WATERSHED FIELD GUIDE + WORKBOOK

NAME

CLASS INFORMATION

NORTHEAST OHIO REGIONAL SEWER DISTRICT
STORMWATER/WATERSHEDS EDUCATION :: TENTH-GRADE LEVEL

WATERSHED
FIELD GUIDE +
WORKBOOK

Student safety contract

COMMITMENT TO SAFETY AND INSTRUCTION

Yes, I will...

- ○ Read the lab investigation before coming to class.
- ○ Wear protective equipment as directed to protect my eyes, face, hands and body while conducting activities.
- ○ Follow all instructions given by the instructor.
- ○ Conduct myself in a responsible manner at all times.

I, _____, have read and agree to abide by the safety regulations as set forth above, as well as any printed instructions provided by my instructor or the school district.

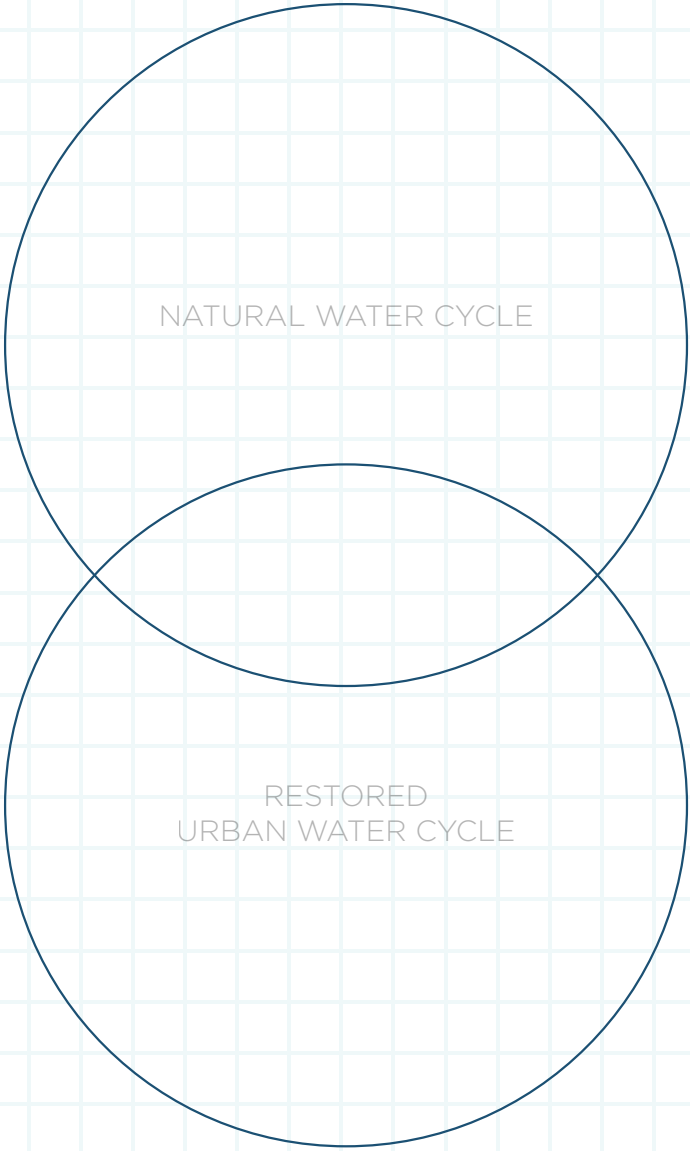
I agree to follow all other written and oral instructions given in class.

