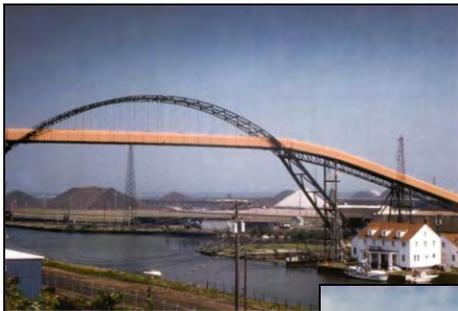




# Delisting Targets For Ohio Areas of Concern

Ashtabula River  
Black River

Cuyahoga River  
Maumee River



*Ashtabula River*



*Cuyahoga River*



*Black River*



*Maumee River*

# Delisting Targets for Ohio Areas of Concern

Ashtabula River \* Black River \* Cuyahoga River \* Maumee River

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## Disclaimer

This document is intended to be used as guidance to assist the local  
Ohio AOC committees in determining delisting targets for their areas of concern.

This document does not carry the force of law. Also note that some targets  
may change as various Ohio EPA rules and regulations are updated or the results of new research  
become available. The original targets were developed in 2005 and revised and updated in 2008.

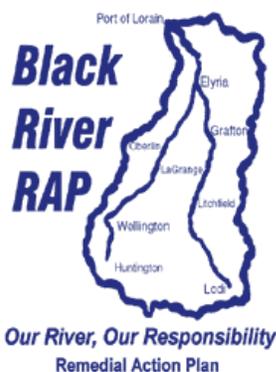
## Introduction

For decades, the same river segments were repeatedly identified as the most contaminated areas around the Great Lakes. The adoption and implementation of environmental laws and regulations significantly reduced the discharge of pollutants, but these areas continued to experience severe environmental degradation. In 1985, the Water Quality Board of the International Joint Commission (IJC) designated these locations as Areas of Concern (AOC) and recommended the development of comprehensive remedial action plans (RAP) to concentrate on the cleanup and restoration of beneficial uses to these areas. New, creative, innovative, collaborative and wide-reaching approaches would be needed to achieve this goal. The eight Great Lakes States and the Province of Ontario agreed to the challenge, and Ohio EPA took the lead for the program in Ohio. As outlined in the Great Lakes Water Quality Agreement, the goal of the RAPs is to restore all beneficial uses in each AOC via an ecosystem approach and with considerable public participation.

There are four AOCs in Ohio: the lower two miles of the Ashtabula River; the entire Black River watershed; the lower 45 miles of the Cuyahoga River, including all tributaries and the adjacent shoreline; and the lower 23 miles of the Maumee River, including several adjacent watersheds that discharge directly to Lake Erie. Ohio EPA, in collaboration with USEPA, is responsible for ensuring that RAPs are implemented in Ohio. However, neither the State nor Federal Governments has sufficient resources, the historical knowledge, nor even the authorities to restore all the impairments identified. Restoring the AOCs will have to be a collaborative effort with the local communities, businesses and industries. Initial public meetings on the RAP process and the outstanding environmental problems in each AOC were held in 1987. At those meetings, the local communities showed a great interest in taking a strong role in restoring their rivers. The Ohio EPA invited the local communities to become active partners in the development and implementation of the RAPs.



Local committees have been created in each of the AOCs to coordinate the development and implementation of the RAPs. Ohio EPA works with these committees as an equal partner in the RAP process. The local committees have been built with the intention of obtaining representation from all of the local agencies, organizations, and unaffiliated citizens with an interest or a stake in river remediation.



Each of Ohio's RAPs has been organized somewhat differently, depending on the unique characteristics of each AOC. These characteristics include: the nature of the environmental problems; sources and causes of the problems; available resources (both technical and financial); political climate; public interest; and the volunteer base.

The ecosystem approach and the public involvement requirements of the RAP process have allowed the RAPs to be as flexible and

innovative as needed to restore all beneficial uses to each AOC. An Ohio EPA State Coordinator and an U.S. EPA Liaison have worked with the local communities and coordinated much internal cross program technical assistance from agency staff. This agency-wide cooperation has been invaluable to the RAP program. Promotion of the following principles by Ohio EPA has led to an effective RAP program in Ohio:

- Empowering the local communities with Ohio EPA as an equal partner
- Community participation promotes local ownership
- Participation of professional planners
- Top-down commitment
- Keeping RAP needs and accomplishments high profile
- Creating a separate identity
- Staff enthusiasm, dedication, and creativity
- Volunteer enthusiasm, dedication, and creativity
- Developing partnerships with existing programs
- Constant communication at all levels
- Extensive efforts to seek funding
- Setting achievable milestones to encourage enthusiasm and maintain interest
- Strategic planning
- Numerous efforts to keep the public informed, aware and involved
- Keeping State and U.S. elected officials apprised of RAP efforts and needs



