

Land Use and Watershed Pollution

Lesson Abstract

Summary:	Students will be given a piece of land from a watershed pattern and build items for the land which fit into the land use category they have randomly drawn. Students will piece together the watershed, record point and non-point water pollution from each land source. They will identify the pollution coming downstream from other land pieces feeding into their watershed property.
MO GLE:	SC 5.3.A.6
Subject Areas:	Science, Social Studies, Communication Arts, Fine Arts
Show-Me Standards:	Goals – 1.8, 3.1, 3.3, 3.5, 4.3, 4.7 Strands – SC 5, 8; SS 5, 7; CA 6; FA 1
Skills:	Observation, inference, analysis, synthesis
Duration:	2 class periods (50 minutes)
Setting:	Classroom and/or drainage channel or stream close to the school
Key Vocabulary:	Watershed, drainage, runoff, point source pollution, non-point source pollution, ground water

Rationale:

Water quality is impacted by the land use practices within a given watershed. Surface and subsurface water can be affected both negatively and positively by various types of land use practices. Students are potential landowners who will impact water quality and quantity by their land use practices and conservation habits.

Student relevance:

- Water quality is essential to human life thus, survival.
- Water quality is the product of a watershed's land use practices and human activities.
- Students are affected by living downstream.

Learning Objectives:

Upon completion, students will be able to . . .

- Identify, compare, and contrast two types of water pollution, non-point and point sources.
- Identify how pollution travels down stream throughout a watershed and affects others downstream.

Students Need to Know:

- Water travels downhill.
- Water pollution exists.
- Water pollution comes from point and non-point sources.
- Water pollution is often a function of land use practices.
- Most people live downstream and are affected by pollution sources from upstream.

Teachers Need to Know:

- Missouri basins.
- Watershed definition and how to identify boundaries.
- Point and non-point water pollution sources (see Introduction to Watershed and Geology Module).

Resources:

Missouri's Hidden Waters

Available from the Missouri Department of Natural Resources, Division of Geology and Land Survey, P.O. Box 250, Rolla, MO 65402, (573)368-2125.

website for DNR publications:

<http://www.dnr.mo.gov/geology/adm/publications/pubscatalog.pdf>

Materials Needed for Lesson:

Transparencies

Missouri Publicly Owned Point-Source Discharges (make from provided copy)

Missouri Industrial and Mining Point-Source Discharges (make from provided copy)

Handouts

Sample *Watershed Pattern*

Land Use Cards (copy and cut) – one card per numbered *Watershed Pattern* piece

Other Materials

Assorted colored paper scraps

Scissors (one per student or pairs of students)

Markers, colored pencils, or crayons

One of the following items (butcher paper, large roll of bulletin board paper, poster board or typing paper) cut and numbered according to the provided or similar *Watershed Pattern*. (Note: This *Watershed Pattern* will need to be prepared ahead of time.)

Draw out a *Watershed Pattern* on large sheets of paper or poster board making the pattern used fit together and appropriately show how streams feed into each other. Outline the watershed boundaries and place a number in the top right-hand corner as shown on the provided pattern. Cut the *Watershed Pattern* in squares and/or rectangles according to the numbers and laminate for reuse.

Procedure:

Part One: Put It All Together

- Review all modules from the previous lessons (Missouri Regions, Basins and Watersheds).
- Define and discuss the differences between point and non-point pollution.
- Show the two transparencies *Missouri Publicly Owned Point-Source Discharges* and *Missouri Industrial and Mining Point-Source Discharges*, discuss the maps and point and non-point pollution.

Part Two: Land Divisions and Uses Drawing

- Tell students that they are all going to own a piece of land.
- Ask them to reach into a designated container and draw out a *Land Use Card* (copy, cut, and categorize cards beforehand).

Examples of Categories:

Animal Agriculture (cow pastures, hog feedlots, chicken houses)

Crop Agriculture (cornfields, fruit trees)

Urban Suburbs (neighborhoods, small parks, schools, roads, apartments)

Commercial Area (shopping malls, downtown areas, roads, hospitals)

Industrial (factories—have students determine for what)

Recreational (camps, ball parks, amusement parks)

Wildlife (natural reserve areas)

Mining (open pit mines, mining shafts, tailing ponds)

Forests for timber (forests, selective or clear cut)

Power production (coal burning plant, nuclear, hydroelectric—only if the student's property contains a large section of the river)

Rural area (small homesteads or farms)

Municipalities (water treatment plant, drinking water plant)

- Give the students examples of what may be located on each type of land use (see examples provided).
- Discuss the types of point and non-point pollution from each category.