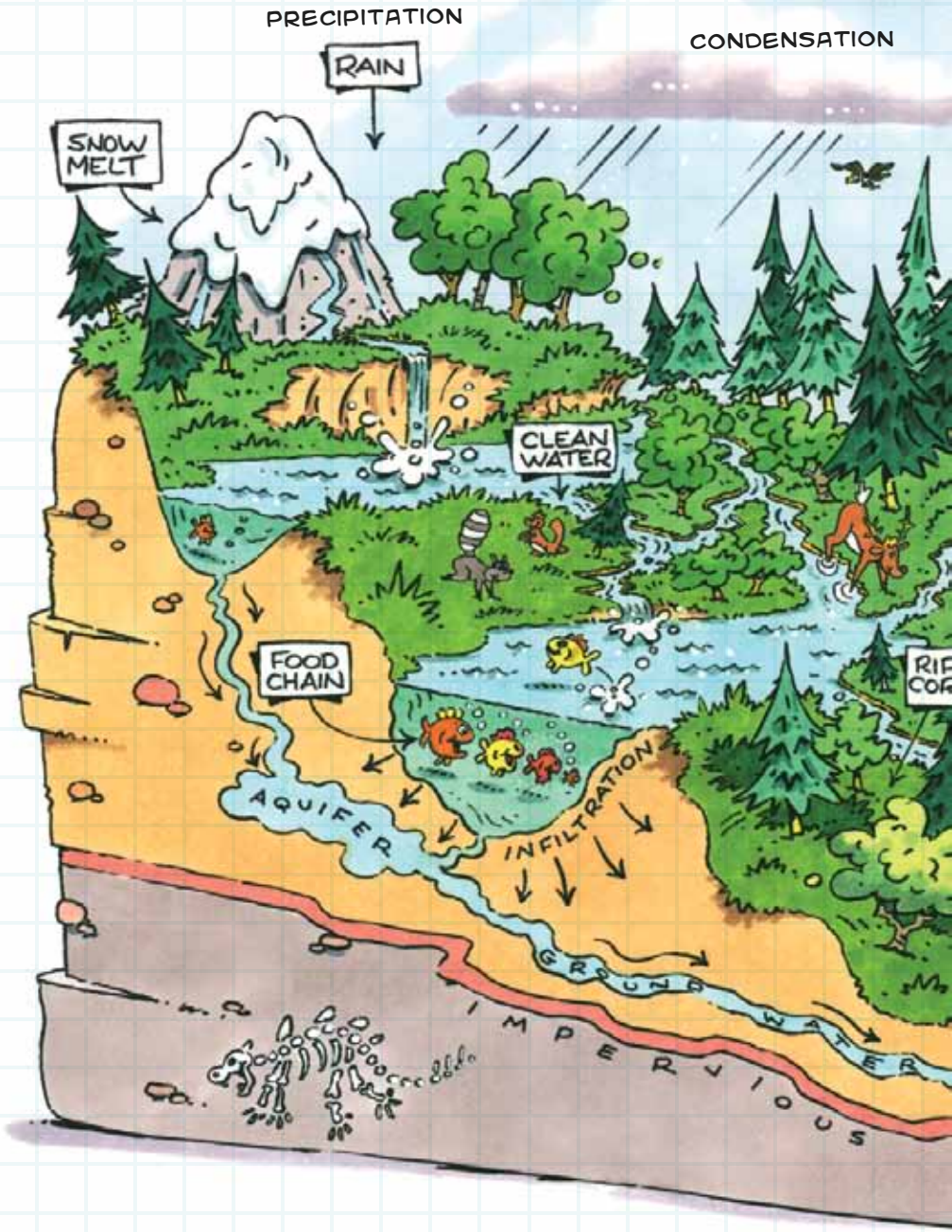
SIGNATURE DATE

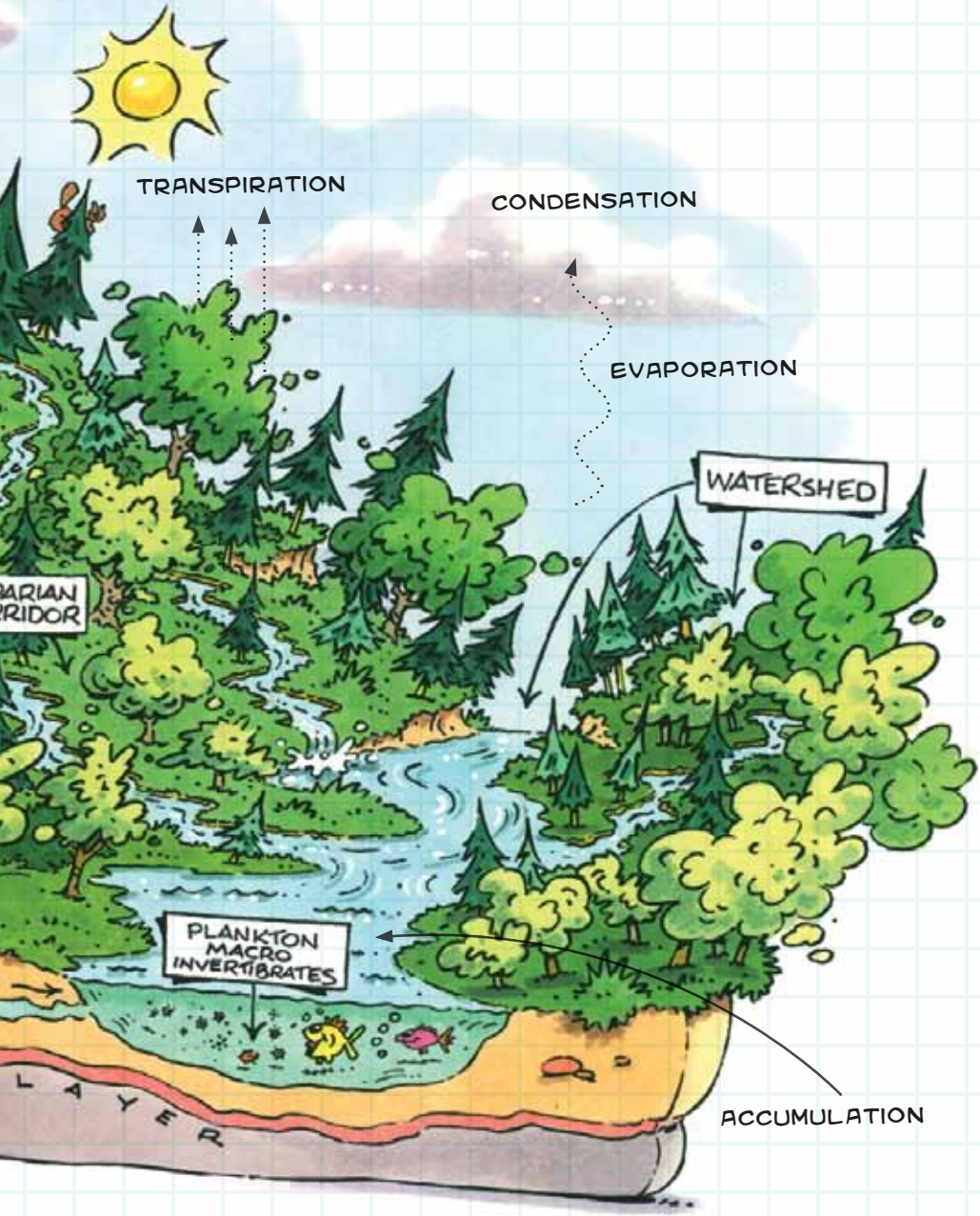
The water cycles

NATURAL WATER CYCLE VS. RESTORED URBAN WATER CYCLE

On the following pages, you will see two illustrations: One of the natural water cycle, and one of an urban water cycle with restored natural elements. Use them to complete the activity below.

