Section

I

Considerations for Future Lists

As new ideas are introduced and in the general course of progress, it is natural for evaluation and reporting of water quality conditions to evolve. Since the introduction of the integrated report format in 2002, methods for evaluating the recreation use, the human health use (via fish contaminants), and public drinking water supply use have been systematically added to the traditional aquatic life use reporting.

This section identifies future reporting possibilities and the status of each. The potential future changes include reporting on more types of waters (wetlands, inland lakes) or reporting on specific pollutants of interest (mercury). Information on the State's response to an emerging issue (harmful algae blooms) is also included.

I1. Wetlands

Ohio EPA began developing tools to determine the beneficial use status of wetlands in 1995. In 1998, the State of Ohio adopted wetland water quality standards. The wetland water quality standards assign the "wetland" use to all wetlands and codify narrative criteria that protect wetland functions, including hydrology, biological diversity and recreational aspects of a designated wetland. A new rule package including wetland numeric biological criteria has been proposed that would establish benchmarks for attainment of a tiered, ecoregion-specific wetland aquatic life use system. These rules would allow the ecological integrity of a particular wetland to be evaluated using vascular plants and/or amphibians.

With hundreds of thousands of potential wetlands to be evaluated, methods to accurately characterize the overall status of wetlands in an assessment unit (which may include large numbers of undesignated wetlands) are being considered. In the future Ohio EPA plans to incorporate wetland information into the Integrated Report using the following methodology:

1) Identify historic wetland resources: Soil Survey Geographic (SSURGO) data will be used to quantify the approximate area of wetland habitat thought to exist within each HUC12 at the time of European colonization. The current National Resource Conservation Service (NRCS) mapping assigns a percent hydric value to each soil map unit in this GIS layer. The total area for each type of soil within a given watershed will be multiplied by these percent hydric values and summed for the entire watershed to provide the estimated amount of historic wetlands.

2) Identify the amount of existing wetland resources: National Wetland Inventory (NWI) data, which identifies all wetlands in Ohio, has been generated using recent infrared and true color orthophotography (2006/2007). These data were completed for Ohio in late 2009. Wetland loss can be quantified for each HUC12 using the current NWI in conjunction with the SSURGO analysis of historic wetlands.

3) Preliminary off-site (Level I) wetland condition assessment: For all NWI wetlands within each HUC12, a preliminary GIS assessment will be conducted to quantify the wetlands most likely to be in poor, moderate, good, or excellent condition. Each emergent, scrub-shrub, and forested wetland will be buffered two different distances; from the edge of the wetland polygon to 100 meters, and from 100 to 350 meters. At this time it is anticipated that the following metrics will used in this analysis:
    a. Landscape Development Index (LDI) - 1992 National Land Cover Dataset (NLCD) data

b. Landscape Development Index - 2001 NLCD data
c. Percent Impervious Surface - 2001 NLCD Impervious Surface GIS Layer
d. Percent Forested Area - NLCD Impervious Surface GIS Layer
e. Amount of roads located within each buffer area (feet per acre) – ODOT roads GIS layer
f. Percent of buffer area consisting of Urban land use categories – 2001 NLCD data
g. Percent of area consisting of other NWI wetland (emergent, scrub-shrub, or forested) polygons
h. Percent of buffer consisting of "historic forest"- defined as being labeled as forest on the most recent (30 to 40 years old) USGS 7.5 minute topographic maps. Extracted as a separate GIS layer from the Digital Raster Graphic (DRG) representation of these maps
i. Forest stability – if total buffer area was > 60% forest on the original DRGs and >60% on the 2001 NLCD layer, wetland receives 10 points for this metric (0 points if condition is not met)
j. Endangered/Threatened species presence within buffer – if known occurrence of an endangered or threatened species in the ODNR Natural heritage database exists within the buffer, wetland receives 10 points for this metric (0 points if condition is not met)

All metrics will be calculated and summed for each wetland within both buffer distances (100 points each). The total metric score will be calculated by multiplying the inner buffer (100 meters) by 0.67 and the outer distance (100-350) by 0.33, and adding the two results. Total scores will be between 0 and 100 and will be broken into quartiles for each wetland type to estimate the predicted ecological condition of all wetlands.

4) All wetlands monitored by the Ohio EPA Wetland Ecology Group since its inception located within each HUC12 will be identified. The resultant Ohio Rapid Assessment Method (ORAM) for wetlands, as well as the Amphibian Index of Biotic Integrity (AmphIBI) and Vegetation Index of Biotic Integrity (VIBI), scores will be presented. As new wetlands are monitored between the reporting cycles, information within this table will change.

5) Site specific studies conducted during a given reporting cycle as part of our U.S. EPA Wetland Development Grant commitments will be summarized and included as a separate section within the Integrated Report.

Ohio EPA is accepting suggestions about this proposed methodology.

I2. Inland Lakes and Reservoirs

Ohio EPA initiated a renewed monitoring effort for inland lakes in 2008. This report assesses three of the four beneficial uses that apply to inland lakes: recreation, public drinking water supply, and human health (via fish tissue). Ohio EPA is in the process of updating the water quality standards rules for lakes. Once these rule updates are complete, Ohio EPA expects to include an assessment of the aquatic life use for lakes as a factor in listing watershed or large river assessment units in future 303(d) lists. This section outlines the current status of the monitoring effort for inland lakes, summarizes needed administrative rule changes and previews a potential methodology for assessing the lake habitat aquatic life use in future 303(d) lists. The section was first introduced in 2010 and has not changed appreciably since 2010 because the

administrative rule changes have not yet occurred. The results shown in this section display data reported in the 2010 IR and add new data. Ohio EPA intends to continue monitoring inland lakes and reporting results in future cycles.

