

**SECTION 1.5 INTRODUCTION**

**1.5 Read**

1 class period\* U

**Introducing the Rouge River Watershed**

**Overview**

Students have learned about watersheds and studied specific watersheds in Michigan. In this section, students read about the Rouge River watershed. The Rouge River watershed is used as an example of one watershed that has changed over time due to the way people have used the river and the adjoining land. In this section, students will see the Rouge River as a part of a bigger system and will read about some of the history of the watershed. They also learn that watersheds throughout Michigan eventually drain into one of the Great Lakes. Students begin to understand that changes in the quality of the river water brought about by human activity affect people living in the watershed. Students begin to apply this information to the possible changes in the town of Wamego and the Crystal River there. They will use this information in subsequent lessons when they discuss changes in water quality brought about by four different land uses.

| Targeted Concepts, Skills, and Nature of Science   | Performance Expectations  |
|--|---|
| Humans use rivers for residential, commercial, industrial, and agricultural purposes. Their activities affect water quality along a river.   | Students should be able to recognize how land along a river is used and that these uses can have multiple affects on the quality of a watershed.  |
| Watersheds define the flow of water from an area into a river system and the flow of river systems into lakes and oceans. Nested watersheds are smaller watersheds that are a part of larger watersheds. | Students should be able to say that a large watershed is made up of and fed by many smaller watersheds or sub-watersheds. Water from watersheds flows into larger bodies of water such as rivers and lakes, which eventually flow to the ocean. |

**Materials**

- 1 per class** an overhead projection of Michigan watersheds
- 1 per student** laminated maps of Rouge River area
- 1 per group** blue and red washable markers or crayons

\*A class period is considered to be one 40 to 50 minute class.

## Activity Setup and Preparation

Make an overhead projection of the map of Michigan watersheds shown on page 29.

Make sure you have sufficient maps of the Rouge River area that students can mark as they answer question 2 under *Reflect* on page 31.

## Homework Options

### Reflection

- **Science Content:** Research and describe ways in which people have impacted a watershed where you live. *(Answers will vary but should include the following common uses: residential, recreational, commercial, industrial, and agricultural. Some activities may have benefited a watershed, such as cleaning up one that has been damaged or neglected.)*
- **Science Process:** Make a flow chart that demonstrates the main parts of the watershed in which you live or a process, such as getting ready for school. *(Answers will vary. Flow charts should include arrows, indicating that this is an ongoing process and indicating the direction in which the process or sequence is moving.)*
- **Science Process:** Identify local organizations involved with water quality improvement where you live. Briefly describe the kinds of work they do that benefits the watershed. *(Many watersheds have groups who monitor water quality and periodically meet to collect trash that has accumulated within the streams of the watershed.)*

### Preparation for 1.6

- **Science Process:** How can a model help you understand something that is very complex? *(In Section 1.6, students will view a teacher-run model of a stream table to prepare them to build their own.)*
- **Nature of Science:** How does collaborating on a design and building a model with others reflect the way scientists work on a problem? *(Answers will vary but should include that working together to design and run a model reflects the way scientists work because scientists often have to work with others who bring different ideas to help solve a problem. The final outcome will be the result of many different people's thoughts.)*



**SECTION 1.5 IMPLEMENTATION**

† 1 class period\*

**1.5 Read**

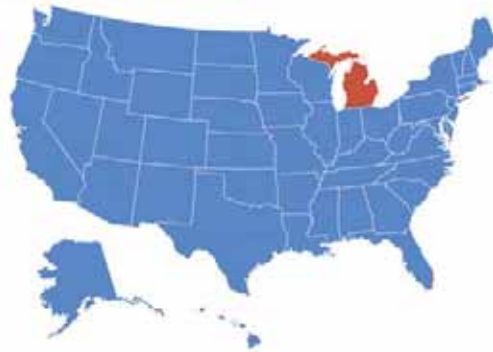
**Introducing the Rouge River Watershed**



The Rouge River running through a city.

You used a relief map of the state of Michigan to see how different watersheds nested within one another. You applied what you learned about how water flows from higher to lower elevations to identify the different watersheds in the area. Throughout the rest of this Unit, you will be looking at one specific watershed in Michigan. You will examine the Rouge River watershed. (Rouge is the French word for red.) You can apply what you discover about the Rouge River to investigate other watersheds, including your own.

