

# Floods and Foibles in Calgary, Alberta\*

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## Introduction

Calgary ([Figure 1](#)), site of the 2016 AAPG Annual Convention and Exhibition, is characterized by sunny skies, mountain views and a few contradictions. It's an oil and cowboy city (at least it likes to think so), which – despite its conservatism – elected the first Muslim mayor in North America and helped elect a left-wing provincial government. The younger demographic in the oil patch thinks anthropogenic warming is a serious issue, while a lot of the old-timer entrepreneurs think it's a hoax. The city has the greatest concentration of geologists in North America outside of Houston, but now many of them are unemployed.

More germane to this piece, the city has been regarded to be generally free of natural hazards: tornadoes ravage Oklahoma, debris flows through Los Angeles every time it rains, Vancouver and San Francisco (and even Ottawa) await their next earthquake... but Calgary sits comfortably on a rolling plain on a solidly built part of the North American plate, north and east of hurricane belts and mostly north of tornado belts, without a volcano in sight. Even the formerly legendary cold winters have lost their punch. It all seemed pretty safe... until the summer of 2013, that is.

## Forgotten Floods

When the Northwest Mounted Police (later to be known as the Royal Canadian Mounted Police) rode west in 1874 to bring law and order to the Northwest Territories, one of their tasks was to stamp out the illegal whiskey trade along the Bow River, which consisted mainly of Americans working out of Fort Benton, Mont.

In 1875, the Mounties' "F Troop" built a fort at the confluence of the Bow and Elbow rivers in what would later be known as Alberta. This was the first building in the future city of Calgary – the site would end up slightly east of downtown. The Mounties were more enlightened land-use planners than subsequent immigrants and city councils: they built their fort on a hill next to, but comfortably above, the confluence. The site has probably never seen a flood any time in the late Holocene.

Not so the floodplain lowlands to the west and south, where the city expanded after the arrival of the Canadian Pacific Railroad in 1883. The two biggest known floods on the Bow River, and possibly the Elbow River, occurred four and 22 years, respectively, after the building of the fort. The Bow and Elbow rivers were in fine fettle back in those days; more big floods occurred in 1902, '15, '16, '23, '29 and '32. But these floods did not deter development in floodplains, which continued apace along both rivers.

The 1932 flood was very large, matched in the 20th century only by the 1902 flood, and would have inflicted great ruin upon the residential communities that sprang up along the Elbow River between 1902 and 1932, but the Glenmore Dam, built on the Elbow to provide a drinking-water reservoir, had just been finished. According to historian Harry Sanders, the reservoir went from empty to a few inches below crest in two days. This fluke blunted the impact of the Elbow flood on the communities, and if there was any impulse to think about floodplain regulation in the 1930s, that was also blunted.

There followed an amazing 70 years. Following the rash of floods around and after the turn of the century, seven decades passed without any discharge that could be labeled a “flood.” The old citizens died or moved out, and first-hand knowledge of the flood hazard gradually dimmed. As it dimmed, houses were built in the most hazardous places, such as filled-in abandoned channels and meander bends. Many students at the University of Calgary, surveyed in the '80s and '90s, did not know it was possible that the Bow and/or Elbow rivers could overtop their banks.

The city and the province knew, however, despite the city's ongoing approvals of floodplain developments. In the late '60s the city started thinking about some kind of floodplain regulation – a fairly progressive thought for a western Canadian city at the time.

The Montreal Engineering Company was hired to conduct a flood hazard study. They picked the 70-year flood as the design flood, mapped inundation limits of it, recommended a floodplain management scheme in which hazard areas would be officially delineated on maps and presented findings at a series of public hearings. Because most attendees at the hearings were floodplain residents, the outcome was predictable: the management scheme was vigorously opposed because property values were deemed to be at risk. The heat was such that the city backed-off, and Calgary's first attempt at land-use planning on floodplains was abandoned.

The city and the province got more serious 10 years later. Alberta Environment, a government department, did another flood study, which came out in 1983. The city, illustrating the old adage “once bit, twice shy,” held no public hearings and asked no community associations for input. Adoption of floodplain regulations seemed to be conducted as a stealth mission. The study defined an inner floodway in which built structures would have a significant backwater effect and an outer floodplain in which built structures would not have such an effect. After the 2013 flood, the “floodplain” zone would be changed to “flood fringe.”

