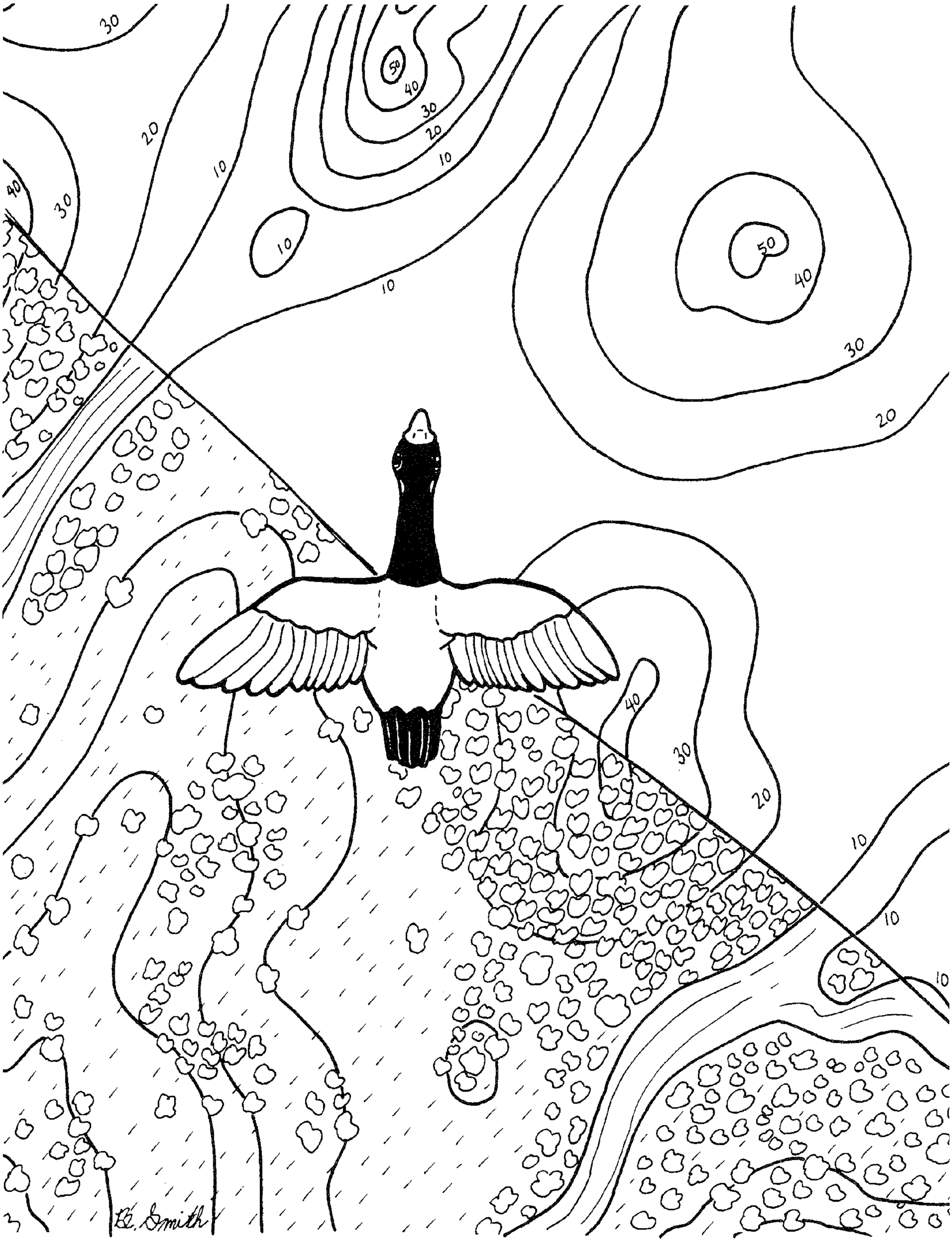
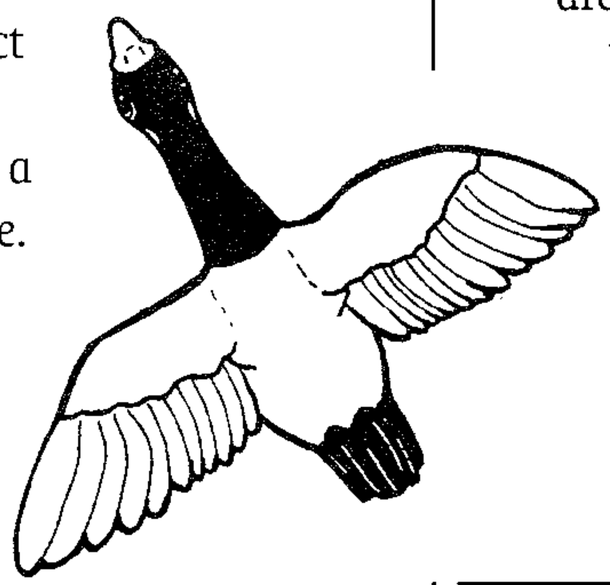
TOPO TWISTER