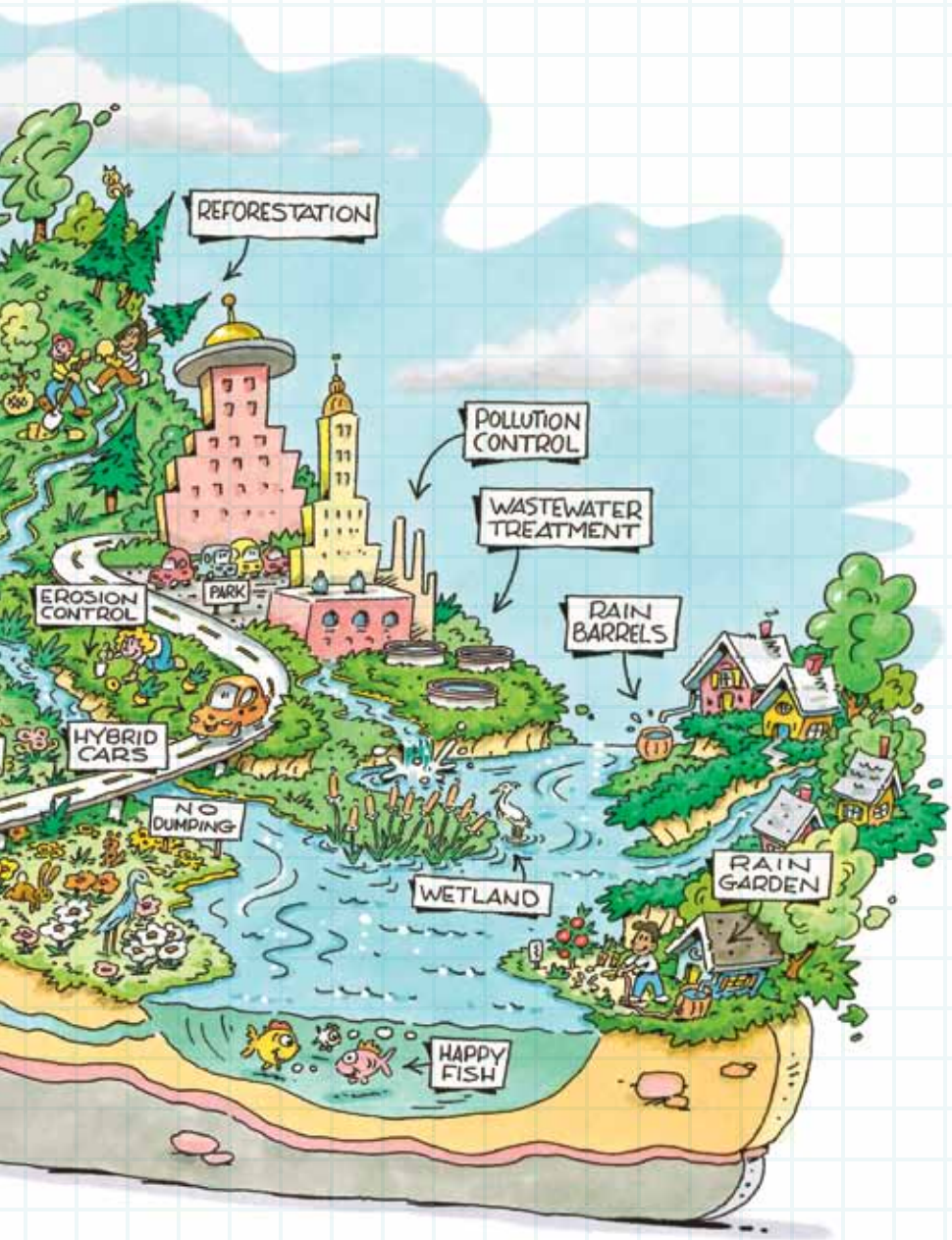



PRECIPITATION
RAIN
CONDENSATION
SNOW MELT
CLEAN WATER
FOOD CHAIN
AQUIFER
INFILTRATION
GROUNDWATER
IMPERVIOUS


TRANSPIRATION
CONDENSATION
EVAPORATION
WATERSHED
PLANKTON
MACRO
INVERTIBRATES
ACCUMULATION
SCHRIER/02

SCHRIER/06'

• RESTORED URBAN WATERSHED •


REFORESTATION
POLLUTION CONTROL
WASTEWATER TREATMENT
PARK
EROSION CONTROL
RAIN BARRELS
HYBRID CARS
NO DUMPING
WETLAND
RAIN GARDEN
HAPPY FISH

What is a watershed?

DEFINING STORMWATER AND WATERSHEDS

Some people say rain, other say rainwater, we say stormwater, and it's more than just rain. **Stormwater is any rainwater or melting snow or ice that flows over the surface of the land to the nearest sewers, lake, or stream.**

Hard surfaces like driveways, roofs, parking lots, and even some lawns pose two stormwater problems: Pollution (like litter, debris, oils, etc. which the stormwater carries to its destination untreated), and increased flow (the water flows quickly and in larger volumes, and that combination can increase flooding and erosion, the washing away of streambank soils).

A watershed is an area of land that drains into a body of water. The largest watershed in Northeast Ohio is Lake Erie. Below is an illustration of a typical watershed.

The water cycle illustrations on the previous pages depict watersheds in which water flows downhill towards the lakes at the bottom of the drawings.

WHY IS IT IMPORTANT?

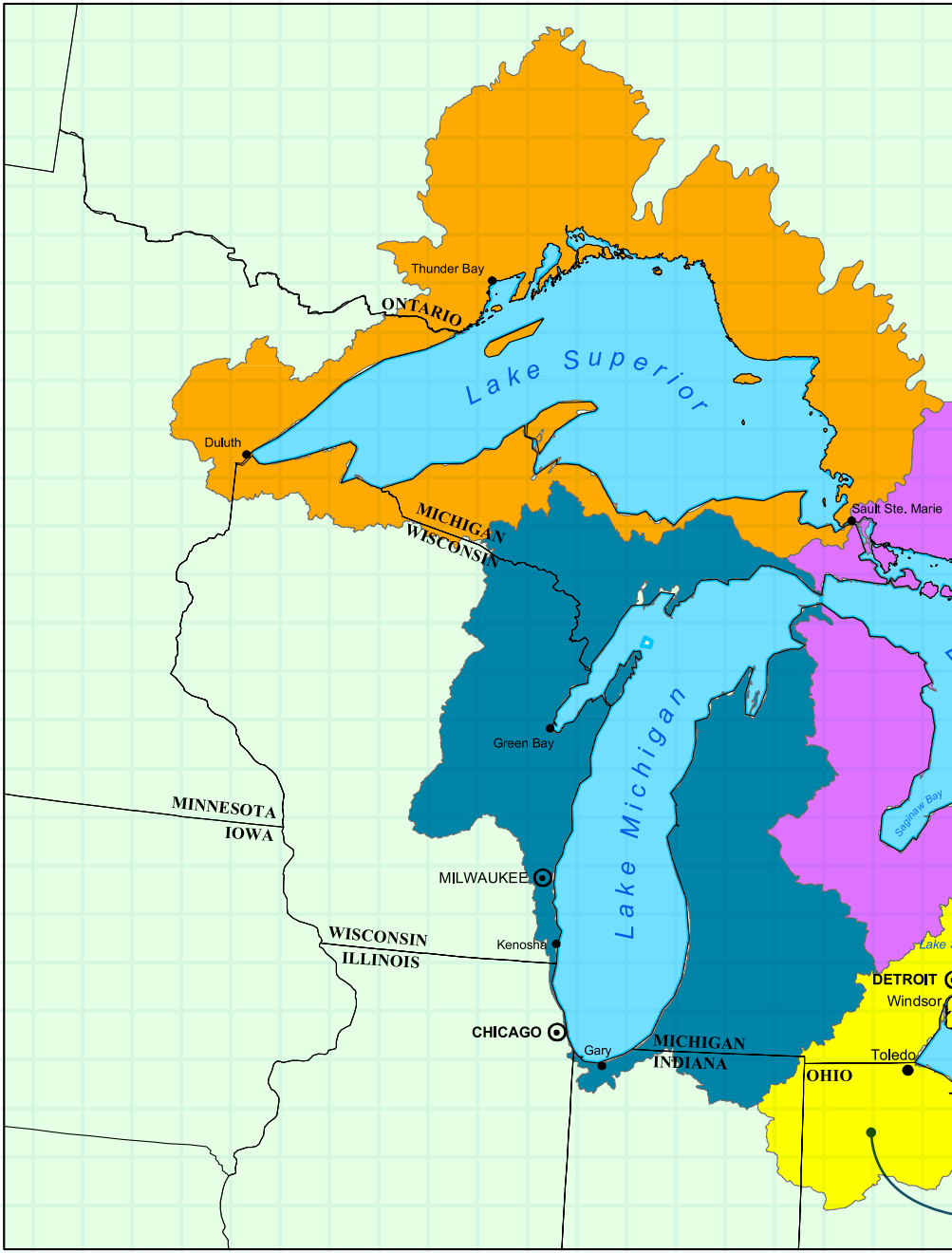
Protecting the Lake Erie watershed and the more than two dozen smaller watersheds that drain into the lake is important to the environment, public health, and the economy of Greater Cleveland.

