Institute for Catastrophic Loss Reduction

CATtales

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Reducing urban flood risk through provincial building and plumbing code interpretation

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Urban flood damages are a recurrent and growing issue for municipalities, insurers and homeowners across Canada. Just this past year, a storm system that affected Thunder Bay and moved through to Montréal resulted in $260 million in insured damages. Also in 2012, a storm moved through southern Ontario affecting several neighbourhoods in Hamilton and Ottawa, resulting in $90 million in insured damages. Indeed, the frequent occurrence of severe rainfall resulting in urban floods across Canada in 2012, including events in Thunder Bay, Hamilton, Toronto, Montréal and Steinbach, Manitoba, prompted Environment Canada to refer to 2012 as ‘The Year of the Urban Flood.’ Aside from the considerable insurance toll associated with sewer backup claims, homeowners are also exposed to health risks associated with raw sewage, dampness and mould growth when their basements flood.

In combination with appropriate downspout and foundation drain disconnections, backwater valves are recommended or required by many municipalities and local authorities across Canada as a household-level measure to reduce the risk of sewer backup in new and existing homes. Education and subsidy programs are frequently used to encourage valve retrofits in at-risk homes. However, retrofit programs have only been partially effective in encouraging homeowners to install backwater valves after they have been flooded or when they live in flood-prone neighbourhoods. Further, backwater valve retrofits are expensive—often totalling in the thousands of dollars—serving as an additional barrier to the installation of these important risk reduction measures. ►

The view from here

Global support for local action

By Paul Kovacs
Executive Director, ICLR

The new global strategy for reducing the risk of loss from earthquakes, flood and storms will be released in early 2015 and initial consultation identified three critical opportunities for improvement – local action, integrated approaches, and enhanced capacity. ICLR's experience provides support that this effort is on the right track, but solutions remain difficult.

In 2005 world leaders met in Japan to establish a ten-year global strategy for disaster risk reduction – the Hyogo Framework. ICLR had a delegation at these meetings. Recently the United Nations issued a report summarizing issues that have arisen in stakeholder discussions about the next framework. Many issues have been identified including three recurring themes.

The first challenge is to ensure that local decision makers have the resources, knowledge and authority to implement effective disaster risk reduction actions. Local action is fundamental for successfully reducing disaster risk, yet challenges are evident around the globe in establishing appropriate mechanisms to decentralize responsibility, resources, regulatory powers, risk knowledge and accountability. A particular focus is on urban centres, home for 80 percent of Canadians and more than half of the world's population. The growing concentration of people and property values in urban centres increases the challenge of disaster management.

ICLR's experience addressing the risk of damage from water, wind, wildfire and earthquakes consistently demonstrates the significant potential for local action, and challenges of securing the resources and authority to act. For example, tens of billions of dollars of investments are required to restore our municipal infrastructure to the operational capacity that was in place in the 1970s, funds that are not presently available to local governments.

The second challenge is to integrate disaster risk reduction with other priorities including climate risk management, poverty reduction and sustainable development. Climate change will bring more large storms and slow onset risks like rising sea levels, so actions to adapt to change in the climate and to reduce disaster risk should merge into a shared plan of action. Moreover, actions to support the most vulnerable populations consistently build resilience to loss from disasters, a challenge that was particularly evident when the earthquake struck Haiti, so disaster risk reduction efforts need to be integrated with actions to promote development and reduce poverty and other forms of vulnerability.

These global lessons are also evident in ICLR's experience in Canada. It is important to integrate work on disaster management, climate change, and local prosperity. Unfortunately, these are presently viewed as independent issues, resulting in duplication of effort and second best policy actions. A unified focus on building resilient communities needs to emerge.

And the third challenge involves building capacity to take action. There is a growing science foundation for action, with better data on risk, consequences, and alternatives, but this knowledge is yet to be appropriately shaped to support decision-making. There is also a growing public awareness about the threat from water, wind, wildfire and earthquakes, but again there remain challenges in translating awareness into support for action. And there is a need to build the capacity and clarify the accountability of decision-makers. Consistently risk reduction actions are most frequently taken just after disaster strikes, and there remain too few examples of proactive investments in prevention and public safety.