Topo Twister

Maps represent the way the earth or a portion of the earth looks. A topographic map shows the elevation or "relief" of the earth's surface by using drawn lines to show its contours. These contours stand for all of the earth's landforms including mountains, hills, lakes, rivers, plateaus, and valleys.

On topographic maps, like those produced by the United States Geologic Survey (USGS), contour lines connect points of equal elevation. Closely spaced lines show a steep slope like a mountain ridge, ravine, or precipice. Lines that are spaced far from one another, with no lines in-between, mean that there is little change in elevation. These would indicate areas such as valley floors, flood plains, plateaus, or coastal areas near sea level.



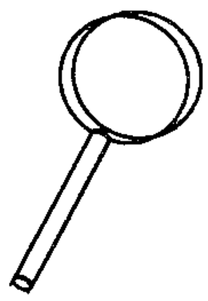
Besides elevation, topographic maps show a number of other types of information including land use, streets, buildings, and habitat types. These maps provide a "birds-eye view" of the entire watershed in which a person lives. Through interpretation of contour lines, symbols, and color one can get an idea of how the land looks without stepping outside. The USGS maps are reviewed and redone periodically, but dates on many of the maps in New Jersey indicate that the newest maps are from the 1980s and some of them are even older. Users of the maps should be aware that ground-truthing is an important process in watershed mapping. Due to changes in the New Jersey from development, maps should always be checked against the actual site.

There are 172 maps (quadrangles) for the state of New Jersey, each of which covers 49 to 71 square miles. The most usable maps for watershed study would be in the 7.5 Minute Series. These maps cover subdivided areas of latitude and longitude and a scale of 1:24,000 indicates that one inch on the map represents 2,000 feet of linear ground.

TAKE A LOOK AT YOUR WATERSHED:

How would some of your watershed's landforms be represented on a topographic map?

What changes do you see in your watershed that need to be added to an updated version of a topographic map?



LESSON 2

Topo Twister

GOAL To develop a broader understanding of the local watershed through the interpretation of United States Geologic Survey (USGS) topographic maps.

TIME • (3) 45-minute periods

OBJECTIVES Students will:

- ✔ create methods for assembling topographic maps
- ✔ locate their "space" within the watershed (home, school, town, etc.)
- ✔ interpret USGS topographic symbols and colors
- ✔ identify subwatersheds on the map

SKILLS observe, organize, interpret, identify, analyze, synthesize, justify

VOCABULARY

cartographer
channelization
closed watershed system
contour line
drainage basin
elevation
greenway
headwaters
land use
open watershed system
river mouth
slope
stream order
subwatershed
sustainable development
topographic map
tributary
USGS quadrangle
watershed

PRIOR KNOWLEDGE Students should have background in:

- the way a watershed functions
- map reading and interpretation

CORE CURRICULUM CONTENT STANDARDS

- Language Arts 3.1 (14,15) 3.2 (8,11)
- Science 5.1 (4,6) 5.10 (5,11) 5.12 (4,6,9,10)
- Social Studies 6.6 (10,15,16) 6.7 (6,8,11) 6,8 (8,9,13) 6.9 (5,7)

MATERIALS

- ❑ 1 set of USGS topographic maps for your drainage basin (See Appendix B for a complete listing of maps for each of the major drainage basins.)
- ❑ USGS topographic symbols key (See Appendix B)
- ❑ 6 to 8 copies of the USGS topographic map for your local subwatershed
- ❑ Laminating materials
- ❑ Velcro
- ❑ Nonpermanent markers

