OUR WATERS

The waters of Southeastern Wisconsin are vast but vulnerable.
We depend on our waters for drinking water, irrigation, industry, transportation, power production, recreation and scenic beauty.
Understanding our region's water-related issues and future challenges can help us protect clean, abundant water for generations to come.

Beach Water Quality

Water quality impacts our region's fishing and swimming, tourism and industry, public health and ecosystem health. Water quality gains more attention during summer, when it determines if locals and tourists can swim at regional beaches.

Health departments monitor beach water and post advisories or closings if swimming could pose a health risk. *E. coli* bacteria is used as the main indicator of health risks, although the strains common on beaches (unlike those that cause food poisoning) rarely sicken swimmers. *E. coli* is useful because since it is found in human and animal waste, high levels indicate the presence of other organisms associated with fecal contamination, some of which can cause illness.

The bacteria and other pollutants that affect our water quality come from a variety of sources.

Regional Pollution Sources

Stormwater

Stormwater is runoff from rainfall or melting snow that can flow over land surfaces or through storm drains to streams and beaches. Excess stormwater can lead to combined sewer overflows.

Urban Runoff

Stormwater or other runoff flowing over urban lands, such as roadways and parking lots, can carry garbage, oil, road salts, and other contaminants to local waters.

Agricultural Runoff

Stormwater or irrigation runoff flowing over agricultural lands, such as fields and animal feedlots, can carry fertilizers, pesticides, sediments and animal wastes into surface waters.

Animal Waste

Droppings from gulls, other wildlife and pets can be washed into surface waters with stormwater and other runoff.

Sewer Overflows

Overflows can discharge partially treated or untreated sewage (from sanitary sewers) or sewage and stormwater (from combined sewers) into surface waters. Overflows may result from system failures or extreme weather.

Southeastern Wisconsin Beaches

Fact or Fiction

- ✗ Beach advisories and closings are primarily caused by sewer overflows.
- ✓ Gulls, stormwater outfalls and runoff are the main pollution sources at many local beaches.
- ✗ Beach advisories in Chicago are connected to sewer overflows in Milwaukee.
- ✓ Beach advisories are based on levels of *E. coli*, which survives poorly in open water, so Milwaukee sources are not related to *E. coli* in Chicago.
- ✗ There are more beach advisories in recent years because regional water quality has declined.
- ✓ There are more advisories because monitoring increased when BEACH Act programs began in 2003, and because of annual variation in rainfall events that cause runoff.
- ✗ Beach advisories show that Lake Michigan is generally polluted.
- ✓ Beach advisories result mainly from local pollution sources and do not reflect Lake Michigan's overall water quality.

Beach Water Quality

Algae Trouble

Cladophora, a wispy green algae that some mistake for sewage sludge when it washes ashore, first plagued the Great Lakes 50 years ago. Then, excessive growth was "fertilized" by phosphorous pollution. With phosphate-free detergents and improved sewage treatment and agricultural practices, the algae growth declined.

In the past decade, the Cladophora problem has resurged. Today it is harder to explain because phosphorous levels in most Great Lakes water meet quality standards.

Scientists are investigating the algae's relationship to nutrient cycles, changing climates, and invasive mussels. One theory is that since mussels filter the lake and increase water clarity, more sunlight can reach Cladophora and fuel its growth. Researchers are also exploring prediction and clean up of the problem algae.

Key Legislation

Great Lakes Water Quality Agreement (1972)

This agreement established common U.S. and Canadian goals for Great Lakes resources. The countries agreed to control pollution, research and monitor lake health and work toward ecosystem restoration.

Clean Water Act (1972)

This major federal water quality legislation requires the Environmental Protection Agency (EPA) to establish water pollution limits and regulate pollutants (chemical, biological, sewage, dirt, heat and trash) with permits. In Wisconsin, the EPA delegated administration of the Act to the DNR.

Coastal Non-point Pollution Control Program (1990)

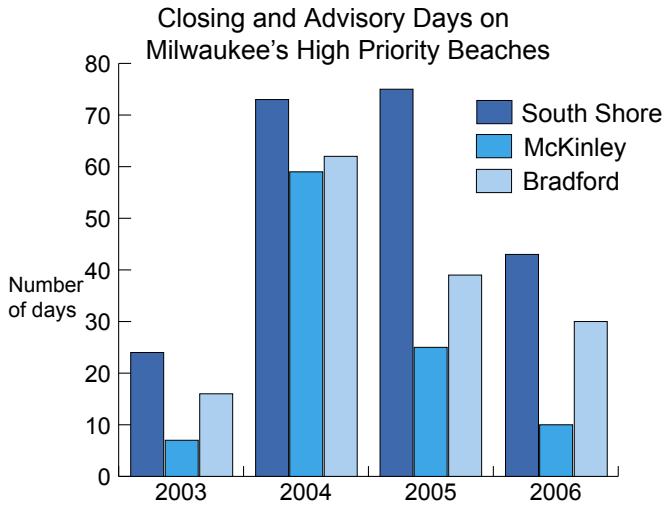
Requires 34 states to develop management programs for coastal non-point pollution. Wisconsin's program was initially accepted conditionally. Now, after changes to animal lot runoff and nutrient management plans, Wisconsin meets all federal requirements.