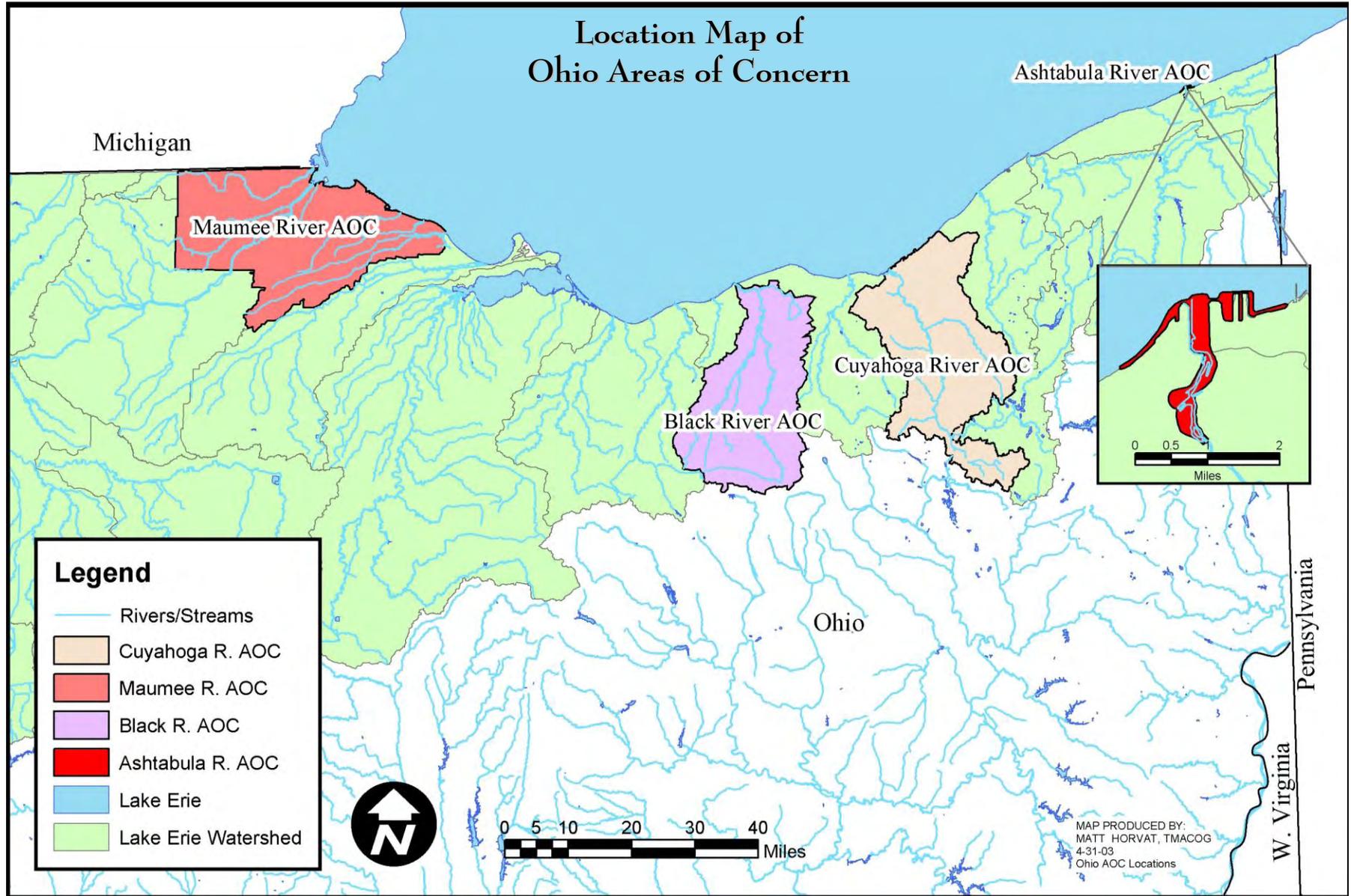
Working under these principles, the RAP groups have assessed the impairments to beneficial use (Stage 1 Reports), prepared status reports, identified sources, and defined many remediation and restoration needs. Projects have been implemented to better define impairments and sources, remediate sources, restore habitat, remove contaminated sediments, and outline plans for strategic action.

It was difficult to track progress in reaching RAP goals because the emphasis of the overall RAP program was solely on delisting an entire AOC. In 2001, the US Great Lakes Policy Committee (USPC) recommended that an incremental delisting approach be taken to better measure RAP progress. This meant that stream segments of an AOC could be delisted as they were restored, and select beneficial use impairments could be delisted as established goals were achieved. This would allow for a truer representation of the tremendous amount of work invested in AOCs, as opposed to the measurement of progress based only on whether an entire AOC had been delisted.



It is highly recommended that each RAP group become familiar with the USPC delisting guidance document.

In 2005, Ohio EPA developed the minimum delisting targets acceptable under State of Ohio regulations and policies to provide Ohio RAPs with a baseline from which to fashion targets and milestones that may be specific to their AOC. This document was updated in 2008. The local RAP groups may adopt this document in total or select more stringent or additional targets if they choose.



## Developing Ohio's Delisting Targets

The Ohio EPA RAP team reviewed the original listing/delisting criteria provided by the IJC (IJC 1991) and slightly revised them to account for any regulatory or program changes that have occurred since they were developed. This allowed Ohio EPA to draft listing criteria from a State regulatory perspective. The team then determined what criteria the State would require to document that a beneficial use had been restored, and termed it the State delisting target. These targets are based on existing State rules and regulations, State policies, or other State guidance whenever possible. State criteria for any regulatory program must be at least as stringent as federal criteria, so a comparison to federal standards was automatically built into the process. This document was subject to internal program review at Ohio EPA to ensure it is accurate and understandable. Connections and commonalities to other State watershed-based initiatives were examined where applicable.

Beneficial Use Impairment (BUI) Assessment Reports prepared for the Lake Erie Lakewide Management Plan (LaMP) were used as background references and to better connect the AOCs to Lake Erie. All reference documents used or that may be useful to the RAPs in setting their own delisting targets, are listed in the write-up for each BUI, and are obtainable from Ohio EPA. A rationale is presented for each BUI, explaining how each proposed target was selected. Suggested milestones for tracking progress toward achieving the delisting target are also presented. Several BUIs include milestones that may qualify them for being designated as an area in recovery. This means that all remedial activities identified have been implemented and only monitoring is required to determine when the delisting targets have been achieved. It may take several years for the effects of remedial actions to be measured in environmental results.

This document is intended to be used by Ohio RAP groups as a reference document to establish delisting targets and milestones specific to their AOC. For example: different RAPs may select different target sentinel species; habitat characteristics and needs in one AOC may be different in another AOC; fish consumption advisories in one AOC may be due to local sources while in another they reflect the same conditions present in Lake Erie. Each RAP may also have different milestones to measure their progress. It is the responsibility of each RAP, in collaboration with Ohio EPA, to adopt delisting targets and milestones that reflect the needs of their AOC and meet the minimum State delisting targets. Each RAP may also adopt this document as their targets. When RAP is used in this document, it is typically referring to the local RAP committee/group.

On the following page is a consolidated table listing the impairment status of all the beneficial uses in each Ohio AOC. A beneficial use was listed as impaired if it was impaired anywhere within the boundaries of the AOC. Several of the RAPs have prepared more detailed assessments that further assign use impairment by tributary or stream segment within their AOC. This approach is encouraged as the USPC Guidance (2001) allows that stream segments or tributaries within an AOC can now be delisted incrementally. This is a positive step toward better tracking RAP progress, particularly in the larger AOCs. It also allows closer alignment with the Ohio EPA approach to monitoring the attainment of water use designations as detailed in Section 3745-1 of the Ohio Administrative Code.

