge base. Six mechanisms were proposed, and the participants weighed in on the degree to which each mechanism held strong potential for advancement in their sector:

- The representatives from municipalities and other organizations (e.g. upper-level government) favoured the creation of a framework that better recognizes and credits the work done by municipalities to reduce flood risks. To be robust and widely applicable, this framework could be developed jointly by multiple municipalities, the insurance sector and other relevant organizations, and provide a mechanism to identify risk reduction credits for effective mitigation by municipalities. These credits could be applied by adding them as a secondary layer of risk assessment information to existing flood hazard maps. It should also be noted that with enhanced mitigation, the number or magnitude of claims may decrease, which could ultimately reduce the cost of insurance premiums.
- As a result of the findings from the pilot project, the mechanism that garnered the greatest support from the insurance sector was achieving open access to high-resolution topographic data across Canada.
- All sectors were in favour of supporting a better shared understanding of what information is available and where (i.e. making data more discoverable).

- There was an expressed desire to develop a committee of cross-sector representatives for evaluating next steps on data access and/or sharing strategies.
- A mechanism which was not as highly ranked as other options, but which still received interest from all sectors, was the development of a data standard to support shared use. This standard would ensure that the data type, size and format is such that all sectors can more readily incorporate the data in flood risk evaluation.
- The idea of creating a third-party data broker was discussed at length. Implementation would require an independent organization (with government oversight) to coordinate and house relevant data for flood risk evaluation. Data ownership and privacy, as well as the logistics of data management, were cited by the various sectors as major hurdles to overcome.

A proactive, cross-sector effort is needed to continue to advance flood risk evaluation in Canada. CWN and IBC are now exploring ways to develop these mechanisms and further engage all sectors. Both organizations see strong potential to create a central hub to coordinate and house relevant data for flood risk evaluation. The data that is gathered for this central hub will require expert curation to more effectively coordinate and integrate information, and also to connect the various sectors for more informed decisions on flood risk management.

Improving access to richer information is a significant opportunity for Canadian municipalities, insurers and homeowners to better understand flood risk and take action. Municipalities can then better identify high risk areas, prioritize investments to reduce risk, undertake mitigation, and ensure better recognition and support for the value of that mitigation from the public and governments. The insurance sector can proceed with more confidence that they have appropriately and accurately priced flood risks. Homeowners, armed with knowledge of their flood risk, can take steps to protect their property or purchase appropriate insurance.

APPENDIX: CROSS-SECTOR MEETING PARTICIPATION

Flooding is a national-scale issue that is posing significant challenges to municipalities, the insurance sector and the federal government. In 2018 and 2019, Canadian Water Network (CWN) and the Insurance Bureau of Canada (IBC) convened a series of cross-sectoral meetings to better understand what actions each sector was taking with regard to flood risk management; discuss the results of the modelling project; and generate next steps to better enable and accelerate knowledge sharing. CWN and IBC thank the attendees for their contribution to the advancement of flood risk evaluation, including:

- Alberta Capital Region Wastewater Commission
- Aon Reinsurance Solutions
- Aviva Insurance Company of Canada
- CAA Insurance Company
- Canadian Water Network
- Capital Regional District (Victoria)
- City of Calgary
- City of Regina
- City of Windsor
- Conservation Ontario
- Environment and Climate Change Canada
- EPCOR Water Services
- Federation of Canadian Municipalities
- Grand River Conservation Authority
- Halifax Water
- Hamilton Water
- Impact Forecasting
- Institute for Catastrophic Loss Reduction
- Insurance Bureau of Canada
- Intact Centre on Climate Adaptation
- Intact Insurance Company
- JBA Consulting
- Mantle
- Natural Resources Canada
- Ontario Clean Water Agency
- Public Safety Canada
- Regional Municipality of Durham
- Regional Municipality of Peel
- Regional Municipality of Waterloo
- Regional Municipality of York
- Royal & Sun Alliance Insurance Company of Canada
- Swiss Reinsurance Company Ltd.
- TD General Insurance Company
- The Geneva Association
- The Water Research Foundation
- Toronto Water
- Town of Tecumseh
- Travelers Insurance Company of Canada
- Union Water Supply System
- University of Waterloo
- Utilities Kingston
- Ville de Montréal
- Ville de Québec
- Western University

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