ICLR has found that in Canada, like most other countries, the majority of actions to reduce the risk of damage from water, wind and wildfire have come after a disaster. I am encouraged by proactive efforts over the past forty years to reduce the risk of earthquake damage through actions in the building code, and the seismic safety retrofit programs for schools in British Columbia and some hospitals in Quebec, but these actions remain the exception to a general trend of reaction.

I support the debate proposing increase attention of these three challenges. I strongly support the emerging focus on resilient communities. Perhaps solutions will emerge for these difficult issues will emerge through global action. It is possible to prevent hazards from becoming disasters but this requires investment in resilient infrastructure and informed communities. **CT**

Code interpretation: A method to require backwater valves in new homes

Provincial code wordings provide an important means of requiring the installation of backwater valves in new homes. The key sentence of the 2010 National Plumbing Code related to backwater valve installation, which is applied in provincial building and plumbing codes across the country, states that when a sewer connection: "...*may* be subject to backflow, a...backwater valve shall be installed on every fixture drain connected to them when the fixture is located below the level of the adjoining street."

Discussions with local code officials across Canada suggested that the above sentence is somewhat vague and subject to interpretation. A key source of the lack of clarity regarding this sentence is deciding when a new home's sewer connections "may" be subject to backflow. Interpretation of the word "may" can have a considerable impact on the frequency of installation of backwater valves in new homes, as the sentence may be interpreted in one of several ways, including:

- Homes *may* be subject to backflow if they are constructed as infill development in areas with histories of sewer backup or if they are built in new developments that are connected to older sewer systems that have histories of sewer backup. When the code is interpreted in this manner, backwater valves would be installed in new homes only in rare or specific circumstances (for example, only when they are connected into older systems that have histories of sewer backup).
- Any home with sewer connections below the adjoining street *may* be subject to backflow. When interpreted in this manner, backwater valves are required in essentially all new homes that are serviced by public, underground sewer systems—even in new, greenfield development where there is no history of sewer backup.
- The code may be interpreted in a manner that requires valve installations in no circumstances, and only provides the authority to install backwater valves should they be requested by developers or home-buyers.

Given the considerable uncertainties associated with sewer backup, it is prudent for local authorities to consider any home connected to an underground sewer system as exposed to sewer backup risk and require the installation of backwater valves in all new homes that are serviced by public sewer systems. Regional sewer backup events are almost entirely unpredictable and are subject to uncertainties associated with infiltration and inflow into sanitary and storm sewer systems, construction errors, homeowner behaviour and the occurrence of extreme rainfall events.

The impacts of climate change will only serve to increase the unpredictability of wide-spread sewer backup events. Further, experience in Canada has shown that many developments, both new and old and serviced by combined or separated sewer systems, can experience regional sewer backup events. Indeed, a July, 2012 flood event in the Binbrook neighbourhood of Hamilton (cover photo) has shown that extreme rainfall can result in regional sewer backup events even in very new subdivisions with separated sewer systems. Further, many of the neighbourhoods that experienced regional sewer backup events during the August 19, 2005 extreme rainfall event in southern Ontario were also serviced by modern, separated sewer systems.

Aside from addressing many of the uncertainties associated with regional sewer backup events, it is much less expensive to install backwater valves in new homes. The cost of installing a valve in a new home is approximately $150-$250, while the cost of retrofitting a valve ranges from $1,000 to $2,000, if not more. Several municipalities have implemented programs to help homeowners offset the cost of retrofitting backwater valves. These programs often provide between $500 and $3,000 to help homeowners install backwater valves and associated risk reduction measures. Municipalities have also found that education and subsidy programs aimed at encouraging homeowners to implement risk reduction measures have frequently been only partially successful, with uptake rates sometimes ranging from 10 to 50% of eligible households. Low uptake rates indicate that retrofit programs alone will not be adequate to address the rising cost of urban flood events.

