

They waterproofed their homes. Quebec's outdated building codes left them vulnerable

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Carole Linteau carries a few bags to help her sister out of her house, during flooding of the Chaudière River on April 20, 2019 in Sainte-Marie, Que. JACQUES BOISSINOT/THE CANADIAN PRESS

As the Chaudière River receded from the downtown area of Sainte-Marie, Quebec, in 2019, it left the usual devastation after a flood – mud-smearred streets, basements drenched in dirty water, a park where the retreating current had left tires, garbage bins and other detritus.

But there were more peculiar sights in the town – buildings that had slumped backward or slipped sideways from their foundations by several centimetres. Inside, their floors were slanted, and joists had cracked.

These were houses that had been waterproofed, with the installation of impermeable barriers around the foundations. But those measures backfired. The houses were watertight but unable to resist the hydraulic pressure that lifted them from the ground.

“That was the worst part of everything that hit us,” recalled Korine Rousseau, who spent \$125,000 to waterproof one of her rental properties, a four-unit apartment block that

sits about 160 metres from the river banks. The building had moved from its foundations and ripped away from its wooden entrance stairs.

But while there are building strategies that could have prevented Sainte-Marie's houses from being dislodged by the 2019 flood – in which the water rose higher and lasted longer than previous floods – none of those are found in any building codes or bylaws. That's unfortunate, as an expert panel appointed by the Quebec government [cautioned](#) in a 2020 report that “it's likely we'll see an increase in the probability of extreme hydrological events on the Chaudière River over the next few years.”

This isn't a problem specific to Sainte-Marie, of course. [A Globe and Mail examination](#) of the country's national and provincial building codes shows that they are bereft of requirements to deal with the increasingly harsh weather disruptions associated with climate change, including flood threats.

In Canada, regulating buildings and construction standards is a provincial responsibility. However, provinces and territories model their codes after the National Building Code, either to draft their own codes or by adapting the national document. In Quebec, the province's code doesn't apply to residential buildings of less than three storeys or nine units, leaving it to municipalities to address that sector through local bylaws. As a result, requirements vary by municipality. Sainte-Marie, for instance, does not have construction bylaws and leaves it to builders to follow the provincial code. Other towns and cities adopted the national code, which is released every five years or so, but are using old editions.

Located south of Quebec City, Sainte-Marie is often flooded each spring. But in April of 2019, the damage was unprecedented. More than 900 homes had to be evacuated, including the waterproofed buildings.

“Those houses hadn't been designed to withstand such a water level,” said Simon Lacroix, an engineer who works with Axys Consultants, a Sainte-Marie firm. He inspected around 80 houses, including seven with failed waterproofing, to help document claims by homeowners applying for provincial financial aid.

He explained how the waterproofing actually made things worse because, since it didn't let water into those houses, they became like boats, lifting off their foundations. “The higher the water rises, the more Archimedes's principle applies. The higher the water, the harder it pushes on the building.”

While the Quebec construction code states that builders have to account for the effect of water pressure rising underneath foundations, “those criteria are generic, and there is nothing specific on how to attain them,” Mr. Lacroix said.

He said engineers who designed the waterproofing had to rely instead on a policy from the Environment Department. An annex in that policy says that builders in a flood zone have to take into account the resistance to water at the level of a 100-year flood –

meaning the kind of flood that has a 1 per cent chance of occurring in a year at a specific location.

Instead of that half-page annex, Mr. Lacroix said it would be more helpful if engineers had more guidance from building codes, municipal construction bylaws or updated flood maps. “The codes, the standards, the maps aren’t keeping up with climate change.”

Beyond river floods, a growing area of damage stems from heavy rainfall flooding in urban areas. In July of 2013, for example, massive thunderstorms hit Toronto, resulting in flash floods and nearly \$1-billion in insured losses.

“The average repair cost of a flooded basement is somewhere in the neighbourhood of \$40,000 ... so that means a huge out-of-pocket expense for Canadians,” said political scientist Daniel Henstra, co-lead of the Climate Risk Research Group at the University of Waterloo.

That damage occurs because, when there is heavy rainfall, sewers can become overwhelmed and will back up drainage pipes, flowing instead into basements.

A simple device known as a backwater valve can prevent that from occurring, thanks to a flap that blocks water from flowing up the drain. Though it costs thousands of dollars to dig up a basement to insert this device in existing homes, it is much less expensive to add it when building a new house. Yet, its installation is not universally mandated because of ambiguous language in both provincial and national codes.

In Ontario, the province’s code requires that homes with drains must be fit with backwater valves if they “may” be subject to backflow.

Ontario Auditor-General Bonnie Lysyk has found that the word “may” left the Ontario code open to diverging local interpretations. Her office surveyed 52 municipalities and found that only 14 require backwater valves in new homes with basements.

In Windsor, for example, all new homes must have the device. But Toronto only requires the valve in areas “that have been identified as locations subject to backflow,” the city said in a statement to The Globe.

Ontario’s wording on backwater valves comes from the wording of the National Plumbing Code, which is a federal model code on which provinces and municipalities base their own codes. In 2013, nearly a decade before Ms. Lysyk’s report, the insurance industry-backed Institute for Catastrophic Loss Reduction (ICLR) proposed changing that code to remove the word “may” and make backwater valves a requirement in all new residential buildings. But amending national codes is a slow, methodical process. Proposals are reviewed by committees made up of industry representatives, building users, regulators and construction experts.

It took 10 months for a federal committee to analyze the ICLR code-change request. After another 11 months, the matter was referred to a subcommittee. The wording hasn't changed.

“There is an institutional path dependence and real conservatism against changing the building code and I can understand why, because these are binding rules that have universal application. They require enforcement, they require inspection, new expertise,” Prof. Henstra said.

In the wake of the 2019 flood, nearly 400 homes had to be demolished in Sainte-Marie, including a dozen belonging to Ms. Rousseau. She estimates she lost a million dollars and is stuck with six empty lots where rental properties once stood. On the Sainte-Marie land survey, the location of her waterproofed apartment building is now marked as “undeveloped and unused land.”

Before the next flood arrives, Mr. Lacroix is recommending upgrades to homeowners. He waterproofed for a client in a way that he says will make her home withstand the new higher flood reality: he poured a heavier foundation and instructed the homeowner that, once water reaches a certain level, to open the basement windows and let it penetrate so it holds down the building rather than letting it float. They're the type of strategies he'd like to see made national standards for the construction industry.

Élène Levasseur, a researcher on flood resilience for the non-profit group Architecture Without Borders Quebec, agreed that flood-proofing amendments to the national code would help nudge provincial and municipal officials to modernize their own rules.

“But,” she said, “it's a ship that's hard to turn.”