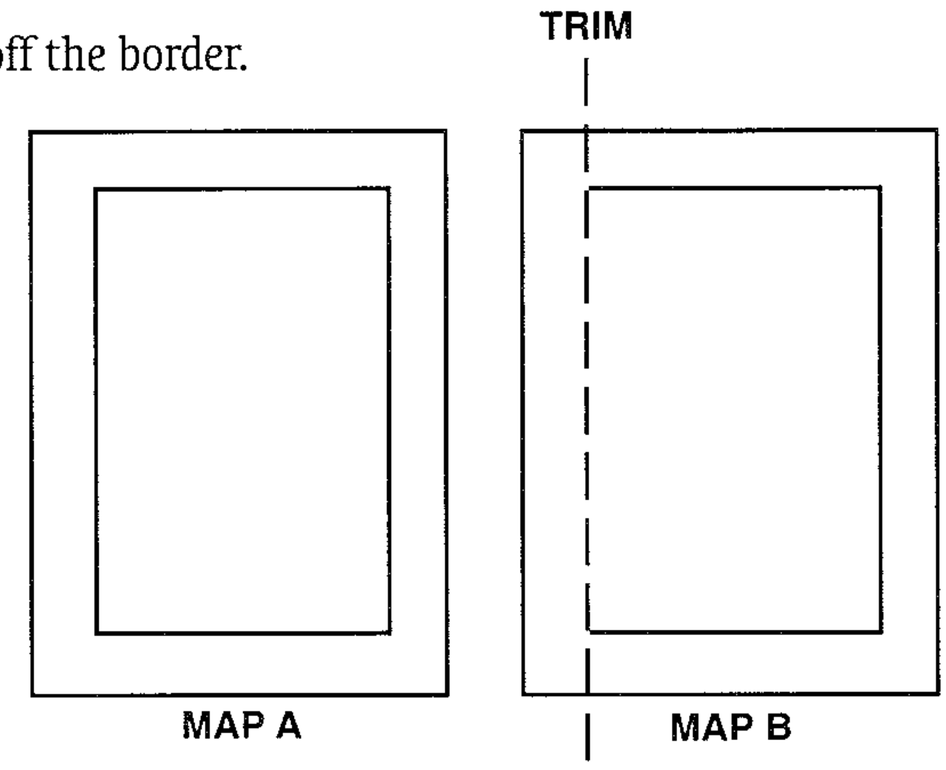
PREPARATION

1. Obtain copies of the appropriate USGS topographic maps for your basin. (See Appendix B.)
2. Laminate maps then trim them according to the diagram. (Figure 2A). Be sure to allow at least ½ inch of overlap to apply the Velcro pieces.
3. Affix three or four Velcro pieces to the back (and front) of each map edge. Make sure these line up. It will make it easier for students to attach the individual map edges together.
4. Copy the section(s) of topographic map(s) which include your subwatershed and laminate these for student use.
5. Identify a site in the school where the maps can be manipulated and then assembled on the floor.

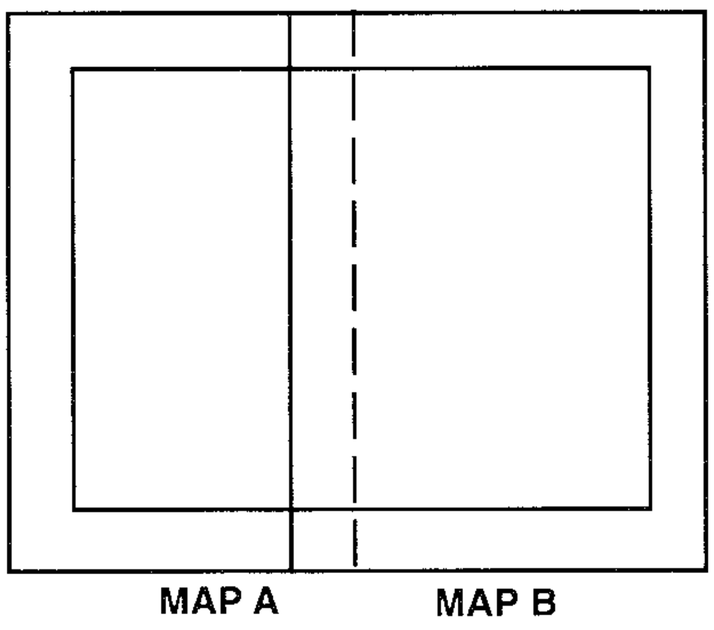
NEW JERSEY AUDUBON SOCIETY

Figure 2A
CREATING THE BASIN MAP

Step 1: Trim off the border.