The city enacted by-laws prohibiting new development in the floodway, but allowed existing residences to be maintained and even replaced. In the floodplain, new development, including residential subdivisions, would be allowed if first floors and all electrical and mechanical equipment were above flood level. Ironically, there was little or no general communication about the flood hazard coming from the city or the province before 2005; it may be that the city wanted to keep the issue quiet to keep the floodplain residents quiet.

## Wake-up Call

The two rivers continued their mild-mannered ways through 2004. However, in June 2005, a series of potent storms passed through southern Alberta. Although towns south of Calgary were flooded three times, only one distinct peak on the Bow River hydrograph occurred in Calgary, on June 19. The Elbow also overtopped its banks. Living Calgarians witnessed their first flood. The city's evacuated 1500 residents, and flood-damage costs to the City of Calgary were estimated at \$75 million.

At the time, it seemed like a big number, but the flood in Calgary was actually small, compared to what the rest of Alberta experienced. Although some small streams in the province experienced greater-than- 100-year floods that month, the event in central Calgary was merely a 15-year flood. Yet the total damage across southern Alberta was estimated at nearly half a billion dollars. So much damage was caused by floods (mainly outside of Calgary) that some provincial politicians were getting uncomfortable with the amount of relief being paid out by the province.

After the 2005 flood, the government commissioned a report, led by Highlands Member of the Legislative Assembly George Groeneveld, to recommend ways to better prepare for floods and -own on damage relief. The most progressive recommendation of the report was that the province should stop selling floodplain land for development: "Undeveloped flood plains are the natural and most effective form of flood mitigation, and this recommendation will protect those areas," said Groeneveld. Another recommendation was that a note should be placed on the title of every property in a 100-year flood zone so that new buyers would be aware of the situation.

The ultimate fate of the Groeneveld report was not surprising: a Global News headline after the 2013 flood read "Alberta government failed to act on flood prevention report." Although they had gotten off fairly easily, Calgarians now recognized that their two rivers could, well, maybe, flood. But nothing much changed at City Hall or in the provincial government. The province continued to sell Crown land on floodplains for development, and many floodplain residents who were not affected by the 2005 flood assumed they were safe. Real estate transactions continued without discussion of flood risk.

## The Great Flood

In late June of 2013, bolstered by saturated mountain snow packs, a stalled upslope low-pressure system, and anomalous behavior of the jet stream, the great flood came. It rained heavily for two days, with storm runoff augmented by high-elevation snow melting in the rainy onslaught. The bulk of the precipitation fell west and southwest of Calgary, right over the headwaters of the Bow and Elbow rivers. In Calgary ([Figure 1](#)), each of the two rivers carried the equivalent of three 2005 floods stacked together.

Calgary saw 75,000 people evacuate. The city's downtown core, home of Alberta's oil patch, was evacuated and had its power cut-off, and the 350,000 who work downtown enjoyed a multi-day holiday. Parts of downtown and many residential districts ended-up underwater ([Figure 2](#)). The Saddledome, which is the local professional hockey and entertainment venue, was filled up to the 10th row. The entire Calgary Stampede grounds were also flooded, less than two weeks before the 2013 fair and rodeo were scheduled to open. (The Stampede movers and shakers vowed that the show would go on, in time, and it did. The Saddledome reopened in October with an Eagles concert.)

## **Aftermath**

When all was said and done, the 2013 Calgary flood (more properly, “the southern Alberta flood,” but most of the damage was in Calgary) ranked as the most destructive and costliest natural disaster in Canadian history although it may be outdone by the Fort McMurray fire of early May.

Four people drowned in the flood, one of them in Calgary. Insurable damages are estimated to be close to \$2 billion and total damages should round out at about \$6 billion.

Then-Provincial Environment Minister Diana McQueen was quoted, “I want to stress that what Alberta has experienced in this past week was unprecedented... No report or recommendation looking at the lessons of the past could have prepared us for this event.”

She apparently hadn’t heard about the 1879 and 1897 floods, which were much bigger.

In the aftermath, everybody agreed that the community spirit and mutual support generated by the flood were awesome. But as for the central post-flood question – “What to do about the flood hazard going forward?” – there is no agreement, and the community spirit has, shall we say, thinned.