BEACH Act (2000)

This amendment to the Clean Water Act requires the EPA to reduce the risk of illness from recreational waters. States with coastal and Great Lakes beaches must adopt water quality standards and monitor beach water for health risks. Wisconsin's monitoring program (funded by the EPA and the DNR) is being expanded to inland recreational beaches.

Wisconsin's Monitoring Program

Wisconsin monitors water quality at 113 of 190 public Great Lakes beaches, as well as beaches at inland state parks. High priority beaches - those that are popular and at risk for water quality problems - are tested most frequently, at least five times per week.



Sources: "Beach Advisory and Closing Online Notification," U.S. EPA, at http://oaspub.epa.gov/beacon/beacon_national_page.main. "Wisconsin Beach Health Home Page," at http://www.wibeaches.us.

From Memorial Day to Labor Day, city and county health officials collect beach water samples from shallow water. They post advisories based on *E. coli* tests of the samples or when rain, algae buildup or pollution events predict health and safety hazards.

The EPA recommends that health officials post advisories and closings at certain *E. coli* levels. These are based on swimmers' risks of developing stomach illnesses. Bacteria levels are measured in colony forming units, or CFU's, of bacteria per 100 milliliter (mL) water sample.

Advisory signs are posted when bacteria levels reach 235 CFU/100mL

Closing signs are posted when bacteria levels reach 1000 CFU/100mL

Identifying Beach Bacteria Sources

Great Lakes WATER Institute scientist Sandra McLellan is working to identify sources of *E. coli* on Southeastern Wisconsin beaches. This will help focus regional efforts to improve surface water quality and reduce the number of beach advisories.

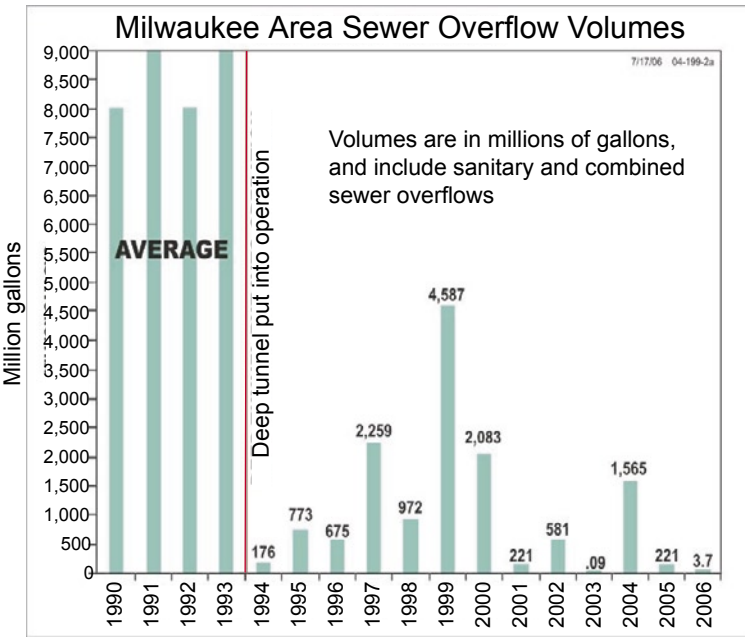
Her research suggests most bacteria that triggers beach advisories and closings is from local sources such as gulls, stormwater outfalls and runoff (from parking lots and urban areas) - not regional sources such as sewer overflows.

McLellan tested water at South Shore Beach (which has the most water quality advisories in the area) for several years, and found a correlation between gull populations, stormwater discharge to the area and high *E. coli* levels.

Scientists in McLellan's lab also use DNA-based methods to trace sources of beach bacteria. With genetic analysis they can detect bacteria specific to humans, which could indicate sewage contamination, at beach sites. The laboratory is developing genetic markers to detect other bacteria sources, such as gull waste. Genetic tests complement other approaches such as spatial sampling and testing for antibiotic resistance of beach *E. coli*.

Since humans are exposed to antibiotics they often harbor bacteria that resist the drugs. This makes human *E. coli* from sewer overflows more likely to survive antibiotic exposure (more "resistant") than *E. coli* from other sources, such as wildlife that are not exposed to antibiotics.