Over the summer and fall of 2012, ICLR surveyed over 240 local officials from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick and Nova Scotia, representing 160 local authorities and municipalities responsible for building and plumbing code implementation. The survey was aimed at increasing our understanding of how local officials interpret code wordings related to backwater valves and how these interpretations affected the frequency of installation of backwater valves in new homes.►

Survey findings

Survey respondents were provided with a copy of sentence 2.4.6.4. (3) of the National Plumbing Code and asked if this sentence was intrepreted in their jurisdictions to require backwater valves in all or most circumstances, in rare or specific circumstances, or under no circumnstances. As presented in Figure 1, the majority of respondents from Alberta, Saskatchewan, Manitoba and New Burnswick/Nova Scotia indicated that this sentence of the code was interpreted in a way that required backwater valves in all or most new homes. However, in British Columbia and Ontario, the majority of local authorities represented in the survey interpreted this section of the code to requre backwater valves only in rare circumstances.

In Alberta, local code enforcement officers are encouraged to interpret this part of the Alberta Plumbing Code in the following way: "A [backwater valve]...shall be installed on drains...installed below the adjoining street and, therefore...subject to backflow." In other words, local code enforcement officers are encouraged to consider any drain that is connected to a public sewer system below the level of the adjoining street to be at risk of sewer backup. When the code is interpreted in this way, new homes are required to have backwater valves. Similarly, many respondents from Saskatchewan, Manitoba, New Brunswick and Nova Scotia indicated that local authorities interpreted the code in a manner that required backwater valves in all or most new homes.

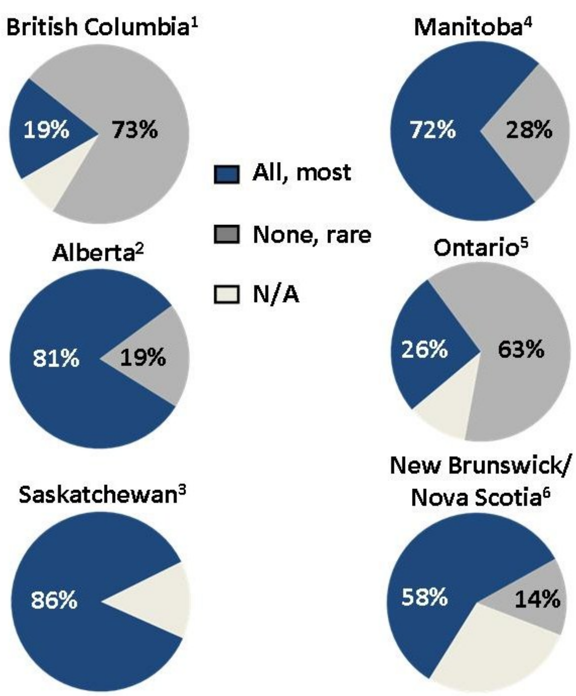

Figure 1: Summary of results. [1]n=41, [2]n=21, [3]n=7*, [4]n=25, [5]n=58, [6]n=7
*Saskatchewan respondents largely represented Regional Health Authorities, which interpret the provincial plumbing code for a large number of municipalities

The survey also revealed that the manner in which code wordings are interpreted had a significant impact on the reported frequency of installation of valves in new homes. As reported in Figure 2, municipalities that interpreted the code in a way that required valves in all or most new homes were far more likely to indicate that more than 51% of homes built since 2005 in their jurisdictions had sewer backwater valves.