## Status of Ohio Areas of Concern Beneficial Use Impairments

| Beneficial Use Impairment |   | Ashtabula    | Black        | Cuyahoga     | Maumee       |
|---------------------------|---|--------------|--------------|--------------|--------------|
| BUI 1:                    | Restrictions on Fish Consumption                                    | Impaired     | Impaired     | Impaired     | Impaired     |
|                           | Restrictions on Wildlife Consumption                                | Not Impaired | Not Impaired | Not Impaired | Impaired     |
| BUI 2:                    | Tainting of Fish and Wildlife Flavor                                | Not Impaired | Not Impaired | Not Impaired | Not Impaired |
| BUI 3:                    | Degradation of Fish Populations                                     | Impaired     | Impaired     | Impaired     | Impaired     |
|                           | Degradation of Wildlife Populations                                 | Not Impaired | Not Impaired | Not Impaired | Not Impaired |
| BUI 4:                    | Fish Tumors or Other Deformities                                    | Impaired     | In Recovery  | Impaired     | Impaired     |
| BUI 5:                    | Bird or Animal Deformities or Reproductive Problems                 | Not Impaired | Not Impaired | Not Impaired | Not Impaired |
| BUI 6:                    | Degradation of Benthos  | Impaired     | Impaired     | Impaired     | Impaired     |
| BUI 7:                    | Restrictions on Dredging Activities                                 | Impaired     | Impaired     | Impaired     | Impaired     |
| BUI 8:                    | Eutrophication or Undesirable Algae                                 | Not Impaired | Impaired     | Impaired     | Impaired     |
| BUI 9:                    | Restrictions on Drinking Water Consumption or Taste & Odor Problems | Not Impaired | Not Impaired | Not Impaired | Not Impaired |
| BUI 10:                   | Beach Closings (Recreational Contact)                               | Not Impaired | Impaired     | Impaired     | Impaired     |
| BUI 11:                   | Degradation of Aesthetics   | Not Impaired | Impaired     | Impaired     | Impaired     |
| BUI 12:                   | Added Costs to Agriculture or Industry                              | Not Impaired | Not Impaired | Not Impaired | Impaired     |
| BUI 13:                   | Degradation of Phytoplankton and Zooplankton Populations            | NA           | NA           | NA           | NA           |
| BUI 14:                   | Loss of Fish Habitat  | Impaired     | Impaired     | Impaired     | Impaired     |
|                           | Loss of Wildlife Habitat  | Not Impaired | Impaired     | Not Impaired | Impaired     |

*\*BUIs are current as of 2008. BUI status listed as unknown in previous documents has now been defined as impaired, not impaired or NA.*

## How to Use this Document

The write-up for each BUI follows the same format to provide consistency throughout. The IJC Listing Guideline from 1991 is presented first as the historical baseline for why a beneficial use was considered to be impaired. Next, the State of Ohio Listing Guideline is presented emphasizing the State regulations, policies or guidance that would need to be exceeded to designate this use as impaired.

The State of Ohio Delisting Target includes the specific State criteria, standards or guidance that must be met to delist. A “✓” preceding a target indicates that target must be met to delist. Using these guidelines, a RAP can delist an entire AOC or develop a strategy to delist only specific stream segments within the AOC. In some cases, the RAP will have the option of meeting one of several targets to delist. These targets are separated by an “OR”. In other cases, there are several targets, all of which must be met if the beneficial use is to be delisted. These targets are connected by an “AND”.

The State of Ohio Delisting Milestones offer options to track how close the RAP is getting to reaching its target goal. This will allow the RAPs to measure and celebrate progress even if no uses have been restored yet. Milestones are preceded by an “➤”. A milestone preceded by a “✓” indicates the milestone represents the delisting target. Several BUIs include milestones that will place them in the category of “area in recovery”.

The rationale explains in detail how the targets were chosen, how they relate to Ohio rules, regulations and guidance, or how Ohio EPA chose a target if there were no State water quality standards or guidance specific to measuring the impairment status of a beneficial use. All the references consulted are listed so the RAPs can utilize the same references, or better understand how a particular delisting target was selected. At the end of each BUI section, the reader is provided with a list of the universal general USPC recommendations for evaluation of suitable delisting criteria.

The Appendices include excerpts from some of the reference documents commonly referred to in the text, the hydrologic units applicable to each AOC boundary, suggested sample surveys that can be used to assess progress toward some targets, and a glossary of acronyms and abbreviations.

RAP participants are encouraged to direct any questions, requests for references, or needs for additional information to the Ohio EPA RAP Coordinators.

## BUI 1: Restrictions on Fish and Wildlife Consumption

### IJC Listing Guideline

An impairment will be listed when contaminant levels in fish or wildlife populations exceed current standards, objectives or guidelines, or public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must be due to contaminant input from the watershed.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

1) An advisory or restriction to fish or wildlife consumption of one meal per month (or more stringent) is imposed by the Ohio Department of Health and 2) is due to sources within the AOC.

### State of Ohio Delisting Target

- ✓ No fish consumption advisories of one meal per month (or more stringent) have been issued by the Ohio Department of Health that can be attributed to sources within the AOC.
- **AND** —————
- ✓ No wildlife consumption advisories of one meal per month (or more stringent) have been issued by the Ohio Department of Health that can be attributed to sources within the AOC.

### State of Ohio Delisting Milestones

- Track change in number/type of consumption advisories.
- Track change in levels of contaminants in species with consumption advisories. Contaminant levels in fish tissue should not exceed 220 µg/kg (ppb) PCBs, or 220 µg/kg mercury.
- Track change in levels of contaminants in the water column and sediment.
- ✓ No consumption advisories of one meal per month (or more stringent) in effect due to contaminant sources from within the AOC.

### Rationale

While most Ohio sport fish are of high quality and a good source of protein, levels of chemicals such as PCBs, mercury, lead, and other metals and pesticides have been found in some fish from certain waters. To ensure the continued good health of Ohioans, the Ohio Department of Health, in cooperation with the Ohio Environmental Protection Agency and Ohio Department of Natural Resources, issues fish consumption advisories per Chapter 3701 or the Ohio Revised Code. Ohio uses the Protocol for a Uniform Great Lakes Sport Fish Advisory (1993) and the 2005 addendum to establish fish consumption advisories for PCBs and mercury, respectively. These are the contaminants that drive most of the advisories in Ohio waters.

Snapping turtles are currently the only wildlife species with a consumption advisory in effect as issued by the Ohio Department of Health. This advisory was listed based on the results of a one-time study done in 1997. All turtles had high levels of PCB and mercury in fat and liver tissue

and advisories stress not eating those portions of the turtle. Currently, turtles from the Black, Ashtabula and Maumee Rivers have a one meal per week advisory for mercury which is similar to the statewide blanket advisory for fish, and not considered impaired. The Ottawa River has a do not eat advisory due to mercury, and it is the only portion of an AOC with a wildlife consumption impairment.

Note that the status and types of consumption advisories currently in effect are most likely quite different than what was reported in the RAP Stage 1 Reports. Most fish consumption advisories now are driven by PCB or mercury contamination. Earlier advisories may also have been issued due to elevated levels of tumors in brown bullhead associated with high PAH concentrations in sediments, the presence of a myriad of chlorinated organic chemicals, or for some other reason.

Sources of contaminants originating outside an AOC (upstream, long range transport of contaminants released to the air and deposited in the AOC, from open lake waters, etc.) that result in a fish or wildlife consumption advisory should not impinge on the ability to delist an AOC. In these instances, a listing of “Impaired – Not Due to Local Sources” could be used. However, whenever possible, the RAP should attempt to ensure that another responsible party or existing program is addressing source control outside the AOC boundaries.