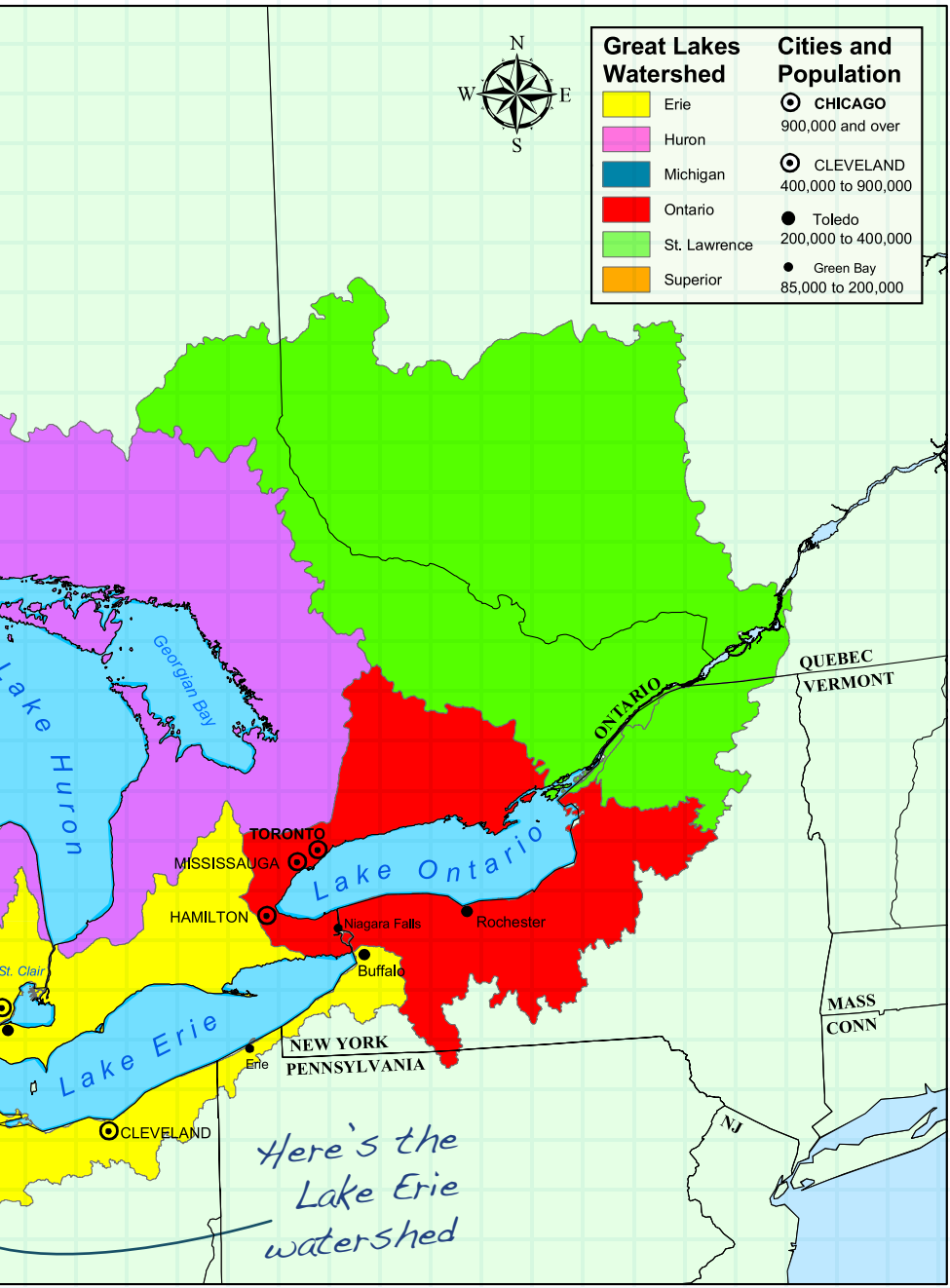
Watershed

BRAINSTORMING AND NOTES

Great Lakes watersheds

OHIO DEPARTMENT OF NATURAL RESOURCES




N
W
E
S
Great Lakes Watershed
Erie
Huron
Michigan
Ontario
St. Lawrence
Superior
Cities and Population
CHICAGO
900,000 and over
CLEVELAND
400,000 to 900,000
Toledo
200,000 to 400,000
Green Bay
85,000 to 200,000
Lake Huron
Georgian Bay
Lake Ontario
Lake Erie
St. Clair
TORONTO
MISSISSAUGA
HAMILTON
Niagara Falls
Rochester
Buffalo
Erie
CLEVELAND
NEW YORK
PENNSYLVANIA
ONTARIO
QUEBEC
VERMONT
MASS
CONN
NJ
Here's the Lake Erie watershed

ACTIVITY: Model watershed

OBJECTIVE

Create a model of a watershed to observe contamination.

MATERIALS

- Basin
- Sponges
- Spray bottle
- Water
- Food coloring
- Foil
- Tape
- Paper towels
- Shallow pan
- Toothpicks
- Variety of materials provided by your teacher

DIRECTIONS:

1. Using what you know about watersheds, create a landscape with the materials provided.

   Your watershed must include:
   - an elevation
   - a basin
   - stream/creek
   - factories
   - buildings
   - farm

2. Once the body of the watershed is complete, spray it with the spray bottle to simulate rain. Observe the patterns of where the rain falls and how it is absorbed or where the runoff flows. **Record your observations:**

3. Dry the model with paper towels. Add food coloring, powders and other items to the watershed to simulate contaminants in the environment. Be creative in your use of materials! For example, the crushed angel hair pasta makes an excellent pile of straw on the farm **Record what "contaminants" you added to the model and what they represent:**

4. Spray the model with the spray bottle again. Observe what happens to the contaminants, the ground water, and the water in the "lake." **Record your observations:**

QUESTIONS

1. Describe the paths of the rain through your watershed.

2. Explain how the buildings and other obstructions affected the path of the water.

3. How does the condition of the lake in your watershed relate to what happens to the Cuyahoga River and Lake Erie?

pH of water

MEASURING ACIDS AND BASES

Acidic and basic are two extremes that describe chemicals, just like hot and cold are two extremes that describe temperature. Mixing acids and bases can cancel out their extreme effects; much like mixing hot and cold water can even out the water temperature. A substance that is neither acidic nor basic is neutral.