I2.1 Background of Ohio's Inland Lake Water Quality Monitoring Program

Ohio EPA's work to assess lakes began in 1989 with a Clean Water Act Section 314 Lake Water Quality Assessment grant that supported the evaluation of 52 lakes. Various additional grants enabled the evaluation of 89 more lakes through 1995. An analysis and determination of beneficial use status for 447 public lakes (greater than 5 acres in surface area) was presented in Volume 3 of the 1996 Ohio Water Resource Inventory (305(b) report). As part of that report, Ohio EPA developed and applied the Lake Condition Index (LCI) to characterize overall lake health and to assess beneficial use status.

After dedicated U.S. EPA funding for lakes monitoring ended, Ohio EPA monitored only 53 lakes over the next 10 years. The Ohio LCI, developed by Ohio EPA between 1990 and 1996 to report on the status of lake condition in Ohio, became obsolete with the passage of Ohio's Credible Data Law (House Bill 43 (amended), effective 10/21/2003). This law requires that all decisions on impairment for surface waters (streams, lakes, wetlands) use only level 3 credible data. Ohio's LCI assessment process included a combination of level 2 and level 3 credible data to make impairment decisions.

Ohio EPA began researching ways to re-establish a lakes monitoring program in 2005. During the 2007 field season, Ohio EPA participated in the U.S. EPA-sponsored National Lakes Survey. Ohio was assigned 19 lakes that were selected through a probability-based random selection process. The effort served as a precursor for renewed lake sampling program in Ohio.

I2.2 Status of Inland Lake Program

Ohio EPA currently has resources to monitor up to 16 lakes per year using the strategy described in Section I2.2.1. Priority is being placed on lakes used for public drinking water or used heavily for recreation and suspected of being impaired for either of those uses. Secondary priorities not being addressed because of limited resources include developing a more robust sampling program, expanding to a wider variety of lakes, exploring the use of remote sensing in the screening of water quality in lakes, and attempting to track water quality changes in lakes that might be attributed to Section 319 funding and other watershed water quality improvement efforts. The objectives for monitoring inland lakes are to:

- Track status and trends of lake quality
- Determine attainment status of beneficial uses
- Identify causes and sources of impaired uses
- Recommend actions for improving water quality in impaired lakes.

In this report, Ohio EPA discusses lake use impairment for recreation, public drinking water, and human health (fish tissue) and previews a methodology for including inland lakes in the aquatic life use listing. The aquatic life use listing is dependent on the rule changes to Ohio's water quality standards, which include adoption of nutrient criteria. Once the criteria are adopted into Ohio's water quality standards rules, Ohio EPA expects to be able to definitively report on the status of the aquatic life use for the following 23 lakes in a future Integrated Report including:

- Buckeye Lake – Fairfield, Licking, Perry Counties
- Clear Fork Reservoir – Richland, Morrow Counties

- Swift Run Lake – Miami County
- Veterans Memorial Reservoir (Fostoria Reservoir #6) – Hancock County
- Frazier Quarry (Maysville Regional Water District Reservoir) – Muskingum County
- Dillon Lake – Muskingum County
- Cutler Lake (Blue Rock Lake) – Muskingum County
- Deer Creek Lake – Stark County
- Beaver Creek Reservoir – Seneca County
- Akron water supply reservoirs (Lake Rockwell, East Branch and LaDue Reservoirs)
- Barnesville – Belmont County (3 reservoirs)
- Woodsfield – Monroe County
- Griggs Reservoir – Franklin County
- O'Shaughnessy Reservoir – Delaware County
- Kiser Lake – Champaign County
- Lake Loramie – Shelby County
- Lake Vesuvius-Lawrence County
- Metzger Reservoir – Allen County
- Timber Ridge-Gallia County

I2.2.1 Lake Sampling – Lake Habitat Aquatic Life Use Assessment

Ohio EPA has implemented a sampling strategy that focuses on evaluating the water quality conditions present in the epilimnion of lakes. The sampling target consists of an even distribution of a total of ten sampling events divided over a two-year period and collected during the summer months. Key water quality parameters sampled include total phosphorus, total nitrogen, chlorophyll a, Secchi depth, ammonia, dissolved oxygen, pH, total dissolved solids, and various metals such as lead, mercury, and copper. Details of the sampling protocol are outlined in the Inland Lakes Sampling Procedure Manual, available on Ohio EPA's web page at: http://www.epa.ohio.gov/dsw/inland_lakes/index.aspx.

I2.2.2 Water Quality Standards for the Protection of Aquatic Life in Lakes

Presently, lakes in Ohio are designated as exceptional warmwater habitat (EWH) with respect to the aquatic life habitat use designation. Revisions to Ohio's WQS that would change the aquatic life use from EWH to lake habitat (LH) are in progress. A primary reason for this revision is that in Ohio, a set of biological criteria apply to rivers and streams, whereas no biocriteria apply to lakes. The numeric chemical criteria to protect the LH use will remain the same as the criteria to protect the EWH use that currently applies to lakes, with a suite of nutrient criteria added. A set of numeric criteria that apply to all surface waters for the protection of aquatic life, regardless of specific use designation, will also apply to inland lakes and are referred to as "base aquatic life use criteria" in the proposed WQS rules. The base aquatic life use criteria will be the same aquatic life numeric criteria that currently apply to lakes. Examples include various metals such as copper, lead, and cadmium as well as organic chemicals such as benzene and phenol. Specific details concerning the revisions to the water quality standards rules can be reviewed on Ohio EPA's web page at the following address: http://www.epa.ohio.gov/dsw/rules/draftrules.aspx.

The chemical criteria specific to the LH aquatic life use in the proposed water quality standards rules are depicted in Table I-1. In addition to these parameters, the base aquatic life use criteria that apply to lakes and can be reviewed on Ohio EPA's web page at: http://www.epa.ohio.gov/portals/35/rules/draft_1-42new_base%20ALU%20criteria_aug08.pdf.