Up-to-date comprehensive fish and wildlife consumption advice is available on the Ohio EPA web page at: [www.epa.ohio.gov/dsw/fishadvisory/index.aspx](http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx). In 2003 a general state-wide restriction was issued advising not to eat more than one meal per week of fish caught from any waters in Ohio due to widespread low levels of mercury. This blanket statewide advisory is protective of the most sensitive human populations and pre-empted the listing of other one week advisories that were mostly due to PCBs. In order to keep the fish consumption advisory information as simple as possible, the web page now only lists the more restrictive one month or greater advisories. This does not mean the PCBs have gone away. Therefore, when conducting a study to determine if the local advisories are strictly related to sources from outside an AOC, it is important to examine the actual fish tissue data for the area in question and not just whether an advisory is listed on the web page. Fish tissue data is available from Ohio EPA. In the Ohio Integrated Report, beginning in 2006, water body impairments were included based on fish tissue concentrations as related to water quality criteria. These numbers and results are somewhat different than the concentrations that trigger fish consumption advisories. For the AOC delisting targets, we will continue to keep the targets focused on the existence of fish consumption advisories rather than fish tissue concentrations.

## References

Great Lakes Sport Fish Advisory Task Force. 1993. Protocol for a uniform Great Lakes sport fish consumption advisory. Council of Great Lakes Governors.

Great Lakes Sport Fish Advisory Task Force. 2006. Mercury addendum to the protocol for a uniform Great Lakes sport fish consumption advisory. Council of Great Lakes Governors.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Lambert, L. 1998. Impairment assessment of beneficial uses: Restrictions on Fish and Wildlife Consumption. Lake Erie LaMP Tech. Rept. No. 2. (Available on-line at [www.epa.gov/glnpo/lakeerie/buia/consum.html](http://www.epa.gov/glnpo/lakeerie/buia/consum.html).)

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie) )

Ohio Sport Fish Consumption Advisory, Ohio EPA. (Available on-line at: [www.epa.ohio.gov/dsw/fishadvisory/index.aspx](http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx) )

Ohio EPA. 1996. Ohio Water Resources Inventory, Volume 2 - Ohio Fish Tissue Contaminant Monitoring. (Available on-line at: [www.epa.ohio.gov/portals/35/documents/96vol2.pdf](http://www.epa.ohio.gov/portals/35/documents/96vol2.pdf))

Ohio EPA. 2006. State of Ohio cooperative fish tissue monitoring program sport fish tissue consumption advisory program ([www.epa.ohio.gov/dsw/fishadvisory/overview.aspx](http://www.epa.ohio.gov/dsw/fishadvisory/overview.aspx))

Ohio EPA. 2006. Integrated Report. Appendix A. Supplemental information on the use of fish tissue data. ([www.epa.ohio.gov/portals/35/tmdl/2006IntReport/IR06\\_app\\_A\\_fish\\_suppl\\_info\\_final.pdf](http://www.epa.ohio.gov/portals/35/tmdl/2006IntReport/IR06_app_A_fish_suppl_info_final.pdf))

Ohio Department of Health. 1997. Criteria for Establishing Fish Consumption advisories in Ohio for PCBs, Lead, and Mercury.

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

**This method of evaluation allows for subsequent assessment of the status of the beneficial use and follows the general US Policy Committee recommendations for delisting principles and criteria as listed below:**

- Allows for periodic review by respective State and Federal agencies in conjunction with the public and all stakeholders.
- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 2: Tainting of Fish and Wildlife Flavor

### IJC Listing Guideline

An impairment will be listed when ambient water quality standards (WQS), objectives, or guidelines for the anthropogenic substance(s) known to cause tainting, are being exceeded or survey results have identified tainting of fish or wildlife flavor.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

1) Levels of compounds associated with tainting exceed Ohio WQS within the Area of Concern or 2) Wildlife officials indicate tainting of fish and wildlife flavor is found within the area.

#### State of Ohio Delisting Target

- ✓ No WQS exceedences of compounds associated with tainting within the Area of Concern (phenol, 2-chlorophenol, 2,4-dichlorophenol)
- **OR** —————
- ✓ No reports of tainting from wildlife officials

#### State of Ohio Delisting Milestones

- If there is a potential for phenolic compounds associated with tainting to be present in the area, track change in levels of these compounds in water and sediment quality data.
- ✓ No WQS exceedences of tainting compounds noted in AOC.
- **OR** —————
- Survey of wildlife officials to assess if problems of tainting may exist.
- ✓ No problems of tainting noted.

### Rationale

Phenol and chlorinated phenols are the chemicals most often associated with organoleptic (taste and odor) effects. Phenols and related compounds may be present in waste products from oil refineries, coke plants, gas plants, some chemical producing facilities, plastics manufacturing, road surfacing, dyes, disinfectants and various industries and processes that use phenolic substances as raw materials. Concentrations of pure phenol above 15,000-25,000 µg/l have been found to affect taste and odor in fish (Shumway and Palensky, 1973). Phenols react with chlorine to produce chlorinated phenolics. Threshold levels for chlorinated organics above which taste and odor may occur in fish range from 1 µg/l to 84 µg/l. This range was determined by testing rainbow trout after a 48 hour exposure period (U.S.EPA, 1980). Ohio does not have any WQS to protect against fish tainting, but does have the following standards to prevent organoleptic effects in drinking water: 0.1 µg/l of 2-chlorophenol; 0.3 µg/l of 2,4-dichlorophenol; and 1.0 µg/l of phenol. Levels of these compounds below Ohio WQS for drinking water should preclude tainting of fish or wildlife flavor.

Elevated phosphorus concentrations that cause algal blooms may in turn cause a taste or odor problem in fish or wildlife. However, any occurrence would likely be short-lived, not persistent and therefore not considered an impairment.

All of Ohio's RAPs originally listed tainting as "Unknown but impairment not suspected." A survey conducted in 2006 by the University of Toledo for Ohio EPA, confirmed that tainting is not impaired in any Ohio AOC.

## References

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

Lambert, L. 1997. Impairment Assessment of Beneficial Uses: Tainting of Fish and Wildlife Flavor. Lake Erie LaMP Technical Report No. 3. ([www.epa.gov/glnpo/lakeerie/buia/lamp3.pdf](http://www.epa.gov/glnpo/lakeerie/buia/lamp3.pdf))

Lawrence, P. 2007. Assessing selected unknown beneficial use impairments for Great Lakes Areas of Concern in Ohio. University of Toledo.

