

**WE CARE ABOUT WATER.
IT'S WHAT WE DO.**



**INDIANA
AMERICAN WATER**

From Here to There

Investigating Point and
Non-Point Source Pollution

- **Grade Level:** 5-12
- **Objective:** Students will gain an understanding of the types of pollutants that can impact a watershed, as well as predict the path of pollutants using a topographic map
- **Subjects:** Geography, Environmental Studies, Chemistry, Writing

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INTRODUCTION

Watersheds, also known as drainage basins, are areas of land that drain into a common body of water, such as a lake, river or stream. As water travels over the land's surface—it may pass through farm fields, forests, lawns and city streets—on its course to a waterway. Or the water may seep into the soil and travel as groundwater. Either way, the water body is impacted by what happens, good or bad, in the watershed. And, that water body could be the source of that community's drinking water supply.

If we take a closer look at the types of pollutants that can impact a watershed, most can be categorized as either point or non-point source pollution.

- **Point Source Pollution:** This is where you can literally point to and confirm the origin of the pollution. A leaking sewer pipe releasing effluent into a river, for example, is a specific, identifiable source of pollution and is considered point source pollution.
- **Non-point Source Pollution:** This type of pollution comes from a wide area and no single location is the point of origin. For example, during the spring, several homeowners in the same development spread fertilizer on their lawns. A heavy rain washes the excess fertilizer into a storm drain, which carries it to a stream. Other examples could include litter, grass clippings, animal waste and road salt. Many of these items are not intentionally placed into the aquatic ecosystem, which is why it's important to build awareness and identify ways we can reduce our impacts on the watersheds in which we live.

Water pollutants can further be classified into eight main categories: organic pollutants, inorganic pollutants, thermal pollution, plant nutrients, sediment, radioactive contaminants, infectious agents and oxygen consuming wastes.

Remediation efforts and techniques will depend on the origin of the pollution, as well as the pollutant type. Oftentimes, addressing water pollutants requires a combination of enforcement, education and technology.

DID YOU KNOW?

You live and go to school or work in a watershed. Good or bad, your actions can impact the water resources

MATERIALS NEEDED

- Piece of paper
- Pen or pencil
- Enclosed map

FROM HERE TO THERE

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INDIANA
AMERICAN WATER

EXERCISE

In a region with diverse land use and a high population density, there are a variety of potential water pollutants. An understanding of land relief and changes in elevation is critical in predicting the path of a pollutant moving toward a surface water feature. Rain water will move from areas of high elevation to areas of low elevation bringing with it whatever has been dissolved or suspended in its path.

Land cover also impacts the path of rainwater as it travels through the watershed. Impervious surfaces greatly increase the speed of flow and prevent water from infiltrating the ground where it may be filtered naturally. Forests found along stream corridors (riparian vegetation) can slow the flow of runoff and filter some nutrients before they reach the stream, river or lake. Thus the ability to read a topographic map and landscape can be of great use in keeping surface waters clean and addressing water pollution when it occurs.

For this exercise, students will view a map of a developed region on the mid-Atlantic coast where there are extensive areas of urban development and suburban sprawl. On the map are seven numbered locations representing pollution events. Students will categorize the sources of pollution and determine which body of water is most impacted, using the data provided.

WATER POLLUTION EVENTS

- 1 An aging sewage disposal tank has sprung a leak and raw sewage is leaking onto the ground.
- 2 Pesticides are liberally used at Locustwood Cemetary to suppress plant and animal pests.
- 3 In the residential area of West Haddonfield, several intense thunderstorms moved through the region during the night on the eve of trash day. High winds and torrential downpours overturned trash bins and all over town, municipal solid waste was washed away.
- 4 Along an old railroad track in a ravine tons of grass clippings from the golf course has been all but forgotten. Wind and rain are moving material from the pile.
- 5 An oil tanker has overturned on Brace Road and refined gasoline has poured onto the road surface.
- 6 Garden State Horse Park uses both inorganic fertilizers and manure to maintain acres of grass and garden.
- 7 The banks of the Cooper River are eroding due to heavy recreational use, heavy runoff and flooding and impaired riparian vegetation.

