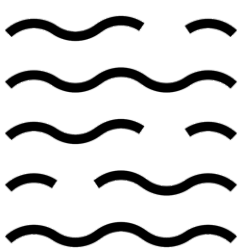

Water: Nature's Bridge

Cedar Creek

When you look around the Zoo, what are some things you see that connect humans and animals?
Water is one thing that provides this connection, as it is the foundation for all living things. Water is also an engineer, shaping and molding the land and its surroundings.

1. Find one of the bridges within the Dallas Zoo that is built over Cedar Creek, a tributary of the Trinity River. The Trinity River stretches a total of 710 miles, reaching from North Dallas and ending at Galveston Bay. Although we may not be sitting at the beach, the water under our feet connects to the ocean at some point. Based on this, where might the things we see floating in the water eventually end up? Why?

Begin by observing Cedar Creek and the water as it flows.

2. What do you notice about the flow of water in different parts of the stream? Does it appear to flow the same way with the same rate of speed? Are there any areas where the flow is slower or faster than others? Why?

3. Are there any patterns created by the water on the land surrounding the creek? Describe or draw the patterns you observe.

4. If you are able to move to another nearby bridge to observe the same creek, how does the creek appear differently from your new location?

5. This is a diagram of different parts of a stream. Study the diagram, then see if you can identify the pool, riffle, and run of the body of water you are observing. Discuss with a partner.

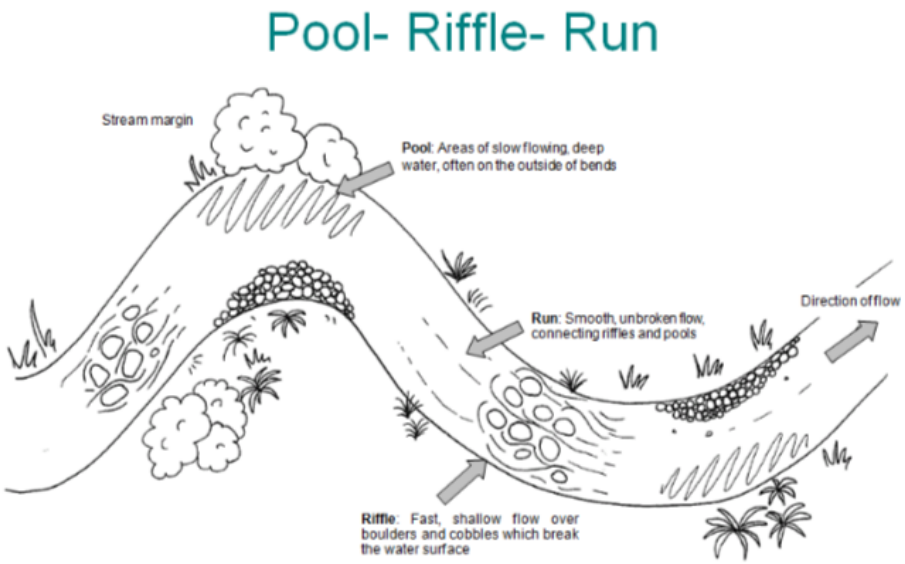

*Figure SEQ Figure * ARABIC 1 From the Cary Institute: https://www.caryinstitute.org/sites/default/files/public/downloads/lesson-plans/water_life_riffle_and_pool_background.pdf*

6. Use this chart to draw/record your observations of Cedar Creek (some cells are filled in as an example):

	Water Speed	Depth	Direction	Turbulence
Pool		*Harder to see the bottom, appears deep*		
Riffle				*Water does not seem to move as smoothly- some bumps*
Run				

7. Based on your observations, predict where you might find the highest concentration of organisms, like vegetation or fish. Also consider what types of organisms may be more comfortable in one part of the creek over another. Why?
   You can read this article to learn more about the different parts of a stream: http://www.lakesuperiorstreams.org/understanding/ riffle_run_pool.htm

As you observe the stream, notice if there's anything that doesn't seem to belong (hint: trash or debris). Trash is one of the largest pollutants of freshwater systems, like Cedar Creek, that end up in our oceans.

While you explore the Dallas Zoo, look for different ways water is used in the animal habitats. Is it used as a pool, stream, drinking source, a physical barrier, or some combination? How are the animals interacting with the water?

Take it Home

Analyze just how quickly a piece of trash in the Trinity River or one of its tributaries, like Cedar Creek, could end up in the ocean.

Explore real-time water data from USGS-TXWSC:
waterdata.usgs.gov/tx/nwis/current?type=flow&group_key=basin_cd&search_site_no_station_nm=Trinity

Real-time Water Data of the Trinity River at Dallas :

https://waterdata.usgs.gov/tx/nwis/uv/?site_no=08057000&PARAmeter_cd=00065,00060

1. Trinity River is 710 miles long. If a piece of trash started at the beginning of the river (known as the headwaters), approximately how long would it take for it to end up in Galveston Bay? We can estimate this knowing the average velocity of the Trinity River: 0.01 miles per hour.
   Hint:
   Velocity= Distance/Time

2. What other factors could influence travel time?

Water: Nature's Bridge

Cedar Creek

When you look around the Zoo, what are some things you see that connect humans and animals?
Water is one thing that provides this connection, as it is the foundation for all living things. Water is also an engineer, shaping and molding the land and its surroundings.