(Note: Depending on the number of students in the class and the number of watershed land pieces in the pattern, some students may need to share land pieces and work

together on one category, or some students may need to have two pieces of land and draw out two categories.)

- Ask students to decide exactly what they are going to put on their land within the category that they drew.
- Give each student a piece of land (identified by a number) and have them use pieces of colored paper to cut out and create items to put on their land that represents their category. (Be sure that they label everything. If you are not planning to reuse the land pieces, students can just draw on them.)

Part Three: Piece It All Together

- Ask students to tape or place their land use items on the land pieces.
- On the floor, wall, or a table that is large enough, place the pieces together one piece at a time.
- Discuss the category and the possible point and non-point pollution that may be coming off the property and running into the nearest stream channel.
- As the watershed is pieced together, point out to students the watershed drainage pattern that evolves. (Note the stream orders taught in the watershed lesson previously. Note where higher and lower elevations are located in the watershed.)
- To provide structure and focus, have students keep a chart of the pieces by numbers and record the land use category and possible pollutants that may run off from the given land use (have them separate the point from non-point).
- As the watershed builds, some pieces of land (from the same categories) will have identical or nearly identical point and nonpoint pollution sources. Have students refer to a previous piece number to speed up the process.
- Once the watershed is completely constructed, ask students to star or circle their own land number and then identify all the other pieces of land that drain into their land. (Do one piece as an example.)
- Have students check off land numbers on their list that drain into their property.
- Point out how most of us live downstream from each other and discuss specific point and non-point sources that are coming from upstream.
- Discuss how land use affects quantity as well as quality of water. Examples:
 - 1) Pavement increases water quantity in streams yet decreases the amount available in ground water.
 - 2) Industry and some agricultural operations use large amounts of water, reducing the amount available to streams and landowner's wells.

Evaluation Strategies:

Have the students do one of the following items:

- Write a letter to each other as neighboring landowners. In the letter, suggestions should be made as to how the two landowners can work together to solve water problems. Students should demonstrate understanding of various impacts of land uses and an understanding of the rights and responsibilities of landowners.

They should also demonstrate correct grammar, friendly letter composition and construction, use standard English, and write legible.

- Write a paragraph, story, poem, or rap explaining how we all live downstream.
- List point and non-point pollution sources.

Extension Activities:

- Take students to a nearby stream channel or drainage ditch. Have students observe the land use practices in the surrounding areas and ask them to record their observations.
- Either in the classroom or at the site, divide students into pairs and have them share their observations. Ask students to compile a list of possible pollution sources. Determine the point and non-point pollution that could wash into the channel.
- Ask the class to discuss the possible effects of this pollution downstream from the site. Have students brainstorm possible pollution prevention methods to decrease the runoff of pollutants from both point and non-point sources.
- Ask students to create a chart and/or map of their direct observations and inferences. Have students speculate on the quality of water as the channel combines with other channels to make larger rivers.
- Have students research and redesign their land use practices to decrease the point and non-point pollution runoff from their land. Discuss how this may impact downstream water quality and quantity.
- Have students complete the Watershed Knowledge Questionnaire.

Suggested Scoring Guide:

