Section

A

An Overview of Water Quality in Ohio

Kings Creek in winter, looking upstream from the confluence with Mad River

Clean water is important to Ohio's economy and standard of living.

Ohio is an economically important and diverse state with strong agriculture, manufacturing, and service industries. Ohio is also a water-rich state bounded by Lake Erie on the north and the Ohio River on the south, with more than 25,000 miles of named and designated streams and rivers within its borders. The suitability of these waters to support society's needs for water supplies and recreation is critical to sustaining Ohio's economy and the standard of living of Ohio citizens. Surface waters—rivers, streams, lakes—provide the majority of water used for public drinking water; for recreation such as swimming, boating, and fishing; and for industrial uses including manufacturing, power generation, irrigation, and mining.

Ohio EPA monitors water quality in Ohio and reports its findings.

Monitoring the quality of Ohio's valuable water resources is an important function of the Ohio Environmental Protection Agency. Since the early 1970s, Ohio EPA has measured the quality of Ohio's water resources and worked with industries, local governments, and citizens to restore the quality of substandard waters. The Agency reports its findings through meetings and reports. This particular report is required by the federal Clean Water Act to fulfill two purposes:

- to provide a summary of the status of the State's surface waters
- to develop a list of waters that do not meet established goals—the "impaired waters."

Under the Clean Water Act, once impaired waters are identified the state must take action to improve them. Typically, the actions include developing restoration plans [total maximum daily loads (TMDLs)], water quality based permits, and nonpoint pollution control measures. As such, this report is an important document that provides information and direction to much of the State's work in water quality planning, monitoring, financial and technical assistance, permitting, and nonpoint source programs. The report is updated every two years.

Over the past 30 years, Ohio EPA has developed innovative monitoring methods that directly measure progress toward the goals of the Clean Water Act. Generally recognized as a leader in water quality monitoring, Ohio uses the fish and aquatic insects that live in streams to assess the health of Ohio's flowing waters. Aquatic animals are generally the most sensitive indicators of pollution because they inhabit the water all of the time. A healthy stream community is also associated with high quality recreational opportunities (e.g., fishing and boating). Stream assessments are based on the experience gained through the collection of over 26,000 fish population samples and nearly 12,000 aquatic insect community samples.

Ohio EPA biologists collect fish samples

In addition to biological data, Ohio EPA collects information on the chemical quality of the water (more than 100,000 water chemistry samples), sediment, and wastewater discharges; data on the contaminants in fish flesh; and physical habitat information about streams. Taken together, this information identifies the factors that limit the health of aquatic life and that constitute threats to human health.

Results show water quality is impaired but continues to improve.

Ohio EPA developed methods to determine how well Ohio's waters support four specific uses of water: human health impacts related to fish tissue contamination, recreation, human health impacts related to drinking water, and aquatic life (fish and aquatic insects). Available data were compared with established water quality goals, and the results of the comparison indicate which waters are meeting goals and which are not. The results for each use are discussed in the next few pages.

To assess the **human health impacts related to fish tissue contamination**, Ohio EPA uses the same data that are used to generate Ohio's sport fish consumption advisory. Although the data are the same, the analyses are different. Ohio EPA urges Ohio's anglers to consult the sport fish consumption advisory regarding which and how much fish to eat.

For the analysis in this report, approximately two-thirds of Ohio's medium and large streams and publicly owned lakes have some fish tissue data available. Of those, about one-third do not have enough data to determine the impairment status. About 17% of monitored streams were "unimpaired" for the contaminants, while almost half of streams are "impaired." For lakes, almost one in ten is impaired and almost half are not impaired by the six fish tissue contaminants.

The most common contaminant is polychlorinated biphenyls (PCBs), followed by mercury. A few waters contain fish whose flesh is contaminated by dichlorodiphenyltrichloroethane (DDT), mirex, or hexachlorobenzene; data show no streams or lakes with fish contaminated by lead.

PCB contamination is widespread usually because of historical sources. Areas with attributable contamination and areas of special concern are being addressed through programs such as the Great Lakes Legacy Act, Superfund or the Resource Conservation and Recovery Act.

