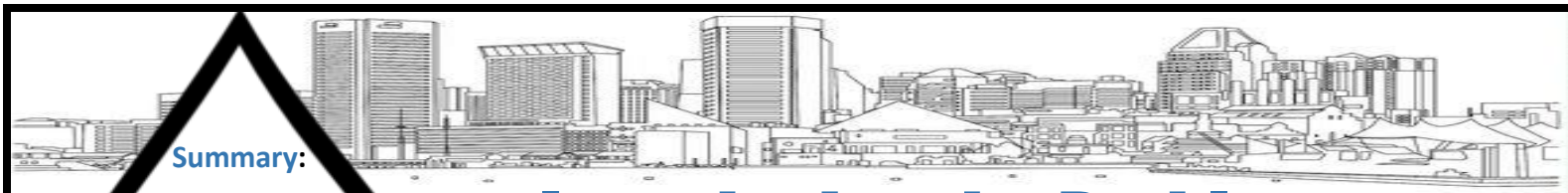


# Introducing the Problem of Flooding in Baltimore

Lesson 1


**Summary:**

This lesson begins with students taking a preassessment then having a class discussion about flooding. The discussion will involve student initial thoughts, students then gather information from stakeholders.
The lesson ends with students diagramming the causes and consequences of flooding.


***Materials Needed:***

- Computer for each student
- Introduction to Flooding Powerpoint
- Stakeholder presentations
  - Blue Water Baltimore
  - Ellicott City July 2016 Flash Flood
- Ingredients of Flooding Diagrams Powerpoint
- Note Catcher
- A large chart or whiteboard ideally that you can keep posted throughout the duration of the Comp Hydro unit.
- Markers
- Optional: History of Flooding in Baltimore Powerpoint; Science Behind Urban Rain Events Powerpoint

**Purpose/Objectives:**

- To understand what constitutes a flood
- To gauge student understanding while also conveying the key concepts to be explored in the unit; precipitation and runoff.
- To identify what students already know to build on and add to/modify
- To pique student interest in the problem from different perspectives

***Comp Hydro Learning Goals Alignment:***

D7 H8

***Next Generation Science Standards Alignment:***

HS-ESS3-6. HS-ESS3-1 HS-LS2-6.

***Agenda:***

| *Activity #* | *Activity Label* | *Timing* | *Activity Description* |
|---|---|---|---|
| | Pre-assessment | 50 min class period | Students complete pre-assessment to establish prior knowledge. |
| 1 | Class Discussion | 25 minutes (10 discussion/ 15 PP) | What is a Flood? – students share initial ideas about flooding and take notes during the introduction to flooding PowerPoint presentation |
| 1a | Stakeholder Presentations | 10 minutes (5 per perspective) | a. In-person or video about flooding in Baltimore from community perspective<br>b. In-person or video about flooding in Baltimore from a scientist's perspective |
| 2 | Brainstorm Flood Ingredients and human impacts | 30 minutes | Students are given a basic conceptual framework for the three key "ingredients" of flooding, then (in pairs) brainstorm causes and consequences for each of these "ingredients" and ways that human activity influence the causes and thereby the frequency and intensity of flooding in Baltimore |

*Safety Concerns:*

- Remind students about proper use of the internet.
- Remind students that disagreements during a class discussion are not personal attacks but should be backed up with evidence and express a point of view.

# Activity One: Class Discussion and Stakeholder Presentations

Lesson 1


***Summary:***

What is a Flood? – students share initial ideas about flooding and take notes during the introduction to flooding PowerPoint presentation


***Materials Needed:***

- Introduction to Flooding Powerpoint
- Stakeholder Powerpoint presentations
  - Blue Water Baltimore
  - Ellicott City July 2016 Flash Flood
- Worksheet: Note Catcher

***Activity Sequence:***

1. Guide students through a discussion of what they think a flood is AND what causes flooding. While the focus of the unit is not on the impacts of flooding, it would be good to solicit these ideas as well as their ideas about what floods are and what causes them. Record their ideas on the board. Make sure students identify *precipitation* and *runoff* as the two major causes of flooding.
2. Show Introduction to Flooding Powerpoint
3. Introduce the overall unit by reviewing some of the focal questions:
   a. Why do watersheds in Baltimore flood so frequently and violently?
   b. Will flooding become more frequent with climate change?
   c. What can we do to predict when and where there will be floods?
   d. What can we do to reduce the frequency and/or severity of floods?
4. Introduce the stakeholder presentations (or the invited stakeholder(s)) to your class and then show the PowerPoint presentations from
   a. Blue Water Baltimore (community stakeholder)
   b. Ellicott City Flood (community stakeholder)
   c. If time permits, review a couple of key flood events from Baltimore's past such as Tropical Storm Isabel and/or Hurricane Agnes.
5. Have a brief discussion of what your students found most interesting and important for the upcoming unit on flooding in Baltimore.