Land Use and Watershed Pollution

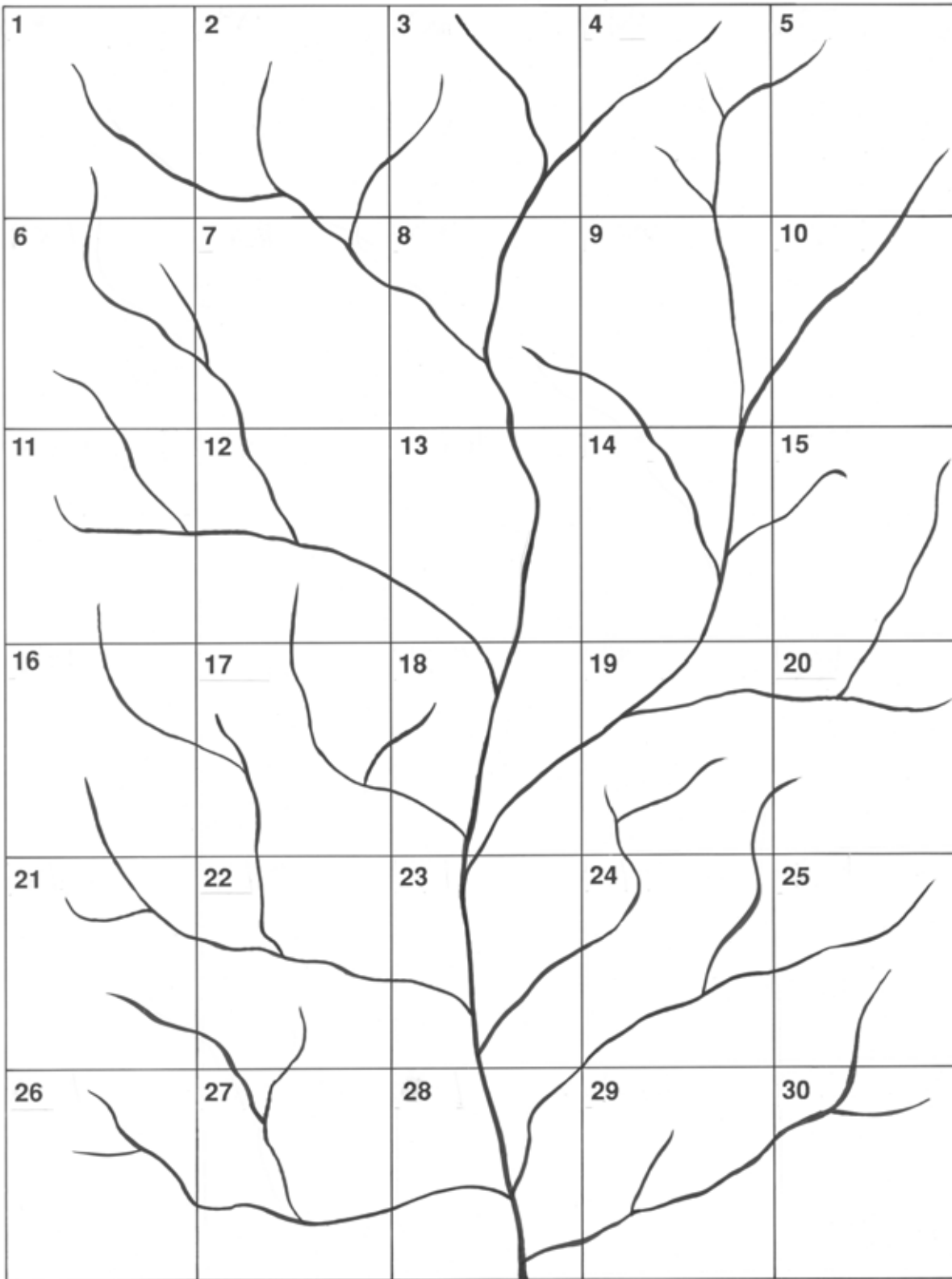
Teacher Name: _____

Student Name: _____

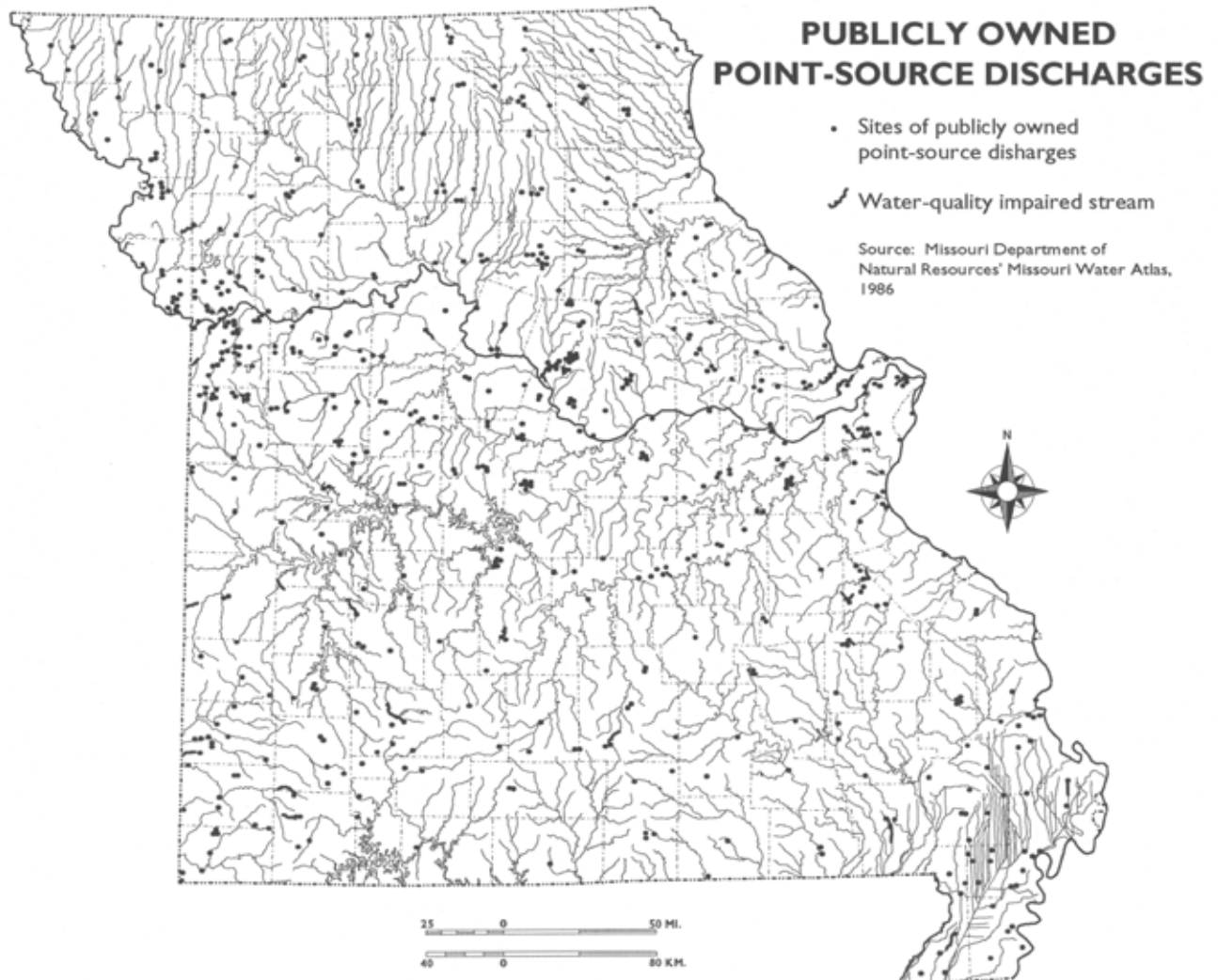
CATEGORY	4	3	2	1
Information Gathering	Accurate information taken from several sources in a systematic manner.	Accurate information taken from a couple of sources in a systematic manner.	Accurate information taken from a couple of sources but not systematically.	Information taken from only one source and/or information not accurate.
Construction - Care Taken	Great care taken in construction process so that the structure is neat, attractive, and follows plans accurately.	Construction was careful and accurate for the most part, but 1-2 details could have been refined for a more attractive product.	Construction accurately followed the plans, but 3-4 details could have been refined for a more attractive product.	Construction appears careless or haphazard. Many details need refinement for a strong or attractive product.
Chart - Content	Chart provides a complete record of planning, construction, testing, modifications, reasons for modifications, some reflection about the strategies used, and the results.	Chart provides a complete record of planning, construction, testing, modifications, and reasons for modifications.	Chart provides quite a bit of detail about planning, construction, testing, modifications, and reasons for modifications.	Chart provides very little detail about several aspects of the planning, construction, and testing process.
Data Collection	Data taken several times in a careful, reliable manner.	Data taken twice in a careful, reliable manner.	Data taken once in a careful, reliable manner.	Data not taken carefully OR not taken in a reliable manner.
Plan	Plan is neat with clear measurements and labeling for all components.	Plan is neat with clear measurements and labeling for most components.	Plan provides clear measurements and labeling for most components.	Plan does not show measurements clearly or is otherwise inadequately labeled.