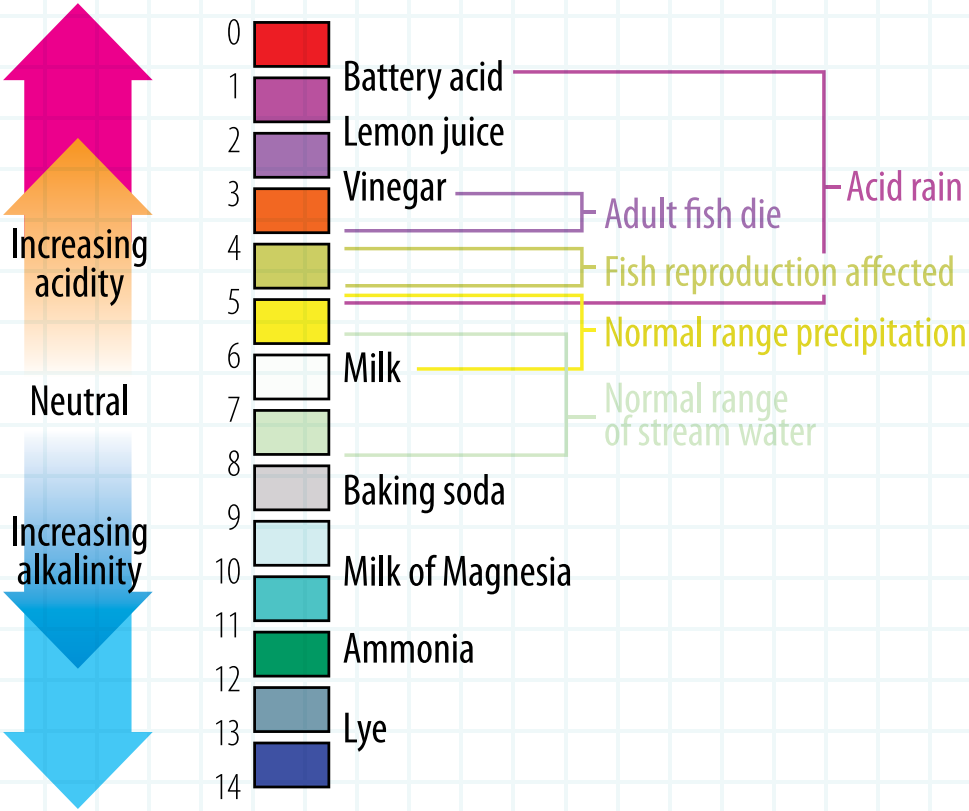
The **pH scale** measures how acidic or basic a substance is. It ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic, and a pH greater than 7 is basic. Each whole pH value below 7 is ten times more acidic than the next higher value. For example, a pH of 4 is ten times more acidic than a pH of 5 and 100 times (10 times 10) more acidic than a pH of 6. The same holds true for pH values above 7, each of which is ten times more alkaline—another way to say basic—than the next lower whole value. For example, a pH of 10 is ten times more alkaline than a pH of 9.

Pure water is neutral, with a pH of 7.0. When chemicals are mixed with water, the mixture can become either acidic or basic. Vinegar and lemon juice are acidic substances, while laundry detergents and ammonia are basic.

Chemicals that are very basic or very acidic are called "reactive." These chemicals can cause severe burns. Automobile battery acid is an acidic chemical that is reactive. Automobile batteries contain a stronger form of some of the same acid that is in acid rain. Household drain cleaners often contain lye, a very alkaline chemical that is reactive.

Shortcut for this info online:
neorsd.org/ph

From the Environmental Protection Agency



pH scale from Northeast Ohio Regional Sewer District

NOTES

ACTIVITY: pH lab

OBJECTIVE

Students will use process skills to predict and determine the pH of common household items

MATERIALS

- Litmus paper
- Styrofoam cups
- Water
- Chemical contaminates provided by your teacher

DIRECTIONS:

1. Obtain materials from your teacher.
2. Label each cup with the “contaminant.”
3. Dissolve some of the contaminant in the water
4. Predict the pH of each item.
5. Dip the litmus paper into the substance and quickly remove.
6. Compare the color of the litmus paper to the pH indicator.
7. Record your findings on the chart on the next page.

SUBSTANCE	PREDICTION: ACID OR BASE?	PREDICTED pH LEVEL	ACTUAL: ACID OR BASE?	pH

QUESTIONS

1. Why do you think bases make good cleaners?

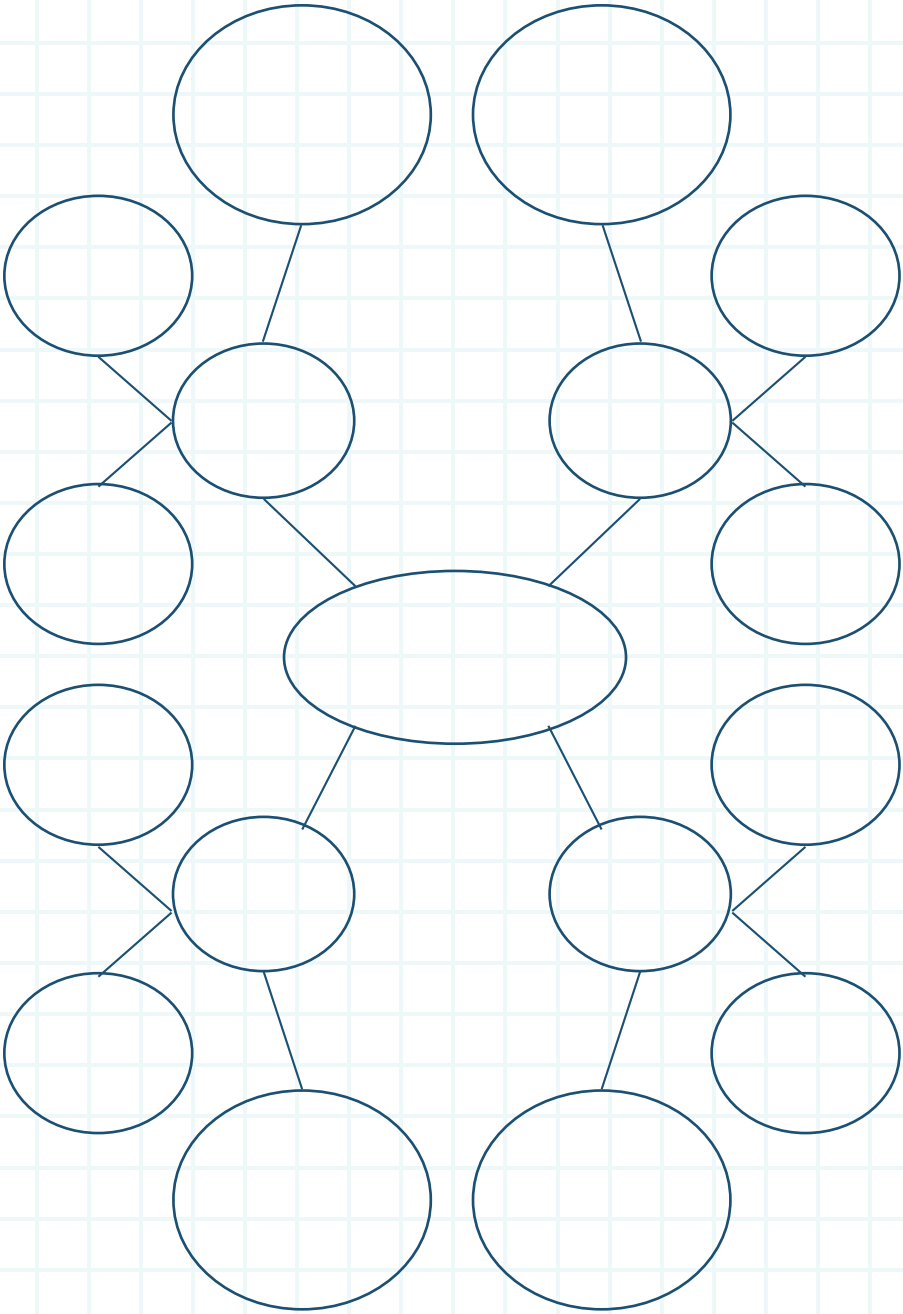
2. Why is it necessary for our bodies to maintain a blood pH as close to 7.0 as possible?