McLellan has found contamination at most regional beaches is not linked to sewage. Future work in her laboratory will determine if there are health risks associated with beach bacteria from other sources, such as animal waste.



Source: Milwaukee Metropolitan Sewerage District numbers reported to Wisconsin DNR.

Despite this scientific evidence that gulls, stormwater and runoff threaten beach water quality, there is a misperception in the media and the public that sewer overflows are to blame.

Downtown Milwaukee has a combined sewer system that carries both stormwater and sewage to treatment facilities. In past decades, overflows were common when rainfall caused stormwater to exceed the sewer's capacity. Since Milwaukee Metropolitan Sewerage District's (MMSD's) deep tunnel project expanded sewer storage capacity, rainfall rarely causes overflows.

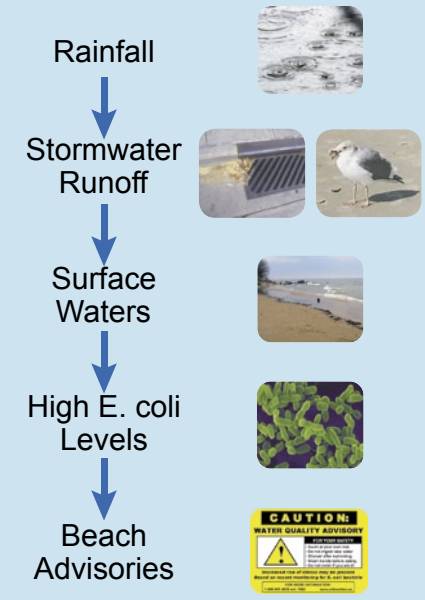
Drawbacks of current beach monitoring:

- *E. coli* tests take 18-24 hours to process, so advisories reflect "yesterday's" bacteria levels.
- *E. coli* is not an effective indicator of regional water quality because it does not survive in open waters of Lake Michigan.

Goals for improved beach monitoring:

- Health officials will continue to use sensitive models to predict *E. coli* levels.
- Scientists and health officials are working to develop more immediate indicators of beach water quality, including predicting health risks based on rain and pollution events or algae buildup.
- New research is also underway to map the flow of runoff through Milwaukee's harbor and Lake Michigan to help us understand its effects on regional water quality.

Typical Beach Pollution Chain of Events in Southeastern Wisconsin



Non-point Source Pollution

Many threats to regional beach health - and to water quality nationwide - are classified as non-point pollution. A 2000 EPA report describes non-point sources of pollution as the greatest threat to the nation's water quality. Managing non-point pollution is a challenge because of the variety and widespread nature of its sources.

Non-point pollution originates from a wide area, not a specific source or "point." It occurs when rain, snowmelt, or irrigation flows over land as runoff, and carries sediment, nutrients and toxins from urban, industrial and agricultural activities into waters.

Reducing Regional Non-point Pollution

Green roofs are created by converting flat rooftops to garden space to absorb urban rainfall and reduce runoff from rooftops. Green roofs also conserve energy - they absorb heat during the day, helping cool the building below.


Photo: GLWI

Green roofs are growing in Milwaukee - this one is at the Great Lakes WATER Institute.

Wet detention basins are permanent pools designed to collect, treat and release stormwater runoff. They effectively reduce non-point pollution at construction sites, urban areas, and some agricultural areas.


Photo: Center for Watershed Protection

Porous pavement lets rainfall seep underground through parking lots, streets, and driveways, reducing stormwater runoff.

A **buffer strip** is an area of dense, grassy vegetation that slows runoff and traps sediment. Buffer strips can control erosion at construction sites and reduce non-point pollution of surface waters in agricultural and urban areas.


Photo: Wisconsin DNR

A buffer strip protects a rural stream.

An **infiltration basin** is an open basin, or series of basins, with a flat, vegetated floor that collects runoff or stormwater. These basins let runoff slowly infiltrate the ground, decreasing non-point pollution of waterways and increasing ground water recharge. Some can be used as recreational areas when dry.


Photo: Wisconsin DNR

Rain gardens are planted in low-lying or wet areas to absorb rainfall and reduce runoff. Homeowners can plant rain gardens to catch runoff from rooftops or paved areas and help it infiltrate underground instead of flowing to stormwater drains and waterways.


Photo: Wisconsin DNR

Native plants like prairie flowers and grasses are ideal for rain gardens, green roofs and buffer strips. They require less maintenance and have deep roots that create pathways for water to seep underground.

"Our Waters" fact sheets are published by the University of Wisconsin-Milwaukee and the Great Lakes WATER Institute with support from the Brico Fund.

Find more information online at **www.glwi.uwm.edu/ourwaters** or e-mail **our-waters@uwm.edu.**

Fact sheet updated 01/2007