Table I-1. Proposed[1] lake habitat use criteria.
Note: All criteria are outside mixing zone averages unless specified differently.

Parameter Lake type	Form[2]	Units[3]	Statewide criteria	Ecoregional Criteria[4]				
				ECBP	EOLP	HELP	IP	WAP
Ammonia	T	mg/l	Table 43-4	--	--	--	--	--
Chlorophyll a [5]								
Dugout lakes	T	µg/l	6.0	--	--	--	--	--
Impoundments	T	µg/l	--	14.0	14.0	14.0	14.0	6.2
Natural lakes	T	µg/l	14.0	--	--	--	--	--
Upground reservoirs	T	µg/l	6.0	--	--	--	--	--
Dissolved oxygen [6] All lake types	T	mg/l	5.0 OMZM 6.0 OMZA	--	--	--	--	--
Nitrogen [5]								
Dugout lakes	T	µg/l	450	--	--	--	--	--
Impoundments	T	µg/l	--	930	740	930	688	350
Natural lakes	T	µg/l	638	--	--	--	--	--
Upground reservoirs	T	µg/l	1,225	--	--	--	--	--
pH All lake types	--	s.u.	A	--	--	--	--	--
Phosphorus [5]								
Dugout lakes	T	µg/l	18	--	--	--	--	--
Impoundments	T	µg/l	--	34	34	34	34	14
Natural lakes	T	µg/l	34	--	--	--	--	--
Upground reservoirs	T	µg/l	18	--	--	--	--	--
Secchi disk transparency [7]								
Dugout lakes	--	m	2.60	--	--	--	--	--
Impoundments	--	m	--	1.19	1.19	1.19	1.19	2.16
Natural lakes	--	m	1.19	--	--	--	--	--
Upground reservoirs	--	m	2.60	--	--	--	--	--
Temperature All lake types	--	--	B	--	--	--	--	--

1 Proposed in draft water quality standards rules, August 2008.
2 T = total.
3 m = meters; mg/l = milligrams per liter (parts per million); µg/l = micrograms per liter (parts per billion); s.u. = standard units.
4 ECBP stands for Eastern Corn Belt Plains; EOLP stands for Erie/Ontario Lake Plain; HELP stands for Huron/Erie Lake Plains; IP stands for Interior Plateau; and WAP stands for Western Allegheny Plateau.
5 These criteria apply as lake medians from May through October in the epilimnion of stratified lakes and throughout the water column in unstratified lakes.
6 For dissolved oxygen, OMZM means outside mixing zone minimum and OMZA means outside mixing zone minimum twenty-four-hour average. The dissolved oxygen criteria apply in the epilimnion of stratified lakes and throughout the water column in unstratified lakes.
7 These criteria apply as minimum values from May through October.
A pH is to be 6.5-9.0, with no change within that range attributable to human-induced conditions.
B At no time shall the water temperature exceed the average or maximum temperature that would occur if there were no temperature change attributable to human activities.

I2.3 Preview of Future Listings

An important distinction between assessment of aquatic life uses of rivers and streams in Ohio versus lakes is that the former relies on biological monitoring and a comparison of those results to the biological criteria as the assessment tool. Ohio does not have biological criteria that apply to lakes. As a result, the assessment methodology for the lake habitat aquatic life use will rely solely on the results of water quality sampling and a comparison of the results to the

applicable numeric criteria. This is an obvious and important difference to the weight-of-evidence approach traditionally used by Ohio for rivers and streams.

I2.3.1 Methodology Preview: Lake Habitat Use Assessment

The following protocol is intended to be used to determine the attainment status of the LH aquatic life use in a future Integrated Report. This is dependent upon the completion of the water quality standards rulemaking currently in progress, which provide the foundational components necessary to complete the actual assessment process. The proposed protocol for assessing the LH aquatic life use designation for the purpose of this preview is outlined below.

1) Comparison of individual sample concentrations for any base aquatic life use parameter sampled to the base aquatic life Outside Mixing Zone Average (OMZA) numeric criterion. If more than 10% of the samples within an assessment period (typically two years) exceed the OMZA numeric criterion, the LH use is considered to be impaired.
2) Comparison of the ammonia concentrations of the lake samples collected to the LH OMZA numeric criterion. The LH use is considered to be impaired if more than 10% of the individual samples exceed the OMZA.
3) Comparison of the average dissolved oxygen content of the epilimnetic samples of a thermally stratified lake (or samples throughout the water column of an unstratified lake) to the OMZA dissolved oxygen criteria for the LH use designation. If more than 10% of the average dissolved oxygen values do not meet the OMZA criterion, the LH use is considered to be impaired.
4) Comparison of the median pH value of the epilimnetic samples of a thermally stratified lake (or samples from throughout the water column of an unstratified lake) to the OMZA pH criteria for the LH use designation. If more than 10% of the median pH values do not meet the OMZA criterion, the LH use is considered to be impaired.
5) Comparison of the median chlorophyll a concentration of the samples collected over the sample period (typically two consecutive summers) to the applicable chlorophyll a criterion for the type of lake and ecoregion in which the lake is located. The LH use is considered to be impaired if the median chlorophyll a concentration exceeds the applicable chlorophyll a criterion.
6) Total phosphorus, total nitrogen and secchi depth parameters are used to flag potential impairment of the LH aquatic life use designation. Exceedance of these nutrient criteria is determined in a manner similar to that described for chlorophyll a. However, exceedances of the criteria for these parameters will trigger listing on the state's "watch list" rather than a determination of use impairment. Lakes listed on the watch list will be factored into the prioritization process for additional monitoring.

I2.3.2 Results

Table I-2 describes the assessment status of the LH aquatic life use designation for fifteen lakes sampled by Ohio EPA in 2008-2010 based on the protocol outlined in the previous section.