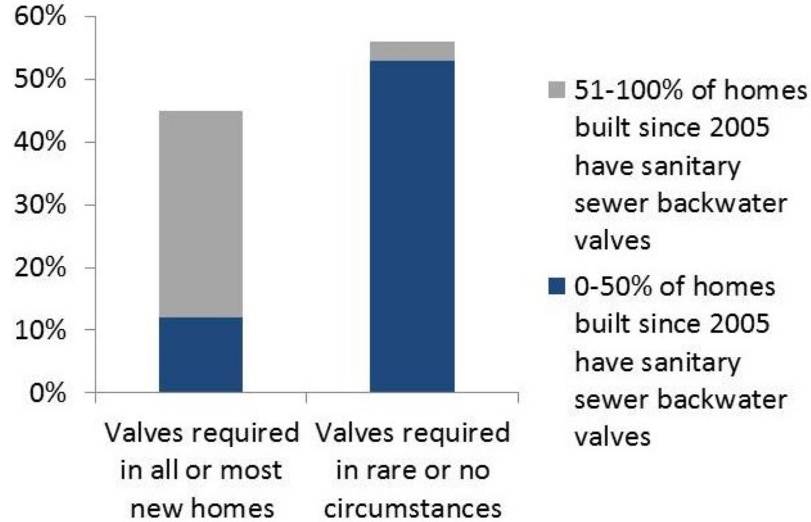

Figure 2: Code interpretation and installation frequency. *n=120

In Ontario, several municipalities, including the cities of Toronto and Windsor, now interpret the Ontario Building Code in a way that requires installation of valves in all or most new homes. For example, policies adopted by these cities have stated that "the whole City be declared at risk of basement flooding in the event of unusually severe or extreme precipitation...." and "...despite all reasonable precautions the City's sewer system could be overwhelmed, and building drains may be subject to backflow...." By recognizing that any home *may* be subject to backflow, backwater valves are required for all new homes in these municipalities.

Several survey respondents commented on the ambiguous nature of the code sentence related to backwater valves. For example, a respondent from Belleville, ►

Ontario stated that the reference related to backwater valves in the Ontario Building Code "...is one of the worst worded articles of the Code. I can interpret this clause either to require backwater valves in all cases or very few cases. It needs to be re-worded to make the intent more easily understood."

Respondents from other Ontario municipalities also expressed a level of frustration regarding code wordings related to backwater valves. For example, a respondent stated that "the key word…is 'may'…it does not say that one has to be installed nor does it say that one is not required. It's a grey area of the code." A further respondent said that "the code states that a backwater valve shall be installed on drains that 'may' be flooded. Any drain 'may' flood, but there is little political will to force residents to spend money" on backwater valve installations.

Recently, the Town of Collingwood adopted a code interpretation to require backwater valves in all new homes. Collingwood's Chief Building Official (CBO) stated that they "…asked new home developers if they could guarantee that [sewer backup] would never happen [in new subdivisions], and the response was 'no.'" Since the developers could not guarantee that sewer connections would not be subject to backflow, they must consider that the connections *may* be subject to backflow. As stated in the Ontario Building Code, if drains *may* be subject to backflow, sewer backflow protection shall be installed. ►

Collingwood, Ontario now requires backwater valves in all new home construction

In a letter dated January 10, 2013, drafted by the Town of Collingwood's Chief Building Official Bill Plewes, the Town now requires backwater valves in all new home construction effective February 1, 2013.

The letter opens by quoting a new ICLR publication '*Urban flooding in Canada: Lot-side risk reduction through voluntary retrofit programs, code interpretation and by-laws*', released on February 16. Plewes was one of several municipal building and water officials given an advanced draft of the publication and asked to review it and provide comments before it was published.

The letter begins: "Based on a document that was just recently drafted, it is stated urban flood damages are a current and growing issue for municipalities, insurers and homeowners across Ontario and Canada. Damages from urban flood events often total in the $10s and $100s of million dollars a year across Canada…In addition to the financial costs of sewer back water flooding, there are significant health concerns. Sewer backups occur when there are massive amounts of water overloading a drainage system. This results in waste water (including human waste) flooding into basements. Floods from sewer backup introduces black mould, bacteria carrying pathogens, and sewage waste into homes creating significant health risks for the building occupants. A significant amount of these could be prevented by installing a backwater valve in the building drain."

Plewes notes in the letter that "there is enough historical data collected in Collingwood to require backwater valves be installed in every new dwelling that has fixture(s) below the adjoining street level."

