GeoConvention 2015
GEOSCIENCE
new horizons
Telus Convention Centre • 4-8 May 2015 • Calgary, AB Canada

High water in June 2013: More flood than meets the eye

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Summary

At $1.7 billion dollars in damages so far, the flood that struck southern Alberta in June 2013 is the most expensive natural disaster recorded in Canadian History. Understanding the mechanisms of flooding which caused the damage will allow for better planning for development on the flood plain. Channels migrate, and with this migration, floodplains are established. In river systems like those seen in Calgary, the floodplains are made of alluvium, transported there by migrating channel systems. This results in a river-connected alluvial aquifer, in which water travels with relatively higher conductivity. Many homes that were affected by the flood were built on the river-connected alluvial aquifers, allowing rapid movement of floodwaters into their homes at times of high flow. While many residents near the river channel reported overland water (or surface water) as the first route of entry to their homes, other residents reported only having sewage back-up in their basements. The latter, however, can be a manifestation of groundwater inundation, as an increase in the water table height often results in the infiltration of sewage systems, subsequently entering homes through toilets, sinks, and shower drains.

Currently, groundwater movement in aquifers related to flooding is not well characterized, and its effect on residential buildings is not understood. However, flooding due to groundwater inundation manifests differently than that due to overland or surface water flooding, and these differences can be exploited to determine the nature of the floodwater origin. This interdisciplinary study used a door-to-door survey, combined with air photo analysis, to understand how each home in the areas along the Calgary rivers was affected. Based on survey questions focusing on route of floodwater entry, floodwater height, and basement depth below grade, patterns emerged which differentiated surface water from groundwater homes. Furthermore, the extent of groundwater and surface water inundation was determined, as well as estimated residential economic damage caused by each of the flooding types.

While flooding is mostly considered as an overland phenomenon, it is important to consider the effects of a rising water table, especially in zones of high hydraulic conductivities such as in a river-connected alluvial aquifer. Knowledge from this project has major implications in city growth and development, as well as in engineering projects aimed at mitigating future flood damages, as some structures and mitigation techniques are agnostic to groundwater inundation.