Step 2: Place Map "B" on top of Map "A" to create an overlay system. Do this for all the maps in the system.



Step 3: Affix a velcro strip to the front of the border of "A" and another to the back of "B".

PROCEDURE

Period 1

1. Discuss what a USGS topographic map is and what a cartographer does.
2. This activity is designed so students will be able to visualize a major drainage basin.

   Have the students assemble the USGS maps in one of the following ways:

   Basic version: Divide the students into small groups. Give each group a series of adjoining maps (4 or 5). Have each group assemble its small section of the drainage basin then work with the other groups to assemble the entire basin.

   Challenge version: Scatter all the maps on the floor and challenge the students to work together as a group to create the entire basin.
3. Have the students explain their strategies for assembling the maps. [*Matching roads, rivers, town names, colors, quadrangle names, landforms, lakes, etc.*]
4. Ask each student to look at a section of the basin and take turns describing the symbols, lines, and colors that they see. Ask them to hypothesize what these may indicate. Use the "Topographic Map Symbols" sheet provided by the USGS as a key.

Period 2

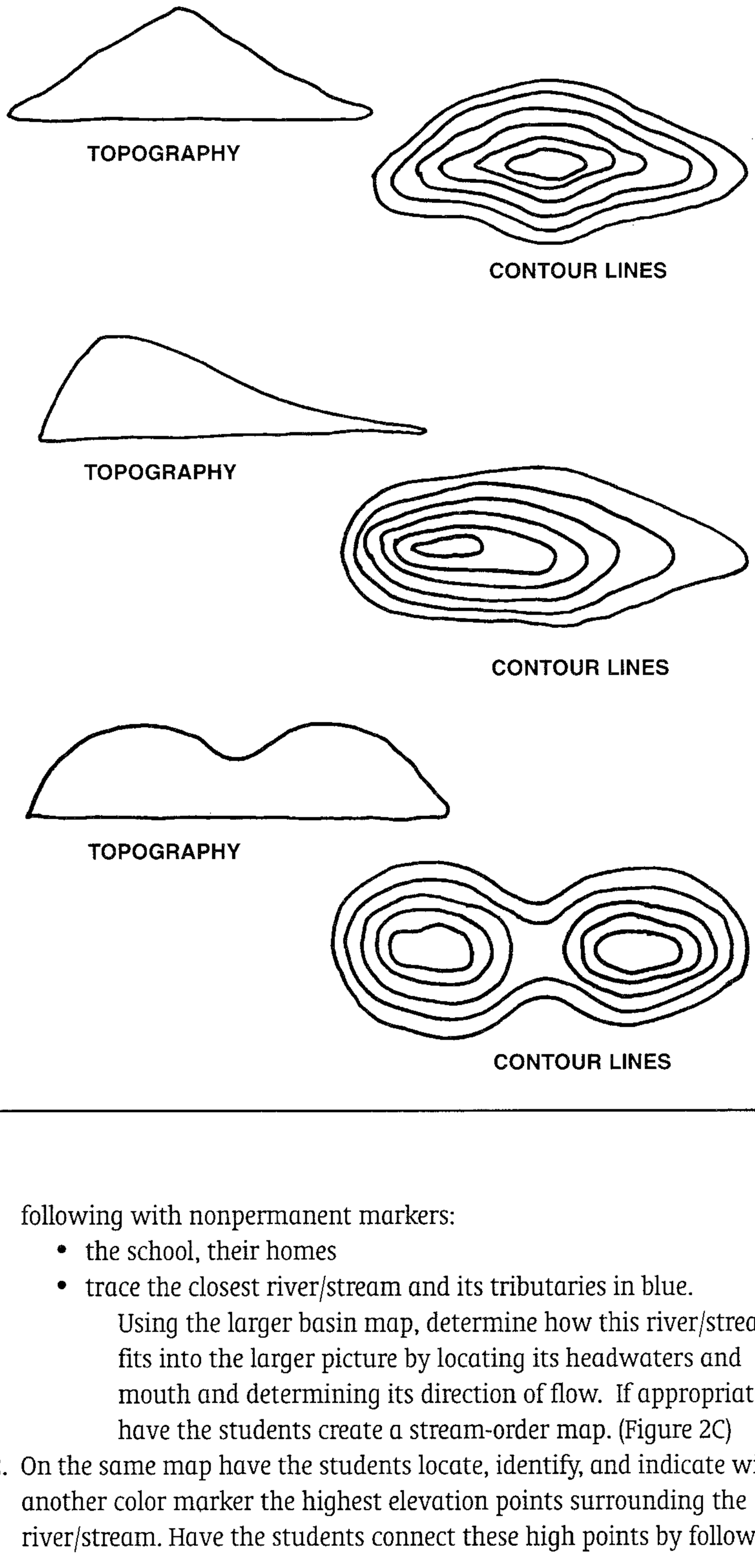
1. On one of the topographic maps, have each student locate a brown contour line.
   a. Discuss the difference between a contour line (thin brown line, usually indicating elevation changes of 10 or 20 feet) and a contour index line (thicker, darker brown line that has an elevation number on it).
   b. Ask the students to locate an elevation number on one of the contour index lines.
   c. Have them determine the elevation of that index contour and then their original contour line.
   d. Discuss how different elevations are represented on the map using the contour lines. [*Contour lines that are drawn close together indicate steep slopes and contour lines that are spaced further apart indicate gentler slopes.*]
2. Use Figure 2B to help the students visualize how contour lines translate into mountains and valleys.
3. Ask the students to locate the upland regions and lowland regions of the basin and justify their findings.
4. Have the students locate examples of the major map colors: green, blue, gray, pink, and purple. Discuss what these colors indicate. [*Green is generally undeveloped open space, forests, and farmland, whereas pink (salmon) or gray indicate built-up areas. Purple indicates information that has been added during an update and blue signifies water*]. Ask the students to describe the basin's land use based on where the different colors are located on the maps.

