Investigating Stream Flow in your Local Watershed.

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Introduction:

A watershed is essentially an area where all the water drains to a common location. In the United States there are over 2,000 watersheds. These watersheds come in all shapes and sizes and greatly impact all living things within its boundaries. Humans have also both relied on watersheds as well as impacted them throughout history. This is true for your local watershed and can be explored in a way that helps students understand their local watershed and what impacts humans have had on it in the past and their responsibilities as responsible citizens in protecting and maintaining their watershed.

Notes for the teacher:
For the elaborate section of this lesson you can research your local watershed. Many of these have websites with an abundant amount of information you can use in place of the information I used for my school's local watershed. Feel free to modify any parts of this lesson to include your school's local watershed. Also, when doing the elaborate activity please make sure to visit your stream/creek ahead of time and make sure it is open to the public or secure the proper permission from the land owner if it is on private property.

Grade Level:

6-8th Grade

Objectives:

1. Students will be able to describe the flow of water through a watershed and how the parts of the watershed are connected.
2. Students will be able to explain how human activities affect the watershed and change the surface of Earth.
3. Students will be able to describe the origins of pollution in a watershed and their impact on the quality of life found in the watershed.

MI Content Benchmarks met or partially met:

- **E.ES.07.82** Analyze the flow of water between the components of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater.
- **E.ES.07.41** Explain how human activities (surface mining, deforestation, overpopulation, construction and urban development, farming, dams, landfills, and restoring natural areas) change the surface of the Earth and affected the survival of organisms.
- **E.ES.07.42** Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere, (car exhaust, industrial emissions, acid rain, and natural sources), and how pollution impacts habitats, climatic change, threatens or endangers species.

Earth Science Literacy Principles met or partially met:

- 5.5 – Earth's water cycles among the reservoirs of the atmosphere, streams, lakes, ocean, glaciers, groundwater, and deep interior of the planet.
- 9.4 – Humans affect the quality, availability, and distribution of Earth's water through modification of streams, lakes, and groundwater.

Engage (~10 mins)
Capture the student's attention, stimulate their thinking and help them access prior knowledge.

Start by showing a short video of the Enbridge oil spill from 2010 that leaked into the Kalamazoo River (http://www.freep.com/article/20100728/NEWS06/7280352/Oil-spill-near-Kalamazoo-River-causes-stench-mess). In the video it discusses the basics of the oil spill and that it actually leaked into a creek that connected to the Kalamazoo River. Then show the students the map of the oil spill (http://www.freep.com/assets/freep/graphic/C416216588.JPG) highlighting where the spill was and that it was far away from us in actuality. Ask the students to reflect on what they remember about the oil spill and why were people in Kalamazoo worried? Using the guiding questions try to get students thinking about run off and how a watershed is composed of a series of waterways that are connected and each feeds into the other.

Guiding Questions

- What do you remember about the oil spill?
- What were some of the concerns involving living things and humans?
- About how many gallons of oil leaked into the Kalamazoo River watershed?
- When looking at the map, where did the leak start? About how far did the oil travel from the original leak?
- How do you think the oil got to Morrow Lake? Explain your thinking.
- If it was not stopped in Morrow Lake where do you think it would have gone? Explain your reasoning.

Explore (~45 mins)
Give students time to think, plan, investigate and organize collected information.

Discuss with students that we will be investigating how water moves through a watershed and brainstorm ways to start collecting data on water movement. Examples would be measuring the speed the water travels, amount moving, looking at the size of the waterways and how smaller dump into larger streams/rivers, the farther you are down a waterway the faster the water moves and usually the larger the stream/river.

Have students investigate water movement using the online virtual river lab website http://www.sciencecourseware.org/VirtualRiver/ and complete the "River Discharge" activity. This will introduce students to the different components of a river and how to measure discharge. Discharge is how much water moves through a waterway in a certain amount of time. This is also important in helping students understand how scientists collect data on watershed movement. They will calculate discharge in the elaborate section of the lesson.

Explain (~45 mins)

Involve students in an analysis of their explorations. Use reflective activities to clarify and modify their understanding.

After students have completed the computer lab have a discussion about what they did.

Guiding Questions

- What are the parts of a river?
- What are some of the tools used to measure discharge? If we don't have these are there other ways we could do the measurements?
- What steps do we follow to measure discharge?

With some research on your own watershed you could now introduce it here as I will with the Davis Creek watershed website. With the students I can tie in the idea of there being all sorts of different watersheds ranging in size and shape. The Davis Creek watershed (http://www.theforum.org/Davis/) is the watershed around our school and is part of the larger Kalamazoo River watershed (http://www.kalamazooriver.net/). This is where we can reflect on the oil spill and discuss the connectivity of all the parts of a watershed and the movement of water. Also, Google Earth is a great tool in helping your students see their local watershed and using the time lapse tool available you can even show how it has changed over time. This is also where I can discuss the history of Davis Creek using the links for the newsletters to discuss how it also was polluted with oil and went through a massive cleanup effort. With some research you can find similar topics of human impact on your watershed to bring into the discussion.