***Key Vocabulary:***

- Flood
- Precipitation
- Runoff
- Watershed

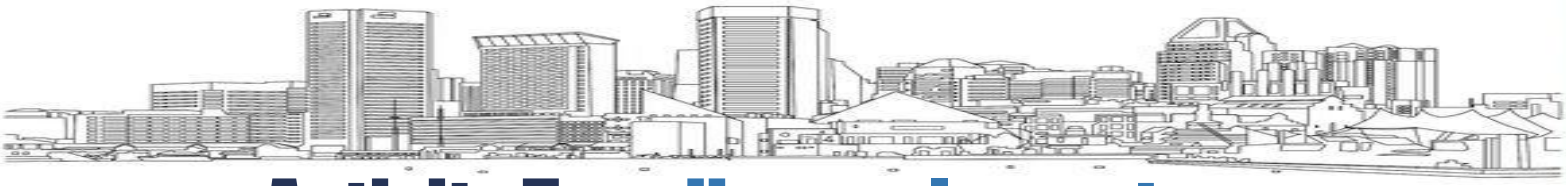
***Tips & Tricks!***

Create local connections by reviewing past flooding events in Baltimore:

- Tropical Storm Isabel
- Hurricane Agnes

*Safety Concerns:*

- Remind students about proper use of the internet.
- Remind students that disagreements during a class discussion are not personal attacks but should be backed up with evidence and express a point of view.



# Activity Two: Human Impacts on Flooding

Lesson 1


***Summary:***

Students are given a basic conceptual framework for the three key "ingredients" of flooding, then (in pairs) brainstorm causes and consequences for each of these "ingredients" and ways that human activity influence the causes and thereby the frequency and intensity of flooding in Baltimore.


***Key Vocabulary:***

- Flooding
- Channel Capacity
- Runoff
- Precipitation
- Watershed

***Tips & Tricks!***

If you have a class set of whiteboards and markers have students build their own "ingredients of flooding" diagram where they can add their ideas throughout the lesson.

***Materials Needed:***

- A large chart or whiteboard ideally that you can keep posted throughout the duration of the Comp Hydro unit.
- Markers
- Ingredients of Flooding Diagrams Powerpoint

***Activity Sequence:***

1. On a whiteboard or large flip chart reproduce the "Ingredients of Flooding" Conceptual Diagram, leaving room above and below the three circles for adding ideas from the students later in the activity. A teacher version of the diagram is available in the Lesson Resources folder for Lesson 1. Follow this sequence:
    a. Put the title on the top of the diagram and explain to the students that you are going to go over the key ingredients or factors involved in flooding. Make it clear that we are considering stream or river flooding, NOT coastal or storm surge-related flooding.
    b. Starting on the right side, write and circle, "Exceeds Channel Capacity". Explain that flooding occurs at any given point along a river or stream (or even a street in their neighborhood) when the amount of water reaching that point exceeds the channel's capacity. This can result in water being too high and/or more powerful than we define as 'acceptable.' You can acknowledge that defining this level is up to us. Flooding is, per se, a relative term.
    c. Then in the middle write and circle "Excessive Runoff" and draw an arrow to the circle on the right. Explain that for a large amount of water to reach the focal point along the river or stream, it must runoff from the land and stream network upstream from that point.
    d. Then on the left, write and circle, "Excessive Precipitation" and draw an arrow to the other circle. Explain that for a large amount of water to runoff, a large amount of water needs to enter the feeding area as precipitation (rain or snow).
2. Have the students brainstorm in pairs to answer the question
   *What factors cause each of the three ingredients of flooding - excessive precipitation, excessive runoff, exceeding channel capacity - and what are some of the other consequences of these processes?*
3. Have students brainstorm in pairs to answer the question
   *How could people and their activities influence the factors affecting each of the three ingredients involved in flooding in Baltimore?*
4. After 5 minutes or so, have students share their ideas and record them on the board or flip chart. Make sure you have some good ideas for each ingredient:
    a. Ways that people might increase the amount and/or intensity of rainfall
    b. Ways that people might increase the amount of runoff in a watershed
    c. Ways that people might increase the impact the capacity of channels to carry water (not the focus of the unit, but important to acknowledge nonetheless)

   A sample of the diagram with the kinds of ideas we are hoping to gather from the students is included in the Lesson Resources folder.