Period 3

1. Divide the students into small groups and distribute a copy of the topographic map which includes the local subwatershed. These maps may need to be pieced together from several USGS quadrangles, but the final map should be laminated so it can be reused. Have the students locate and identify the

Figure 2B
CONTOUR LINES, ELEVATION, AND TOPOGRAPHY

The landform (left) is represented as contour lines on a map (right).



following with nonpermanent markers:

- the school, their homes
- trace the closest river/stream and its tributaries in blue.

  Using the larger basin map, determine how this river/stream fits into the larger picture by locating its headwaters and mouth and determining its direction of flow. If appropriate have the students create a stream-order map. (Figure 2C)

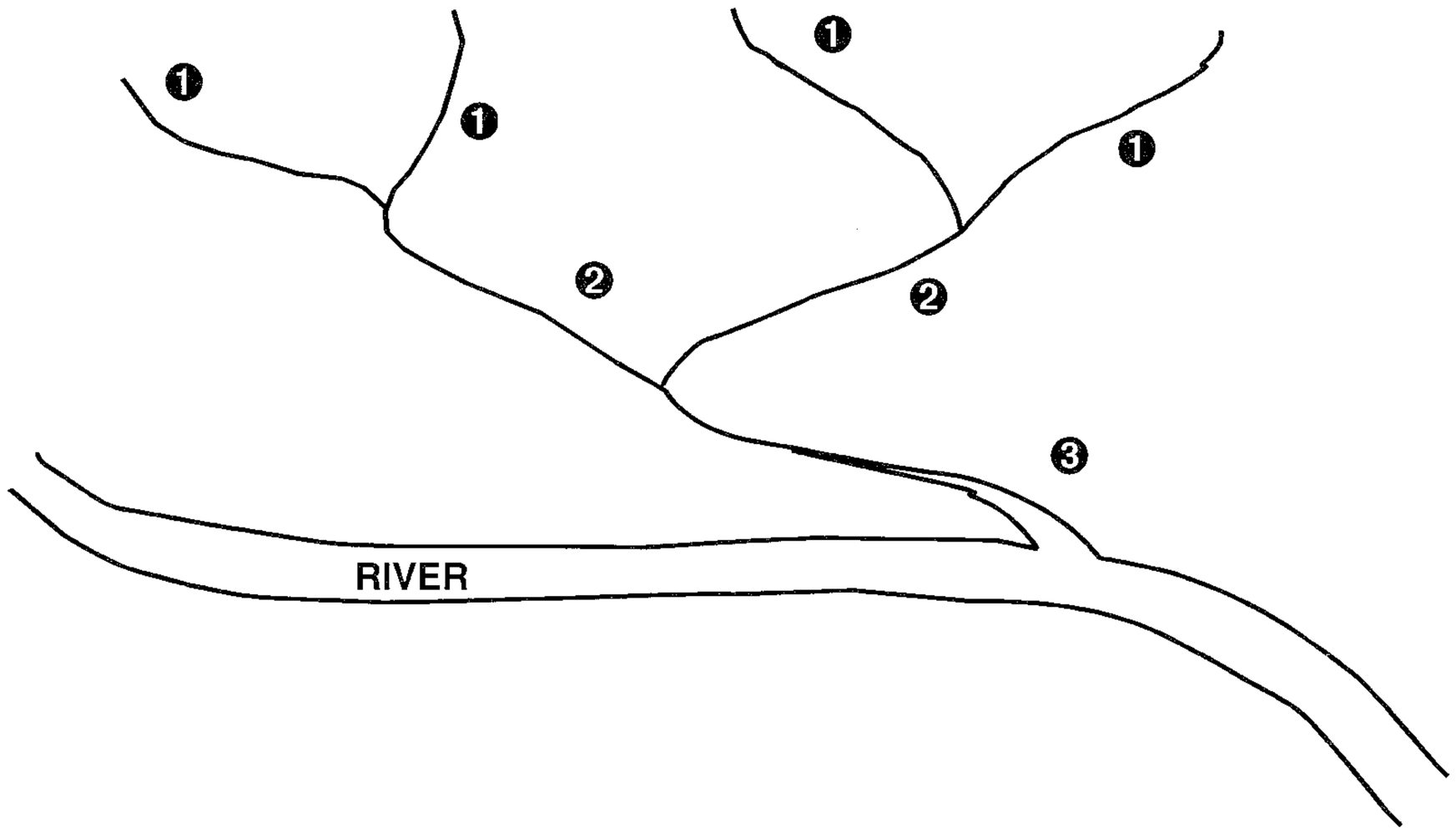
2. On the same map have the students locate, identify, and indicate with another color marker the highest elevation points surrounding the river/stream. Have the students connect these high points by following ridges and crossing slopes at right angles to the contour lines. This will help determine the watershed's boundaries. Determine if the watershed is an open or closed watershed system.