Table I-2. Summary of the lake habitat use assessment for lakes sampled in 2008-2010 using the draft assessment methodology described in this section.

Note: Values in red represent an exceedance of criteria resulting in a determination of non-support of the lake habitat aquatic life use designation. Values in yellow represent an exceedance of the criteria resulting in addition to the watch list.

Lake	Eco-region[3]	Lake Type[2]	Lake Habitat Use Status	Tiered Aquatic Life Criteria							Base Aquatic Life Criteria[1] (Units are percentages)									
				chl. *a*	t-P	t-N	sec-chi	D.O (%)	pH (%)	NH_3 (%)	TDS	As	Hg	Se	Cd	Cr	Cu	Pb	Ni	Zn
				Seasonal Median Values				Percentage of Samples Exceeding the OMZA Criterion												
Clear Fork Reservoir (Richland County)	EOLP	DPI	Non-Support	17.7 µg/L	17.5 µg/L	615 µg/L	1.20 m	10	0	0	0	0	0	0	0	0	0	10	0	0
Buckeye Lake (Licking County)	EOLP	DPI	Non-Support	76.4 µg/l	67.5 µg/l	1075 µg/l	0.57 m	70	0	0	0	0	0	0	0	0	0	0	0	0
Swift Run Lake (Miami County)	ECBP	DPI	Non-Support	72.1 µg/l	72 µg/l	550 µg/l	0.44 m	50	0	0	0	0	-	0	0	0	0	0	0	0
Dillon Reservoir (Muskingum County)	WAP	DPI	Non-Support	44.7 µg/l	132 µg/l	730 µg/l	0.81 m	0	0	0	0	0	0	0	0	0	0	0	0	0
Deer Creek Reservoir (Stark County)	EOLP	DPI	Non-Support	30.9 µg/l	29 µg/l	820 µg/l	0.66 m	35.7	7.1	0	0	0	0	0	0	0	0	10	0	0
Vets Memorial Reservoir (Hancock County)	HELP	UP	Non-Support	10.5 µg/L	18 µg/L	1830 µg/l	2.11 m	0	10	0	0	0	0	0	0	0	0	0	0	0
Frazier Quarry (Muskingum County)	WAP	DPI	Watch	2.3 µg/L	15 µg/l	500 µg/l	5.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0
Cutler Lake (Muskingum County)	WAP	DPI	Non-Support	12.1 µg/L	21 µg/l	550 µg/l	0.67 m	67	0	0	0	0	-	0	0	0	0	0	0	0
Beaver Creek Reservoir (Seneca County)	HELP	UP	Non-Support	20.8 µg/L	14 µg/L	2355 µg/l	1.36 m	0	60	0	0	0	0	0	0	0	0	0	0	0

Lake	Eco-region[3]	Lake Type[2]	Lake Habitat Use Status	Tiered Aquatic Life Criteria							Base Aquatic Life Criteria[1] (Units are percentages)									
				chl. *a*	t-P	t-N	sec-chi	D.O (%)	pH (%)	NH_3 (%)	TDS	As	Hg	Se	Cd	Cr	Cu	Pb	Ni	Zn
				Seasonal Median Values				Percentage of Samples Exceeding the OMZA Criterion												
East Branch Reservoir (Geauga County)	EOLP	DPI	Non-Support	26.3 µg/L	31 µg/L	960 µg/l	1.11 m	45	9	0	0	0	0	0	0	0	0	0	0	0
LaDue Reservoir (Geauga County)	EOLP	DPI	Non-Support	24.7 µg/L	16 µg/L	910 µg/l	1.58 m	40	0	0	0	0	0	0	0	0	0	0	0	0
Lake Rockwell (Portage County)	EOLP	DPI	Non-Support	28.8 µg/L	25 µg/L	1000 µg/l	1.26 m	36	0	0	0	0	0	0	0	0	0	0	0	0
Barnesville #1 (Belmont County)	WAP	DPI	Non-Support	10.4 µg/L	13 µg/L	481 µg/l	1.12 m	0	40	0	0	0	0	0	0	0	0	0	0	0
Barnesville #2 (Belmont County)	WAP	DPI	Non-Support	15.2 µg/L	16 µg/l	515 µg/l	1.6 m	0	0	0	0	0	0	0	0	0	0	0	0	0
Barnesville #3 (Belmont County)	WAP	DPI	Watch	4.9 µg/L	18 µg/l	250 µg/L	1.93 m	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodsfield (Monroe County)	WAP	DPI	Non-Support	39.2 µg/L	28 µg/l	735 µg/l	1.33 m	20	50	0	0	0	-	0	0	0	0	0	0	0
Griggs Reservoir (Franklin County)	ECBP	DPI	Non-Support	50.6 µg/L	92 µg/l	3052 µg/l	0.83 m	36	9	9	0	0	0	0	0	0	0	0	0	0
O'Shaughnessy Reservoir (Delaware County)	ECBP	DPI	Non-Support	52.1 µg/L	57 µg/l	3760 µg/l	0.84 m	45	0	0	0	0	0	0	0	0	0	0	0	0
Kiser Lake (Champaign County)	ECBP	DPI	Non-Support	68.3 µg/L	75 µg/l	1230 µg/l	0.78 m	80	0	0	0	0	0	0	0	0	0	0	0	0
Lake Loramie (Shelby County)	ECBP	DPI	Non-Support	89.1 µg/L	270 µg/l	1140 µg/l	0.15 m	36	0	9	0	0	0	0	0	0	0	0	0	0

1 Represent parameters typically included in a standard lake assessment; additional parameters sampled as necessary.
2 DPI = impoundment; UP = upground reservoir
3 ECBP = Eastern Corn Belt Plains; EOLP = Erie/Ontario Lake Plain; WAP = Western Allegheny Plateau; HELP = Huron/Erie Lake Plains

I3. Mercury Reduction at Ohio EPA

Mercury is a persistent bioaccumulative toxic metal that is widely used in many products. Once mercury is released into the environment its toxicity, persistence and ability to travel up the food chain are important issues for human health and the environment. Ohio has a statewide health advisory for mercury from fish consumption for sensitive populations: women of childbearing age and children fifteen years old or younger (issued by Ohio's Department of Health).