Mercury contamination is ubiquitous because of aerial deposition from local, regional and global sources. Thus, solving the problem of mercury contamination requires solutions on a broader scale than at a watershed level. Ohio is targeting mercury from consumer products such as switches and thermometers through legislation banning the sale of such products. Ultimately, increases in renewable energy sources and clean coal technology usage will lessen Ohio's mercury burden.

Are fish safe to eat?

While most Ohio sport fish are safe to eat, low levels of chemicals like polychlorinated biphenyls (PCBs) and mercury have been found in some fish from certain waters.

To help protect the health of Ohioans, the Ohio EPA in conjunction with the Ohio Department of Health offers an advisory for how often these fish can be safely eaten. An advisory is advice, and should not be viewed as law or regulation. It is intended to help anglers and their families make educated choices about where to fish, what types of fish to eat, how to determine the amount and frequency of fish consumed, and how to prepare fish for cooking.

By following these advisories, citizens can gain the health benefits of eating fish while reducing their exposure to unwanted contaminants.

Fish populations contaminated by hexachlorobenzene, DDT and mirex are already in the process of being restored through various initiatives in state and federal waste remediation programs.

The **recreation** analysis focuses on the amount of bacteria in the water. For Lake Erie public beaches, the frequency of swimming advisories varies widely, ranging from 0% at Kelleys Island State Park beach to nearly 50% at Euclid State Park beach. Generally, beaches located near population centers tend to have the most problems.

Beaches on the Lake Erie islands are nearly always suitable for swimming. Several beaches stand out as consistently good performers over the past several recreation seasons, including Battery Park, Catawba, East Harbor, Hoffman, Kelleys Island, Lakeside, Lions Park, Old Womans Creek, Port Clinton, South Bass Island and Walnut Beach. These beaches infrequently exceeded the goal of fewer than 10 days per season under advisement. There were also several beaches that performed poorly on a consistent basis, with four beaches (Clifton, Edson Creek,

Swimmers at East Harbor State Park on Lake Erie

Euclid and Villa Angela) under advisement over 40% of the past five recreation seasons.

For inland streams, bacteria levels were low in about one in ten watersheds. About three in ten watersheds had high levels of bacteria. The remaining six in ten did not have enough data for evaluation. Ohio's 23 large rivers fare somewhat better, with about 20% having relatively low bacteria levels and 20% showing higher levels of bacteria. About 60% did not have enough data collected in the past five years to evaluate. High bacteria levels are often observed during periods of higher stream flows associated with heavy rains.

Is it safe to swim or wade?

For the most part, water in Ohio is safe for swimming or wading. Water activities are more dangerous after heavy rains due to the obvious physical dangers of being swept into the faster flows, but also because chemicals and bacteria wash into the streams along with the water that runs over the land. In some communities, sewage systems cannot handle the extra volume of water and release untreated sewage during and after heavy rains.

There are some areas where the waters and/or sediments have high levels of contaminants, including polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs), so swimming or wading in these areas is not recommended.

Although not sampled as frequently as streams or Lake Erie beaches, bacteria levels at most inland lake beaches do not frequently exceed the threshold, resulting in fewer postings compared to some of the beaches along Lake Erie.

Is water safe to drink?

Yes. Public water systems around the state and Ohio EPA work hard to ensure that the water provided meets safe drinking water standards and to make important information available about the sources and quality of the water you drink. However, drinking water advisories do occur from time to time due to treatment plant malfunctions, water line breaks, and the rare case when source water contaminant levels exceed the plant's capacity to remove them. It is important to remember that only a relatively small number of water systems have situations that warrant advisories. In 2010, 99% of all public water systems met all chemical standards. In order to get information about your local drinking water you can read the Consumer Confidence Report (CCR) provided annually by your community water system.

In this report several waters are identified as impaired due to elevated nitrate or pesticides. Water systems in these areas and others with source water contaminants will issue public notice advisories or use additional treatment and water management strategies to assure that safe water is delivered to their customers.

