

Swimming in the Great Lakes

Our nation is blessed with a third coast. More than 1,000 freshwater beaches stretch along 5,500 miles of Great Lakes shoreline, in eight states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin). Great Lakes beaches are the Midwest's playground, providing needed relief to more than 30 million people from the region's hot, humid dog days of summer.

Since the federal BEACH Act was passed in 2000, more attention from beach managers, lawmakers, and scientists is being focused on these Midwest treasures. Before the Act was passed just 250 Great Lakes beaches were being monitored; by 2006 more than 550 beaches were monitored. The frequency with which beaches are being monitored, whether weekly, twice weekly or daily, has also increased by nearly 45 percent.¹ As a result of increased monitoring, most states now have a better sense of the scope of contamination at their beaches. Despite these improvements, there are still a number of needed measures to make Great Lakes beaches safe for public use and enjoyment. Legislatively, the Great Lakes Regional Collaborative, represents an attempt by Midwest lawmakers to fill funding gaps for programs like the BEACH Act that do not provide enough money to address the source of Great Lakes beach contamination.

While beaches are generally better monitored than in the past, there continues to be room for improvement in monitoring and public notification. Forty nine percent of Great Lakes beaches are not being monitored, including popular beaches in Michigan. Monitoring of high priority beaches is also inconsistent from state to state. Some states monitor daily and others weekly. In part, this appears dependent upon sources of funding and staffing levels. This inconsistency makes water quality comparisons between beaches difficult and leaves public health less than optimally protected.

During 2006, U.S. Great Lakes beaches had 3,003 days of closings and advisories..

Table 1. Number of Great Lakes Beaches Identified and Number Designated as High Risk (Tier 1) Beaches During the 2006 Beach Season

State	Number of Great Lakes Beaches Identified	Number of Tier 1 Beaches
IL	73	62
IN	31	8
MI	972	212
MN	79	8
NY*	39	21
OH	48	19
PA	12	10
WI	191	26
Total	1,445	366

*NY Great Lakes beaches only

Table 2. Monitoring Frequency of Great Lake Beaches by Priority

State	High-risk	Medium-risk	Low-risk
Illinois	5-7 days per week	1 day per week	Not monitored
Indiana	5 days per week	5 days per week	5 days per week
Michigan	1-2 days per week	1 day per year	Not monitored

Testing the Waters 2007

State	High-risk	Medium-risk	Low-risk
Minnesota	2 days per week	1 day per week	Not monitored
New York	1-2 days per week	Once every 2 weeks	1 day per month
Ohio	4 days per week	Not applicable ^a	1 day per week
Pennsylvania	2 days per week	1 day per week	Not applicable ^b
Wisconsin	4-7 days per week	2 days per week	1 day per week

Source: GAO analysis of information provided by state BEACH Act officials.

a Ohio reported that the state does not currently classify any beaches as tier 2.

b Pennsylvania reported that the state does not currently classify any beaches as tier 3.

Public notification, like monitoring, is critical to protecting public health, but it is inconsistent both within and across states. States differ not only in the information they use to make beach closing and advisory decisions, but also in how they convey this information to the public. While some states issue both advisories and closings, others issue only closings or only advisories. In addition some states post signs at the beach to notify users, while others have telephone hot-lines or Internet postings.

Monitoring reveals the extent to which sources of beachwater pollution remain unaddressed. Closings and advisories continue to steadily rise while the sources of that pollution are usually not even identified, much less controlled. A recent study estimated that 20 cities dump almost 25 billion gallons of untreated sewage into the Great Lakes each year through combined sewer overflows.² Further improvements to monitoring and public notification programs should include ensuring all popular coastal beaches are tested, expanding to popular inland beaches, developing better indicators of the wide variety of potential swimming-related illnesses (particularly viral illnesses such as hepatitis), and faster turn-around time of test results. Five Great Lakes agencies in four states (the Lake County Health Department in Illinois, the Cuyahoga County Health Department in Ohio, the Milwaukee Health Department in Wisconsin and the Indiana Dunes National Lakeshore and Gary Sanitation District in Indiana) are successfully using predictive models to make real time beach closure and advisory decisions.

BACTERIA IN GREAT LAKES BEACHWATER

For the third consecutive year, NRDC conducted a comparative analysis of water quality at beaches all along the U.S. Great Lakes shoreline. Using publicly available monitoring data from all eight Great Lakes states, we show the percent of all beach water samples collected in 2006 that exceeded the BEACH Act required daily maximum standard of 235 *E.coli* colony forming units per 100ml of freshwater.

