



Name: **ANSWER KEY**

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Colorado Flood - Student Worksheet

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

- How is flood risk changing in Colorado? Write at least three things in the What I Know section of the KWL Chart below.
- Watch the news stories [1976: Deadly Big Thompson flood devastates Colorado](#) and [Dramatic images show devastating flooding in Colorado](#) to get a feel for the impacts of floods on people and the environment.
- Write down your observations and questions about flooding in the “What I Wonder” section of the KWL Chart.



KWL Chart	
What I Know	Answers will vary.
What I Wonder	Answers will vary.
What I Learned (Activity 3)	Answers will vary.



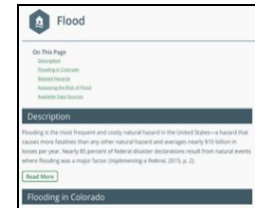
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Part 2: Flood Data Analysis Stations

Jigsaw Station 1: Colorado Flood Fast Facts

Read the [Colorado Planning for Hazards -- Flood](#) webpage.



1. What is the difference between a “general flood” and a “flash flood”?

A general flood is a long-term event that can last for multiple days over widespread areas, whereas a flash flood develops rapidly and occurs in an isolated area.

2. What is a floodplain?

A floodplain is land adjacent to rivers, streams, lakes and other water bodies that gets flooded periodically.

3. Who identifies flood hazard areas (floodplains)?

The Federal Emergency Management Agency (FEMA) identifies flood hazard areas in their Flood Insurance Rate Maps (FIRMs).

4. What are the greatest risks that floods pose in Colorado?

Damage to property and human life

5. What are the main causes of floods and flash floods?

Floods are most frequently caused by heavy precipitation from storms with sustained wet weather and/or severe thunderstorms. Floods and flash floods can also be caused by ice jams, or rapid melting and runoff from winter storms. Overflows or failures of dams and other water systems can cause flooding as well.



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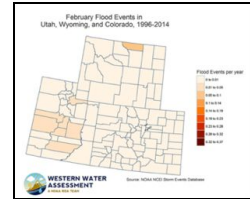
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Jigsaw Station 2: Seasonality and Location of Floods and Flash Floods in Colorado

Select and analyze the Monthly Maps of Significant Weather Events “[Flood](#)” and “[Flash Flood](#)” series to assess the frequency and locations of floods in the state.

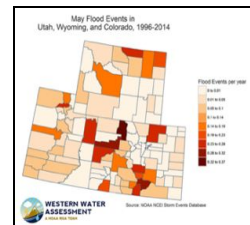
6. In Colorado, when does flooding mainly occur (months/seasons)?

Spring and summer (April-September)



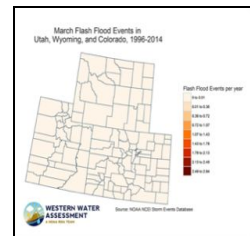
7. In Colorado, where does flooding mainly occur (geographic area/counties)?

South central Colorado, eastern foothills and western slope



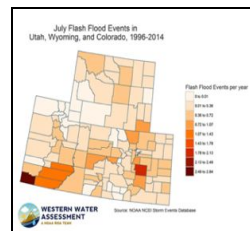
8. In Colorado, when does flash flooding mainly occur (months/seasons)?

Summer (June-September)



9. In Colorado, where does flash flooding mainly occur (geographic area/counties)?

Eastern foothills and plains, western slope



10. Compare and contrast the timing and location of floods and flash floods in Colorado.

Most floods and flash floods occur in the summer (June-September), but floods can occur earlier in the year (April-May). The highest number of floods occurs in May, and the highest number of flash floods occur in July and August. More flash floods occur in Colorado than floods. Both types of flood occur along the Front Range, the Western Slope, and South Central Colorado.



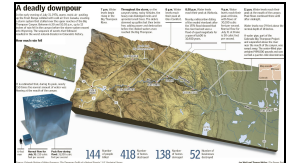
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Jigsaw Station 3: Big Thompson River Topography

Explore the “A Deadly Downpour” infographic (slide 14 and 15 of the [lesson slides](#)) and the [Colorado Floodplain GIS](#).

11. The “A Deadly Downpour” infographic shows a topographic relief map of the Big Thompson watershed. The Big Thompson runs from Estes Park to Loveland on the map. Describe the topography of the Big Thompson watershed.



The Big Thompson watershed is very steep and mountainous on the west end of the watershed from Estes Park to downstream of Cedar Cove , and very flat on the east end of the watershed near Loveland.

12. Explore the Floodplain for the Big Thompson River on the [Colorado Floodplain GIS](#). Type “Loveland, CO” into the Search bar, and zoom out so you can see the stretch of the Big Thompson River that runs between Estes Park and Loveland. What do you observe about the Big Thompson floodplain (purple and blue areas) between Loveland and Estes Park?

In the steep part of the watershed, the floodplain is very skinny and small along the Big Thompson. The floodplain gets much larger as the land flattens out towards Loveland.

13. Why would flat areas have larger floodplains than steep mountainous areas?

Because the water can spread out to a wider area when the land next to the riverbed is not steep. Steep canyon walls constrain floodwater to a smaller area.

14. If you were to build a house close to the Big Thompson River, where would you want it to be located?

If it were in the canyon, I would want the house high up the hillside. If the house were downstream closer to Loveland, I would want it far away from the river.