Guiding Questions

- What do you think makes a watershed?
- What role does run off play in a watershed?
- Do urban areas have more or less run off into their waterways? Why?
- What do you notice about the size of the waterways as you move through the watershed? Do they get smaller or bigger? Why?
- So reflecting on what we looked at with the oil spill, why were people worried in Kalamazoo and other places "downstream"?
- How does this idea of discharge relate to the oil spill we looked at?
- How can understanding discharge help study pollution in watersheds?

This is also a good spot to preview the field trip lab for the next day. I use Google Earth to show the students were we will be walking as well as go over expectations and the time table. This is really important in that students will have a short amount of time to collect the data once we are to Davis Creek.

Elaborate (~60 mins)

Give students the opportunity to expand and solidify their understanding of the concept and/or apply it to a real-world situation.

Students will visit the Davis Creek near Milwood Magnet School. Students are asked to make observations about what they see around the creek and take measurements to calculate the creek's discharge by completing the Davis Creek Discharge Worksheet (Appendix A).

This is again where you can tie in your own watershed by looking for a creek/stream by your

school that students could visit. The worksheet could then be modified to have students measure the discharge of your local waterway.
Evaluate (~ 10 mins) Evaluate throughout the lesson. Present students with checklists or data sources at the beginning. Provide ways of documenting observations that they and you can see. Also develop a simple evaluation tool that the teacher can use later to gauge learning.
Using their understanding of watersheds and the movement of water throughout the watershed students will complete the formative assessment on run off and watersheds (Appendix B).

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Appendix A

Davis Creek Discharge Worksheet

Introduction: Today we will be visiting the Davis Creek near our school. Scientists study water movements through watersheds by making observations and measurements of the speed and amount of water that moves through the waterway giving them important information on how the watershed works. Davis Creek is part of the Davis Creek watershed and is part of the Kalamazoo River watershed as it provides water to the Kalamazoo River and eventually to Lake Michigan.

Objective: To calculate the discharge of Davis Creek.

Procedure: Please complete the tasks below in your science journal. Be sure to title your entry and date the page.

Part I – The walk to the creek.

As we walk to the creek make observations about what you see around the Davis Creek? What sort of businesses are near the creek? How could these affect the quality of the creek and watershed as a whole? What pieces of evidence are there relative to wildlife being present near the creek? Do you feel this is a "healthy" ecosystem based on your observations? Before starting your data collection make a guess as to what the discharge would be for Davis Creek in gallons/second?

Part II – Collecting Data at Davis Creek.

In order to make the calculations of discharge for the creek you will need to collect the following pieces of data below. Also, you need to make a cross sectional scaled drawing of the creek.

- Using a measuring tape measure the width (in feet) of the creek.
- Break the creek into 5-10 sections, each around 3 feet wide. This will be used to make a better calculation of the discharge.
- Have a group of students measure the depth of each section (in feet).
- Measure the velocity of the creek. We will use the marshmallow method due to not having the actual instrument. To do this with a partner measure out a known length along the riverbank (example – 20 feet). Then have the person upstream toss a marshmallow into the creek and time how long it takes for the marshmallow to travel that distance. You can then calculate the velocity by dividing the distance by the time it took it to travel there (Example – 20 feet/10 seconds = 2 feet/second). Do this 3 times and average the velocity.

Part III – Calculating Discharge

In your science journal please calculate the discharge of the different sections. The discharge will be in cubic feet /second or cfs. In order to calculate discharge use the formula…

Discharge = width x length x velocity

Note: You will need to do this for each section where the width should be 3 feet and use the depth of that section with the average velocity. Then to find total discharge you will need to ADD all the sections together.

I would also like you to convert the discharge into gallons/second. 1 cfs = 7.48 gallons. This means you need to multiply your answer by 7.48 and this will give you discharge in gallons/second.

Part IV – Discussion Questions

1. What is the discharge of Davis creek in gallons/second? Is this higher or lower than your guess?
2. Did the parts of the creek look more natural or manmade? What evidence do you have to support your claim?
3. We have made the assumption that as you move through a watershed the rivers/streams will become larger in size. For example, the Kalamazoo River is a larger than Davis Creek. Why do you think this is true using what we looked at and discussed today?
4. If one of the surrounding factories had a chemical spill that got into Davis Creek, what do you think would happen and how fast do you think the pollution would move through the watershed? How would it affect the other parts of the watershed? Use what you observed today to support your thinking.

Appendix B

Davis Creek Watershed Formative Assessment

You and some of your friends are watching the news over the summer when there is a report of an oil spill near Davis Creek. The reporter says that nearly 1 million gallons of oil were dumped into the creek. Your friends start to talk about what will happen to the oil. Below are each friend's thoughts to what they think will happen to the oil. Please tell me which friend you agree with the most and explain your reasoning.

Emily – "The oil will evaporate into the air causing acid rain in the watershed."

Jason – "The oil will simply soak into the ground and disappear into the watersheds groundwater."

Jacob – "The oil is going to move through the watershed causing pollution for miles and eventually make its way to a larger body of water."

Alexis – "The animals inside the watershed will be affected and possibly die but nothing else should be harmed."

Who do you agree with the most? _____

Explain your reasoning: _____

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