**Where is the Rouge River Watershed Located?**



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**1.5 Read**

**Introducing the Rouge River Watershed**

*Students are introduced to the Rouge River and its watershed in Michigan, which will be the focus of the remainder of this Unit.*

**Engage**

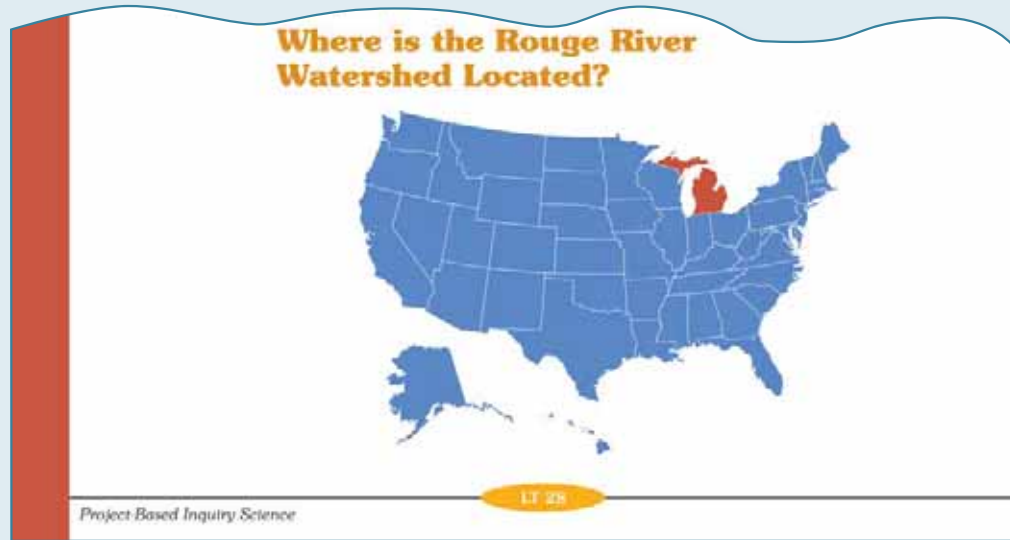
Photographs can be useful tools for making observations and drawing tentative conclusions about changes in the Rouge River watershed. Ask students to use the photograph to describe how they think some of the land is being used in this watershed. List students' ideas.

\*A class period is considered to be one 40 to 50 minute class.

## Where is the Rouge River Watershed Located?

10 min.

*Based upon the photographs, hold a class discussion about what students perceive about how the Rouge River watershed is being used.*



### Engage

Show a projection of the map on page 29 to illustrate the watersheds throughout Michigan. Ask students to identify the markings on the map. *(They are nested watersheds and watershed boundaries. Certain cities are identified: Detroit, Lansing, and so on.)* Ask students to review what they already know about watersheds and, looking at the diagram, determine what Michigan’s watersheds flow into. *(All Michigan watersheds flow into one of Lakes Superior, Michigan, Huron, or Erie. Some of this water eventually flows into Lake Ontario, but not directly from Michigan watersheds.)*

#### NOTES

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## 1.5 Read



When you are thinking about the Rouge River, begin by thinking where it is located in the U.S.A. Michigan.

Next, look at the map of Michigan. The Rouge River watershed is near Detroit. This is an area where many people live.

When you look in the southeast corner of Michigan, you will see that the Rouge River watershed has been highlighted on the map. The Rouge River watershed is nested in many watersheds in Michigan. It is part of the larger watershed of the Detroit River.

The Detroit River flows into Lake Erie and is part of the Lake Erie watershed. The Lake Erie watershed is a smaller part of the St. Lawrence/ Great Lakes watershed. The St. Lawrence/ Great Lakes watershed is part of the huge watershed that covers the entire eastern half of the United States and some of Canada. All these watersheds are nested, one within the other. When water is added to a bigger one, it moves to the smaller ones. Eventually, all the watersheds in Michigan drain into one of the Great Lakes.

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LIVING TOGETHER

### △ Guide

Ask students to summarize the main idea in the last paragraph on page 29 to reiterate that watersheds flow into larger bodies of water such as the Great Lakes. Then, explain that a tool called a flow chart could be used to graphically depict that concept. Explain that a *flow chart* is a tool that can help a person to remember a sequence.

