Lesson Slides Middle School Hazard Lesson: Flood





One River, Two Floods: The Big Thompson River Floods



These materials were developed by CIRES Education & Outreach at the University of Colorado Boulder. <u>https://cires.colorado.edu/outreach/projects/HEARTForce</u>



Setting the Stage

In 1976, and again in 2013, the Big Thompson River in Colorado experienced major rain-related flooding events that greatly impacted the people and environment of this Front Range watershed.

The 1976 flood resulted in 144 deaths and \$35 million in damage in the Big Thompson drainage. The 2013 Colorado flood caused nine deaths and \$2 billion in damage in the Front Range overall, including two deaths and \$80 million in damage in the Big Thompson drainage.







Driving Questions:

- What are the main causes and impacts of floods?
- When and where are floods most likely to occur in Colorado?
- What actions should people take before, during, and after a flood?

Materials & Procedures

- Use a computer device and internet connection to complete the lesson activities.
- Record your activity responses in your student handout.





Lesson Overview

- Activity 1 (Engage): An Introduction to Flood Concepts & Case Study
- Activity 2 (Explore): Flood Data Analysis Jigsaw
- Activity 3 (Explain): Community Flood Risk & Response





Activity 1: What are the main causes and impacts of floods?

KWL Chart	
1. What I <mark>K</mark> now	
2. What I Wonder	
What I Learned (Activity 3)	





Activity 1: What are the main causes and impacts of floods?



Watch: <u>1976: Deadly Big Thompson</u> <u>flood devastates Colorado</u>



Watch: Dramatic images show devastating flooding in Colorado



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Activity 1: What are the main causes and impacts of floods?

	KWL Chart
1. What I <mark>K</mark> now	
2. What I Wonder	
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Station 1: Colorado Flood Fast Facts

Description

Flooding is the most frequent and costly natural hazard in the United States—a hazard that causes more fatalities than any other natural hazard and averages nearly \$10 billion in losses per year. Nearly 85 percent of federal disaster declarations result from natural events where flooding was a major factor (*Implementing a Federal*, 2015, p. 2).

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Flooding in Colorado

Colorado communities are impacted by flooding on an annual basis, and nearly every community in the state is subject to special flood hazard areas as mapped by FEMA and as made available through the Colorado Water Conservation Board. In addition, there are approximately 677 state-regulated dams that, in the event of a failure, could cause loss of life and/or significant property damage in communities located within downstream flood hazard areas.



damage to private property and public

The most flash-flood prone regions of Colorado are found along the base of the lower foothills east of the mountains. Several extreme floods such as the infamous Big Thompson Canyon flood of July 31, 1976, have occurred in this vulnerable area. Flash floods occur on the Western Slope as well, but with typically lower frequency and intensity due to a reduced supply of moisture to fuel such storms (*Colorado Climate Center*, 2015).

Infrastructure across the Front Range of Fle Colorado. Source - Federal Emergency nagement Agency. Colorado Town Isolated. May 1, 2014. Photo by Steve Sumwalt.

due to a reduced supply of moisture to fuel such storms (*Colorado Climate Center*, 2015). Flood hazards pose major risks to property and human life and have caused some of the largest disasters in Colorado history in terms of financial costs and casualties. Between 20 to 30 large-

Read: Colorado Planning for Hazards - Flood

- 3. What are the main causes of floods and flash floods?
- 4. What are the greatest risks that floods pose in Colorado?





Station 2: Location and Frequency of Floods and Flash Floods in Colorado



Analyze: <u>Flood</u> maps

- 5. In Colorado, when does *flooding* mainly occur (months/seasons)?
- 6. In Colorado, where does <u>flooding</u> mainly occur (geographic area/counties)?





Station 2: Location and Frequency of Floods and Flash Floods in Colorado, cont.



- 7. In Colorado, when does flash flooding mainly occur (months/seasons)?
- 8. In Colorado, where does <u>flash flooding</u> mainly occur (geographic area/counties)?





Station 3: Visual Comparison of Big Thompson Flood Events





Explore: <u>Big Thompson Watershed</u> Explore: <u>Big Thompson Floods of 1976 and 2013</u>

9. Describe the general topography of the Big Thompson River watershed.

10. Compare and contrast the amounts of precipitation and locations of precipitation for the 1976 and 2013 floods (note: read the descriptions below the images, too).