3. What effect do environmental pH changes have on wildlife?

4. Explain which is more detrimental to the environment, acidic or basic pH.

5. What is acid rain? Where does it come from?

Effects of pH and pollution



Letter-writing

FORMATTING AND OUTLINING YOUR IDEAS

ACTIVITY: Cleaning point source pollution

METHODS AND RESULTS

TECHNOLOGY	ORIGINAL CUP, ESTIMATED mL OF OIL	DUMP CUP, % OF OIL REMOVED	OIL SPILLS WHILE CLEANING UP	WATER REMOVED, ESTIMATED mL OF WATER
SPOON				
STRAW				
MEDICINE DROPPER				

ANALYSIS AND CONCLUSIONS

1. Which technology resulted in the most spills during cleanup?

2. Which technology caused the least disturbance of the habitat (removed the least water from the sample)?

3. Which technology would result in the highest fine?

4. Were the three technologies equally effective in helping you remove 50% of the pollution?

5. State a conclusion which relates to your original hypothesis.

The Great Lakes

As the largest freshwater bodies in the world, containing 18 percent of the world's total supply of fresh water, the Great Lakes are a pre-eminent environmental concern. At the time of the first Earth Day, in 1970, it was popular to say that Lake Erie was "dead," especially since the Cuyahoga River—the one that caught fire in Cleveland—drained into it.

Today the level of the Great Lakes is about 18 inches below average—the result of several years of below-average rainfall and snowfall in the region. While the Great Lakes continue to face significant environmental challenges, there are, as with the Chesapeake Bay, many signs of significant progress. The EPA has developed a framework for tracking conditions and trends in the Great Lakes with more than 100 indicators, although many of these lack adequate data for drawing firm conclusions.

The annual report State of the Great Lakes nonetheless provides a wealth of data enabling policymakers to identify areas of progress and the conditions that remain problematic.[17] Among the highlights of the EPA's State of the Great Lakes draft report for 2009 (the most recent one available):

- The overall quality of the finished drinking water in the Great Lakes basin can be considered good. The potential risk of human exposure to the noted chemical and/or microbiological contents, and any associated health effect, is generally low.

- The EPA judges several indicators of benthic conditions to be "mixed" and/or "deteriorating," chiefly because of low or declining numbers of proxies such as Diporeia (a macro-invertebrate that looks like a

tiny shrimp) and Aquatic Oligochaetes (a species of freshwater worm).

- Levels of phosphorus runoff have been flat or declining slowly in most of the Great Lakes, though the runoff into Lake Ontario—the lake with the highest levels in 1970—has declined more than 75 percent.

- Populations of salmon and trout have increased more than tenfold since the mid-1960s; meanwhile, contaminants in Great Lakes fish have fallen to levels such that the fish are safe for eating most of the time. As recently as the late 1980s, contaminant levels were such that advisories against eating any fish were in widespread effect. Since the early 1980s levels of dioxin related compounds have fallen more than 90 percent in most waters of the Great Lakes, though some local areas of elevated levels remain. The EPA judges the level of contaminants in the Great Lakes fish population to be "improving."

- Heavy metal and toxic chemical concentrations have been monitored in lakebed sediments, bird eggs, multiple species of fish, and even snapping turtle eggs. Table 1 displays the declines detected in lakebed sediment samples in two survey periods: 1968–1972 and 1997–2002. DDT and its breakdown compounds such as DDE cause some birds, including bald eagles and herring gulls, to lay eggs with abnormally thin shells, which hinders reproduction.

- Trends in bird populations are decidedly mixed. Out of 18 species of wetland birds such as terns, wrens, and blackbirds, only six are experiencing increases in population, while the rest are deteriorating. However, populations of bald eagles, osprey, and cormorants have seen major rebounds. Figure 31 displays the growth in the population of nesting double-crested cormorants in Lake Ontario. In a release titled "Winning the War on Contaminants," Environment Canada (Canada's EPA) comments: "The cormorant

> disappeared as a nesting bird on Lakes Michigan and Superior and only about 10 pairs remained on Lake Ontario. From 1973 to 1993, however, the cormorant population increased over 300-fold to more than 38,000 pairs. The cormorant is now more numerous on the Great Lakes than at any time in its previously recorded history."[18]

The Great Lakes now serve as an example of how the ecological balance can be disrupted less as a byproduct of industrial and agricultural activity and more as a byproduct of our interconnected world. The most significant threat to the ecological balance of the Great Lakes no longer comes mainly from industrial pollution or toxics, but from biological imbalances. The proliferation of zebra mussels, a non-native species that has entered the Great Lakes region chiefly in the ballast water of cargo ships, currently presents one of the more significant environmental challenges for the Great Lakes. The zebra mussel is only one of more than a hundred non-native or "exotic" species now found in the Great Lakes.

These exotic species crowd out habitat of indigenous species. Yet the Great Lakes Initiative and many environmental activists continue their crusade against chlorine and other synthetic chemicals that no longer pose a serious threat. Professor Bill Cooper of Michigan State University comments: "If one wished to allocate scarce monetary and human resources so as to maximize the reduction in ecological risk per unit of resource expended, one would do more good by regulating and/or limiting the introduction of exotics

than by obtaining marginal reductions in trace levels of existing toxicants." Michigan and other states have developed aquatic nuisance management plans, and ships transiting the Great Lakes now face a bevy of requirements designed to eliminate the discharge of biologically contaminated water.

Yelling “fire” in a Crowded River

THE CUYAHOGA STORY

2011 Almanac of Environmental Trends (Steven F. Hayward)

The Cuyahoga River fire continues to be a prominent and compelling image of man’s relationship to the natural environment. Immortalized in song (Randy Newman’s “Burn On” and R.E.M’s “Cuyahoga”), and fodder for countless Cleveland-bashing jokes from standup comics, the incongruously short-lived fire (it was put out in about 20 minutes, causing a mere $50,000 in damage to a railroad trestle) burns on in memory.

“You would think that people would forget about it after all this time—but no,” Jim White, executive director of the Cuyahoga River Community Planning Organization, told the Cleveland Plain Dealer. “I had a visitor here from Russia recently and the first thing he wanted to see was where the river burned.”

Much of what we think we know about the Cuyahoga River fire is myth, as Jonathan Alder noted in the most detailed scholarly survey of the episode, and the deeper story about the Cuyahoga offers important lessons about familiar patterns of environmental thought that need revising to meet new circumstances. “The conventional narratives, of a river abandoned by its local community, of water pollution at its zenith, of conventional legal doctrines impotent in the face of environmental harms, and of a beneficent federal government rushing in to save the day, is misleading in many respects,” Adler wrote in “Fables of the Cuyahoga.” “For northeast Ohio, and indeed for many industrialized areas, burning rivers

were nothing new, and the 1969 fire was less severe than prior Cuyahoga conflagrations. It was a little fire on a long-polluted river already embarked on the road to recovery."