In a follow-up discussion with ICLR's Dan Sandink, Manager of Resilient Communities & Research and author of '*Urban flooding in Canada*', Plewes said that "The Ontario Building Code states that 'where a building drain or branch MAY be subject to backflow, a backwater valve shall be installed.' We asked new home developers if they could guarantee that back flooding would never happen and the response was 'No.' That said, we found it very easy to make the installation of the backwater valve mandatory. Interpreting the code in a way that requires developers to install backwater valves in new homes allowed the Town to avoid the complicated task of developing a municipal by-law to require this important measure."

"On a side note," Plewes added, "not a single developer disagreed with our thought process and they are now using the backwater valve as a selling feature."

Previous research conducted by ICLR revealed that a mainline, full port, normally open backwater valve, when properly installed and maintained, in tandem with the severance of foundation drains (i.e. weeping tile) from the sanitary sewer, is one of the best measures a homeowner can take to reduce the risk of stormwater and/or sewage backing up into a basement. But provincial building code and/or local by-law requirements to install such valves in new homes is spotty across the country, often owing to code interpretation.

Collingwood now joins a number of municipalities across the country in requiring backwater valves in new homes, including Winnipeg, Edmonton, Toronto, Ottawa, Windsor and Hamilton. **CT**

Collingwood's CBO further reported that adopting a code interpretation to require backwater valves was an easier process than developing a by-law to require valves in new homes. Further, rather than experiencing push-back from the local development industry due to the small extra cost associated with installing valves in new homes, the official reported that developers are now using backwater valves as a selling feature for new homes.

Application type	Benefits	Drawbacks
Retrofit	• Known risk areas, identified through historical sewer backup occurrence, can be targeted with retrofit programs	• It is difficult to encourage homeowners to retrofit valves • Valve retrofits are expensive • Reactive, post-event approach to risk reduction • Valves must be maintained over time to remain functional • Possibility for displacement of other methods of reducing sewer backup risk (i.e., improved infrastructure)
Installation in new homes	• Significantly lower installation costs • Provides protection to all homes regardless of sewer backup history • Accounts for uncertainties created by climate change and infiltration/inflow • Shifts liability of installation costs (e.g., retrofit program cost) away from municipality	• Valves must be maintained over time to remain functional • Possibility for displacement of other methods of reducing sewer backup risk (i.e., improved infrastructure, pre-development risk assessments)

Table 1: Benefits and drawbacks of requiring backwater valves in new homes vs. homes with histories of sewer backup. Our survey revealed that there is substantial precedence for the requirement of backwater valves in all new homes. Indeed, the majority of survey respondents from Alberta, Saskatchewan, Manitoba and the Atlantic provinces represented in the survey indicated that backwater valves are required in all or most new homes. To promote the installation of backwater valves in new homes, ICLR has recently made a submission to the National Plumbing Code to clarify wordings related to backwater valve installation, and is engaging the Canadian home building industry in various strategies to increase the resilience of new homes to climate extremes.

Conclusion

While many municipalities may wait until severe or repeated basement flooding events have occurred to implement measures to encourage or require backwater valve installation in homes through retrofit and education programs, there are many advantages of installing valves in new homes. These advantages include the significantly reduced cost of valve installation and the protection of all properties, regardless of the historical occurrence of sewer backup. Installation of valves in new homes is especially important given the uncertainties associated with infiltration and inflow in separated municipal sewer systems and the occurrence of unpredictable, extreme precipitation events that frequently lead to the occurrence of regional sewer backup events. Many additional benefits of installing valves in new homes are presented in Table 1. **CT**