U.S. EPA is allowing states to identify waters for a special 303(d) list category devoted to mercury issues (5M). While moving in this direction would be preferable as a way to focus on this important pollutant, Ohio EPA has decided that such a move is not possible for this report. At the same time, Ohio EPA is taking action to decrease mercury pollution and these efforts are summarized here.

I3.1 Ohio Law

House Bill 443 was made law on January 4, 2007. The law has the mercury product regulations created initially in House Bill 583 and Senate Bill 323, establishing sales bans for certain mercury products. Public and private schools through high school were not to purchase mercury, mercury compounds or mercury-measuring devices for classroom use as of April 6, 2007. Mercury thermometers and mercury-containing novelty items were not to be sold in Ohio as of October 6, 2007. The sale of novelty items that have mercury cell button batteries are banned starting in 2011. Mercury thermostats were not to be sold or installed as of April 6, 2008. There are exemptions to the sales bans.

I3.2 Ohio Projects

The Ohio EPA works in several areas seeking to reduce mercury emissions and increase awareness:

- identification of air sources of mercury, including identification of waterbodies in the State impaired by mercury predominantly from atmospheric deposition, potential emissions sources contributing to deposition in the State, and adoption of appropriate State-level programs to address in-state sources

- identification of other potential multi-media sources of mercury, such as mercury in products and wastes, and adoption of appropriate State-level programs (note that mercury-containing products may be a source of mercury to the air and other media during manufacturing, use, or disposal)

- quantifying multi-media mercury reductions achieved by scrubber systems installed at Ohio power plants in response to a lawsuit filed by several northeastern states

- adoption of statewide mercury reduction goals and targets, including percent reduction and dates of achievement, for air and other sources of mercury, as well as reduction targets for specific categories of mercury sources where possible

- multi-media mercury monitoring, including water quality, air deposition, and air emissions monitoring

- standardizing reporting for all publicly owned treatment works with mercury variances in relation to submitting data for the annual Pollutant Minimization Program report

- investigating mercury in various types of wastewater, including
    - primary materials industries, including primary metal production, oil refining, and coal facilities
    - facilities processing steel scrap (continuous casting and steel foundries)
    - publicly-owned treatment works, which looks at indirectly discharging industries through the pretreatment program and facility Pollutant Minimization Plan
    - coal power plant wastewater from scrubbers, ash ponds and "Low Volume" wastewaters
    - other industries in interactive allocation segments to get an accurate accounting of mercury in the segments

- working to control discharges from the State's one mercury cell sodium/chlorine plant. The current consent order includes reducing fugitive air emissions that have contributed to storm water discharges of mercury. The plant will be scrubbing cell emissions with water and sending those discharges to the plant's zero discharge process treatment system. The consent order also requires the company to track mercury mass balances through the facility, and recycle where possible. This includes using collected storm water as process water make-up

- public documentation of the State's mercury reduction program in conjunction with the State's Integrated Report, and public reporting of progress in carrying out the State's programs and reducing in-State mercury sources

- coordination across States, where possible, such as multi-State mercury reduction programs. Ohio EPA has representatives in several organizations that work toward this goal.

In addition, several specific projects are underway as described below.

Mercury Collection and Recycling
Mercury collection and recycling occurs at several businesses in Ohio. Names and contact information for these facilities are available on the Ohio EPA mercury recycling vendor website (http://www.epa.ohio.gov/ocapp/Recycle.aspx).

Mercury Switch Removal Program moved to the National Program
In September 2006, Ohio was one of the first states to partner with the National Mercury Vehicle Switch Recycling Program (NMVSRP) to collect automobile mercury switches. Initially Ohio administered the incentive program. While Ohio EPA administered the program, auto recyclers in Ohio collected for recycling 41,310 mercury-containing automobile switches and $123,900 in incentives were awarded. NMVSRP took over all aspects of Ohio's switch collection program in September, 2008 including incentives. Currently Ohio works to direct auto recyclers to the national program and assist them when they have questions.

Ohio Good DEED Program
The Ohio Dental Association (ODA) initiated the Good DEED (Dedicated to Environmental Excellence in Dentistry) program their new recognition program on May 31, 2010. It is a voluntary program to recognize the efforts of dental offices to operate in an environmentally

responsible manner. The Good DEED program uses a tiered approach for recognizing dental offices that minimize the environmental impact of their practices on Ohio's environment. It includes: comprehensive on-line checklists to identify American Dental Association best management practices (BMPs), environmental regulations that apply to dental offices, and best management practices to help your business be more sustainable and preserve and protect natural resources. The two tiers of the program recognize dental practices that follow the American Dental Association's BMPs including the installation of amalgam separators and a second tier of recognition, for dental offices pursuing more environmentally sustainable activities.

Ohio Hospital Project
Ohio EPA works with The Ohio Hospital Association to reduce the generation of hospital waste, including mercury, which hospitals commonly have in thermometers, blood pressure monitors and other equipment. A formal agreement between the two organizations was signed as part of Ohio Pollution Prevention Week, September 20-24, 1999. The Ohio Healthy Hospitals Pollution Prevention Initiative is based on a federal agreement signed by U.S. EPA and the American Hospital Association. The goal of the program is to provide tools to support hospitals' continued efforts to minimize the production of pollutants and reduce the amount of waste generated.