The Cuyahoga and other rivers had experienced more severe fires repeatedly over the decades stretching back into the 19th century; indeed, a 1936 fire on the Cuyahoga River burned for five days. Over in Chicago, waste from the meatpacking industry so fouled an urban arm of the Chicago River that it became known as "Bubbly Creek." Upton Sinclair memorialized it in his muckraking expose of the meatpacking industry, The Jungle:

> "Bubbly Creek" is an arm of the Chicago River, and forms the southern boundary of the yards: all the drainage of the square mile of packing houses empties into it, so that it is really a great open sewer a hundred or two feet wide. One long arm of it is blind, and the filth stays there forever and a day. The grease and chemicals that are poured into it undergo all sorts of strange transformations, which are the cause of its name; it is constantly in motion, as if huge fish were feeding in it, or great leviathans disporting themselves in its depths. Bubbles of carbonic acid gas will rise to the surface and burst, and make rings two or three feet wide. Here and there the grease and filth have caked solid, and the creek looks like a bed of lava; chickens walk about on it, feeding, and many times an unwary stranger has started to stroll across, and vanished temporarily. The packers used to leave

> the creek that way, till every now and then the surface would catch on fire and burn furiously, and the fire department would have to come and put it out.

By 1969 local efforts to improve water quality in Cleveland were starting to make headway, but they were ironically impeded by bureaucratic red tape. As Adler explained: Cleveland had embarked on a long and costly cleanup effort before the Cuyahoga became a national symbol. Subsequent federal efforts received more attention—and far more credit—but it appears the tide was turning well before Congress enacted the 1972 Clean Water Act. One problem Cleveland faced was that the Cuyahoga was treated as an industrial stream, and state permits inhibited local cleanup efforts. Public nuisance actions and enforcement of local pollution ordinances, in particular, were precluded by state regulation, while federal laws protecting commercially navigable waterways went largely unenforced. Local efforts to reverse the Cuyahoga's pollution prior to the 1969 fire included a $100 million bond issue to finance river cleanup, litigation against polluters, and greater enforcement of state water pollution control statutes—measures that received much of their support from the Cleveland business community. The federal government provided "not one dime" of assistance, despite the Cuyahoga's role as one of the main polluters of Lake Erie, a major interstate body of water. Cleveland had also enacted one of the toughest local air pollution laws before the federal Clean Air Act.

The Cuyahoga River fire of 1969, along with the contemporaneous Santa Barbara oil spill, is said to have been an impetus behind the passage of the federal Clean Water Act and other landmark

legislation near the time of the first Earth Day—legislation widely considered to mark the beginning of serious efforts to clean up our air, water, and other resources. As Adler shows, this conventional narrative has numerous defects, omissions, and counter-intuitive conclusions—points that other scholars have amplified in recent years. The enhanced federal role in environmental protection and the founding of the EPA in 1970 are certainly important and have had large positive effects, but a balanced view will keep in mind additional dynamic factors in the story—especially whether the top-down model of the 1970s should still be the default model for environmental protection in the 21st century.

Meanwhile, how is the Cuyahoga River doing 40 years later? The Cleveland Plain Dealer reports that when the Ohio state EPA began assessing fish populations in the Akron-to-Cleveland stretch of the Cuyahoga in the 1980s, their field biologists would often come back with a count of 10 fish or less. Not 10 species, but 10 actual fish total. But when biologists visited the same stretch last summer, they found 40 different species now thriving in the Cuyahoga, including steelhead trout and northern pike. Steve Tuckerman of the Ohio state EPA told The Plain Dealer: "It's been an absolutely amazing recovery. I wouldn't have believed that this section of the river would have this dramatic of a turnaround in my career, but it has."

Indeed, the Cuyahoga is expected this year to meet the Federal Clean Water Act's stringent standard for healthy habitat for aquatic life. Quite a contrast from the early years after the 1969 fire, when a federal report found that "the lower Cuyahoga has no visible signs of life, not even low forms such as leeches and sludge worms that usually thrive on wastes."

Toxic chemicals in the Cuyahoga is focus of environment group on World Water Day

BY MICHAEL SCOTT, THE PLAIN DEALER

Published: Thursday, March 22, 2012
Reproduced from http://cleveland.com

CLEVELAND, Ohio—Today is World Water Day, a day marked first by the United Nations in 1993 to focus international attention on water issues.

Worldwide, that focus is mostly on bringing clean water and sanitation to countries and people suffering from a lack of one or both.

Statistics show that about 783 million people—nearly 100 times the population of New York City—still lack access to improved sources of safe drinking water and more than 40 percent live in Sub-Saharan Africa, according to the Huffington Post.

Locally, environmental groups are still drawing attention to the pollution going into the Cuyahoga and other rivers and Lake Erie.

Environment Ohio, a statewide nonprofit advocacy group, today released a report that says some 9 million pounds of toxic chemicals are still dumped into Northeast Ohio waterways alone, despite improvements in the 40 years since the federal Clean Water Act was first approved by Congress.

The report, "Wasting Our Waterways: Industrial Toxic Pollution and the Unfulfilled Promise of the Clean

Water Act," also reports that 226 million pounds of toxic chemicals were discharged into 1,400 waterways across the country.

"Ohio's waterways are a polluter's paradise right now. Polluters dump 9 million pounds of toxic chemicals into Ohio's lakes, rivers and streams every year," Sarah Hyman of Environment Ohio said in a statement. "We must turn the tide of toxic pollution by restoring Clean Water Act protections to our waterways."

The environment group drew its statistics from the U.S. EPA's Toxics Release Inventory for 2010, the most recent data available.

"Our city and region's biggest asset is Lake Erie and its tributaries," said Cleveland City Councilman Brian Cummins of Ward 14. "Water quality is critical to the health of the lake and our waterways and, although much progress has been made, there is still a lot to be done in enforcing and strengthening our existing laws."

Other findings in the report:

- Industrial facilities discharged about 3,700 pounds of chemicals linked to developmental disorders and reproductive problems into the Cuyahoga River.

- The Ohio River is ranked first in the nation for highest amount of total toxic discharges, with 32 million pounds discharged in 2010.

"As community leaders we must work to protect and improve the quality of life of our residents," said Cuyahoga County Councilwoman Sunny Simon of

District 11. “In order to address quality of life issues, we must take action to protect our environment, including our waterways and natural spaces. Based upon the findings in the new report, it is critical that we take decisive action now.”

Environment Ohio used the report to advocate for pollution prevention, calling on industry to switch from hazardous chemicals to safer alternatives, or the Obama administration to finalize guidelines and conduct a rulemaking to clarify that the Clean Water Act applies to all of waterways and for tougher EPA rules on water quality.

“We need the Clean Water Act to protect every stream and every body of water, no matter how small or how far from the river, lake or ocean,” said Jane Goodman, Executive Director of the Cuyahoga River Community Planning Organization. “Healthy waters are always on the move, and our efforts to protect them need to keep moving forward, not backward.”