FURTHER DISCUSSION

- How do you think human activity has changed the topography of your watershed?
- Locate bodies of water that were created by dams or changed by the construction of new roads. How is this shown on the map? [*straight lines*] How do you think this has affected the surrounding area?
- Locate rivers or streams where people have channeled the waterway by means of artificial embankments (cement conduits, stream straightening). What might be the pros and cons associated with altering natural steam beds? [*pros - controls floodwaters, moves floodwaters along quicker, allows for more development; cons - alters the natural systems adjacent to the stream bed, destroys the natural systems that function as flood control (i.e., swamps, marshes, and flood plains), alters natural habitat for species*]
- Locate any reservoirs and discuss their purposes. [*store drinking water, control flood waters, provide recreational opportunities*]. Why do you think these are located where they are? Could there have been a better location? Where and why?
- Give reasons why various land uses are located where they are. Do these meet human needs, environmental preservation, or both?
- How might future development of the watershed address 'sustainable development'?

Figure 2C
CREATING A STREAM-ORDER MAP

Stream systems resemble a tree. The trunk becomes the largest river in the system, the biggest branches are the river's major tributaries and the smallest twigs are the streams located at the headwaters. Scientists categorize river systems in the following way: streams without tributaries are first-order streams (1), streams that receive only first-order streams are called second-order streams (2). When two second-order streams meet they become a third-order stream (3). This continues until the largest river in the system is reached.



ASSESSMENT

Pose the following scenarios:

- If you were a cartographer, how would you improve these topographic maps to help you interpret them better?
- If your job was in watershed management, what would you do to your watershed to balance the need for open space and economic growth?
- Discuss how past, present, and future land use might affect water quality and the quality of land in the watershed.

EXTENSION

Challenge the students to develop a "greenway" for their watershed by selecting specific tracts of land that would be the most useful in preserving water quality and reduce filtration costs for potable water.

EMPOWERMENT CHALLENGE

Arrange for the students to visit a portion of their local watershed to try and correlate "real" features with the features that are visible on the corresponding topographic map. This process is called "ground-truthing."

LESSONS FROM OTHER SOURCES

Beneath the Shell - Topo Trouble
Sourcebook for Watershed Education - Watershed Mapping
The Ways of the Watersheds - Line Up!
WOW! The Wonders of Wetlands - Over Hill & Dale

REFERENCES

United States Geologic Survey, Topographic Map Symbols instructional pamphlet.