FROM HERE TO THERE

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INDIANA
AMERICAN WATER

POLLUTION CATEGORIES

- **Organic Pollutants:** Industrial chemicals such as solvents, oils and pesticides.
- **Inorganic Pollutants:** Industrial chemicals such as acids and metals.
- **Sediment or Substrate Material:** Sand, silt and clay that enter waterways from erosion and runoff.
- **Oxygen Consuming Waste:** Manure, animal products and waste from paper mills.
- **Plant Nutrients:** Nitrates and phosphates used heavily in agriculture, golf courses and residential areas.
- **Thermal Pollution:** Excess heat from energy facilities that use surface water for cooling processes or from extensive deforestation along stream corridors.
- **Infectious Agents:** Pathogens such as bacteria, viruses and protists. Sources include sewage, or they can also be naturally occurring, but increase in abundance from other pollutants.
- **Radioactive Waste:** Elements and compounds that emit radiation. Sources can include hospitals, energy facilities, weapons production and storage sites.

MAP COLORS AND FEATURES

- Green = Forest/tree cover
- White = Open space, trees not the dominant vegetation
- Pink = Urban/developed area
- Blue = Water features
- Red and black lines = Transportation corridors
- Black squares and polygons = Houses and buildings
- Brown lines interrupted by numbers = Contour lines/elevation

TASKS

1. Categorize each pollution event as point or non-point and identify which pollution class(es) is involved.
2. For each pollution event, determine which body of water will be most impacted.
3. Rank the pollution events in order from most to least concerning.

POLLUTION EVENT RANKING

Rank the pollution events in order from most concerning to least concerning (1 = most concerning; 7 = least concerning).

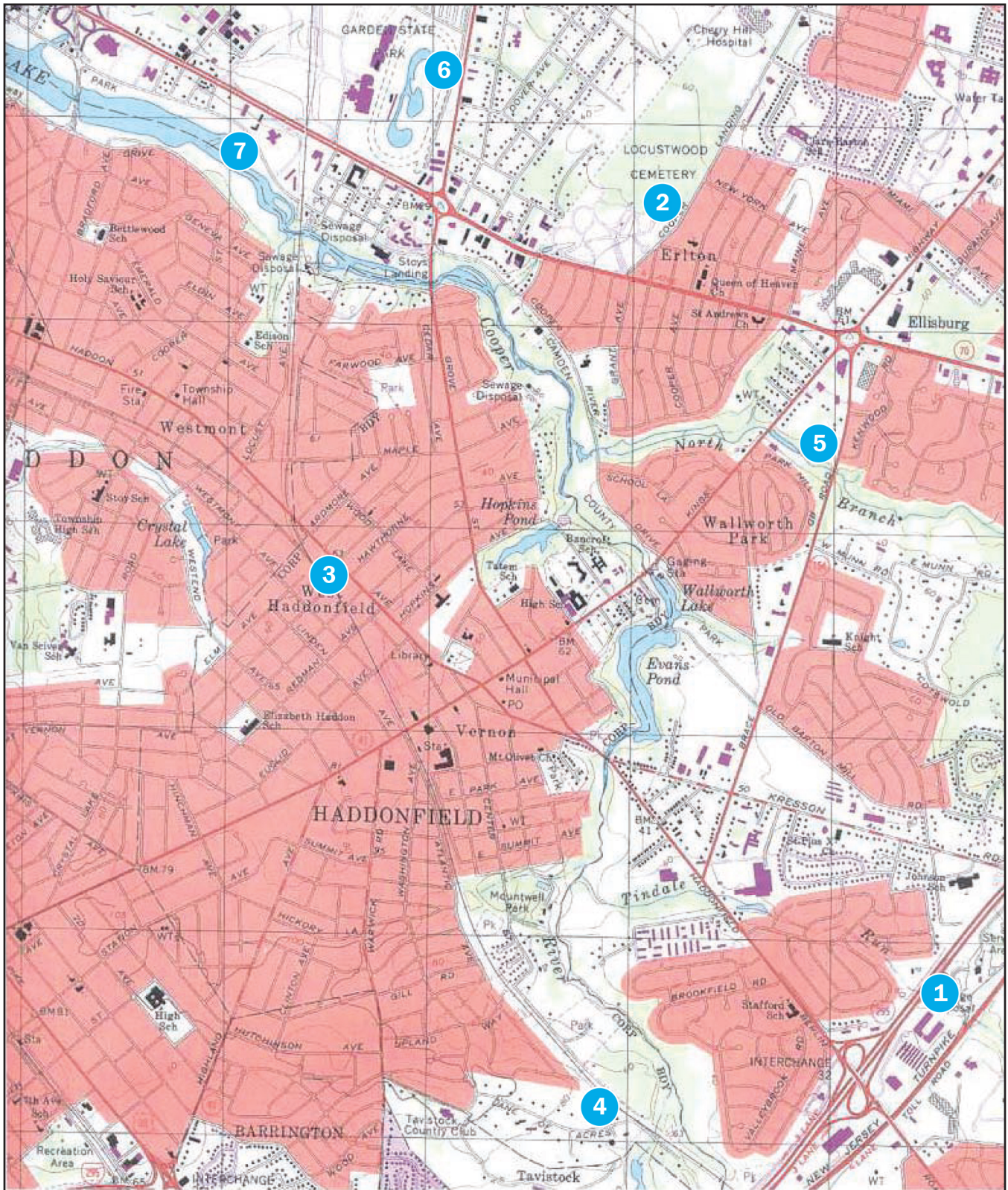
- _____ Leaking sewage disposal tank
- _____ Pesticides used at Locustwood Cemetary
- _____ Intense thunderstorms in West Haddonfield
- _____ Grass clippings along railroad tracks from the golf course
- _____ Overturned oil tanker on Brace Road
- _____ Use of inorganic fertilizers and manure at Garden State Horse Park
- _____ Cooper River bank erosion