For the 2006 beach season, the NRDC dataset includes monitoring results for 11,242 samples at 348 high risk Great Lakes beaches (i.e. popular beaches and or beaches near potential pollution sources). Region wide, at these so-called “Tier 1” beaches, 13 percent (1,498) of all samples exceeded the BEACH Act standard in 2006. Ohio ranked highest (22%), followed by New York’s Great Lakes beaches (19%), Indiana (19%), Illinois (15%), Minnesota (14%), Wisconsin (11%), Pennsylvania (11%), and Michigan (4%) (see Table 3). Looking at Great Lakes urban areas, Cleveland’s Tier 1 beaches had the highest percent exceedance (35%), followed by Toledo (24%), Milwaukee (18%), Chicago (18%), and Duluth (14%) (See Table 4).

NRDC identified 25 high risk beaches in every Great Lakes state except Pennsylvania that exceeded the standard more than 25 percent of the time (see Table 5).

The percent of samples exceeding the BEACH Act standard increased from 12 percent in 2005 to 13 percent in 2006.

The number of beaches that did not have a single exceedance increased to 257 in 2006 from 239 in 2005. Every Great Lakes state except Pennsylvania and Illinois had at least one beach without a single exceedance in 2006

Table 3. Rank of States by Percent of Samples at High Risk Beaches Exceeding the National Standard in 2006

State	Total Samples	Number of Tier 1 Beaches with Monitoring Data	Percent Exceedance
OH	1,066	20	22%
NY	632	23	19%
IN	516	7	19%
IL	3,682	51	15%
MN	411	8	14%
WI	963	26	11%
PA	1,502	7	11%
MI	2,470	207	4%

Table 4. Rank of Urban Areas by Percent of Samples at High Risk Beaches Exceeding the National Standard in 2006

City	State	Total Samples	Tier 1 Beaches with Monitoring Data	Percent Exceedance
Cleveland	OH	215	3	35%
Toledo	OH	98	2	24%
Milwaukee	WI	98	2	18%
Chicago	IL	1561	24	18%
Duluth	MN	411	8	14%

Table 5. High Risk Beaches with More Than 25 Percent of Samples Exceeding the National Standard in 2006

State	County	Beach	Total Samples	Percent Exceedance
IL	Cook	Jackson Park Beach	71	54%
IL	Lake	North Point Marina North Beach	90	47%
OH	Cuyahoga	Villa Angela St. Pk.	72	44%
OH	Cuyahoga	Euclid St. Pk.	72	42%
MN	St Louis	Lk Sup, Park Point, Southworth Marsh, Duluth	63	41%
MI	Wayne	Crescent Sail Yacht Club	40	38%
WI	Sheboygan	Kohler Andrae State Park North Picnic Beach	27	37%
NY	Chautauqua	Main Street Beach	17	35%
NY	Chautauqua	Wright Park East	20	35%
MI	St Clair	Conger-Lighthouse Beach	15	33%
MN	St Louis	Lk Sup, St. Louis Bay, Pk Pt 20th/Hearing Is, Duluth	65	32%
WI	Sheboygan	Kohler Andrae State Park Nature Center Beach	28	32%
WI	Sheboygan	Kohler Andrae State Park North Beach	28	32%

