

How Do Rainstorms Cause Flooding in Alberta?

Overview

A flood is a natural event during which normally dry land is covered by water. It can occur when the amount of runoff from rainfall or snowmelt exceeds the infiltration and drainage capacity of a watershed. As a result, water levels in streams and lakes rise and inundate the surrounding area.

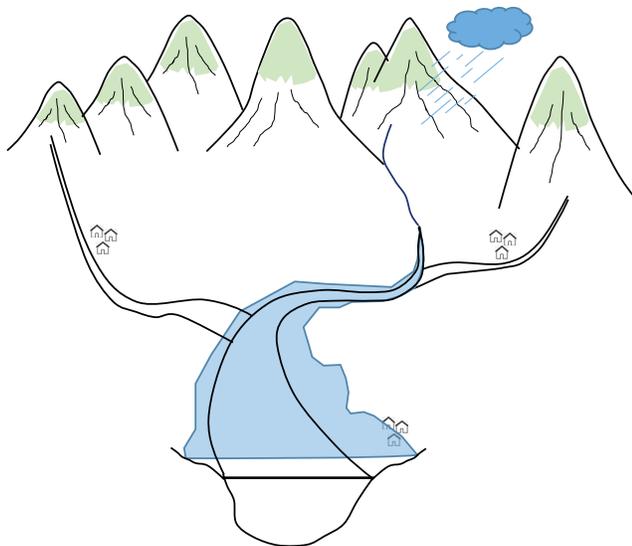


Figure 1: Precipitation can drive flooding downstream

Rainstorm Floods in Alberta

Major river flooding in Alberta is typically due to excess runoff as a result of large rainfall or rain-on-snow events. Potential for such floods exists in the foothill areas from May to September when cold low-pressure weather systems enter the province. This means that the big floods in Alberta are driven by weather conditions, which makes their prediction very difficult.

The amount of rain that runs off depends on the rainfall characteristics, soil condition, and watershed topography.

Rainfall Characteristics

The amount of runoff depends on the amount, duration, and intensity of the rainfall event. Slow rates of rainfall and snowmelt allow the water to enter the soil (called infiltration), meaning little water will run off. On the other hand, high rates of rainfall that far exceed the infiltration capacity of the soil may result in flooding.

Soil Condition

Runoff occurs when the rate of rainfall or snowmelt exceeds the rate at which water enters the soil. The infiltration rate varies depending on the soil type, existing soil moisture, and rain duration. Flooding is more likely if the soil is already saturated from a prior precipitation, or if the ground is frozen.

Watershed Topography

The unique topography of Alberta also has a significant impact on the type and amount of precipitation, and on how fast water flows. Rainfall in the Rocky Mountains and Foothills can be greater than the rain on the Prairies. As well, due to steeper slopes, water moves faster and has less time to infiltrate, which could result in rapid flooding in foothill areas, for example Cougar Creek in the Town of Canmore.

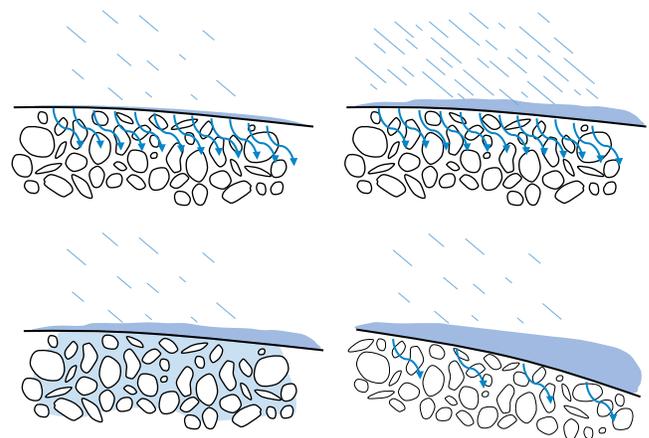


Figure 2: High-intensity rainfall (top right), saturated soil (bottom left), and steep slopes (bottom right), or a combination of these factors result in less infiltration and more runoff, hence increasing the potential of flooding.

Rainstorm Formation

Two flood-producing weather conditions are of particular importance in Alberta:

1. severe rainstorms resulting from large-scale low-pressure weather systems; and
2. summer thunderstorms due to local convective weather systems.

Severe rainstorms over the eastern slopes of the Rocky Mountains can trigger major floods like the flood of June 2013. A low-pressure system originating in the Gulf of Alaska moves eastward across the continent, carrying moisture from the Pacific. In some cases, the system is large enough to bring moisture into Alberta from the Gulf of Mexico. In the case of southern Alberta, these systems can then get pushed up against the eastern slopes of Rocky Mountains where they may stall for a couple of days. This results in heavy rainstorms over a large area along the foothills.

Early and accurate prediction of floods due to this system is very difficult because it takes only a couple of days for this weather system to form in the Gulf of Alaska and then bring rain to Alberta. Also, the exact storm path can change radically, which weather models cannot predict accurately. Moreover, the distance separating Alberta's major basins is relatively small, for example a 100 km shift in the storm's path is the difference between a flood in the City of Calgary and a flood in the City of Red Deer. To overcome these difficulties, the River Forecast Centre continuously monitors weather conditions and updates its forecast as the event progresses and more current information is available.

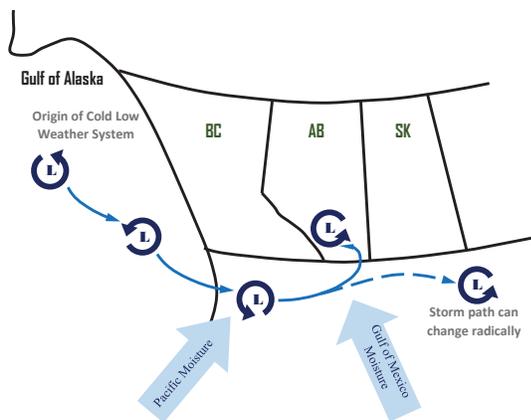


Figure 3: Progression of the “Cold Low” weather system

Summer thunderstorms form when moist warm air masses rapidly rise up through the atmosphere, which typically occurs during warm days. This forces moisture out of the clouds which can result in heavy rainfall.

Summer thunderstorms can form over a very short time span, therefore, the timing and location of these storms cannot be predicted accurately. They typically move eastward across the province, don't last long, and usually dissipate by the end of the day.

Because these systems produce relatively large amounts of rainfall over a concentrated area, they will not typically result in flooding of major rivers, but may cause urban flooding or flooding of low-lying areas as excess runoff tries to make its way to streams and rivers.

Download the Alberta Rivers app for current information about snow, river flows, lake levels, precipitation, and ice conditions across the province, plus important advisories sent straight to your cell phone.