FROM HERE TO THERE

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Source: USGS 7.5 minute map, Camden Quadrant, New Jersey

FROM HERE TO THERE

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INDIANA
AMERICAN WATER

QUESTIONS

1. What are the impacts of each pollution event?
2. What criteria did you use for your ranking the pollution events?
3. Which pollution events were you most concerned about? Explain.
4. Which were you least concerned about and why?

EXTENSIONS

- Obtain a copy of the USGS map of your community and identify the land use and potential sources of point and non-point source pollutants.

RESOURCES

- EPA: www.epa.gov – research water quality and the right-to-know program
- USGS Maps: topomaps.usgs.gov – research and purchase topographic maps

COMMENTS

We want to know what you think. Feedback and/or suggestions for improving this lesson plan can be e-mailed to joi.corrado@amwater.com.

NOTES

FROM HERE TO THERE

Investigating Point and Non-Point Source Pollution



INDIANA
AMERICAN WATER

DEFINITIONS

- **Land Relief:** Land relief, or terrain, is the vertical and horizontal dimension of land surface. When relief is described underwater, the term bathymetry is used.
- **Non-point Source (NPS) Pollution:** Refers to diffuse contamination that does not originate from a single discrete source.
- **Point Source Pollution:** Contaminants that enter a waterway through a discrete conveyance, such as a pipe or ditch.
- **Storm Drain:** A drain/drain system designed to drain excess rain and ground water from paved streets, parking lots, sidewalks, and roofs.
- **Suburban Sprawl:** The spreading outwards of a city and its suburbs to its outskirts. These low-density developments on rural land are often segregated by use (i.e., stores and residential) and design features that encourage car dependency.
- **Surface Water:** A water feature that exists and remains at the surface such as that found in streams, rivers, lakes, wetlands, and marine basins
- **USGS Topographic Map:** Maps produced by the United States Geologic Survey that depict general land cover features, natural and anthropogenic, as well as contour lines that indicate elevation.
- **Watershed:** Also known as drainage basins, are areas of land that drain into a common body of water, such as a lake, river or stream.

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In a world where everything we touch frequently changes, water is our constant. We've never stopped needing it to drink, to cook, to clean, to live. We'll always need it for sanitation, for fire protection, for watering our lawns and washing our cars.

It's easy to take water for granted. And because so many do, we don't.

We are scientists, environmentalists, innovators, and protectors. We are also residents and employees in the communities we serve. We understand how important, how precious, and how critical water is to daily life.

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A special thanks to Ron Smith for developing the core content of this lesson plan. Ron Smith, a science educator from NJ, has been teaching biology, environmental science and interdisciplinary studies in the classroom, lab and field for 18 years. It was important for us that our lesson plans be crafted by an educator for educators. We appreciate his hard work.

Last updated: 12-2010