Rubric Made Using: **RubiStar** (<http://rubistar.4teachers.org>)

Watershed Pattern

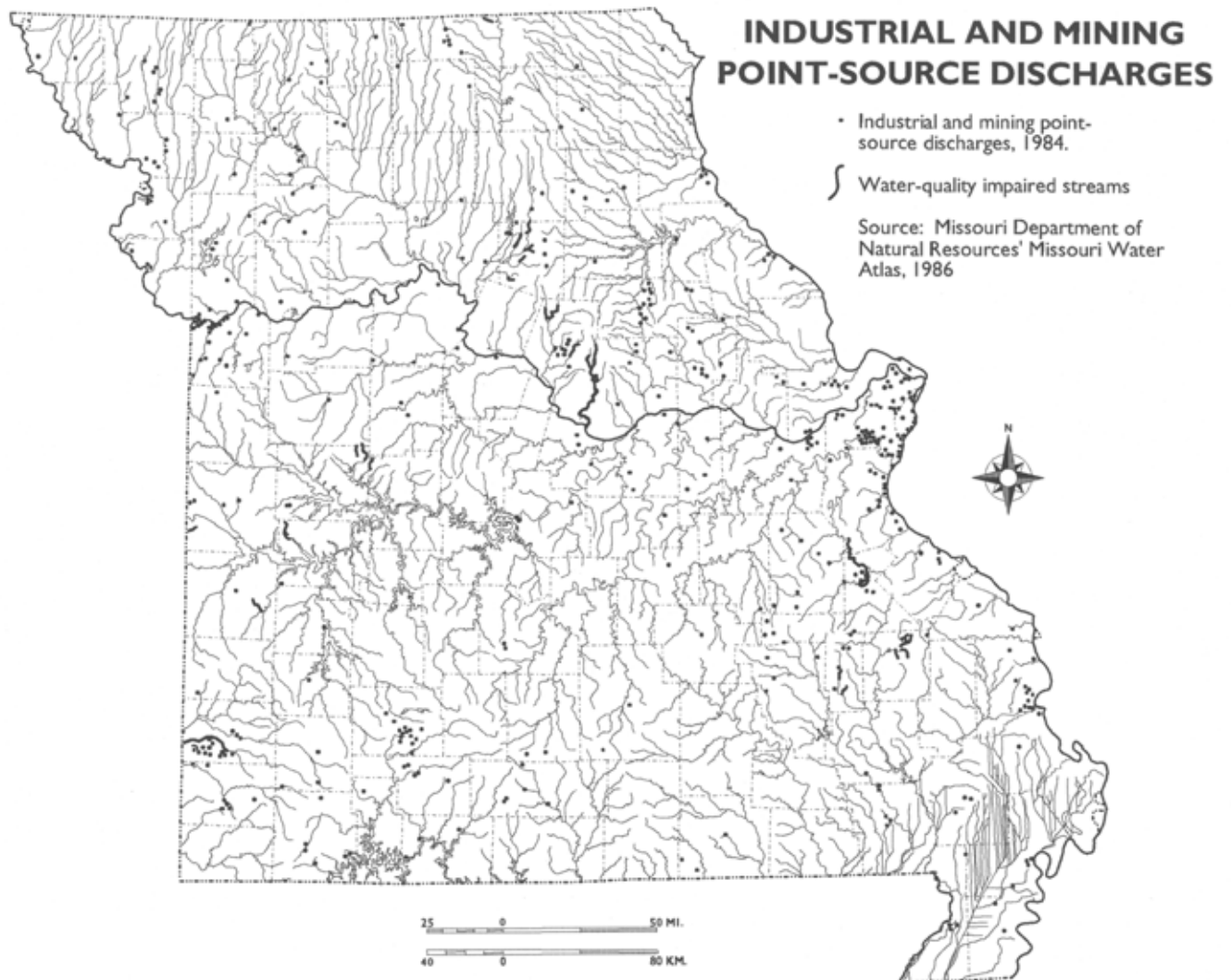


Missouri Publicly Owned Point-Source Discharges



Source: *Missouri Water Atlas*, 1986, Missouri Department of Natural Resources, Division of Geology and Land Survey

Missouri Industrial and Mining Point-Source Discharges



Source: *Missouri Water Atlas*, 1986, Missouri Department of Natural Resources, Division of Geology and Land Survey

Land Use Cards

(Make copies and cut for drawing)