I3.3 Interagency Groups

Members of the Ohio EPA are involved in several collaborative groups with representatives from various organizations and agencies.

- Great Lakes Regional Collaboration (GLRC) – formed with members from the federal Great Lakes Interagency Task Force, the Council of Great Lakes Governors, the Great Lakes Cities Initiative, Great Lakes tribes and the Great Lakes Congressional Task Force. The group includes members from non-governmental organizations and other interests in the Great Lakes Region. The GLRC created a strategy (released in December 2005) to restore the Great Lakes basin. Most recently the GLRC released a draft document that describes a strategy to phase-down mercury in products within the Great Lakes drainage area, which includes a portion of northern Ohio.

- Binational Toxics Strategy Mercury Workgroup – The Binational Toxics Strategy Mercury Workgroup is comprised of representatives from state governments, the United States and Canadian federal governments, and several environmental groups. Its purpose is to set mercury reduction goals applicable to the aggregate of releases to the air nationwide and of releases to the water within the Great Lakes Basin.

- Ohio River Sanitation Commission (ORSANCO) NPDES Workgroup – This on-going workgroup developed a common framework for monitoring power plant ash pond and scrubber discharges for low-level mercury. These data will be used, along with ORSANCO's mixing zone phase-out, to reduce mercury discharges to the Ohio River.

- Quicksilver Caucus – The Quicksilver Caucus (QSC) was formed in May 2001 by a coalition of State environmental association leaders to collaboratively develop holistic approaches for reducing mercury in the environment. Caucus members who share mercury-related technical and policy information include the Environmental Council of the States (ECOS), the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), the National Association of Clean Air Agencies (NACAA), the

Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), the Association of State Drinking Water Administrators (ASDWA) and the National Pollution Prevention Roundtable (NPPR). The QSC's long-term goal is that State, Federal, and International actions result in net mercury reductions to the environment. The QSC is working collaboratively and in partnership in three priority areas:

- stewardship approaches for reducing mercury in the environment and managing safe, long-term storage of elemental mercury nationally and internationally
- multi-media approaches for a mercury-based TMDL taking into account the contributions of the air and waste program as well as using their statutes to craft solutions
- approaches to decrease the global supply and demand for mercury.

Ohio Sport Fish Consumption Advisory – The current Ohio Sport Fish Tissue Monitoring Program has monitored contaminants in sport fish since 1993. Three state agencies participate: the Ohio Department of Natural Resources (ODNR), the Ohio Environmental Protection Agency (Ohio EPA) and the Ohio Department of Health (ODH). Both ODNR and Ohio EPA collect fish throughout Ohio's jurisdictional waters. Ohio EPA analyzes the fish samples, reviews the data and issues fish consumption risk assessment evaluations. ODH releases fish consumption advisory issuance information to the public and provides fish consumption information to Ohio citizens as part of the Women's, Infant's and Children's (WIC) and the Help Me Grow (HMG) Programs' activities. Information is distributed where fishing licenses are sold, through pamphlets available in four languages, and via the Internet. See http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx.

I3.4 Ohio Resources

A number of videos, fact sheets, and presentations are available on the Ohio EPA website that relate to mercury. These include household mercury fact sheets, an introduction to mercury issues, a guide for dealing with mercury by school administrators, an informational sheet for building awareness of mercury in schools, information about mercury in industry, and suggestions for developing a community mercury reduction program.

I4. Harmful Algal Blooms

Cyanobacteria are photosynthesizing bacteria, commonly called blue-green algae, that are capable of producing toxins (cyanotoxins) that affect the skin, liver or nervous system. They can also cause water quality deterioration associated with excessive biomass production (such as depleted dissolved oxygen levels, fish kills, taste and odor problems in drinking water, and elevated trihalomethane levels). A large bloom of cyanobacteria that causes harmful effects is called a harmful algal bloom (HAB).

Cyanobacteria have the ability to adapt to a wide range of temperatures and water flow regimes, contributing to their common occurrence across Ohio waters. The presence of cyanobacteria is not necessarily a concern, but harmful blooms can form when conditions are favorable for rapid growth. When excess nutrients are present, especially phosphorus, these bacteria can form expansive blooms and produce cyanotoxins at levels of concern for humans and animals.

The harmful effects of these blooms are well documented in scientific literature and recognized by U.S. Environmental Protection Agency (U.S. EPA), Center for Disease Control (CDC) and World Health Organization (WHO) as causing acute and chronic impacts in human and animal populations. U.S. EPA recognizes that HABs are increasing in spatial and temporal prevalence in the U.S. and worldwide and that their highly potent toxins are a significant hazard for human health and ecosystem viability. While not currently regulated in drinking water, cyanobacteria and their toxins are on U.S. EPA's Office of Water Unregulated Contaminant Monitoring Regulation List 3 and Contaminant Candidate List. The WHO has developed risk-based thresholds for adults for recreational exposure at 20 parts per billion (ppb) and at 1 ppb for drinking water for microcystin.

A harmful algal bloom along western shore of Kelleys Island August 11, 2011

I4.1 Response to Harmful Algal Blooms

As incidents of HABs have increased, Ohio's response has evolved. In 2008, a HAB workgroup consisting of representatives of state and federal agencies, academia and volunteers was formed. Ohio Department of Natural Resources (ODNR), Ohio Department of Health (ODH) and Ohio EPA developed the State of Ohio Initiative to Address HABs in Ohio's Inland Lakes and Lake Erie and a state-wide algal toxin sampling program. A HAB steering committee was formed in November 2010 to further refine Ohio's HAB response strategy and develop a consistent sampling methodology, terminology, algal toxin thresholds, and advisory protocols.