#### TEACHER TALK

“A flow chart is a simple way to connect things—to show the order in which a number of things, processes, or events occur. Let’s make a flow chart using the last paragraph on page 29 starting with Rouge River watershed to show how watersheds feed into larger bodies of water.”

**META NOTES**

A sequence or flow chart can help students keep track of the order in which events or a process occurs. A flow chart can be used to describe any watershed simply with each step being a larger body of water or leading to a larger body of water.

**△ Guide**

With the help of a map showing the United States and Canada, have students identify major parts of the path that water travels from the Rouge River watershed to the Atlantic Ocean. With their input, create a flow chart that depicts this sequence (Rouge River watershed→The Detroit River→Lake Erie→the Saint Lawrence River→the Atlantic Ocean). Students should be able to say that water moves from watersheds into progressively larger bodies of water.

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Learning Set 1 • How Do Flowing Water and Land Interact in a Community?

## How Have People Used the Rouge River?

About 1.3 million people live, work, and play in the Rouge River watershed. Although the river with all its branches is 203 km (126 miles) long, that is still a lot of people. Throughout time, people have used the river for many different purposes. It has supplied drinking water and fish. It has been used for generating electricity. And it has been used as a dumping ground for waste.



Over 150 years ago, there were very few people living in the Rouge River watershed. Most of them lived in Detroit. The Rouge River was clean and had lots of fish in it, even though waste was dumped into it.

Then, about 100 years ago, the population in the watershed started to grow. Many factories for building cars, trucks, and airplanes moved into the area. With the factories came the people who worked in them.

With the increase in population, the demand to use the river water also increased. More cities and towns began to dump sewage into the river. More river water was needed to generate electricity. Some of the industrial waste was dumped into the river or buried in nearby areas.

Over time, the amount of sewage in the river made recreational activities impossible. Starting around 1950, people began to recognize that the quality of the river was very poor, and something had to be done. In the following years, sewage treatment plants were built. Cities were told they could no longer dump their waste into the river. Areas close to the river were set aside and protected as public parks. Although these measures helped to improve the river environment, illegal dumping of garbage and

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## How Have People Used the Rouge River?

10 min.

*Students learn that humans use the Rouge River watershed for a variety of purposes and that these uses impact the watershed in a variety of ways.*

### Engage

Help students build a picture of the history the Rouge River watershed and as it is today by having them read page 30. First, have students gather in their groups or teams. While students are gathering into their groups, write a list of categories on the board for students to use in a discussion after they read information about the watershed:

- Changes in population: (increased over 150 years from few to more than 1 million people)
- Effects of increased population: (more people usually means more waste, more industry, greater demand for water)

- Uses of the river over time: (drinking water, factories for cars, truck, airplanes; waste dumping)
- Ways to help a watershed: (sewage-treatment plants instead of dumping; clean-up by citizen/environmental groups; laws to prevent illegal dumping)

**△ Guide**

Have one member of each group read aloud a portion of page 30 to emphasize how the Rouge River watershed has been used and has changed over time. At the end of the reading, ask volunteers to describe one thing they heard in the reading about how the Rouge River watershed has changed. Record their suggestions under one of the categories you have listed.

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## 1.5 Read

waste continued. In the 1980s, groups of citizen volunteers decided to remove all the garbage still found along the river banks. These groups have been working on this cleanup ever since. Every year they meet for at least one day to clean up the areas along the river.

### Stop and Think

Look back at the pictures you saw at the beginning of this Unit. These pictures showed many different ways people use a river. All these pictures were taken along the Rouge River, in Michigan. Look at each picture and answer the following questions. Be prepared to share your answers with your group and the class.

1. Does the river flow through a city or town, or through a farm? Can you tell by looking at the pictures?
2. Where do you think the different pictures you saw were taken? Where do you think the industrial parts of the river might be? On a map of the watershed, color that area blue. Where do you think the river is used for recreation? Color that area red.
3. Compare your answers to the answers of other members of your group. Did you all pick the same areas? What else do you need to know to decide if the areas of the map are correctly identified?
4. How do you think the changes in the quality of the river water affect the lives of people living in the watershed?
5. List three examples of human activities that affect the quality of a river. Use what you learned about the Rouge River to explain what might happen to the river, and how the people in the watershed are affected by the changes in water quality.
6. Do you know of groups that are involved in cleaning up the river nearest your home? Do a little research to see if there is a group near you.



