ACTIVITY 1

Skipton's Water

CARD-BASED INVESTIGATION

1 : SKIPTON'S WATER

GUIDING QUESTION

What role can evidence play in decision-making?

INTRODUCTION

Some 1.1 billion people worldwide lack reliable access to freshwater, while a total of 2.7 billion people have very limited access to freshwater for at least 1 month of the year. Some areas of the world have large reservoirs of freshwater, such as Lake Kariba in Zambia and Zimbabwe, the Bratsk Reservoir in Russia, and the Great Lakes in the United States and Canada. Other areas, such as Brazil, receive high levels of freshwater in the form of rain or snow. Parts of the world that have large populations but limited freshwater resources often face severe water shortages. Even within countries with lots of freshwater resources, safe drinking water may not be readily available to all residents. In this activity, you will make a decision about drinking water.

Lake Michigan, one of the Great Lakes, is a source of drinking water for more than 40 million people in the United States and Canada.

CONCEPTUAL TOOLS

MULTIPLE LINES OF EVIDENCE

SHARED REALITY

PROCEDURE

PART A: EVALUATING EVIDENCE

MATERIALS LIST

FOR EACH GROUP OF FOUR STUDENTS

- SET OF 16 DATA CARDS

FOR EACH STUDENT

- STUDENT SHEET 1.1 "Plan for Skipton's Water"
- STUDENT SHEET 1.2 "Evaluating Data"

1 Read the following scenario. See Figure 1.1 for a map of the Skipton area.

Skipton is a medium-sized town near the Mizu River. For many years, Skipton has piped in freshwater for residential use from the larger city of Aquaville. Aquaville is near Lake Timtim, a huge freshwater lake from which Aquaville sources its water. Piping water from Aquaville to Skipton costs the town of Skipton money, and it is money that the town no longer has. Skipton is in debt and working on developing its own water supply directly from Lake Timtim to save money. This process will take a couple of years.

In the meantime, some members of the town have proposed a short-term solution: using water from the Mizu River. Although this will save the town $3 million over 2 years, the river's flow is not large enough to provide a reliable long-term solution. The main source of the river is snow melt from the Clarity Mountains about 100 miles upstream. The water is clear and has no odor. The results of pH tests—which determine if the water is too acidic or basic for residential use—show that the water falls within the recommended range of 6.5–9. It has been routinely tested for microbial contaminants, and bacteria levels are low (within a normal range). The plan is to treat the water with chlorine, which kills most bacteria and viruses, before piping it into homes.

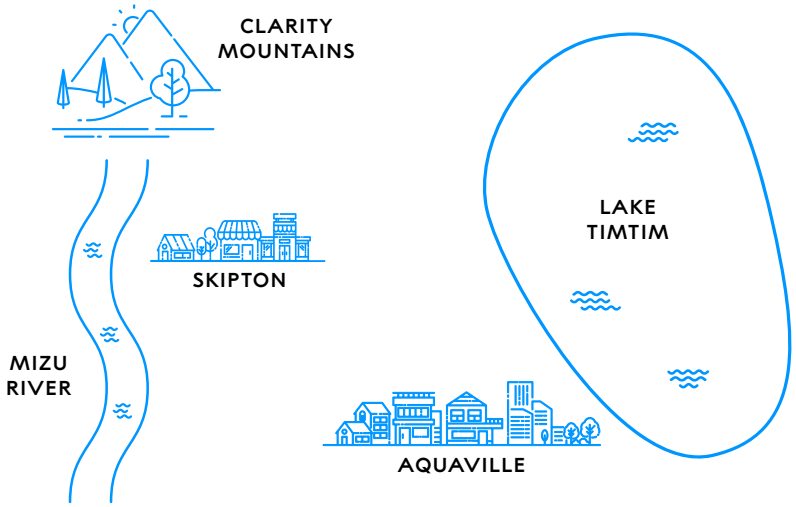

FIGURE 1.1
Map of Skipton Area

PART A: EVALUATING EVIDENCE (CONTINUED)

2 With your group, discuss whether Skipton should use water from the Mizu River for residential use for a period of 2 years.

3 On Student Sheet 1.1, "Plan for Skipton's Water," record:
- your initial decision about the proposal.
- evidence that supports your decision.
- any questions you have.

4 Your group will receive a set of Data cards 1–8. Work together to read aloud the information on each card.

5 As a group, discuss and sort each of the cards based on whether or not it is relevant to using water from the Mizu River.

Remember to listen to and consider the ideas of other members of your group. If you disagree with others in your group, explain why you disagree.

6 On Student Sheet 1.2, "Evaluating Data," record:
- whether the data is relevant to the decision.
- whether it provides evidence that supports or refutes the use of the Mizu River.

7 Based on this new data, record on Student Sheet 1.1 your updated recommendation (even if it remains the same), additional evidence that supports your decision, and any new questions you have.

8 Your group will receive a second set of Data cards 9–16. Work together to:
- read aloud the information on each card.
- discuss and sort each of the cards based on whether or not it is relevant to using water from the Mizu River.