Glossary

TERMS FROM YOUR FIELD NOTEBOOK AND FOR CLASS DISCUSSION

A

Abiotic: Not associated with or derived from living organisms. Abiotic factors in an environment include such items as sunlight, temperature, wind patterns, and precipitation.

Atmosphere: the gaseous envelope surrounding the earth; the air.

B

Biotic:
1. Consisting of living organisms. An ecosystem is made up of a biotic community (all of the naturally occurring organisms within the system) together with the physical environment.

2. Associated with or derived from living organisms. The biotic factors in an environment include the organisms themselves as well as such items as predation, competition for food resources, and symbiotic relationships

C

Capillary action: Movement of water through very small spaces due to molecular forces called capillary forces.

Collection: Water that is sent to the water treatment system begins in collection.

Combined sewer overflow: Discharge of a mixture of storm water and domestic waste when the flow capacity of a sewer system is exceeded during rainstorms.

Condensation: The conversion of a gas to a liquid.

Condensation: When a gas turns into a liquid.

Conservation:
1. Protection of valued resources the prevention the management and care of natural resources.

2. Protection from change, the keeping or protecting of something from change, loss or damage.

Cuyahoga River: Located in Northeast Ohio in the United States. Outside of Ohio, the river is most famous for being "the river that caught fire" in 1969, helping to spur the environmental movement in the late 1960s and early 1970s. Native Americans called this winding water "Cuyahoga," which means "crooked river" in the Iroquois language.

Cycle(s)
1. Repeated sequence of events
2. Time between events
3. Complete process

E

Ecology: dealing with the relations and interactions between organisms and their environment, including other organisms.

Environment: all the external factors influencing the life and activities of people, plants, and animals.

Erosion: the process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves, etc.

Evaporation: the process by which water is changed to gas or vapor; occurs directly from water surfaces and from the soil.

F

Filtration: Process by which water seeps into to ground.

Freshwater lakes: Naturally occurring water on the Earth's surface in ice sheets, ice caps, glaciers, bogs, ponds, lakes, rivers and streams, and underground as groundwater in aquifers and underground streams.

Freshwater: water found in rivers, lakes under the ground; fresh water is not salty and it is good to drink.

G

Gas: Matter that is neither liquid nor solid and expands or contracts rapidly and uniformly with temperature changes.

Glaciers: a large body of ice moving slowly down a slope or valley or spreading outward on a land surface.

Great Lakes: A group of five freshwater lakes of central North America between the United States and Canada, including Lakes Superior, Huron, Erie, Ontario, and Michigan. French traders first sighted the lakes in the early 17th century. Today the Great Lakes connect Midwestern ports with the Atlantic Ocean via the St. Lawrence Seaway.

Green infrastructure: Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to storm water management systems that mimic nature by soaking up and storing water.

Groundwater: The water beneath the surface of the ground, consisting largely of surface water that has seeped down: the source of water in springs and wells.

I

Ice Caps: An extensive dome-shaped or plate like perennial cover of ice and snow that spreads out from a center and covers a large area, especially of land.

Impervious: Not permitting penetration or passage, impenetrable.

Infiltration:
1. The penetration of water through the ground surface into sub-surface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

2. The technique of applying large volumes of waste water to land to penetrate the surface and percolate through the underlying soil.

Investigation: A thorough inquiry intended to develop facts.

L

Lake: A body of fresh or salt water of considerable size, surrounded by land.

Lake Erie: forms Cleveland's northern boundary and is the most shallow and the southernmost of the five Great Lakes. A freshwater lake that provides transportation, employment, food, and recreation to residents of and visitors to Northeast Ohio.

Lake level: a measurement of the depth of water .

Liquid: Consisting of molecules that move easily, unlike those of a solid, but tend not to separate, as do those of a gas.

M

Matter: anything that has mass and takes up space.

N

Natural environment: Encompasses all living and non-living things occurring naturally on earth.

Natural resource: a naturally occurring material, e.g. coal or wood that can be exploited by people

Nonpoint sources: When rain and melting snow flow over the land, pollutants are picked up and carried away to Lake Erie via local streams and storm sewers. This run-off is called non-point source pollution because it enters our streams and storm sewers, not from a single, identifiable source, but from numerous sources spread over a large area.

Non-porous: not permeable to water, air, or other fluids. Not porous; especially not having vessels that appear as pores

P

Pervious: porous, penetrable

Pervious surface: designed to allow infiltration of stormwater through the surface into the soil below where the water is naturally filtered and pollutants are removed. Pervious pavement may include paving blocks, grid pervious concrete, or pervious asphalt pavers,.

pH: Measures the acidity of a solution. It is the negative log of the concentration of the hydrogen ions in a substance.

Point sources: water pollution coming from a single point, such as a sewage-outflow pipe.

Pollutants: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pond: a body of water smaller than a lake, sometimes artificially formed, as by damming a stream.

Porous:
1. Full of or having pores;

2. Admitting the passage of gas or liquid through pores or interstices; and 3. Easily crossed or penetrated.

Precipitation: Liquid or solid water that falls to earth.

R

Recycle: to pass again through a series of changes or treatments.

Reservoir: A place where water is stored.

River: A large natural stream of water of fairly large size flowing in a definite course or channels or series of diverging and converging channels.

Runoff: that part of precipitation or snowmelt that appears in streams or surface-water bodies.

S

Saltwater: Water containing a large amount of salt, seawater.

Sanitary sewer: Relating to public health, especially general hygiene and the removal of human waste through the sewage system

Saturation: A state in which something is completely soaked with liquid (water)

Seas: The salt waters that cover the greater part of the earth's surface.

Sedimentation: The deposition or accumulation of sediments

Slope: To incline or slant upwards or downwards, as a hill.

Soil: The uppermost layer of the earth's surface; dirt.

Storm sewer: A sewer for carrying off rainfall drained from paved surfaces, roofs, etc.

Stormwater: any rainwater or melting snow or ice that flows over the surface of the land to the nearest sewers, lake or stream.

Stream: a steady current in water flowing in a channel or watercourse.

Surface water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.)

T

Topographic maps: a map showing the relief features of the earth's surface, usu. by means of contour lines to show changes in elevation

Transpiration: to give off wastes from the surface in the form of vapor, as plants.

Tributary: a stream that flows to a large stream or other body of water.

Tributaries: The plural form of tributary.

W

Water cycle: The continuous movement of water on, above and below the surface of the Earth, including precipitation, condensation/transpiration, evaporation and collection.

Water pollution: The addition of harmful chemicals to natural water. Sources of water pollution in the United States include industrial waste, run-off from fields treated with chemical fertilizers, and run-off from areas that have been mined.

Watershed: The area of land that drains into a body of water.

Water table: The planar, underground surface beneath which Earth materials, as soil or rock, are saturated with water.

Wastewater: The sanitary sewage from homes and businesses as well as stormwater that enters the street sewers, streams and rivers.

Wetland: A marsh, swamp, or other area of land where the soil near the surface is saturated or covered with water, especially one that forms a habitat for wildlife.

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