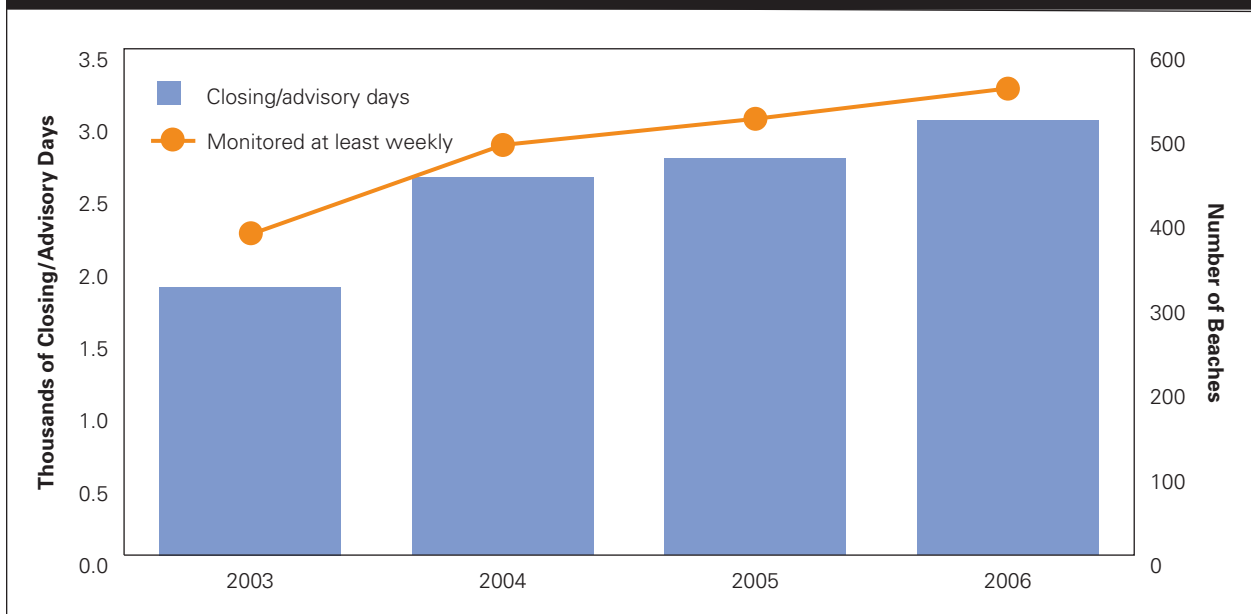
Testing the Waters 2007

State	County	Beach	Total Samples	Percent Exceedance
OH	Cuyahoga	Huntington Beach	73	32%
NY	Monroe	Ontario Beach	93	31%
MI	Cheboygan	Mackinaw City Lighthouse Park	13	31%
MI	Emmet	Wilderness State Park	13	31%
IN	La Porte	Washington Park	147	31%
OH	Ottawa	Camp Perry	49	31%
WI	Sheboygan	Kohler Andrae State Park South Picnic Beach	27	30%
NY	Chautauqua	Wright Park West	21	29%
IL	Cook	Calumet South Beach	68	28%
NY	Monroe	Durand Beach	90	27%
OH	Ashtabula	Lakeshore Park	45	27%
WI	Sheboygan	Blue Harbor Beach	27	26%