Station 4: The 2013 Flood Weather Story



Read: <u>Weather Story forecasts</u>

- 11. On what date was the first flash flood warning issued for the Front Range? When was the last flash flood warning for this area?
- 12. On what date(s) and in what general location (in relation to key cities) did severe flooding occur? Why do you think severe flooding occurred in this area?
- 13. Describe the pattern and location of the flooding between September 17 and September 22, 2013, during the Weather Story forecasts.





Station 5: The 2013 Big Thompson Flood Hydrograph



Streamflow	Rate (cfs=cubic feet per second)
Average flow	72.5 cfs
Average peak flow	1700 cfs
Average 100-year flood peak flow	7360 cfs
1976 flood peak flow	8710 cfs
2013 flood peak flow	18,4000 cfs

Analyze: Data Table

- 14. What data is the graph illustrating? What is the *independent variable* and its units? What are the *dependent variables* and their units? Hint: How is time displayed? What does gage height refer to?
- 15. Describe the general pattern of the data shown on the graph.
- 16. Flood level on the Big Thompson River is at a depth of 5 feet of water. Looking at the graph, approximately when did the Big Thompson River exceed its flood level?





Station 5: The 2013 Big Thompson Flood Hydrograph, cont.

- 17. What information is the data table providing? What do "cfs" units measure? Compare and contrast the cfs values for average discharge rate and flood level discharge rates for the Big Thompson River.
- 18. What is the average discharge rate for the Big Thompson River? How do the 1976 and 2013 flood discharge rates compare to the average peak flow rate and 100-year flood peak flow rates?





Station 6: Flood Safety



Read: Floods Ready.gov



Read: Flood Safety

- 19. What does "Turn Around, Don't Drown!" mean? Why is trying to cross or drive through a flooded area a risk?
- 20. If you live in an area at risk of floods, what should you and your family do to prepare? In the event of a flood warning, what should you do to protect yourself and others with you?





Activity 3.1 Flood Expert Interview



Flood Expert Video



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Activity 3.2 Big Thompson Virtual Diary

Next, watch the short video and read one item from the virtual diary on how people and communities prepared for, responded to, and rebounded from the devastating Big Thompson floods.

- Video: Looking Back at the 2013 Floods (2:12)
- Reading (select one):

Big Thompson Canyon struck again by tragic flooding Lesson Learned: better notifications, monitoring article and <u>photos</u> The 2013 Flood: A timeline article and <u>photos</u> A deadly flood that helped improve weather forecasting Recovering after rivers rage





Activity 3.3 Local Flood News Story

Prompt: Create a local news story in a format of your choice (see options below), that summarizes important information about for people in your community to be "flood wise" before, during, and after a flood.

The format choices for the local flood news story include:

- Newspaper article with one picture and one graph or map (one page)
- Radio story (2-3 minutes in length)
- Video newscast (2-3 minutes in length)

Follow the steps in the table below to create your news story. Be creative, but accurate.





Activity 3.3 Local Flood News Story, cont.

Local Flood News Story

1) KWL Chart	As a group, reflect on what was learned in Activities 1, 2, and 3. Then
"What I Learned"	independently complete the "What I Learned" section of your KWL Chart (see
(see page 2)	page 2 of the student handout) to summarize your learning. Use these
	prompts to reflect on what you learned:
Check when completed	 What important things do you now know about floods that you didn't know before?
	• What should people do to be "flood wise" before, during, and after a flood?

	KWL C	Chart	
What I Learned (Activity 3)			





Activity 3.3 Local Flood News Story, cont.

Local Flood News Story		
 2) Choose a Format Check when completed 	 As a team, choose one of the following formats for your group's Local Flood News Story: Newspaper article with one picture and one graph or map (one page) Radio story (2-3 minutes in length) Video newscast (2-3 minutes in length) 	
 3) Create a Draft Check when completed 	 Referring to notes and responses in your student handout, make a quick draft of your group's product ideas. Your team's news story should summarize and share information about: Causes and impacts of floods in Colorado Locations and times of higher flood risk in Colorado How to prepare for a flood How to respond and stay safe during a flood Describe how people and communities rebound from flood 	





Activity 3.3 Local Flood News Story, cont.

Local Flood News Story		
 4) Create the Final Product Check when completed 	 Create your team's Local Flood News Story. Remember to keep your product brief and summarize these key elements for your community audience: What are causes and impacts of floods in Colorado? Which regions and times of the year have higher flood risk in Colorado? How can people prepare before a flood? How should people respond to stay safe during a flood? What are some ways that people and communities have rebounded after a flood? 	
Lesson Rubric	Refer to the rubric to understand expectations for your final product.	