Activity 1: Resources

**Introduction to Flooding Lesson 1 Activity 1- Note Catcher**

Name: _____ Date:_____

| My Initial Thoughts About Flooding: | My Peers' Initial Thoughts About Flooding: |
|---|---|
| | |

| What is a Flood? | Who are the stakeholders and how has flooding impacted their lives? |
|---|---|
| What Causes Flooding? | |

| Notes About Flooding Events: | What questions do I have about specific flood events? |
|---|---|
| _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | Name of Event:<br>Date Of Event:<br>Question:_____<br>_____<br>_____<br>_____?<br><br>Name of Event:<br>Date Of Event:<br>Question:_____<br>_____<br>_____<br>_____? |

| Notes From the PowerPoint: | What Questions do I have about the PowerPoints? |
|---|---|
| _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | Question:_____<br>_____<br>_____<br>_____?<br><br>Question:_____<br>_____<br>_____<br>_____? |

Activity 2:

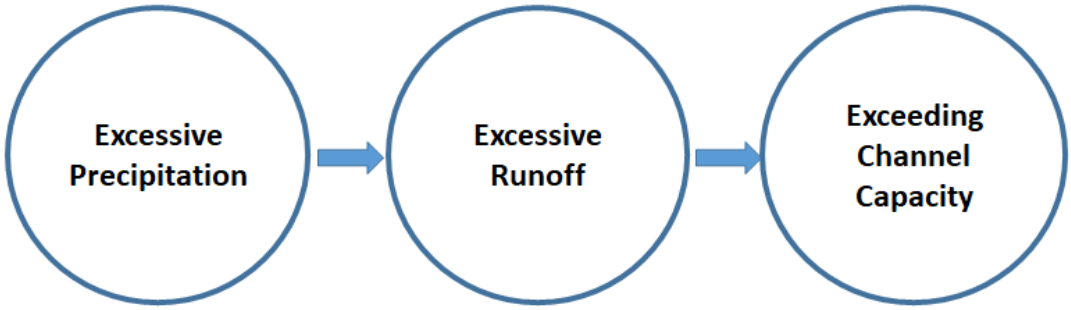
Resources

**Introduction to Flooding Lesson 1 Activity 2- Note Catcher**

Name: _____ Date:_____

# 3 "INGREDIENTS" OF FLOODING

Causes




Consequences

# Teacher Resources

Lesson 1

1. **What is flooding and how is it caused:**
    a. Floods are among Earth's most common and most destructive natural hazards.
        i. https://www.nationalgeographic.com/environment/natural-disasters/floods/
        ii. Video: ..\..\..\..\..\..\Videos\Nat Geo Floods.mp4
2. **Flooding images from the local areas of Baltimore, MD and Ellicott City, MD.**

3. **Key local flood events in Maryland:**
    a. Great Potomac and Susquehanna Flood of 1935.
    b. Hurricane Agnes, 1972.
    c. Twin Floods, 1996.
    d. Hurricane Floyd, 1999.
    e. Hurricane Isabel, 2003.

    Background on these key flood events: https://www.weather.gov/safety/flood-states-md

4. **Background on community stakeholder Blue Water Baltimore**
    a. https://bluewaterbaltimore.org/about/
5. **NOAA Hydrologic Prediction Service**
    a. This model allows for predictions of precipitation/flood of waterways throughout Maryland. Can use resource to discuss local precipitation and flooding predictions.
        i. https://water.weather.gov/ahps2/index.php?wfo=lwx
6. **Runoff background**
    a. Nat Geo- Runoff Video
    b. https://study.com/academy/lesson/what-is-runoff-definition-effects-quiz.html
7. **Human activities influencing flooding**
    a. https://nca2014.globalchange.gov/highlights/report-findings/extreme-weather