Human health impacts related to drinking water focus on nitrate and pesticides. There are a total of 124 public water systems with 130 treatment plants using surface water (excluding Ohio River intakes). Sufficient data were available to evaluate about one-third of the drinking water source waters for nitrate.

The only impaired areas were the Maumee River (the systems for the communities of Defiance, Napoleon, McClure and Bowling Green and the Campbell Soup system) and a portion of the Sandusky River (Fremont). Some areas were identified for a watch list; all were located in the northwestern and central parts of the state. It is difficult and expensive to remove nitrate from drinking water; some systems are conducting nitrate removal pilot studies, but no Ohio surface water systems currently use treatment specific for nitrate removal. Ohio public water systems rely on

blending the surface water with other sources such as ground water, selective pumping from the stream to avoid high nitrate levels by using off-stream storage in upground reservoirs, or issue public notice advisories warning sensitive populations to avoid drinking the water while nitrate levels are high.

Pesticides could be evaluated for about 14% of the drinking water source waters. Five of 18 areas were identified as impaired, all in southwestern Ohio: one in Brown County (Mt. Orab), one in Miami County (Piqua), and the three sources used by the Village of Blanchester in Warren and Clinton counties. Thirteen areas were identified for a watch list because of elevated atrazine. These areas mostly coincide with the predominantly agricultural lands of western and northwestern Ohio.

The bulk of the new data evaluated for the **aquatic life use** is in areas Ohio EPA sampled during 2009 and 2010. Watersheds intensively monitored during 2009 and 2010 included the lower Sandusky River, Sandusky Bay tributaries, Killbuck Creek, central Ohio River tributaries (Captina, Sunfish, McMahon, Cross, Short, and Wheeling subwatersheds), upper and middle Scioto River, middle and lower Great Miami River, southeast Ohio River tributaries (Pine, Ice, and Little Scioto subwatersheds), upper Muskingum/Walhonding tributaries, Ottawa River, and Sandy Creek basins. Detailed watershed survey reports for many of these watersheds are or will be available at http://epa.ohio.gov/dsw/document_index/psdindx.aspx.

Large rivers are making progress towards the "100% attainment by 2020" aquatic life goal.

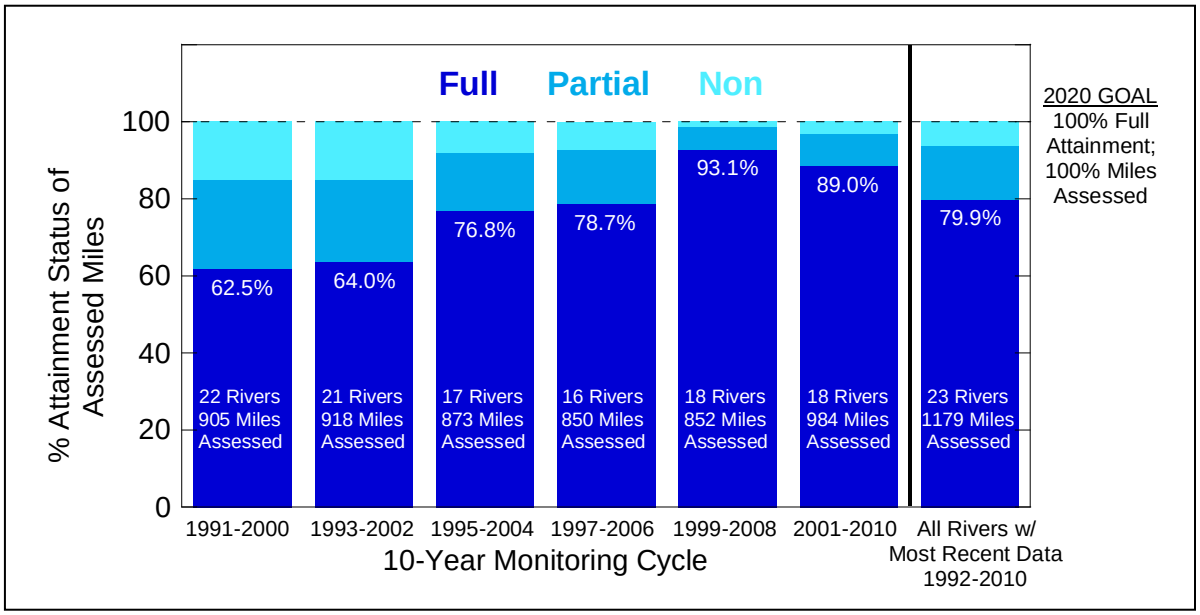
Ohio's large rivers (the 23 rivers that drain more than 500 square miles) continue to show improvement as tracked over the last 20 years. The "100% full attainment by 2020" aquatic life goal statistic now stands at 89.0% full attainment. This statistic is down slightly from 2010 largely because of new assessments in four large rivers, three of which flow through highly urbanized areas and receive large quantities of flow from wastewater treatment facilities. The table below shows that all four of the large rivers have improved dramatically since first sampled in the early- to mid-1980s.