The province’s immediate response was to try to clear the floodway, but it didn’t feel it could force residents out. Instead, it offered to buy them out. Only half took the money and moved.

So now there is a combination of patchwork neighborhoods and remaining floodway obstruction. Remaining floodway residents theoretically will not be eligible for damage relief after the next flood. The couple thousand flood-fringe households can stay put but are required to flood-proof their homes to some degree, in order to be eligible for future damage relief.

## **Policies and Planning For the Next Big Flood**

The province also attempted to enact one of the Groeneveld recommendations: it indicated it would require inclusion of a “location note” on floodplain land titles for information purposes. That lasted only three weeks: the province caved to pressure from wellheeled and politically connected residents of the Elbow floodplain, who continued to worry about their property values and decided that the location notes would be removed if homeowners followed the province’s flood-proofing suggestions.

Knowledgeable institutions (such as WaterSMART Alberta) and academics (such as Ed Watts at Queens, author of the definitive text on hydrology of floods in Canada) are promoting a stop to floodplain development, or even de-development of floodplains, as the primary need. However, after the flood, a Toronto Metro headline read, “Too soon to restrict building in Calgary flood zones, says province.”

Watershed-scale thinkers like Kevin van Tiegheam, the former superintendent of Banff National Park, call for watershed management, but floodplain residents see big engineering structures as the primary need; such structures have the added benefit of allowing politicians to look like they are doing something bold and positive.

Most engineering attention has been paid to the Elbow River, along which private residents clamor for public protection, claiming the dam(s) are needed to protect downtown, even though the Bow was the source of downtown flooding in 2013.

The provincial government has given the go-ahead to a \$200 million dry dam off the Elbow River a little ways upstream of Calgary, designed to impound floodwaters via a diversion canal. The province initially claimed a positive benefit/cost ratio, but later a Calgary Herald headline noted “Report says reservoir costs higher than future flood damage.”

### **The ‘Floodplain Dance’**

Economic projections related to river flooding rest on so many tenuous assumptions that, in the end, most decisions about dams are made on political grounds, and that is certainly true in this case. The lack of clear long-term economic benefit is perhaps overshadowed by the lack of any overall flood mitigation plan into which the Elbow dam could fit. The Bow River, after all, constitutes a much larger threat to city homes and businesses, according to a government-commissioned report. Meanwhile, the dam is opposed loudly by rural landowners who will be affected by the project, and quietly by citizens not on the floodplain who object to subsidizing the floodplain residents with their taxes and higher insurance premiums.

And so the floodplain dance continues, or as Sonny and Cher used to sing, “The beat goes on.” Scientists cannot predict when and where the likes of Slave Lake fires or Montreal ice storms or Oklahoma tornadoes will happen, but they do know where rivers will flood next, and with what average frequencies. On the surface, it seems simple and rational to give the river room to do its thing – flood. But simplicity and rationality are not big players in considerations of flood hazards. Human beings like living on the floodplain, and governments find it difficult to tell them they can’t. We have the same arguments over and over.

Consider this excerpt from a Calgary Herald editorial:

“Only too frequently people fail to realize that they themselves are largely responsible for the disaster brought upon them... in closely built municipalities, disastrous floods will inevitably follow encroachments on the old floodplain...” This editorial wasn’t written after the 2013 flood, but in 1913.

### **Author**

Jerry Osborn ([Figure 3](#)) is a professor of geology in the Geoscience Department at the University of Calgary. His interests are surficial and Quaternary geology, with forays into geomorphology and engineering geology, and, on the side, interactions between science and society. His main line of research is Holocene climate change using glacial-history and lake-sediment proxies. Consulting activities have included aggregate searches, mass-movement -hazards analysis, flood-hazard analysis, and studies of river migration as applied to boundary-law litigation.

Included in the thousands of students who have passed through his introductory geology courses at the University of Calgary are many petroleum geologists working (or formerly working) in Calgary. When time allows he searches for the perfect pumpkin pie recipe and teaches his kids the value of listening to Bob Dylan.