In June 2011, Ohio EPA, Ohio Department of Health (ODH) and Ohio Department of Natural Resources (ODNR) released the *Ohio Harmful Algal Bloom Response Strategy*. The purpose of the strategy, which focuses on publically owned, recreational lakes with public beaches and/or boat ramps, and drinking water source waters, is to protect people from toxins produced by cyanobacteria that may be in recreational or source waters at concentrations that can affect human health.

Ohio's HAB Response Strategy 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 can find the information it needs about HABs and the current state of public waters, including any advisories posted, ODH, ODNR and Ohio EPA developed www.ohioalgaeinfo.com. This web site provides 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. The State expects to revise the strategy as needed in the future as more experience is gained with HABs.

In addition to helping develop the state strategy, Ohio EPA has worked on other HAB-related projects and conducted targeted algal toxin monitoring. Ohio EPA acquired analytical equipment that could be used to perform toxin analysis, evaluated rapid test kits for microcystin

analysis, prepared fish tissue samples for algal toxin analysis and helped develop a workshop for algae identification and cell counting.

I4.2 HAB Advisories and HAB-related Human Illness Reports

Advisories are designed to provide information and warnings to protect public health from the potential health impact of algal toxins present in HABs. In 2010, Ohio EPA, ODNR and ODH developed a three-tiered recreational water advisory system. Advisory signs were posted at 20 state park beaches where microcystin levels were 20 ppb or greater, or if other algal toxins were detected. There are no risk-based thresholds for toxins other than microcystin, but there is scientific evidence that many of these toxins can cause potentially severe human illness. The highest level of advisory, a no-contact advisory, was posted at Grand Lake St. Marys and at Cutler Lake in Blue Rock State Park in 2010. According to ODH, in 2010 there were 64 reports of human illness and 41 of these cases met the definition for probable cases. Additionally, there were seven dog illnesses that met the definition for probable cases; five of the dogs died. In 2011, using the new advisory framework in Ohio's HAB Response Strategy, recreational advisories were posted at five inland lakes and three Lake Erie locations. HAB-related human illness reports are not yet available for 2011.

A harmful algal bloom at South Bass Island September 18, 2011

I4.3 Algal Toxin Monitoring

Monitoring of HABs has occurred in a variety of ways across the state. The main types of monitoring that have taken place are discussed below.

I4.3.1 Algal Toxin Monitoring – Recreational Waters

Ohio EPA began monitoring for algal toxins in recreational waters in 2009, after high levels of the algal toxin microcystin were detected in Grand Lake St. Marys (GLSM) as part of sampling from the National Lake Survey. In response, Ohio EPA and ODNR sampled microcystin at GLSM, lakes included in Ohio EPA's Inland Lake Monitoring Program, and other lakes with harmful algal blooms reported at public beaches or drinking water intakes. Algal toxin monitoring continued in 2010 at additional inland lakes and at select state park beaches and drinking water intakes affected by HABs. In order to evaluate the occurrence of additional algal toxins, analyses were expanded in 2010 to include cylindrospermopsin, saxitoxin and anatoxin-a when the blooms consisted of cyanobacteria capable of producing these other toxins.

In 2009-2010, microcystin toxin levels ranged from non-detect to greater than 2,000 ppb. Cylindrospermopsin, saxitoxin, and anatoxin-a were also detected in Ohio surface waters at low levels. In 2011, Ohio EPA analyzed 376 algal toxin samples and results for microcystin ranged

from non-detect to greater than 100 ppb. Ohio EPA algal toxin results are available for all years at www.ohioalgaeinfo.com.

I4.3.2 Algal Toxin Monitoring and Public Water System Outreach – Drinking Water

In response to the harmful algal blooms detected in 2010, Ohio EPA sampled the raw and finished drinking water of 19 surface water public water systems for algal toxins. Out of 131 samples collected, only one sample of finished (treated) drinking water contained microcystin above detection limits; it was still below Ohio EPA's 1 ppb drinking water threshold. In the raw water, however, microcystin was present in 83% of the source waters sampled.

Ohio EPA monitoring efforts at public water systems continued in 2011 with samples collected at nine Lake Erie and nine inland lake public water systems (PWS). At least eight PWS now voluntarily monitor their raw and finished water to allow the system to respond quickly and potentially avoid toxins or adjust treatment as needed. Overall, 302 algal toxin samples were collected at water systems and there were no finished drinking water detections. Algal toxins persisted in the source water, however, and microcystin concentrations in Grand Lake St. Marys and the western basin of Lake Erie exceeded concentrations measured in 2010.

The cost to water systems for the additional treatment necessary to remove algal toxins and taste and odor compounds associated with algal blooms can exceed hundreds of thousands of dollars per water system per year.

To assist public water systems, Ohio EPA's Division of Drinking and Ground Waters (DDAGW) developed customized HAB educational materials, including a bloom characterization guide, reservoir management fact sheet and algaecide application fact sheet. DDAGW also partnered with the American Water Works Association Ohio Section Technology Committee to develop a white paper about algal toxin treatment for drinking water facilities.

I4.3.3 Algal Toxin Monitoring – Accumulation in Fish Tissue

The freshwater cyanobacterial algal toxin exposure route to humans via fish consumption is not well established. This is at least in part because of the lack of a U.S. EPA-approved method for analyzing for freshwater algal toxins such as microcystin in fish tissue. Many of the studies that have been published use enzyme-linked immunosorbent assay (ELISA) or high-performance liquid chromatography (HPLC) methods for analyzing microcystin in fish tissue, which are known to have a high rate of false-positive results for fish tissue due to matrix interference (G. Boyer, personal comm.). Studies using liquid chromatography/tandem mass spectroscopy (LC-MS/MS) appear to indicate less microcystin accumulating in fish fillets than studies using the other methods, including fish tissue samples run using LC-MS/MS from fish taken from Grand Lake St. Marys that show no detections of microcystin in fish fillets with reporting limits of 0.2 ppb.