1. Find one of the many bridges within the Dallas Zoo that is built over Cedar Creek, a tributary of the Trinity River. The Trinity River stretches a total of 710 miles, reaching from North Dallas and ending at Galveston Bay. Although we may not be sitting at the beach, the water under our feet connects to the ocean at some point. Based on this, where might the things we see floating in the water eventually end up? Where may it ultimately end up? Why?

You may encourage learners to also think about the length of the Trinity River by converting 710 miles to feet (1 mile=5280 feet, 710 miles=3,748,800 feet). Learners may infer that anything floating in the water could ultimately end up in the ocean in Galveston because the Trinity River flows into Galveston Bay.

Begin by observing Cedar Creek and the water as it flows.

2. What do you notice about the flow of water in different parts of the stream? Does it appear to flow the same way with the same rate of speed? Are there any areas where the flow is slower or faster than others? Why?

Answers will vary but learners may notice that the water moves more slowly and smoothly in some parts and faster and and with greater turbulence in others.

3. Are there any patterns created by the water on the land surrounding the creek? Describe or draw the patterns you observe.

Answers will vary. Learners may describe or draw ripple patterns on sand, for example.

4. If you are able to move to another nearby bridge to observe the same creek, how does the creek appear differently from your new location?

Answers will vary. Learners may describe the creek surroundings, the wildlife they notice (fish, turtles), or how the shade/sun is different with varying tree cover.

5. This is a diagram of different parts of a stream. Study the diagram, then see if you can identify the pool, riffle, and run of the body of water you are observing. Discuss with a partner.

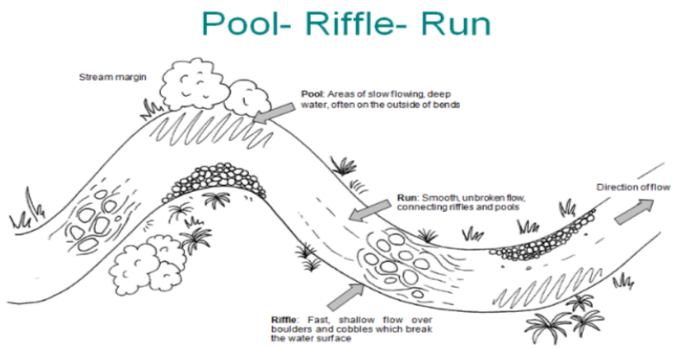

*Figure SEQ Figure * ARABIC \r 1 1- From the Cary Institute: https://www.caryinstitute.org/sites/default/files/public/downloads/lesson-*

As partners discuss, teacher should circulate and ask guiding questions such as, "You've identified that part of the stream as pool. Can you explain your thinking?" or "What do you notice about how quickly the water is moving at the point you are observing?"

6. Use this chart to draw/record your observations of Cedar Creek (some cells are filled in as an example):

Answers will vary.

	Water Speed	Depth	Direction	Turbulence
Pool	*Seems to be moving slowly*	*Harder to see the bottom, appears deep*	*Moving in one direction*	*Little to no turbulence*
Riffle	*Seems to be moving rapidly*	*Shallow, maybe a few inches deep*	*Appears to be moving in multiple directions*	*Water does not seem to move as smoothly- some bumps*
Run	*Seems to be moving at a moderate pace*	*Answers will vary, could be a few inches to a foot or so*	*Moving in one direction*	*Smooth*

7. Based on your observations, predict where you might find the highest concentration of organisms, like vegetation or fish. Also consider what types of organisms may be more comfortable in one part of the creek over another. Why? You can read this article to learn more about the different parts of a stream: http://www.lakesuperiorstreams.org/understanding/ riffle_run_pool.htm

Answers will vary. Fish and other animals tend to prefer pools where water moves more slowly and smoothly. Organisms that cling well, like algae, are able to survive in riffles.

As you observe the stream, notice if there's anything that doesn't seem to belong (hint: trash or debris). Trash is one of the largest pollutants of freshwater systems, like Cedar Creek, that end up in our oceans.

Ask learners to identify different types of debris or trash they notice

Take it Home

Analyze just how quickly a piece of trash in the Trinity River or one of its tributaries, like Cedar Creek, could end up in the ocean:

Explore real-time water data from USGS-TXWSC:
waterdata.usgs.gov/tx/nwis/current?type=flow&group_key=basin_cd&search_site_no_station_nm=Trinity

Real-time Water Data of the Trinity River at Dallas :
https://waterdata.usgs.gov/tx/nwis/uv/?site_no=08057000&PARAmeter_cd=00065,00060

1. Trinity River is 710 miles long. If a piece of trash started at the beginning of the river (known as the headwaters), approximately how long would it take for it to end up in Galveston Bay? We can estimate this knowing the average velocity of the Trinity River: 0.01 miles per hour.
   Hint:
   Velocity= Distance/Time
   Answer: approx. 71,000 hours or 8.1 years

2. What other factors could influence travel time?

Answers may include: size of trash, density (things like empty plastic bottles have low density and are able to travel farther more quickly versus something that has greater density that could sink), whether or not debris is trapped on a rock or tree branch preventing it from traveling farther.

Going Further

Brainstorm: What kinds of trash are most commonly found in oceans?
Why do you think items like cigarettes and plastic bottles are found more frequently than other types of debris?
Show learners a collection of examples of trash that people tend to discard that ends up in the river such as soda bottles, cans, plastic bags. Which ones tend to travel the farthest in the river system and are major problems? Why?
What can you do to prevent trash ending up in waterways?