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-07 of the Ohio Administrative Code. Table 7.1 (Available on-line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

Shumway, D. and J. Palensky. 1973. Impairment of the Flavor of Fish by Water Pollutants. USEPA Office of Research and Monitoring. EPA-R3-73-010.

U.S.EPA. 1980a. Ambient Water Quality Criteria for Chlorinated Phenols. Office of Water Regulations and Standards. EPA 440/5-80-032. Pp B-4, B-6 to B-12.

U.S.EPA. 1980b. Ambient Water Quality Criteria for 2,4-dichlorophenol. Office of Water Regulations and Standards. EPA 440/5-80-042. Pp. B-4, B-7 to B-13.

U.S.EPA. 1980c. Ambient Water Quality Criteria for 2-chlorophenol. Office of Water Regulations and Standards. EPA 440/5-80-034. Pp. B-5 to B-10.

This method of evaluation allows for subsequent assessment of the status of the beneficial use and follows the general US Policy Committee recommendations for delisting principles and criteria as listed below:

- Allows for periodic review by respective State and Federal agencies in conjunction with the public and all stakeholders.
- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 3: Degradation of Fish and Wildlife Populations

### IJC Listing Guideline

An impairment will be listed when fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment-associated contaminants at a site is significantly higher than controls.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

#### **For Fish:**

Ohio EPA surveys or other studies report significant non-attainment of Ohio fish community biological indices due to a cause within the watershed.

#### **For Wildlife:**

Wildlife studies or surveys of wildlife managers indicate degraded or absent populations of selected sentinel species.

### State of Ohio Delisting Target

#### **For Fish:**

- ✓ Index of Biotic Integrity (IBI) and Modified Index of Well Being (MIwb) values do not significantly diverge from state applicable ecoregional biological criteria. (See Appendix B)
- ✓ For lacustraries and nearshore areas, IBI and MIwb values do not significantly diverge from guidelines based on Thoma 1999. (See Appendix B)

#### **For Wildlife:**

- ✓ Healthy, reproducing populations of great blue heron, mink, bald eagle, osprey, river otter or other appropriate sentinel species are present.
- OR**
- ✓ ODNR restoration goals and management objectives are met and wildlife managers indicate populations are not degraded.

### State of Ohio Delisting Milestones

#### **For Fish:**

- Track changes in IBI and MIwb fish community survey results.
- In Recovery Stage Criteria:
  - Both IBI and MIwb values in a designated segment or sub-watershed show continued improvement over 5 years and are within 1.5 times state specified non-significant departure range.
- ✓ Results show compliance with target values.

#### **For Wildlife:**

- Select appropriate sentinel wildlife species to monitor in the AOC
- Track changes in wildlife population survey results.
- Track progress toward achievement of ODNR restoration goals and management objectives related to sites within the boundaries of the AOC.
- ✓ Wildlife managers indicate no problems with wildlife populations.

## Rationale

### For Fish Populations:

The Ohio Water Quality Standards (WQS), Chapter 3745-1 of the Ohio Administrative Code, consist of use designations, chemical criteria and biological criteria designed to represent measurable properties of the environment that are consistent with the narrative goals specified for each use designation. Use designations consist of two broad groups, aquatic life (i.e., aquatic community status) and human use (i.e., water supply, recreational use). In applications of the Ohio WQS to the management of water resource issues in rivers and streams, the aquatic life use criteria frequently control the resulting protection and restoration requirements, hence their emphasis in biological and water quality reports. Also, an emphasis on protecting aquatic life generally results in water quality suitable for all uses. The six different aquatic life uses currently defined in the Ohio WQS are: Warmwater Habitat (WWH), Exceptional Warmwater Habitat (EWH), Coldwater Habitat (CWH), Seasonal Salmonid Habitat (SSH), Modified Warmwater Habitat (MWH), and Limited Resource Water (LRW) (See Appendix A).

Chemical and/or biological criteria are generally assigned to each use designation. As such, the system of use designations employed in the Ohio WQS constitutes a "tiered" approach in that varying and graduated levels of protection are provided by each. This hierarchy is especially apparent for parameters such as the biological criteria.

The attainment status of aquatic life use in rivers is determined by using the biological criteria codified in the Ohio WQS. The biological community performance measures based on fish community characteristics are the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb). The IBI is a multimetric index patterned after an original IBI described by Karr (1981) and Fausch *et al.* (1984). The MIwb is a measure of fish community abundance and diversity using numbers and weight information, and is a modification of the original Index of Well-Being applied to fish community information from the Wabash River (Gammon 1976; Gammon *et al.* 1981). The modification corrects for a predominance and high abundance of fish species tolerant to environmental degradation that would otherwise produce false high readings. The Lake Erie watershed falls within two ecoregions – geographic regions with unique ecological characteristics. These are the Erie/Ontario Lake Plain (EOLP) and the Huron/Erie Lake Plain (HELP). Different biological criteria objectives have been developed for each ecoregion.

In addition to the river habitat areas, two other zones exist - the Lake Erie shoreline and an area where river and lake water mix. Ohio EPA refers to this latter area as a lacustrary (combination of the terms lacustrine and estuary). These areas could also be described as drowned river mouths (lake water flows into the river essentially “drowning” the river mouth). No differences in lacustrary IBI and MIwb guidelines are noted between the two ecoregions - EOLP and HELP. Every named public waterbody in the state has an assigned aquatic use designation and there are target biological criteria for each use designation. The biocriteria for rivers are codified in the Ohio WQS. The indices for the shoreline and lacustrary zones have not been codified and should be considered guidelines (See Appendix B).

In the Ohio WQS, a stream is considered to be in attainment when habitat, fish (IBI and MIwb) and benthos (ICI) community surveys result in attainment of all indices or if only one of the

indices is found to be in non-significant departure. Stream evaluation criteria differ between the two ecoregions where the Ohio AOCs are located. The attainment criteria can be seen below:

|                         | Maumee AOC                             |     |     | Ashtabula River, Black River and Cuyahoga River AOCs |     |     |
|-------------------------|--|-----|-----|--|-----|-----|
|                         | Huron-Erie Lake Plain Ecoregion (HELP) |     |     | Erie-Ontario Lake Plain Ecoregion (EOLP)             |     |     |
| Index – Site Type       | WWH                                    | EWH | MWH | WWH  | EWH | MWH |
| <b>IBI – Headwaters</b> | 28                                     | 50  | 20  | 40   | 50  | 24  |
| <b>IBI – Wading</b>     | 32                                     | 50  | 20  | 38   | 50  | 24  |
| <b>IBI – Boat</b>       | 34                                     | 48  | 20  | 40   | 48  | 24  |
| <b>MIwb – Wading</b>    | 7.3                                    | 9.4 | 5.6 | 7.9  | 9.4 | 6.2 |
| <b>Miwb – Boat</b>      | 8.6                                    | 9.6 | 5.7 | 8.7  | 9.6 | 5.8 |

Ohio EPA has determined non-significant departure for either ecoregion is:

4 points for IBI, and  
0.5 points for MIwb.