### **About Historical Highlights**

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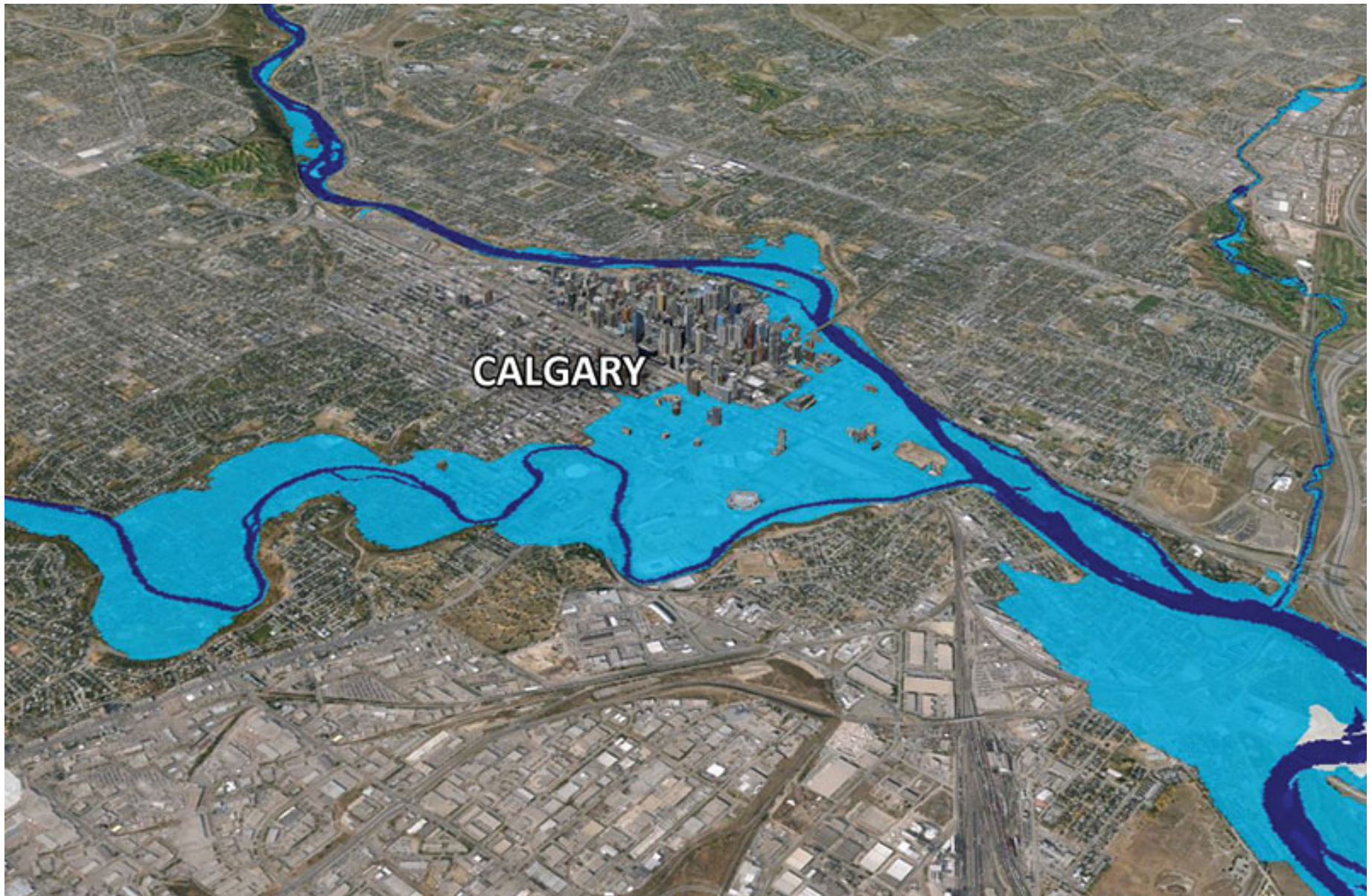


Figure 1. The dark blue represents permanent bodies of water, while the light blue represents overflow during the Alberta floods of 2013. Graphic reproduced by permission from L’Espace au Service de la Terre, using data from the Pléiades satellite .



Figure 2. Looking downtown from Riverfront Avenue in Calgary, during the 2013 Alberta floods. Photo by Ryan L.C. Quan.





Figure 3. Jerry Osborn, author.