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LIVING TOGETHER

## Reflect

15 to 30 min.

*Students will think about the types of places the Rouge River flows through, how people have used the river, and discuss whether the quality of the river reflects the way the river has been used.*

### Engage

To get students thinking about the effect of the uses of the river on the quality of the watershed overall, have them turn back to pages 6 and 7 to determine these possible uses from the photographs on those pages. List each photograph with a brief description (boating, storm drain, farming, houses, and so on).

### Guide

Have students focus on what is going on in each picture and volunteer a use or description. Encourage students to envision themselves in the scene and describe how the river is being used at that point (recreation, industry, agricultural, and commercial). Record students' descriptions next to the appropriate word in the list. It is all right if students suggest interpretations different from those of other students.

### △ Guide and Assess

Prepare students to answer the six *Reflect* questions individually. Caution them that they will next discuss the answers in their groups, then as a class.

Lay out laminated maps and markers for each group to use in completing *Reflect* questions 2 and 3.

#### TEACHER TALK

“Now that we have listed some of the uses and changes that have happened along the Rouge River, let’s think a little more about what this means for the watershed. At first, you will need to turn back to pages 6 and 7 to answer the first two *Reflect* questions. Look at each photograph again. Think about what each scene might be telling you about how a watershed is used every day. Then ask yourself two questions: *What in the photograph tells me how the river is being used?* and *How does this use affect the quality of the river?* Then, answer the remaining *Reflect* questions.

You will then discuss your observations within your group. Finally, be prepared to discuss your answers with the class. Be ready to provide evidence (from the photographs) to support your description of how the river has been used and how these uses have affected the river.”

Provide students with about five minutes to answer questions individually, then, ask them to gather into their groups. Finally, have students discuss their answers to each question as a class. Listen for the following responses or guide students toward these responses.

1. Most students will say that, based on the variety of pictures, the river flows through many different areas—used for industrial, recreational, residential, agricultural, and other purposes.
2. Answers will vary. Many students may say that industrial areas are at the end of the watershed where it flows into a river. Many may suggest that recreational areas are further back up in the watershed where there are fewer people.
3. Answers may vary. Students may say that they need to know more information about the area before they can decide where certain uses would be likely to occur. Ask where they might perform research to obtain this information.
4. Answers will vary about how changes in the quality of the water affect people’s lives. Many will say that industrial areas make the quality less than what it should be.

- 5. Choices of human activities that affect watershed quality will vary. Some will say water consumption by local human population, dumping wastes, industrial uses, and agriculture. **NOTE:** This question is important as it sets students up for *Section 1.6*.
- 6. Answers will vary. Most states have Web sites concerning their watersheds. Information is provided about who to contact for each watershed and what volunteers are doing or can do to clean up a watershed.

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## Apply

10 min.

*The Rouge River is used throughout the Unit as an example of issues about water quality and its effects on humans and other animals living near and in water.*

### META NOTES

Making connections to or being familiar with a local watershed can reinforce the content of this Unit. Throughout this Unit, focus students' attention on making connections between the watershed they are studying (Rouge River) and the status of a watershed in their local community.

## Reflect

Think about the land around Crystal River. How will it be different with buildings on it? When people build buildings, they cover the land and change the types of land cover that originally existed there. Buildings, houses, and roads all cover the ground. Trees, grass, and soil are moved and may or may not cover the ground the same way they did before. Water can soak into soil, but it flows as runoff when it lands on buildings and roads.

Think back to when you have been outside when it was raining. What happened to the rain when it hit the ground? How did the type of land cover affect what happened to the rain? What kinds of land cover are there in your community?

Think about the watershed you built. You decided that as long as you didn't change the structures in the watershed, the water would continue to run off in the same pattern. The direction of the water flow and the places where the water pooled would not change as long as you did not change the objects or the paper. If you had used soil instead of paper, you would have noticed that some water soaked into the ground.