Delisting criteria for fish shall be when values for fish community surveys for a designated stream segment of a sub-watershed meet Ohio WQS or are within non-significant departure levels for both indices (IBI and MIwb). Localized problem areas in a sub-watershed or stream segment may result in lower values, but for this beneficial use, the individual RAPs will determine the average value for designated mainstem and tributary watersheds and utilize this value for comparison to Ohio WQS. See Appendix B for values related to the lacustraries and Lake Erie shore.

For a designated stream or sub-watershed segment to be considered for a listing of “In Recovery”, all actions identified as needed to restore the fish community have been implemented and the fish community survey values must show continued improvement over 5 years and not diverge more than 1.5 times Ohio’s non-significant departure range.

#### **For Wildlife Populations:**

Barring the existence of a wildlife study, two methods of assessing wildlife populations are possible. First, a survey of wildlife officials (county, state, local, or other appropriate organizations) should be able to indicate if any fish-eating or water dependent wildlife populations in the AOC are stressed and for what reason. Second, the establishment of wildlife sentinel species can provide a surrogate to monitor for an indication of the overall health of the wildlife populations.

Great blue heron, bald eagle, osprey, mink, and river otter are the top-level fish eating predatory animals of the Lake Erie watershed and are good indicators of ecosystem health. As such, they are considered to be the primary sentinel species in Ohio. Population studies of these birds and mammals indicate that their numbers are increasing, due to successful reintroduction efforts and declining levels of pollution. Wildlife officials, managers, and other organizations should be able to provide adequate information regarding the status of these populations.

According to the Lake Erie LaMP, if one or more of the following definitions applies to wildlife species in the applicable jurisdiction, this use is considered impaired:

The wildlife population is below a stated objective;

The wildlife population is below the demand placed on it;

The wildlife population is rare, threatened, endangered, or of special concern;

The wildlife population is unable to sustain itself in terms of amount or condition;

The wildlife population is suspected to be degraded, but data is insufficient or inconclusive;

The wildlife population has contaminant burdens that may impair behavior or reproduction, or that of higher trophic level organisms.

Note that most of the suggested sentinel species require a much larger area than the AOC to support sustainable populations. It may be acceptable just to monitor the presence of a species in the area and if it is reproducing or increasing. The input of wildlife managers is important in this decision.

## References

Fausch, D.O., Karr, J.R. and P.R. Yant. 1984. Regional application of an index of biotic integrity based on stream fish communities. *Trans. Amer. Fish. Soc.* 113:39-55.

Gammon, J.R. 1976. The fish populations of the middle 340 km of the Wabash River. Tech. Report No. 86. Purdue University. Water Resources Research Center, West Lafayette, Indiana. 73 pp.

Gammon, J.R., A. Spacie, J.L. Hamelink, and R.L. Kaesler. 1981. Role of electro-fishing in assessing environmental quality of the Wabash River. Pp. 307-324. In: *Ecological assessments of effluent impacts on communities of indigenous aquatic organisms*. ASTM STP 703, J.M. Bates and C.I. Webster (eds.). Philadelphia, PA.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6(6): 21-27.

Lambert, L., J. Robinson, M. Shieldcastle and M. Austin. 2001. Executive Summary: Degraded Wildlife Populations and Loss of Wildlife Habitat. Technical Report No. 5, Lake Erie Lakewide Management Plan, Tech. Rept. Ser.

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

Ohio Department of Natural Resources Strategic Plan 2001-2010.

Ohio EPA. 1999 (Draft). Biological criteria for the protection of aquatic life: Volume IV: Fish and macroinvertebrate indices for Ohio's Lake Erie nearshore waters, harbors, and lacustuaries. Division of Surface Water, Ecological Assessment Unit. Columbus, Ohio.

Ohio EPA. 1999. Biological and Water Quality Study of the Cuyahoga River and Selected Tributaries. Division of Surface Water, Ecological Assessment Unit. Columbus, Ohio.

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1 of the Ohio Administrative Code (Available on-line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Ohio EPA. Biological Criteria for the Protection of Aquatic Life, Volume I: The Role of Biological Data in Water Quality Assessment (02/15/88); Volume II: User's Manual for Biological Field Assessment of Ohio's Surface Waters (01/01/88); Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (09/30/89). (Available on line at: [www.epa.ohio.gov/dsw/formspubs.aspx](http://www.epa.ohio.gov/dsw/formspubs.aspx))

Thoma, R.F. 1999. Biological monitoring and an index of biotic integrity for Lake Erie's nearshore waters. Chapter 16 In T.P. Simon [Ed] Assessing the sustainability and biological integrity of water resources using fish communities. CRC Press LLC, Boca Raton, Florida.

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

Yoder, C. 1987. A Modification of the Index of Well-Being for evaluating fish communities. Ohio EPA, Division of Water Quality Monitoring and Assessment, WQMA-SWS-6, Revision 1, Appendix C-1, November 2, 1987.

**This method of evaluation allows for subsequent assessment of the status of the beneficial use and follows the general US Policy Committee recommendations for delisting principles and criteria as listed below:**

- Allows for periodic review by respective State and Federal agencies in conjunction with the public and all stakeholders.
- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 4: Fish Tumors or Other Deformities

### IJC Listing Guideline

An impairment will be listed when incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of neoplastic or preneoplastic liver tumors in bullheads or suckers.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:  
DELTs (Deformities, Eroded Fins, Lesions and Tumors) percentages exceed 0.5%, or other tumor incidence levels exceed those outlined below and are due to contaminant sources within the boundaries of the AOC.

#### State of Ohio Delisting Target

- ✓ DELT levels in fish do not exceed 0.5%
- **AND** —————
- ✓ Where brown bullhead are present, low tumor prevalence is documented in brown bullhead age three years and older over a series of years. Current guidelines suggest that a 5% incidence of liver tumors and a 12% incidence of external tumors are acceptable to consider the area to be in recovery. Lake Erie regional final targets are under development but will be less than 5% liver tumors and 12% overall external tumors.