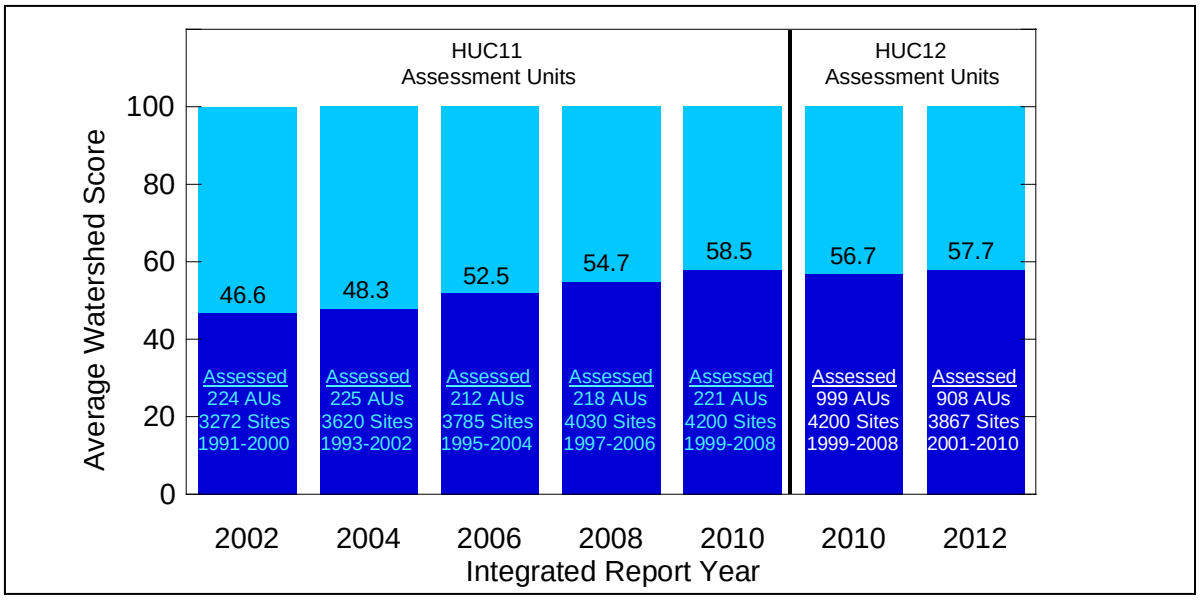
Stream	Year Studied	% of Stream Monitored	% of Aquatic Life Standard		
			Meeting	Partially Meeting	Not Meeting
Sandusky River	1981/88	78	14	31	55
	2009	100	68	1	31
Cuyahoga River	1984/87	100	0	0	100
	2010	95	77	13	10
Scioto River (middle)	1988	74	21	55	24
	2009/10	100	85	8	7
Great Miami River (lower)	1980/82	100	0	17	83
	2009/10	100	80	20	0