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Jigsaw Station 4: The 2013 Flood Weather Story

Look over the National Weather Service's Weather Story forecasts ([lesson slides](#) 16-21) from September 10-22 about the 2013 Colorado Front Range Flood, which included the Big Thompson River flood.



9. On what date was the first flash flood watch issued for the Front Range? When was the last flash flood watch for this area?

The first flood watch was issued on September 13, 2013. The last flash flood watch was on September 16, 2013

11. 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?

Severe flooding occurred on September 14 and 15, 2014. The area with severe flooding was from the Boulder area north to just south of Fort Collins (Loveland is included) and east beyond Fort Morgan in the plains. The flood waters flowed down the river canyons in the Front Range to the plains and the amount of water was more than the rivers and streams could hold; the ground was saturated with rainwater so the extra water could not be absorbed (the rockslide and mudslide warnings are due to water-saturated ground).

12. Describe the pattern and location of the flood between September 17 and September 22, 2013, during the Weather Story forecasts.

The flood advisories began in the foothills of the Front Range from September 17 through September 18, and then the flood threat ended in that area. Downstream, the eastern plains and the northeastern corner of the state had flood warnings from September 17 through September 21; there was a flood advisory in the northeastern corner of the state on September 22, 2013. The flood began in the foothills then reached the flatlands of the northeastern part of the state several days later.



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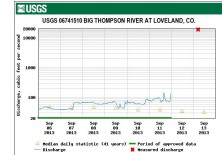
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Station 5: The 2013 Big Thompson Flood Hydrograph

Analyze the hydrograph (slide 23 of the [lesson slides](#)) from the 2013 Big Thompson Flood and watch the first minute of the "[Drew in a Canoe](#)" video, to learn about how river discharge is measured, in cubic feet per second.

13. What does this graph show?

The graph shows the discharge (or amount of water flowing) in the Big Thompson River September 6-13, 2013. The graph also shows the median flow of the Big Thompson River for these days.



14. What is the *independent variable* and its units? What is the *dependent variable* and its units?

The independent variable is time, measured in days. The dependent variable is discharge, measured in cubic feet per second.

15. Watch the first minute of this "[Drew in a Canoe](#)" video, to learn about cubic feet per second. What does Drew use to visualize one cubic foot per second?

Drew uses basketballs floating down the river to represent one cubic foot per second (a basketball is roughly the size of one cubic foot).

16. What does the red point on the graph represent?

The red point represents a discharge measurement on September 13th. "Measured discharge" likely means that someone went to the gauge station rather than a measurement from an automated discharge measuring station.

17. Make an educated guess about why the discharge measurements stopped on September 12th.

Due to high flood waters, the measurements probably stopped because the measurement equipment was damaged and did not produce reliable data.



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Station 6: Flood Safety

Read the National Weather Service [Flood Safety Tips and Resource page](#). Make sure to look through all tabs.

18. Which of these demand immediate action; flash flood warning, flood warning, flood watch, and/or flood advisory?

Both the Flash Flood Warning and Flood Warning demand immediate action, as they are issued when a flood is imminent or already happening.

19. What action should you take if a flash flood or flood warning is issued?

Move to higher ground if you are in a flood prone area.

20. As a kid, what is one thing you can do with your family to prepare for a flood?

Answers will vary.

Examples:

Create a communications plan

Make an emergency kit

Sign up for Notifications

Know your risk (find out if your family lives in a floodplain, know evacuation routes)

21. Is it okay to walk through flood waters? Why or why not?

No. It takes only 6 inches of moving water to knock a person off their feet. Water can be deeper than it appears, and hazardous objects and/or toxic chemicals could be floating in floodwaters.



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Part 3: How can communities know more about and manage their flood risk?

Local Flood News Story

Prompt: Create a local news story in a format of your choice (see options below), that summarizes important information for people in your community to prepare for and understand flood risk.

Choose from the following format choices for the 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)

Use the outline below to collect information from the jigsaw activity to include in your news story.

<p>Station 1: Colorado Flood Fast Facts</p>	<p><u>General Flood vs. Flash Flood</u> Answers the same as above, in jigsaw worksheets.</p> <p><u>Floodplain Information (Definition and Entity in Charge of Floodplain ID)</u></p> <p><u>Flood Risks</u></p> <p><u>Causes of Floods and Flash Floods</u></p>
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<p>Station 2: Seasonality and Location of Floods and Flash Floods in Colorado</p>	<p><u>Time of Year and Location that Floods Usually Occur in Colorado</u></p> <p><u>Time of Year and Location that Flash Floods Usually Occur in Colorado</u></p>
<p>Station 3: Big Thompson River Topography</p>	<p><u>Floodplains in Flat versus Steep Mountainous Areas</u></p> <p><u>How can homeowners know if they are located in a floodplain?</u></p>



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<p>Station 4: The 2013 Flood Weather Story</p>	<p><u>What weather pattern led to the September 2013 flood?</u></p> <p><u>What information can community members learn from National Weather Service Weather Story forecasts?</u></p>
<p>Station 5: The Big Thompson Flood Hydrograph</p>	<p><u>What information do hydrographs show?</u></p> <p><u>Why is it important to measure river discharge (in cubic feet per second)?</u></p>
<p>Station 6: Flood Safety</p>	<p><u>Types of Flood Alerts and What They Mean:</u> <u>Flash Flood Warning:</u></p>



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Flood Warning:

Flood Watch:

Flood Advisory:

How to Prepare for a Flood: