



A River Runs Through It

Objective: Students will identify the different ways that humans change the land and explore the connection between land uses, in relation to upstream-downstream. Students will also match common pollutants found in waterways with associated land uses.

SC Science Standards:

5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of Earth.



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Focus Question: How do humans use and affect our watershed?

Overview:

Students explore concepts related to land use and the importance of working with the community to protect water quality. In this lesson, students will “develop” a parcel of land along a stream or river in order to generate income. They will later learn that their parcel is connected to other parcels along the river’s way to the sea. The way humans use the land and water along their parcel affects land owners and water quality/quantity downstream.

Duration: 70 minutes

Vocabulary:

Land Use – the variety of ways that humans change the natural environment to serve a need

Development- changing the purpose of the land by altering landforms from a natural or semi-natural state to a different land use such as agriculture or housing

Wastewater – water that has been used often contains sewage, paper products, soap, detergents, cleaning products, food, etc.

It also includes chemicals and micro-organisms (germs) that can make people ill and damage the environment.

Sewage – any type of wastewater that is contaminated with feces or urine

Headwaters- Where a river or stream starts; its source.

Watershed - a land area drained by a common river system where all the streams flow to a common outlet.

Materials:

- 2 pieces of poster board: *1st* showing a river cut into 6-8 laminated pieces (each group should get one piece); *2nd* used as a background to hold the pieces in place with Velcro, or tape as they are presented
- Dry Erase Markers of a variety of colors for each group
- Velcro strips or tape

Advanced Preparation:

- Draw a river on a poster board showing the headwater as small streams opening up to a large river.
- Suggestion: Use the Black Line Master for an idea of how to draw the river.
- Cut into six or eight pieces (or enough so that each group has one piece).
NOTE: Cut each piece so that it includes part of the river.
- Number each piece on the back so that it does not show. Label the piece with the stream closest to the mountains as #1; continue in order until all pieces are numbered.

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- Laminate the pieces & place Velcro in the middle of each piece.
- Next, prepare the other piece of poster board with Velcro in the middle of each square in the same location to support the puzzle pieces.

Procedures:

Addressing Prior Knowledge:

Ask volunteers to describe what they may have seen as they look out of a window on a road trip. In what ways does the landscape change as they move along? (This can also be done using Google Earth to give students a simulation of flying over an area.)

Accept all answers. Sample answers include that they may see a city with tall buildings, homes, streets, highways, swimming pools, trees and lakes, farmland, etc. Write these ideas on the board.

Set the Stage:

Tell students that you have some bad and good news to share.

Bad News: A family member, Great Uncle Richie Rich, who owned a large piece of property on the Savannah River, recently passed away. Unfortunately, Uncle Richie had no children, no friends, just a pound pup name Benjamin and 100 acres of land. (This is equal to about the size of 100 football fields.)



Good News: He named you as his sole heir... you inherit the land...and the dog.

Just like your parents, you will have to pay taxes to the government on the land you inherit. You just received a letter saying that you owe \$12,000 in taxes on the land or you will lose it. But how are you going to raise the money? You are still in school! That afterschool job you have wouldn't even cover 10% of the cost of your taxes.

Review Procedures:

Have students come up with ways they could raise the money using their land? Tell students that they may use the land however they like.

Students will work in their small groups to discuss and illustrate how they will develop the land in order to raise the money they need. They will have 10 minutes to develop their plan (or 15 – 20 minutes will allow deeper discussion and time to think about why we are making these decisions) and using markers, draw pictures on their piece of land. They are not allowed to share their ideas with the other groups.

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Each group must include the following items in their illustration:

- Fresh water supply
- Transportation (roads, streets, bike paths, marina, etc.)
- Trash, waste water, and raw sewage storage/treatment
- Shelter
- Power supply
-

Once finished, each group will present their findings.

1. Begin with the group who developed the area surrounding the river's headwaters. The group will locate the puzzle number from the back of their piece and attach it to the poster board.
2. Students present their land development to the class and discuss what changes they made to the river, as well as how their property will affect the water's quality.

Close the Activity:

Once all groups have presented their land, discuss how each group impacts the water downstream. Elicit discussion on what each group could have done to have a lower impact on the watershed.

Introduce the term *land use*. Have students predict the meaning of the term. Explain that land use includes all of the ways that humans use the land. First, we must change the landscape to fit our needs. Then, in many cases, we build structures such as roads and buildings. Have students brainstorm the different kinds of land uses. Write their ideas on the board and *accept all answers*.

Present the categories of land use:

- Agricultural
- Forest/Park/Recreation
- Residential
- Commercial Business
- Industry
- Mixed Use

Tag-a-Toxin Lesson Plan

Have students brainstorm the different types of pollution that are associated with each. Present the matching game using the Interactive White Board technologies.

Land Uses and Associated Pollutants:

- **Agricultural**-nutrients (fertilizers), pesticides, chemicals, organic matter (for instance, soil loss from erosion and plant material), bacteria
- **Forest/Park/Recreation**- Nutrients (fertilizers), trash (debris), pet waste, bacteria
- **Residential**- nutrients(fertilizers), pet waste, bacteria, pesticides, chemicals, trash (debris), oil and gasoline, sediment, (What is this? Heat pollution? Not in standards)
- **Commercial Business**- nutrients(fertilizers),oil, gasoline, chemicals, pesticides,
- **Industry**, pesticides, chemicals, metals, oil and gasoline
- **Mixed Use**- all of these mentioned

Distribute the Curriculum Connection and direct students to use these categories to classify their own neighborhood and the potential impacts that these uses have on the watershed.

Evaluation:

The River Runs Through It! Student Sheet

The River Runs Through It! Curriculum Connection

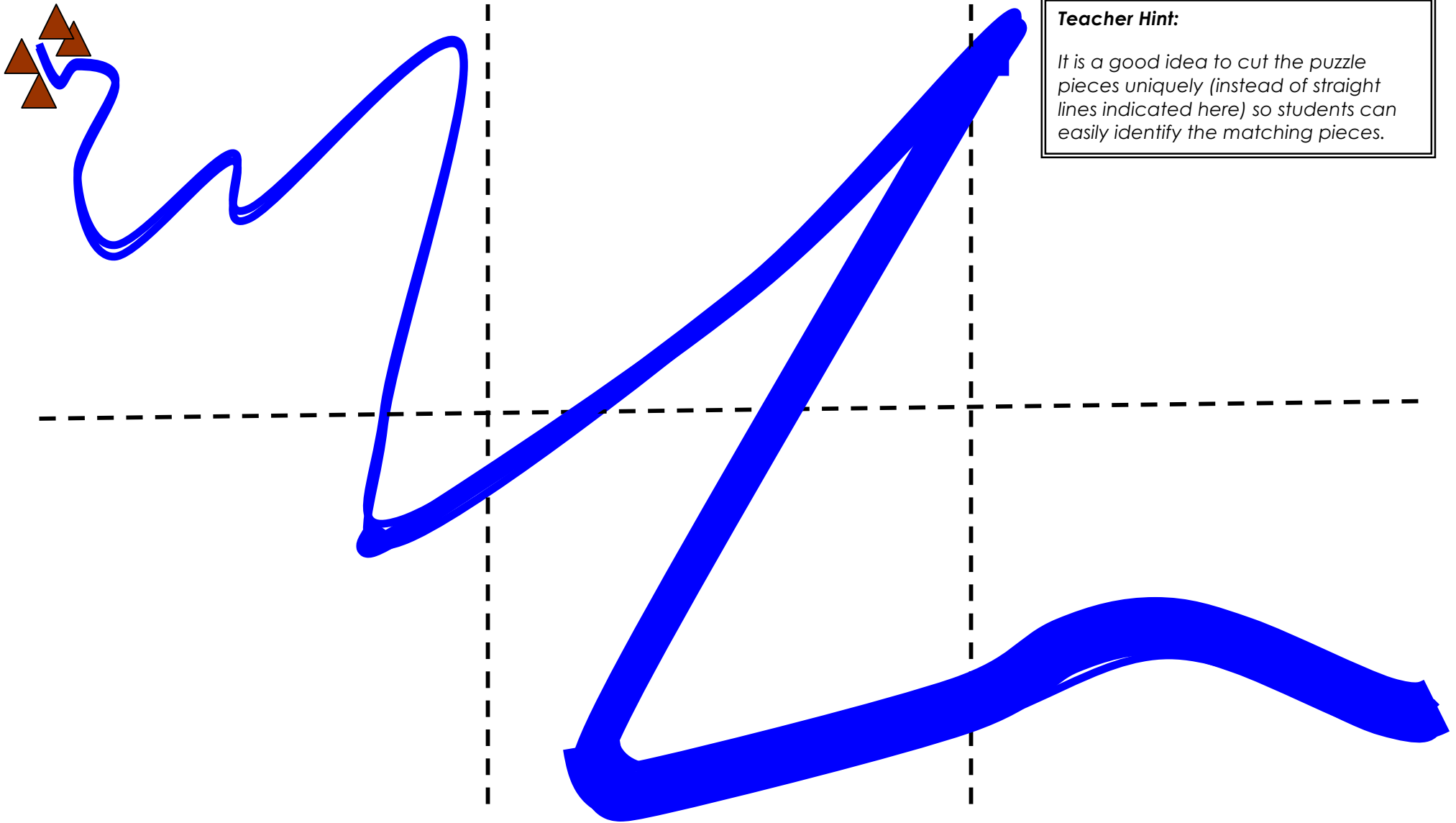
Student Behavior Rubric

Credits:

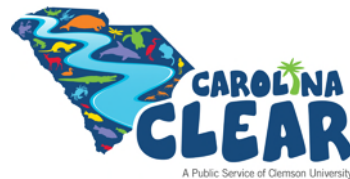
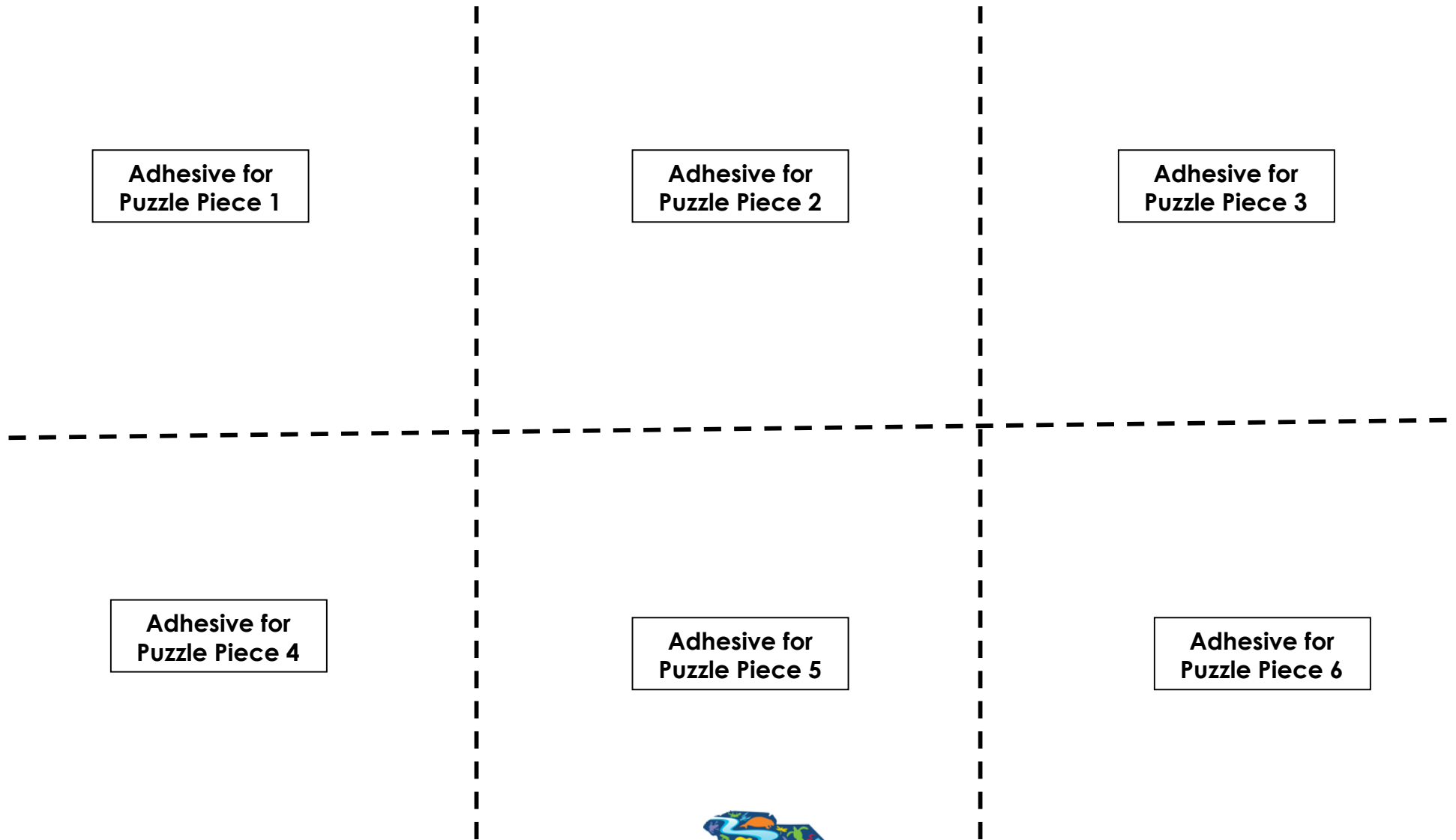
Modified from lessons by L. Spence, COSEE-SE Director (lundie.spence@scseagrant.org), and K. Fuss, Coastal Waccamaw Stormwater Education Consortium Environmental Educator, Coastal Carolina University (kfuss@coastal.edu). Original "River Game" adapted from *The Chesapeake Bay Foundation's Activities Manual for Hands-On Environmental Education*. Appreciation also expressed to Project Wet (Sum of Parts Activity).

Black Line Master: Poster sample of a river line drawing (front)

Guidelines: A version of this image should be copied by hand onto poster. Cut the poster to create six puzzle pieces.



Black Line Master: Poster sample of a river line drawing (back)



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4. What impact do you think these forms of transportation will have on the land and river environments?
5. How did you plan to get rid of waste on the property?
6. What forms of shelter did you provide? Why?
7. What forms of power did you provide? Why?
8. What pollutants are produced in your development and how might they affect the river?
9. Is your property affected by the land upstream? How?
10. Do you think your property affects the water downstream? How?

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Student Name/s: _____

Date: _____ Class/Period: _____

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Curriculum Connection

Land Uses and Associated Pollutants:

- **Agricultural**-nutrients (fertilizers), pesticides, chemicals, organic matter (for instance, soil loss from erosion and plant material), bacteria
- **Forest/Park/Recreation**- Nutrients (fertilizers), trash (debris), pet waste, bacteria
- **Residential**- nutrients (fertilizer), pet waste, bacteria, pesticides,
- chemicals, trash (debris), oil and gasoline, sediment,
- **Commercial Business**- nutrients (fertilizer), oil, gasoline, chemicals, pesticides,
- **Industry**, pesticides, chemicals, metals, oil and gasoline
- **Mixed Use**- all of these mentioned

1. Which land use produces the fewest pollutants? Forest/Park/Recreation (4)
2. Which land use produces the most pollutants? Why?
Mixed Use because it can contain all of the different land uses and their related pollutants.

Answers will vary.

3. Select one pollutant and research how this pollutant (in large amounts) may affect the quality of water in the watershed and the living organisms found there. *Keyword Search: Nonpoint Source Pollution, Land use*

Answers will vary. Some examples are provided here.

a. Associated land use, b. Pollutant:

- Agriculture: soil loss from erosion can clog stream beds and ruin habitat for organisms that live in the stream.
 - Agriculture, residential, commercial business and mixed use: fertilizers applied that are not used by plants can be dissolved into rain water and lead to local waterways. These nutrients will cause algae to bloom (grow rapidly). Too much algae changes oxygen conditions in a waterway, which could result in not enough oxygen for fish (leading to fish kills).
 - Agriculture, residential, parks: bacteria, either from manure management (livestock) or from pet waste, can harm local waterways. Bacteria and viruses from waste can lead to unhealthy conditions for those swimming and using waterways and can mean shrimpers or those harvesting oysters can not use those waters (and make their living).
 -
4. What effect does this pollutant (in large amounts) have on plants and animals? Be specific.

Tag-a-Toxin Lesson Plan

Answers will vary.

- c. What are some ways humans can decrease the amount of this pollutant?

Answers will vary.

- d. How may your neighbors downstream be affected by this pollutant?

Answers will vary.

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Student Name/s: _____

Date: _____ Class/Period: _____

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Curriculum Connection

Land Uses and Associated Pollutants:

- **Agricultural**-nutrients (fertilizers), pesticides, chemicals, organic matter, for instance, soil loss from erosion and plant material), bacteria
- **Forest/Park/Recreation**- Nutrients (fertilizers), trash (debris), pet waste, bacteria
- **Residential**- nutrients (fertilizers), pet waste, bacteria, pesticides, chemicals, trash (debris), oil and gasoline, sediment, heat
- **Commercial Business**- nutrients (fertilizers), oil, gasoline, chemicals, pesticides
- **Industry**-heat, pesticides, chemicals, metals, oil and gasoline
- **Mixed Use**- all of these mentioned

1. Which land use produces the fewest pollutants?
2. Which land produces the most pollutants? Why?
3. Look outside of your home and consider all of the different land uses of your neighborhood. Draw and label the different ways that the land is used below.
4. Look at the information given above under the "Land Use and Associated Pollutants". Identify the possible pollutants which are associated with the land uses you identified in #4.
5. Select one pollutant and research how this pollutant (in large amounts) may affect the quality of water in the watershed and the living organisms found there. *Keyword Search: Nonpoint Source Pollution, Land use*

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- a. Associated land use:
- b. Pollutant:
- c. What effect does this pollutant (in large amounts) have on plants and animals? Be specific.
- d. What are some ways humans can decrease the amount of this pollutant occurring in the environment?
- e. How may your neighbors downstream be affected by this pollutant?

Class Behavior Rubric

Name	Follows Directions 35 points	Completes Task 35 points	Uses Appropriate Voice/Behavior 10 points	Cleans Space 10 points	Total Pts (out of 100)



Lesson Plan Information

Written by Ms. Elizabeth Joyner for Clemson University Carolina Clear program, a comprehensive stormwater education and public involvement program in South Carolina.

Published December 2010 and reviewed by S²Mart Center staff in November 2010.

An interactive whiteboard lesson does accompany this field activity and can be downloaded at www.clemson.edu/carolinaclear.

Please share your feedback and use information with us. This program would like to continue to offer educational resources for South Carolina citizens and would appreciate your feedback, photos, information and comments you would like to share.

For more information, please contact Katie Giacalone, kgiacal@clemson.edu. For more information about Carolina Clear, please visit our website.

Thank you!