Taken collectively since the 1980s, the quality of aquatic life in all of Ohio's large rivers has shown a remarkable improvement. Then, only 21% of the large rivers met water quality standards, increasing to 62% in the 1990s, to 89% today. Areas not meeting the standards have decreased from 79% in the 1980s to 38% in the 1990s to 11% today. Across Ohio, investment in the treatment of municipal and industrial wastewater and improvement in agriculture conservation practices are credited with the turnaround. The rivers described in the table illustrate the point: Sandusky River (highly agricultural land use), Cuyahoga River (Akron/Cleveland metropolitan area), Scioto River (Columbus metropolitan area), and Great Miami River (Dayton/Cincinnati metropolitan area). The substantial aquatic life improvements observed in these rivers over the last 25 years

directly correlate to implementation of agricultural best management practices and upgraded wastewater treatment plants. Of course, being able to track these water quality trends attests to the value of consistent monitoring over time.

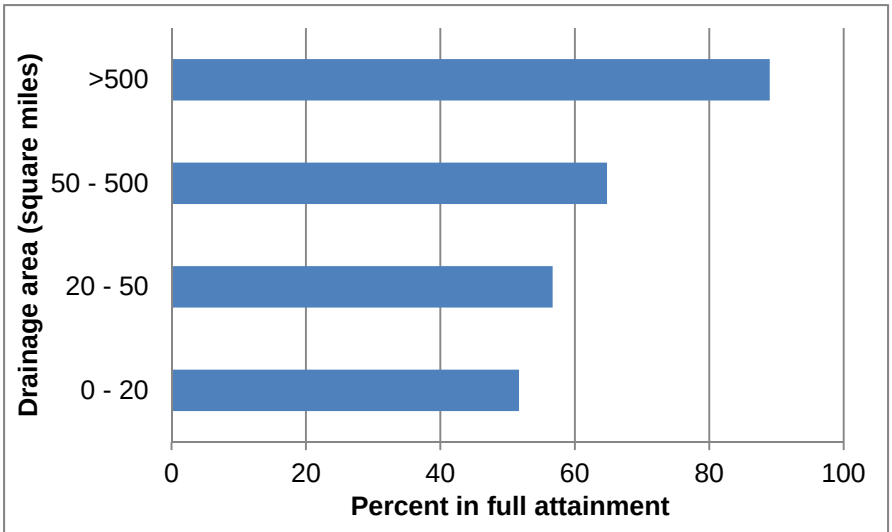
For Ohio's 1,538 12-digit hydrologic watershed units, the score calculated from measurements at individual sites also continued its steady increase, although with an average score considerably lower than the large river full attainment statistic. Watershed scores are roughly equivalent to the percent of sites within the watershed unit that are meeting biological expectations and the designated aquatic life use, but some additional weighting is given to results from larger stream sites in the unit. Based on monitoring through 2010, the average watershed score is now 57.7 (of watersheds with data), up from 56.7 in 2010. Of the 908 watershed units assessed for this report with current data, 337 (37%) scored 80 or above and 282 (31%) scored perfect 100s. The following charts show the progress in attainment status of aquatic life statistics in recent years for both large rivers (upper) and watersheds (lower).





Most aquatic life impairment is caused by land disturbances related to agriculture activities and urban development.

Taking a closer look at the attainment status of individual sites grouped by the amount of land area drained by the stream at that point reveals that unhealthy fish and aquatic insect populations are more common on smaller streams. In other words, the larger the drainage area (and usually the larger the stream), the more likely the stream is to be healthy. This phenomenon correlates well with the most widespread causes associated with the aquatic life impairment in these watersheds.



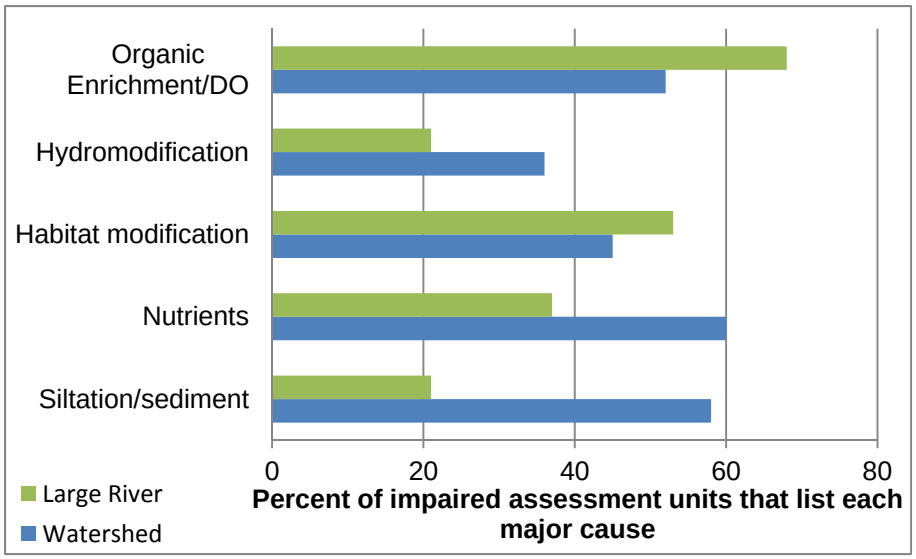
For 0 - 500, based on number of sites in attainment; for >500, based on number of miles.

The top five aquatic life impairment causes for the period 2001 through 2010 are:

- siltation/sedimentation
- nutrients
- habitat modification
- hydromodification
- organic enrichment / dissolved oxygen (DO).

For watersheds, most impairment is related to modification of the landscape. These types of impairments have the most impact on smaller streams. Most of the impaired watershed units with current data (roughly 400 out of 628) had at least one of these causes contributing to impairment and many had two or more of the top five causes listed.

Of note is the prevalence of watersheds and large rivers that are impaired by the generic organic enrichment/DO cause category; 52% of impaired watersheds show "sewage" related impairments such as high biochemical oxygen demand, elevated ammonia concentrations, and/or in-stream sewage solids deposition. Thirteen of 19 impaired large rivers also note sewage-related causes. These are higher percentages than in the recent past and suggests that adequate treatment and disposal of human and animal wastes via wastewater treatment plants, home sewage treatment systems, and land applications of septage and animal manure are becoming more critical water quality issues in many Ohio watersheds.



The major causes and sources of water quality problems are described below.

Organic enrichment is the addition of carbon-based materials from living organisms beyond natural rates and amounts. Natural decomposition of these materials can deplete oxygen supplies in surface waters. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odors associated with the decomposition process.

Siltation/sedimentation describes the deposition of fine soil particles on the bottom of stream and river channels. Deposition typically follows high-flow events that erode and pick up soil particles from the land. Soil particles also transport other pollutants. As the flow decreases, the soil particles fall to the stream bottom. This reduces the diversity of stream habitat available to aquatic organisms.

Nutrient enrichment describes the excess contribution of materials such as nitrogen and phosphorus used for plant growth. Excess nutrients are not toxic to aquatic life, but can have an indirect effect because algae flourish where excess nutrients exist. The algae die and their decay uses up the dissolved oxygen that other organisms need to live. The aquatic community is stressed on both a daily basis and over the long term.

Habitat modification is the straightening, widening, or deepening of a stream's natural channel. Habitat modification can also include the degrading or complete removal of vegetation from stream banks; such vegetation is essential to a healthy stream. These activities can effectively transform a stream from a functioning ecosystem to a simple drainage conveyance. Some aquatic life will not be protected from predators and stressful flows and temperatures. The stream also often loses its ability to naturally process water pollutants.

Hydromodification, or flow alteration, describes any disruption to the natural hydrology of a stream system. Flow alteration includes stream impoundment, increased peak flows associated with the urbanization of watersheds, and water-table regulation through sub-surface drainage. Such changes can cause extended periods without stream flow, more extreme or frequent floods, and loss of fast current habitat in dam pool areas.

Contamination by pathogens occurs when human or animal waste reaches the stream. Pathogenic organisms include bacteria, viruses, and protozoa. Contamination by pathogens is a human health issue, as skin contact or accidental ingestion can lead to various conditions such as skin irritation, gastroenteritis, or other more serious illnesses.

Excessive nutrients lead to excessive algae growth.

The same nutrients that cause impairment of the aquatic life beneficial use also are a major contributing factor to the recent extensive harmful algal blooms (HABs) that have been observed in Lake Erie, the Ohio River, and many inland Ohio water bodies. Grand Lake St. Marys in western Ohio has been particularly affected. HABs, a visually identified concentration of cyanobacteria, can occur almost anywhere there is water: lakes, ponds, storm water retention basins, rivers, streams, or reservoirs. Many HAB-forming organisms are native to Ohio but only cause problems when environmental conditions favor them.

Harmful algal blooms can cause taste and odor problems in drinking waters, pollute beaches with scums, reduce oxygen levels for fish and other animals, cause processing problems for public water supplies, and may generate toxic chemicals. Knowing what triggers HABs is key to reducing their occurrence and impacts. HABs may be minimized, and some completely avoided, by reducing the nutrients and pollutants added to the water.

In June 2011, Ohio EPA, Ohio Department of Health (ODH) and Ohio Department of Natural Resources (ODNR) released a strategy to protect people from toxins produced by cyanobacteria that may be in recreational or drinking waters at concentrations that can affect human health. The report outlines the thresholds set for identified algal toxins, establishes monitoring protocols and identifies the process for posting and removing surface and drinking water use advisories.

To ensure that the public could find the information they needed about harmful algal blooms and the current state of public waters, including any advisories posted, ODH, ODNR and Ohio EPA

developed a web site to provide background information about HABs, tips for staying safe when visiting public lakes, links to sampling information and current advisories and contact information for reporting suspected HABs.

Understanding how various land uses impact water quality can lead to more effective prevention and restoration.

Ohio has embraced a wide variety of economic enterprises over the past 150 years, so it is not surprising that there is a large variety of causes and sources of impairment.

Row crop cultivation is a common land use in Ohio. Frequently, cultivated cropland involves tile drainage, and a challenge is to carry out actions that improve water quality while maintaining adequate drainage for profitable agriculture. The land application of manure, especially during winter months, is often a large source of both bacteria and nutrients entering streams and subsurface drainage tiles. Many cropland practices involve the channelization of streams, which creates deeply incised and straight ditches or streams. This disconnects waterways from floodplains, which has damaging impacts on the quality of the system. The regularity of the stream channel and lack of in-stream cover reduces biological diversity.

Land development is the conversion of natural areas or agriculture to residential, industrial, or commercial uses. Numerous scientific studies show that increasing impervious cover—hard surfaces such as roads, parking lots, rooftops, and lawns—harms water quality. More water runs off the hard surfaces and more quickly. The rate of erosion increases and streams become unstable. The resulting channel is less able to assimilate nutrients and other pollution. Higher runoff volume increases the amount of pollutants (e.g., nutrients, metals, sediment, salts, pesticides). Another problem is that stream temperatures can be raised when water runs over hot pavement and rooftops or sits in detention basins. When this heated water enters a stream, the higher temperatures reduce dissolved oxygen concentrations that aquatic life need to survive. With proper planning of development, many of these problems can be mitigated or avoided entirely.

Agricultural livestock operations can vary widely in how they are managed. Pasture land and animal feeding operations can be sources of nutrients and pathogens. Frequently livestock are permitted direct access to streams. Direct access not only allows direct input of nutrients and pathogens, but also erodes the stream bank, causing excess sediments to enter the stream and habitat degradation. The most critical aspect of minimizing water quality impacts from any size animal feeding operation is the proper management of manure in terms of application and storage.

Industrial and municipal point sources include wastewater treatment plants and factories. Wastewater treatment plants can contribute to bacteria, nutrient enrichment, siltation, and flow alteration problems. Industrial point sources, such as factories, sometimes discharge water that is excessively warm or cold, changing the temperature of the stream. Point sources may contain other pollutants such as chemicals, metals and solids.

