TEACHER NOTES:

BACKGROUND INFORMATION ON WATER TESTING AND ANALYSIS:

If contaminated water is not available or feasible, substitutions can be made:

- Use vegetable oil or motor oil for oil contamination.
- Use vinegar or lemon juice for low alkalinity (acid).
- Use baking soda for high alkalinity (basic).
- Heat water for thermal contamination.
- Use sand, peat moss or dirt for silt.
- Use vanilla extract for aromatic hydrocarbons.
- Use garden fertilizer for agricultural fertilizers.
- Use table salt for dissolved ions.
- Use detergent for phosphates.

Basic testing equipment:

- Commercially available water quality testing kit
- Thermometer

If commercial testing equipment is not available, substitutions or low-tech options can be used:

- Use litmus paper to test for alkalinity.
- Smell the water to test for aromatic hydrocarbons.
- Observe the water for turbidity.
- Allow the water to evaporate for calcium carbonate and salt deposits.
- Observe water for oil.
- Observe water for foaming.

BACKGROUND INFORMATION ON WATER CYCLE AND NATURAL CONTAMINATION

See any earth science text, for example
Spaulding, Nancy and Samuel N. Namowitz. 1994. Earth Science. Massachusetts: D.C. Heath and Company.

See any environmental text, for example
Anderson, Stanley H., Ronald E. Beiswenger, P. Walton Purdom. 1987. Environmental Science, 3rd Edition. Ohio: Merrill Publishing Company.

Drohan, Joy, and Abdalla, Charles. 2000. Valuing Pennsylvania's Water Resources. The Pennsylvania State University, College of Agricultural Sciences, Agricultural Research and Cooperative Extension

Drohan, Joy; Sharpe, William E.; and Smith, Sanford S. 2002. Incredible Water. The Pennsylvania State University, College of Agricultural Sciences, Cooperative Extension.

BACKGROUND INFORMATION ON MAN-MADE WATER CONTAMINATION

See any environmental text, for example
Anderson, Stanley H., Ronald E. Beiswenger, P. Walton Purdom. 1987. Environmental Science, 3rd Edition. Ohio: Merrill Publishing Company.

http://www.umich.edu/~gs265/society/waterpollution.htm
WATER POLLUTION AND SOCIETY By David Krantz and Brad Kifferstein
Two types of water pollutants exist; point source and nonpoint source. Point sources of pollution occur when harmful substances are emitted directly into a body of water. The Exxon Valdez oil

spill best illustrates a point source water pollution. A nonpoint source delivers pollutants indirectly through environmental changes. An example of this type of water pollution is when fertilizer from a field is carried into a stream by rain, in the form of run-off which in turn effects aquatic life. The technology exists for point sources of pollution to be monitored and regulated, although political factors may complicate matters. Nonpoint sources are much more difficult to control. Pollution arising from nonpoint sources accounts for a majority of the contaminants in streams and lakes.

http://www.gdrc.org/uem/water/water-pollution.html
Sources of Water Pollution
a)What are the sources of water pollution?
There are many causes for water pollution but two general categories exist: direct and indirect contaminant sources. Direct sources include effluent outfalls from factories, refineries, waste treatment plants etc.. that emit fluids of varying quality directly into urban water supplies. In the United States and other countries, these practices are regulated, although this doesn't mean that pollutants can't be found in these waters.
Indirect sources include contaminants that enter the water supply from soils/groundwater systems and from the atmosphere via rain water. Soils and groundwaters contain the residue of human agricultural practices (fertilizers, pesticides, etc..) and improperly disposed of industrial wastes. Atmospheric contaminants are also derived from human practices (such as gaseous emissions from automobiles, factories and even bakeries).

BACKGROUND INFORMATION ON SOURCES OF CONTAMINANTS

Limestone bedrock
- Hard water- $CaCO_3$ dissolved in water

Other bedrock
- Dissolved mineral material

Volcanic eruptions
- Acid

Agricultural
- Phosphorus from fertilizer
- Pathogens ex e.coli
- Low Dissolved Oxygen / Organic Enrichment
- turbidity of water (suspended load)
- pesticides
- increased salinity

Coal mining
- Acid mine drainage (low pH)

Coal fired power plants
- Acid drainage from coal piles (low pH)
- Higher temperature of water when cooling water released into streams

Metal mining
- Acid mine drainage

Gas stations / garages
- Oil

Municipal sewage treatment plants
- Pathogens, ex e.coli

Increased salinity

Storm water drains
Pathogens, ex e.coli
Increased salinity

Industry
Chemicals: flouride, cyanide, flourene, chlorine, or hydrogen sulfide, metals, mercury
aromatic hydrocarbons, ex PCBs
increased salinity

construction
silt

logging sites
silt

landfills