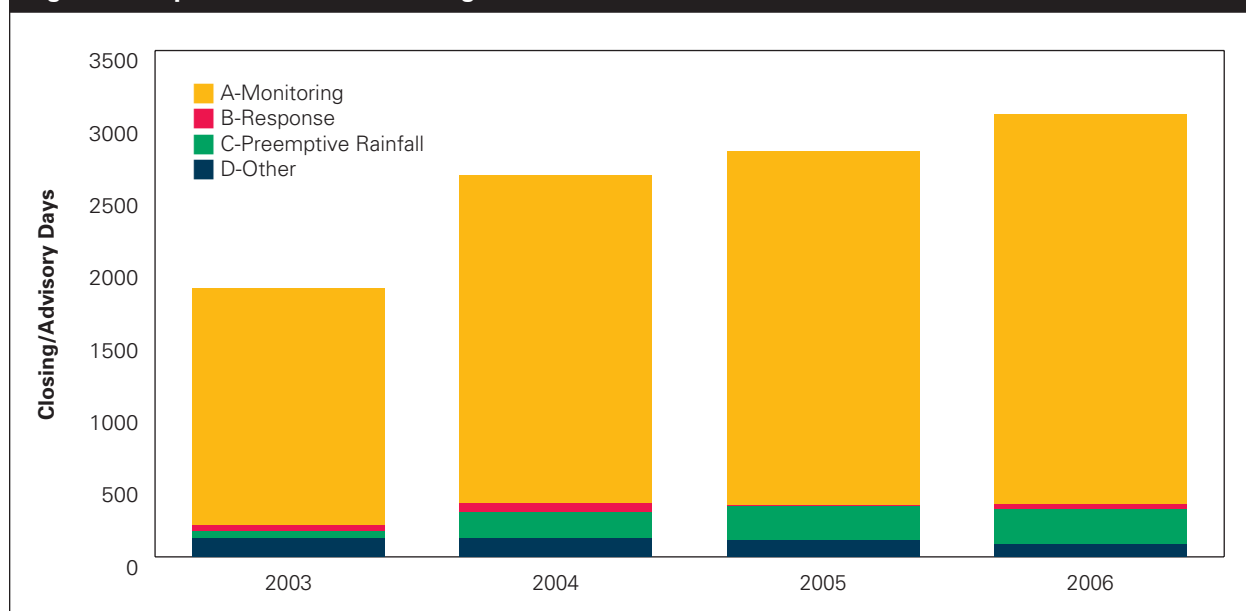
GREAT LAKES BEACH CLOSINGS/ADVISORIES AND POLLUTION SOURCES

- During 2006, U.S. Great Lakes beaches had 3,003 days of closings and advisories, 5 extended closings and advisories (7 to 13 consecutive weeks), and 5 permanent closing and advisory (more than 13 consecutive weeks). Including extended days, the total comes to 3, 269 beach closing and advisory days.
- The number of beach closing and advisory days increased 10 percent in 2006 (263 days) from the previous year (see Figure 1). The major factors leading to the increase in 2006 appear to be heavy rainfall in some areas, a greater number

Figure 1 . Total Closing/Advisory Days at Great Lakes Beaches, 2003–2006 (excluding extended and permanent)



Note: Because of inconsistencies in monitoring and closing/advisory practices among states and the different levels of data submission over time, it is difficult to make comparisons between states or to assess trends based on the closing/advisory data.

Figure 2. Reported Causes of Closings/Advisories at Great Lakes Beaches, 2003–2006

Totals shown are greater than annual totals because some events began as preemptive rain advisories and were extended due to monitoring) Key: (A) Based on monitoring that detected bacteria levels exceeding standards. (B) In response to known pollution event without relying on monitoring. (C) Preemptive due to rain known to carry pollution to swimming waters. (D) Other reason.

of regularly monitored beaches, and unaddressed bacteria-laden stormwater and sewage pollution that contaminate beachwaters.

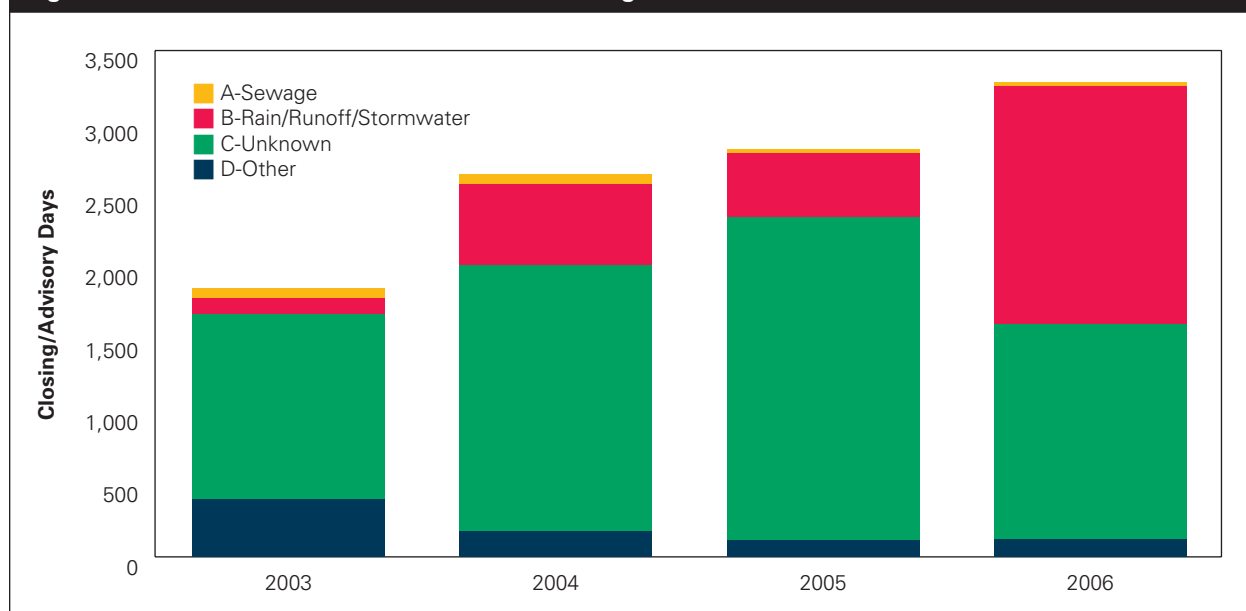
- The continued high level of closings/advisories is an indication that new and more frequent monitoring continues to reveal serious water pollution at our nation's Great Lakes beaches. Figure 2 shows that 2,701 (88 percent) of the 2006 beach closing and advisory days were issued because water quality monitoring showed that bacteria levels exceeded health and safety standards (253 days more than in 2005).