Acid mine drainage impacts streams with high levels of acidity (low pH), high metal concentrations, elevated sulfate levels, and/or excessive dissolved and suspended solids and/or siltation. Acid mine drainage often has toxic effects on stream organisms and degrades habitat quality when deposited metals form a crust on the stream bed and susceptible soils erode from areas disturbed from mining. Ultimately it reduces biological diversity, eliminates sensitive aquatic life, and lowers ecosystem productivity.

Solving Ohio's water quality problems will require collaboration and creativity.

Most of Ohio's water quality problems will not be solved by issuing a permit or building a new wastewater treatment system to treat point sources of pollution. Improving Ohio's surface water quality will require effectively managing land use changes to ensure that polluted runoff is either captured and treated or allowed to infiltrate through the soil before running off into a stream. Restoring and protecting natural stream functions so that pollutants may be more effectively assimilated by streams is also critical. These actions will require various programs and people working collaboratively on local water quality issues and concerns. Local educational efforts and enhanced water quality monitoring will also play important roles if we are to see significant water quality improvements throughout Ohio.

Many areas of the state are benefitting by the participation of individuals and organizations in local watershed organizations. Some of these organizations have been active for quite some time and are successfully influencing local land use decision making and implementing projects designed to improve water quality in their watershed. Since 2000, Ohio EPA has worked in conjunction with the Ohio Department of Natural Resources to provide section 319(h) grant funding assistance to hire local watershed coordinators to help facilitate the development of watershed action plans. In recent years, the emphasis has shifted from developing plans to implementing water quality improvement projects such as stream restoration, dam removals, agricultural best management practices and others. Ohio EPA is measuring improvements resulting from these projects; however, there remain challenges associated with changing land use decisions and consumer and producer attitudes.

The report provides more detail, including Ohio's Section 303(d) list of impaired waters, as required by the Clean Water Act.

This overview is intended to provide a snapshot of water quality conditions, progress and challenges in Ohio; it is only the first section of the much larger and more detailed 2012 Integrated Report.

The opening sections of the report describe the universe of water quality in Ohio—the size and scope of Ohio's water resources, programs that are used to evaluate and improve water quality and funding sources for water quality improvement.

The middle sections are more technical and explain the beneficial uses assigned to Ohio's waters, the assessment methodologies used for the analyses of those uses, the data used to determine whether those uses are being supported, and the conclusions drawn about water quality conditions in each assessment unit.

The closing sections describe how waters found to be impaired will be scheduled for further study. A collection of maps that illustrate current conditions and future plans follow the text. The report concludes with summary tables of various types. The 303(d) list is contained in Section L4. Summaries of the condition of each assessment unit are available at http://www.epa.ohio.gov/dsw/tmdl/2012IntReport/assessment_summaries.aspx.

For more information, please consult these web sites:

Many water quality reports on specific watersheds are mentioned in this overview. Find these reports at http://www.epa.ohio.gov/dsw/document_index/psdindx.aspx

Watershed restoration reports (TMDLs) … http://www.epa.ohio.gov/dsw/tmdl/index.aspx

Fish consumption advisory … http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx

Waters unsafe for wading … http://www.epa.ohio.gov/dsw/fishadvisory/donotwade.aspx

Harmful algal blooms … www.ohioalgaeinfo.com

Integrated Report … http://www.epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx

Ohio EPA Division of Surface Water … http://www.epa.ohio.gov/dsw/Home.aspx

Ohio EPA Division of Drinking and Ground Waters … http://www.epa.ohio.gov/ddagw

Ohio EPA district office contact info … http://www.epa.ohio.gov/directions.aspx

List of Ohio watershed groups … http://ohiowatersheds.osu.edu/groups/

Ohio Department of Natural Resources, Division of Soil and Water Resources … http://www.dnr.state.oh.us/tabid/21817/Default.aspx

U.S. Environmental Protection Agency water program … http://water.epa.gov/