Now you are going to consider the differences among four different land uses. Your teacher will help you understand the characteristics through a class discussion. Use a table like the one below to organize what you learn during the discussion.

| Residential | Commercial | Industrial | Agricultural |
|-------------|------------|------------|--------------|
|             |            |            |              |
|             |            |            |              |
|             |            |            |              |



## What's the Point?

In the United States, many rivers have been used by people for dumping waste, draining storm water, recreation, and industry. The Rouge River is one example of such a river. There are many other rivers across the United States that have been used in the same way. When people use a natural resource like a river, they modify the environment around it. Human activities in any part of the watershed impact the quality of the river because all the water in the watershed sooner or later ends up in a river. Sometimes water travels many miles, over and under the land, to get to the river. It can carry with it many different materials that can make the river unsafe or unclear.

## Engage

Draw students' attention to the *Big Question* across the top of the student page. (*How Do Flowing Water and Land Interact in a Community?*) Then ask them to think again about the challenges faced by the Crystal River, which runs past the little town of Wamego.

## Guide

Ask students to describe the land where they live and any signs of how it might be changing. If they have trouble getting started, you might ask some guiding questions. *Are there individual houses with yards or are there large apartment buildings? Is the land flat or hilly? Are there factories that depend on having a large source of water? Are there any trees or*

woods nearby? Are there groups of stores or tall office buildings? Are there shopping malls surrounded by large parking lots? Are there farms with large fields?

Have students begin to think about how these things might be affecting the watershed in which they live.

Ask students to describe evidence that land where they live has been changed. (*The land was scrapped flat for a new mall. An empty field was laid out with street, houses were built and trees were planted.*) If evidence isn't forthcoming, ask questions to elicit an example something students would recognize. You might ask if anyone has noticed the building of a warehouse or a new development of houses and roads where woods existed a year before. Explain that each of these is an example of evidence that land is changing.

#### TEACHER TALK

“Picture a densely populated city. Now think about what it was like before any buildings were built on it. Why do people build cities? How is it different from suburbs? How is it different from farmland? What kinds of activities take place in each of these areas that would affect a watershed? Make sure you support your ideas.”

### △ Guide and Discuss

Stimulate a class discussion with questions and thoughts about why land changes. Using what they have learned about different types of land uses, have students make suggestions about filling in the table on page 32 with this information. Inform students that as they think of more things pertaining to each kind of land use, they will be able to add to the table.

#### TEACHER TALK

“In this section, you saw that the watersheds in Michigan directly or indirectly affect all of the Great Lakes. You began to think about how different kinds of activities can impact the quality of water in a watershed and eventually impact the quality of a river and the places into which that river flows. In the next section, you will investigate these situations in more detail by modeling how different kinds of land uses affect water quality.”

#### META NOTES

During discussions, listen for students to give evidence or reasons for why land in an area has changed.

#### META NOTES

Students often confuse evidence with opinion when supporting their ideas. Evidence is based on observations of facts. Opinions are often personal interpretations of situations. Keep students focused on clearly observable facts.

#### META NOTES

Continue to draw student's attention back to the *Big Question* throughout the *Learning Set* as students accumulate information.

### Assessment Options

| Targeted Concepts, Skills, and Nature of Science  | How do I know if students got it?   |
|---|---|
| <p>Humans use rivers for residential, commercial, industrial, and agricultural purposes. Their activities affect water quality along a river.</p>   | <p><b>ASK:</b> How do activities along the Rouge River affect the quality of the river water?</p> <p><b>LISTEN:</b> Students should be able to iterate that each activity adds something to the water as it moves through the watershed.</p> <p><b>ASK:</b> Why might an increase in population in a watershed decrease the quality of the available water?</p> <p><b>LISTEN:</b> Students should be able to say that as the population in watershed increases, water quality decreases because more water is used and more wastes of all kinds are produced.</p> |
| <p>Watersheds define the flow of water from an area into a river system and the flow of river systems into lakes and oceans. Nested watersheds are smaller watersheds that are a part of larger watersheds.</p> | <p><b>ASK:</b> Why is water in the Great Lakes affected by activities in watersheds throughout Michigan?</p> <p><b>LISTEN:</b> Students should recognize that watersheds throughout Michigan affect water in the Atlantic Ocean because water from some of these watersheds flows to the Atlantic Ocean.</p>  |

### Teacher Reflection Questions

- Do students understand that water running through a watershed can never truly be cleaned up completely once it is contaminated with wastes from human activities such as industry and recreation?
- Can students ascertain from photographs how humans impact river water quality?
- Did students understand the process of making a flow chart to represent the sequence in which water flows from some Michigan watersheds to the Atlantic Ocean?