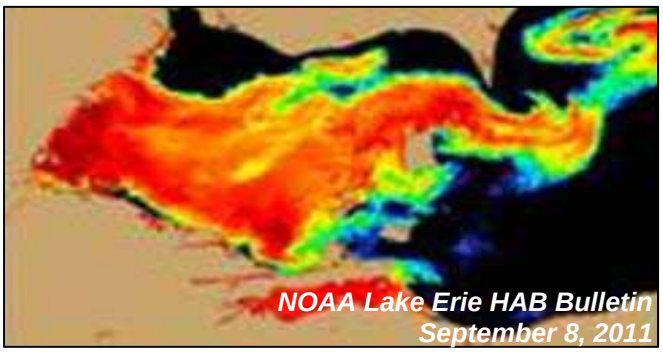
Because of the uncertainty associated with freshwater algal toxin analysis in fish tissue, and the lack of a reliable, U.S. EPA-approved analytical method for microcystin and other algal toxins in fish tissue, the effect of HABs on human health via fish consumption in freshwater systems cannot be determined at this time.

In order to better understand the occurrence of algal toxins in Ohio fish tissue, the Ohio Water Development Authority awarded Ohio EPA a grant to look for microcystin in fish fillets from Grand Lake St. Marys. Ohio EPA's Division of Surface Water (DSW) is contracting with State

University of New York – Syracuse to analyze the fish fillet samples. Preliminary results from fish collected in November 2010 indicate that microcystin is not accumulating or persisting in fish fillets, with reporting limits of approximately 0.2 ppb, well below any health-based advisory limits. DSW collected a second round of fish in June 2011 and included samples from Lake Erie fish. At the time of this report, the samples were in the process of being analyzed. With the help of ODNR, DSW plans to collect three more rounds of fish fillets for microcystin analysis. Depending on the results of the analyses, Ohio EPA will issue advice or conduct additional fish tissue monitoring if microcystin is found in fillets at or near levels that might trigger a "Do Not Eat" fish advisory, which is currently set at 28 ppb.

I4.3.4 Use of Satellite Imagery to Evaluate HABs on Lake Erie and Inland Lakes

NOAA provides a weekly HAB bulletin for the western basin of Lake Erie while there are active blooms in the western basin. Information about NOAA's effort is available online at http://www.glerl.noaa.gov/res/Centers/HABS/. These bulletins include an evaluation of the current extent of the algal bloom and a forecast for bloom movement and growth over the following week. Forecasts are based on specially developed algorithms that estimate cyanobacteria concentrations from satellite imagery and then predict how the bloom will respond to weather conditions. Park managers and Ohio public water systems utilize the NOAA HAB bulletins to target sampling and adjust water treatment if needed. Ohio EPA worked with NOAA to expand this remote assessment approach to include inland lakes and in May 2011, NOAA provided training to Ohio EPA and other state and federal agency partners on how to interpret satellite data. In 2011, Ohio EPA reviewed the inland lake satellite data and used the information to target HAB sampling and provide an early warning for water systems. In an effort to improve the accuracy of satellite-based cyanobacteria estimates, Ohio EPA is sharing algal toxin and phytoplankton data with NOAA to improve algorithm calibrations. Considering the scope and scale of HABs across Ohio, use of satellite imagery and remote sensing will likely be an important tool for the State's HAB response.



I4.4 HABs in Grand Lake St. Marys

Since HABs were first detected at Grand Lake St. Marys as part of the National Lake Survey they have continued to increase in severity. In the spring of 2010, a lake-wide surface algae bloom stretched across 13,500 acres of Grand Lake St. Marys in Mercer and Auglaize counties. Various levels of advisories were posted at the three State Park beaches all summer. Different types of liver and nerve toxins (microcystin, cylindrospermopsin, anatoxin-a and saxitoxin) were detected in the lake throughout the summer. Surface scums were not as prevalent in 2011, but the presence of algal toxins led to advisory postings at all state park beaches. Algal toxin concentrations at the City of Celina's drinking water intake were 23% higher than in 2010 (maximum concentration 43.4 µg/l). The City of Celina continues to test their finished water, which has not had a single detection of microcystin in their finished water since testing began in May 2009.

In 2010, a consultant hired by U.S. EPA developed recommendations for addressing nutrient cycling in the lake and nutrient input from the Grand Lake St. Marys watershed. Two in-lake

pilot projects were conducted in the fall of 2010 to address in-lake HAB issues and results. In 2011, an in-lake alum treatment of 4,000 acres in the center of the 13,500 acre lake was initiated to immediately address phosphorus levels in the center of the lake. Sediment removal at tributaries and rough fish removal were also undertaken. To address the nutrient load from the watershed, farmers are required to develop nutrient management plans to control phosphorus runoff to the lake. A report on progress is expected in late 2011.

Ohio EPA received a grant from the Ohio Water Development Authority to have fish from Grand Lake St. Marys analyzed for microcystin. For more information on fish tissue sampling, please see Section I4.2.3.

I4.5 Addressing HABs at the Source

In addition to carrying out the HAB strategy and revising the strategy as needed, the State of Ohio continues to seek ways to address the root cause of HABs—excessive nutrients that enter the State's waterways. Ohio EPA has submitted a draft "Nutrient Reduction Strategy" to U.S. EPA, seeking approval for the framework that will be used to reduce nitrogen and phosphorus levels in waters of the State. The strategy is part of a multi-faceted, multi-agency effort to solicit input from stakeholder groups in an effort to reduce nutrient impacts in Ohio's waters. The framework will help with developing a plan that protects drinking water, recreational water and aquatic life while considering costs and the current economic climate. In the meantime, as documented throughout this report, ongoing monitoring identifies where nutrients are causing water quality impairments and TMDLs are being developed to quantify needed load reductions.