Major causes of beach closings and advisories in 2006 were as follows (see Figure 2):

- 88 percent were based on monitoring that detected bacteria levels exceeding beachwater quality standards;
- 8 percent were precautionary, due to rainfall known to carry pollution to swimming waters;
- 1 percent were issued in response to known pollution events, such as sewage treatment plant failure or breaks in sewage pipes;
- 3 percent were due to other causes, such as strong waves.

Major pollution sources listed as responsible for 2006 beach closings and advisories include the following (the total is greater than 3,003 and 100 percent because more than one source may have contributed to a given closing or advisory; see Figure 3):

- Unknown sources of pollution caused 1,490 closing/advisory days (50 percent of this year's total), a decrease of 749 days from 2005;
- Polluted runoff and stormwater caused or contributed to 1,643 closing/advisory days (55 percent of this year's total), a nearly 4-fold increase (1,260 days) from 2005;

Figure 3. Sources of Pollution that Caused Closings/Advisories at Great Lakes Beaches, 2003–2006

Totals shown are greater than annual totals because more than one pollution source may have contributed to each closing/advisory) Key: (A) Sewage spills and overflows. (B) Polluted runoff, stormwater, or preemptive due to rain. (C) Unknown. (D) Other reasons, including those with no source information provided.

- Sewage spills and overflows caused or contributed to 33 closing/advisory days (1 percent of this year's total), an increase of 4 days from 2005;
- Elevated bacteria levels from miscellaneous sources (boat discharges, wildlife, etc.) accounted for 118 closing/advisory days (4 percent of this year's total), an increase of 5 days from 2005;
- Preemptive rainfall advisories accounted for 245 closing/advisory days (8 percent of this year's total), an increase of 5 days from 2005.

Based on information for the 2002 swim season, almost every Great Lakes state reported having at least one beach where stormwater, runoff, and/or sewage is a known source of pollution at or near bathing waters. The EPA has not provided updated information on potential pollution sources at Great Lakes beaches since the 2002 swim season. In 2006, six Great Lakes states reported an average of 274 closing/advisory days due to stormwater or runoff (Illinois, Indiana, New York, Ohio, Pennsylvania, and Wisconsin), and two Great Lakes states reported an average of 16 closing/advisory days due to sewage pollution (Indiana and New York).

Health Risks

Because pathogens in sewage-contaminated waters can cause a wide range of diseases—including ear, nose, and throat problems, gastroenteritis, dysentery, hepatitis, and respiratory illness—beachwater pollution threatens the public's health. The consequences of these swimming-associated illnesses can be greater for children, elderly people, pregnant women, cancer patients, and others with weakened immune systems.

Pollution contributed to the contamination of popular beaches. Land development near the lakes and the attendant runoff in particular continues to be a significant contribution to the contamination. In 2006, known sewage contamination from spills, stormdrains, runoff, or leaky septic systems was reported in such popular beach destinations as Woodlawn Beach State Park, New York, and South Shore Beach in Milwaukee, Wisconsin.

In July 2001, 40 people became sick with gastroenteritis after swimming at a public beach on Lake Superior in Minnesota, according to the Centers for Disease Control and Prevention's latest report on disease outbreaks associated with recreational water.³ The following summer, 66 people became sick with gastroenteritis after swimming at a public beach on Lake Michigan in Door County, Wisconsin.

As part of its requirement to develop more protective health standards under the BEACH Act, EPA conducted studies in 2003 at two Great Lakes beaches to determine illness rates for gastrointestinal and respiratory infections among swimmers. At one beach, it was found that those with any contact with water were almost twice as likely to have gastrointestinal illness compared with nonswimmers, with a 10% incidence of illness among swimmers compared to 5% among nonswimmers. The risk of gastrointestinal illness was 14% at the second beach. The presence of the indicator organism enterococcus was associated with the increased risk of illness. The study concluded that enterococcus measured using rapid methods can predict gastrointestinal illness after swimming in fecally contaminated freshwater and that samples collected each morning could allow beach managers to assess the microbiological safety of the beach before most beachgoers are exposed.⁴ A 2002 pilot study found that 17 percent of survey respondents who swallowed water contracted respiratory illness.⁵

Beach Monitoring

- With grants provided to Great Lakes states through the federal BEACH Act, the number of beaches monitored at least once a week increased to 543 in 2006 from 517 in 2005. The percent of Tier 1 beaches monitored at least once a week increased to 96 percent (352) in 2006 from 92 percent (332) in 2005.
- In 2006, six Great Lakes states continued monitoring all of their Tier 1 beaches at least once a week (Indiana, Minnesota, New York's Great Lakes beaches, Ohio, Pennsylvania, and Wisconsin). Illinois monitored 85 percent of its Tier 1 beaches at least once a week in 2006, up from 84 percent in 2005. Michigan monitored 98 percent of its Tier 1 beaches at least once a week, up from 92 percent in 2005.

Bacterial Standards

- The federal BEACH Act of 2000 required that Great Lakes states adopt the EPA published standards, or standards equally protective of public health, by April 2004. The EPA's published standards include a geometric mean value for multiple samples, generally taken over 30 days, and an instantaneous, single sample value. As of the 2005 beach season, all eight Great Lakes states were using the BEACH Act standards to make beach closing/advisory decisions.
- In addition to direct measurement of *E.coli* levels, which typically take 24 hours for results, four states (Illinois, Indiana, Wisconsin and Ohio) are using predictive models at eight beaches (Lake Street Beach, Marquette Park Beach, and Wells Street Beach in Lake County and Ogden Dunes Beach and West Beach - Indiana Dunes National Lakeshore in Porter County, Indiana, Forest Park Beach in Lake Forest and Illinois Beach State Park in Zion, Illinois, South Shore Beach in Milwaukee and Huntington Beach in Cuyahoga County, Ohio). Predictive models allow real-time estimates of *E.coli* levels based on easily measured physical parameters such as wind direction and water temperature. Real-time measurements allow for real-time beach closing/advisory determinations, which are more protective of public health. These models need to be tailored to the unique conditions at each beach, thus requiring significant research and development time. Studies suggest these models are 90-95 percent accurate in predicting *E.coli* levels.

Economic Effects

- Water pollution has a significant economic effect on Great Lakes states. Failing to invest in clean water costs Great Lakes states jobs, job productivity, tourism and property-tax dollars, and economic growth.
- One study estimated economic losses as a result of closing a Lake Michigan beach due to pollution as ranging between \$7,935 and \$37,030 per day

- Polluted waters also cause economic losses from swimming-related illnesses and from beachgoers' lost use of the beach.⁶ A study by the University of Chicago, estimates swim bans at Chicago beaches cost the local economy about \$2.4 million a year.⁷
- Beaches are the top vacation destination in the country. Coastal tourism, dependent in part on clean beaches, generates substantial revenues for state and local governments. According to the Report of the U.S. Commission on Ocean Policy, ocean-related tourism and recreation contributed roughly \$29 billion and 1.67 million jobs to the U.S. economy in 2000.
- Boating is a significant source of economic revenue for the Great Lakes. Nearly one third of the nations' boats are registered in the Great Lakes. In 2003, direct revenue from Great Lakes boating was \$16 billion and it was responsible for 107,000 jobs. Indirect revenue from boating related industries such as manufacturing, marinas, charter operations, restaurants, lodging and other businesses located near docking facilities increased the total number of jobs to 244,000 and revenue to \$19 billion.⁸
- Beach-related products, such as swimsuits, sunscreen, beach chairs, towels, boogie boards, and surfboards, generate hundreds of millions, if not billions of dollars each year in sales. Sunscreen lotions and potions alone earn manufacturers revenues of about \$640 million a year.⁹

RECOMMENDATIONS FOR GREAT LAKES COMMUNITIES

- **Press Congress to pass Great Lakes restoration legislation.** The Great Lakes Collaboration Implementation Act (HR 5100 and S 2545) would appropriate much needed federal grants to Great Lakes states for wastewater infrastructure improvements to reduce beachwater pollution and to three regional U.S. EPA offices to review and upgrade their Great Lakes wet weather programs, including controlling raw sewer overflows, issuing and enforcing permitting requirements to reduce stormwater pollution from construction sites, and managing municipal stormwater.
- **U.S. EPA should allow BEACH Act funding to be used for source elimination.** This was a recommendation made by a panel of experts at EPA's 2006 National Beaches Conference. Local officials in the Great Lakes indicate they lack information on sources of contamination and funds to remediate the sources. In the Great Lakes action to eliminate sources of contamination has been taken at only 14 percent of monitored beaches.
- **Monitor every beach in the Great Lakes.** There are still 274 Great Lakes beaches that are not monitored, the majority located in Wisconsin and Michigan. Many of the beaches are not monitored due to lack of funding, lack of accessible labs and the perception that beaches located away from urban areas are not as susceptible to contamination. As the 2002 outbreak in Door County demonstrated, however, non-urban beaches are vulnerable to bacteria inputs. BEACH Act money can be used to establish labs in non-urban areas.
- **Conduct routine sanitary surveys to identify sources of beach contamination.** In 2002, more than 60 people got sick in Door County after swimming in contaminated water. Prompted by the outbreak, the county initiated the "beach contamination source identification project" to identify sources of contamination and pinpoint appropriate monitoring stations. Door County now monitors over half its beaches and has implemented best management practices at many of its beaches to reduce pollution sources. . In 2006 U.S. EPA announced a program to make \$500,000 in grants available for conducting sanitary surveys at Great Lakes beaches. Through an EPA grant, Lake County, Illinois will begin piloting a sanitary sewer survey methodology at its beaches in 2007.
- **Strengthen programs for control of contaminated stormwater and combined sewer overflows, the largest known causes of beach closures and advisories in the Great Lakes.** Green infrastructure approaches that use soil and vegetation to reduce and filter stormwater flows and lessen the volume of raw sewage discharges from combined sewers are proving promising in Great Lakes cities, such as Chicago and Milwaukee.¹⁰

- **Require real time reporting and direct public notification of sewage overflows.** The other Great Lakes states should follow the lead of Michigan and Indiana and require real time reporting of sewage overflows, including direct public notification. Legislation modeled on both states' laws was introduced this year in Ohio. At a minimum sign posting near outfalls should be provided to alert those recreating in or near the outfalls.
- **Incorporate public education into beach management programs.** Public education continues to be an important tool for reducing bacterial inputs to beaches. Interested communities should contact organizations such as the Alliance for the Great Lakes (www.GreatLakes.org) to start an adopt-a-beach program to help monitor and eliminate sources of contamination at their beach.

Notes

- 1 General Accounting Office (GAO) , "Great Lakes: EPA and States Have Made Progress in Implementing the BEACH Act, but Additional Actions Could Improve Public Health Protections", May 2007, p. 36.,
- 2 Sierra Legal, "The Great Lakes Sewage Report Card", November 2006.
- 3 Jonathan S. Yoder, M.P.H., et al., "Surveillance for Waterborne-Disease Outbreaks Associated with Recreational Water — United States, 2001—2002," in *Morbidity and Mortality Report*, Centers for Disease Control and Prevention, October 22, 2004, 53(SS08);1-22.
- 4 Wade, Timothy J., R. L. Calderon, E. Sams, M. Beach, K. P. Brenner, A. H. Williams, A. P. Dufour, "Rapidly Measured Indicators of Recreational Water Quality Are Predictive of Swimming-Associated Gastrointestinal Illness", *Environmental Health Perspectives* Volume 114, Number 1, January 2006
- 5 Alfred Dufour, Rebecca Calderon, Timothy Wade, Elizabeth Sams, and Michael Beach, *National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water Study*, "West Beach Pilot Study 2002", a powerpoint presentation prepared by U.S. EPA.
- 6 Sharyl J. M. Rabinovici, Richard L. Bernknopf, Anne M. Wein, Don L. Coursey, and Richrd L. Whitman, "Economic and Health Risk Trade-Offs of Swim Closures at a Lake Michigan Beach," in *Environmental Science and Technology*, vol. 38, no. 10, 2004, p. 2742.
- 7 Dr. Sabina L. Shaikh, "Value of Chicago Beaches", University of Chicago, February 20, 2006.
- 8 Great Lakes Commission, "Great Lakes Recreational Boating's Economic Punch", July 2007.
- 9 "New-Wave Sunscreens," *Chemical & Engineering News*, Volume 83, Number 15, American Chemical Society, Washington, D.C., April 11, 2005, pp. 18-22, available at <http://pubs.acs.org/cen/coverstory/83/print/8315sunscreens.html>.
- 10 Kloss, et al, *Rooftops to Rivers* (2006)