9 Complete Student Sheet 1.2 by recording whether the data is relevant to the decision, and whether it supports or refutes the use of the Mizu River.

10 Based on this new data, record on Student Sheet 1.1 your updated recommendation (even if it remains the same), additional evidence that supports your decision, and any new questions you have.

11 Work with your group to:
- describe other future events that might cause you to change your decision about Skipton's drinking water supply.
- brainstorm additional information you would like to have to help you in your decision-making.

Record your ideas in your science notebook.

12 Share your decision(s) about Skipton's water supply and the evidence supporting your decision(s) with your class.

BUILD UNDERSTANDING

1. How did Skipton's residents' observations of the water compare with the results of water quality tests?

2. In Skipton, many of the water quality tests, such as pH, did not indicate any change in water quality over time. Scientific explanations depend on relevant, accurate, and reliable data.

   - Data is relevant if it is closely connected to or related to the idea or question being considered. For example, your body temperature and how you feel are both relevant to whether you are well. The price of a thermometer is not relevant to your health.

   - Data is considered reliable if it can be reproduced consistently. For example, if you take your temperature at three different times and each time it is 100°F, your temperature data is reliable.

   - Accuracy is the closeness of a measured value to a standard or true value. For example, your parent feels your forehead and says you have a fever. When you take your temperature with a thermometer, it shows a reading of 101°F. Based on data from both human senses and a scientific tool, your temperature data is accurate.

   Were the Skipton water quality test results reliable, accurate, both, or neither? Explain your reasoning.

3. You found out more about the town of Skipton's decision from the Data cards. Did you agree with the town's decision about water from the Mizu River? Support your answer with at least three pieces of evidence from this activity and identify the trade-offs of your decision.

   Evidence is information that helps support or refute a claim or leads to the development of a new claim. A trade-off is an exchange of one valued outcome for another by giving up something that is a benefit or advantage in exchange for another benefit that may be more desirable.

The Build Understanding and Connections to Everyday Life questions are intended to guide your understanding. Some of these questions may be discussed with a partner, be part of a class discussion, or require an individual written response. Your teacher will guide you as to how these questions will be used in your class.

CONNECTIONS TO EVERYDAY LIFE

4. In this activity, the Skipton scenario provided an opportunity to conduct a thought experiment by testing ideas about drinking water without doing additional experiments or your own research. This is a common approach used in many fields of study prior to doing real-world work. What are some situations in your daily life where it might be useful for you to conduct thought experiments?

5. In this activity, you began to investigate the role of multiple lines of evidence in supporting or refuting an idea. Consider what role evidence plays in your own decision-making. Imagine that your friend just told you that caffeinated energy drinks are great for breakfast because they help kids focus. On days when she stays up late and doesn't have an energy drink for breakfast, she sometimes falls asleep in class. Did she provide enough evidence for you to choose having an energy drink for breakfast? Explain why or why not.

EXTENSION

In what ways is the scenario of Skipton similar to or different from your community? In the United States, surface water supplies over 60% of public water systems. Surface water is the water from rain and snow that sometimes accumulates in rivers, lakes, and snow-pack (see Figure 1.2). Groundwater, which also comes from rain and snow, accumulates underground and supplies over 30% of public water. Consider the most common source of water in your area and what, if any, are the issues related to water in your community.

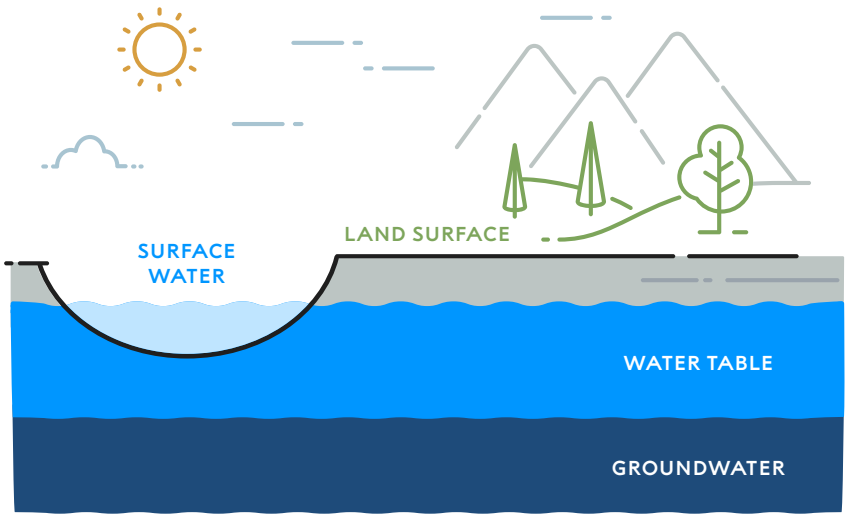

FIGURE 1.2
Water Sources

KEY SCIENTIFIC TERMS

- **accuracy**
- **evidence**
- **multiple lines of evidence**
- **relevant**
- **reliable**
- **trade-off**