#### State of Ohio Delisting Milestones

- Track change in DELT levels in fish community surveys over time
- ✓ DELT levels below delisting target
- Track change in skin and liver tumor levels in brown bullhead three years and older
- Track change in sediment contaminant levels of compounds associated with tumor production, particularly PAHs
- Using brown bullhead three years and older, when liver tumor incidence approaches 5% and overall external tumor incidence approaches 12%, the AOC can be considered for redesignation as an Area in Recovery for fish tumors.
- ✓ Tumor levels below target (Targets will be from reference sites determined by the Pennsylvania Department of Environmental Protection - under development)

### Rationale

Deformities, eroded fins, lesions and tumors (DELTs) are recorded when Ohio EPA conducts fish community surveys. Information on external anomalies is noted because many are either caused or exacerbated by environmental factors and often indicate the presence of multiple sublethal stressors. Morphological abnormalities are uncommon in un-impacted natural fish

populations. DELTs are also included as a metric in the calculation of IBIs. The DELT target percentage of 0.5% is consistent with expert opinion on Lake Erie fish communities and acknowledges background incidence rates (Ohio EPA, 1989; Roger Thoma, Ohio EPA, personal communication).

High occurrences of both external and internal tumors in fish have been associated with carcinogens in sediment and water at a variety of AOCs on the Great Lakes and many other locations in North America (Baumann, 1998). Numerous field and laboratory investigations have demonstrated a cause and effect relationship between carcinogens, particularly PAHs, and liver cancer in fish. Preliminary data from around the Great Lakes would support a liver tumor prevalence of about 5% and an overall external tumor prevalence of 12% in brown bullhead aged three and older as good criterion for an "Area of Concern in Recovery" as opposed to an "Area of Concern" (Baumann, 2002).

Further studies to better understand and measure the causes and frequency of tumors in fish have been completed or are underway by Pennsylvania Department of Environmental Protection and Pennsylvania Sea Grant. Differences in how histopathology was conducted and in collection methods have led to questions about proposed delisting targets. Variables that may affect final results include: geographic location of samples; species; age; season of collection; and location of the tumors (liver, lip, barbel, skin, etc.). Histopathology of both internal and external tumors must also be standardized to verify the difference between benign tumors and carcinomas. Studies have determined that three year old brown bullhead are the most common sentinel species for tumors, and that samples are best collected in the spring when greater numbers of bullhead can be found. The sample size to conduct statistical analysis is large. Considerable expertise is needed to accurately diagnose tumor incidence and it is likely that the data needed to assess the status of this BUI will need to be collected and analyzed by experts in this field. Pennsylvania has developed a sampling manual as well as a guide to identifying tumors. These guides are referenced below and can be found on the web sites noted.

## References

Baumann, P.C., I.R. Smith and C.D. Metcalf. 1996. "Linkages between chemical contaminants and tumors in benthic Great Lakes fish." *J. Great Lakes Res.* 22(2):131-152.

Baumann, P.C. 1998. "Epizootics of cancer in fish associated with genotoxins in sediment and water." *Mutation Res.* 411:227-233.

Baumann, P. C. 2002. Fish Tumor BUI Criteria: Determining Numbers for the Delisting Process. Presentation at The Latest and Greatest for the Great Lakes: Innovations in Assessment, Monitoring and Restoration of Beneficial Uses in Great Lakes Areas of Concern Workshop, Erie, PA, November, 2002. (Available at [www.glc.org/spac/proceedings/pdf/15Baumann.pdf](http://www.glc.org/spac/proceedings/pdf/15Baumann.pdf))

Blazer, V., J. Fournie, J. Wolf, and M. Wolfe. 2007. Manual for the microscopic diagnosis of proliferative liver and skin lesions in the brown bullhead (*Ameiurus nebulosus*). USGS, U.S. EPA, and the Registry of Tumors in Lower Animals Experimental Pathology Lab. Available at: <http://seagrant.psu.edu/publications/technicaldocs.htm>

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-07 of the Ohio Administrative Code (Available on-line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Ohio EPA. Biological Criteria for the Protection of Aquatic Life, Volume I: The Role of Biological Data in Water Quality Assessment (02/15/88); Volume II: User's Manual for Biological Field Assessment of Ohio's Surface Waters (01/01/88); Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (09/30/89). (Available on-line at: [www.epa.ohio.gov/dsw/bioassess/BioCriteriaProtAqLife.aspx](http://www.epa.ohio.gov/dsw/bioassess/BioCriteriaProtAqLife.aspx))

Rafferty, S., and J. Grazio. 2006. Field Manual for assessing internal and external anomalies in brown bullhead (*Ameiurus nebulosus*). Pennsylvania Sea Grant and Pennsylvania Department of Environmental Protection. Available at: <http://seagrant.psu.edu/publications/technicaldocs.htm>

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

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- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 5 : Bird or Animal Deformities or Reproductive Problems

### IJC Listing Guideline

An impairment will be listed when wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or other reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:  
Bird or animal deformities or reproductive problems of sentinel species, due to sources within the AOC, are documented by wildlife managers.

### State of Ohio Delisting Target

- ✓ No reports of wildlife population deformities or reproductive problems from wildlife officials resulting from contaminants within the AOC.

### State of Ohio Delisting Milestones

- Bald eagle eggs do not exceed NOEC for contaminants of concern (4.0 mg/kg total PCB, 3.5 mg/kg DDE, 0.1 mg/kg dieldrin)
- Bald eagles have 1.2 fledglings per occupied nest
- PCB concentrations in other bird eggs and wildlife do not exceed levels associated with embryonic mortality or deformities (LOEC) - and 0.84 mg/kg in mink tissue.
- Track change in levels of contaminants in other wildlife species
- Survey of wildlife officials indicates no problems with reproduction or deformities in AOC sentinel species
- ✓ No reports of wildlife population deformities or reproductive problems from wildlife officials resulting from contaminants within the AOC

### Rationale

Great blue heron, bald eagle, osprey, mink, and river otter are the top-level fish eating predatory animals of the Lake Erie watershed and are good indicators of ecosystem health. As such, they are considered to be the primary sentinel species in Ohio. Population studies of these birds and mammals indicate that their numbers are increasing, due to successful reintroduction efforts and declining levels of pollution. However, these and other animals may continue to be impacted, particularly by legacy pollutants such as PCBs, and their reproductive health may be impaired.

Reproductive impairments cannot be clearly understood without considering the factors that cause them. Wildlife officials, managers, and other organizations should be able to provide adequate information regarding the status of these populations and the presence or absence of deformities and reproductive problems.

### **Suggested Approach To Assessing Impairment**

1. Form a RAP sub-group to produce:
  - a. A database of all known wildlife managers in the Area of Concern
  - b. A wildlife manager survey for review of data (see Appendix E)
2. Using the survey form, collect the necessary data to make a determination of use impairment status.

### **References**

Grasman, K., C. Bishop, W. Bowerman, J. Ludwig and P. Martin. 2000. Executive Summary: Animal Deformities or Reproduction Problems. Lake Erie Lakewide Management Plan (LaMP) Tech. Rept. No. 7. ( Available at: [www.epa.gov/glnpo/lakeerie/buia/reports.html](http://www.epa.gov/glnpo/lakeerie/buia/reports.html))

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).  
Grasman et. al. Lake Erie LaMP Beneficial Use Impairment Assessment: Animal Deformities and Reproduction Impairment. Canadian Wildlife Service 2002.