Notes

Insurance Bureau of Canada. (2012). Canadian Severe Weather: Events and Insured Damage. Toronto: IBC.
[2]Canada's Top Ten Weather Stories for 2012. http://www.ec.gc.ca/meteo-weather/default.asp?lang=En&n=0B8D6A90-1
[3] 2010 National Plumbing Code, sentence 2.4.6.4.(3). Emphasis added.
[4] See the City of Hamilton report on flooding in this neighbourhood here: http://www.hamilton.ca/NR/rdonlyres/1880A339-2534-401D-B971-C1DBF03A6359/0/Apr02_7_1_PED12182a_PW13016.pdf
[5] Sandink, D. (2013). Urban Flooding in Canada: Lot-Side Risk Reduction through Voluntary Retrofit Programs, Code Interpretation and By-Laws. Toronto: Institute for Catastrophic Loss Reduction.
[6] Safety Codes Council. (2007). Plumbing Safety Information Bulletin: Protection of the Drainage System. STANDATA P-07-02-NPC 05, December 2007. Edmonton: Alberta Safety Codes Council.
[7] City of Toronto. (2008). Update on the Engineering Review Addressing Basement Flooding. Staff Report to Council. August 18, 2008.
[8] City of Windsor. (2011). Mandatory backwater valve installation for new home construction for sewers. Report to Council. Windsor: Corporation of the City of Windsor, Office of the City Solicitor – Building Department.
[9] *Thompson's World Insurance News*, April 1, 2013; personal communication, Bill Plewes, Town of Collingwood

Environment Canada adopts the Enhanced Fujita Scale to measure tornadoes

By Glenn McGillivray
Managing Director, ICLR

On April 19, the day after a weak tornado destroyed a horse arena in the Ontario town of Shelburne, Environment Canada announced that the twister was an EF1. The tornado inflicted other, comparatively minor damage over a path 500 metres long and 75 metres wide. No injuries were reported.

EC, however, left one detail out of the report— it has moved to the Enhanced Fujita Scale (EFS) to measure tornadoes. According to one Environment Canada contact: “The announcement of the move was supposed to have gone out, but Shelburne beat us to it.” The twister was the first confirmed tornado in Canada this year.

EC’s new approach follows reforms introduced in the United States in 2007. The move, at least in part, comes out of the partnership between EC and the crisis response unit at Western University, established by Dr. Greg Kopp.

Each time there is a suspected touchdown of a tornado in Canada, EC sends a team to study the damage and 1) determine if there was, indeed, a twister and 2) assign a suspected rating. If the event is within a reasonable distance from Western University, a team of wind engineers also attends the event to assist EC in its analysis and conclusion-making. Once that is done, the engineering team conducts a more detailed survey of the damage with a view to improving house design, construction methods, and use of materials.

Both the team at Western and ICLR were asked by EC to provide letters of support for the possible move from the Fujitia to the Enhanced Fujita, and both teams were eager to comply.

From ICLR’s view, there are a number of benefits to adopting the Enhanced Fujita scale. These include:

- The EFS utilizes scientifically based wind speeds associated with various levels of damage and includes more types of structures with more levels of damage than does the traditional Fujita Scale. This use of a greater number of damage indicators will help make wind damage rating more accurate.
- The EFS has been in use in the United States since 2007 ensuring that a number of tools, training materials and other information is readily available. Use of the EFS will also ensure that Canadian stakeholders are ‘on the same page’ as their U.S. counterparts, cementing better cross-border cooperation and consistency going forward. Because the U.S. adopted the EFS several years ago, the longer Canada waits to implement it, the more the two national databases will diverge, making it difficult to reconcile data differences in the future.
- The EFS is backwards compatible, ensuring that historic storm data remains relevant and useful going forward.

With the instances of property damage caused by extreme wind becoming more frequent and severe in Canada, ICLR unequivocally supports the change from the traditional Fujita Scale to the EFS.

The EFS is one of the tools needed to ensure that going forward, homes, buildings and infrastructure in Canada are constructed using the most accurate empirical-based data possible. **CT**

Comparison Table for the Fujita and Enhanced Fujita Scales

Fujita Scale		EF Scale	
Fujita Scale	3-Second Gust Speed (mph)	EF Scale	3-Second Gust Speed (mph)
F0	45-78	EF0	65-85
F1	79-117	EF1	86-109
F2	118-161	EF2	110-137
F3	162-209	EF3	138-167
F4	210-261	EF4	168-199
F5	262-317	EF5	200-234