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

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- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 6: Degradation of Benthos

### IJC Listing Guideline

An impairment will be listed when benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment-associated contaminants at a site is significantly higher than controls.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:  
Ohio Environmental Protection Agency surveys report a significant departure from macroinvertebrate community biological criteria or guidelines due to sources or causes within the AOC.

### State of Ohio Delisting Target

- ✓ Invertebrate Community Index (ICI) values do not significantly diverge from state biological criteria in designated segments or sub-watersheds of the AOC (See Appendix B)
- ✓ For lacustraries, ICI should not significantly diverge from the guidelines shown in Appendix B.

### State of Ohio Delisting Milestones

- Track change in benthic community survey results
- Track levels of contaminants in sediment
- In Recovery Stage Criteria
  - ICI values in a designated segment or sub-watershed show continued improvement over 5 years and are within 1.5 times state specified non-significant departure range.
- ✓ Results show compliance with target values.

### Rationale

The Ohio Water Quality Standards (WQS; Ohio Administrative Code Chapter 3745-1) consist of designated uses and chemical and biological criteria designed to represent measurable properties of the environment that are consistent with the narrative goals specified by each use designation. Use designations consist of two broad groups, aquatic life and human life uses (i.e. public water supply, recreational use, etc.)

In applications of the Ohio WQS to the management of water resource issues in rivers and streams, the aquatic life use criteria frequently control the resulting protection and restoration requirements, hence their emphasis in Ohio EPA biological and water quality reports. Also, an

emphasis on protecting aquatic life generally results in water quality suitable for all uses. The six different aquatic life uses currently defined in the Ohio WQS are Warmwater Habitat (WWH), Exceptional Warmwater Habitat (EWH), Coldwater Habitat (CWH), Seasonal Salmonid Habitat (SSH), Modified Warmwater Habitat (MWH), and Limited Resource Water (LRW) (see Appendix A).

Chemical and/or biological criteria are generally assigned to each use designation in accordance with the broad goals defined by each. As such the system of use designations employed in the Ohio WQS constitutes a "tiered" approach in that varying and graduated levels of protection are provided by each. This hierarchy is especially apparent for parameters such as the biological criteria.

The attainment status of aquatic life uses is determined by using the biological criteria codified in the Ohio WQS. The biological community performance measure which is to be used is the Invertebrate Community Index (ICI) which is based on macroinvertebrate community characteristics. The ICI is a multimetric index patterned after an original Index of Biological Integrity (IBI) described by Karr (1981) and Fausch *et al.* (1984). The ICI was developed by Ohio EPA and further described by DeShon (1994). Note that the ICIs for the tributaries are considered criteria and adopted in the State WQS. The ICIs for the lacustaries are guidance and have not yet been finalized or adopted into State rules. No differences in ICI targets are noted for the two ecoregions - Erie/Ontario Lake Plain (EOLP) and Huron-Erie Lake Plain (HELP) - in the Lake Erie watershed. (See Appendix B for more detail and a description of lacustaries.)

In the Ohio WQS, a stream is considered to be in attainment when habitat (QHEI), fish (IBI and MIwb) and benthos (ICI) community surveys result in attainment of all indices or if only one of the indices is found to be in non-significant departure. In both ecoregions in which Ohio's four AOCs are located, Ohio's ICI standard is a value of 34 for warmwater habitat and 46 for exceptional warmwater habitat. Ohio EPA has determined non-significant departure from these values is  $\pm 4$  points. For a designated stream segment or sub-watershed to be considered for a listing of "In Recovery", all actions recommended to improve the benthos population have been implemented, and the ICI values must show continued improvement over 5 years and not diverge more than 1.5 times Ohio's non-significant departure range. Localized problem areas in a sub-watershed or stream segment may result in lower ICI values for that area, but for this beneficial use assessment, the individual RAPs can determine the average ICI value for the stream segment or sub-watershed being assessed and use that value for comparison to Ohio WQS.

## References

DeShon, J.D. 1995. Development and application of the invertebrate community index (ICI), pp. 217-243. In W.S. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Risk-based Planning and Decision Making*. Lewis Publishers, Boca Raton, FL.

Fausch, D.O., Karr, J.R. and P.R. Yant. 1984. Regional application of an index of biotic integrity based on stream fish communities. *Trans. Amer. Fish. Soc.* 113:39-55.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6 (6): 21-27.

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

Ohio EPA. 1997. Development of biological indices using macroinvertebrates in Ohio's nearshore waters, harbors, and lacustuaries of Lake Erie in order to evaluate water quality. Division of Surface Water. Ecological Assessment Unit. Columbus, Ohio.

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Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-07 of the Ohio Administrative Code (Available on-line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Ohio EPA. Biological Criteria for the Protection of Aquatic Life, Volume I: The Role of Biological Data in Water Quality Assessment (02/15/88); Volume II: User's Manual for Biological Field Assessment of Ohio's Surface Waters (01/01/88); Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (09/30/89).

Ohio EPA. 1999 Draft. Biological criteria for the protection of aquatic life: Volume IV: Fish and macroinvertebrate indices for Ohio's Lake Erie nearshore waters, harbors, and lacustuaries. Division of Surface Water. Ecological Assessment Unit. Columbus, Ohio.

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- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 7: Restrictions on Navigational Dredging Activities

### IJC Listing Guideline

An impairment will be listed when contaminants in sediments exceed standards, criteria or guidelines such that there are restrictions on dredging or disposal activities.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:  
Contaminants in sediment exceed sediment quality guidelines used by the State such that there are restrictions on navigational dredging or disposal activities.

### State of Ohio Delisting Target

- ✓ There are no restrictions on navigational dredging or disposal activities due to contaminants in sediment. (See Rationale \*)

### State of Ohio Delisting Milestones

- Identify ongoing sources (point and nonpoint) of sediment contamination.
- Remediate or eliminate sources and track changes in pollutant loadings to ensure that all known sources have been controlled.
- Compare the concentrations of contaminants in sediments to available sediment quality guideline levels
- Document improvements to other beneficial uses that are impaired by the presence of contaminated sediments in the dredged area.
- Sediments are suitable for upland reuse.
- Sediments meet Ohio EPA guidelines for open water disposal.
- ✓ There are no restrictions on dredging or disposal activities due to contaminants in sediment.

### Rationale

This BUI specifically addresses areas within the boundaries of AOCs that are dredged to maintain navigable depths.

Ohio EPA does not have sediment standards. However, the Agency follows certain guidelines for determining if sediments are causing environmental impacts and are in need of remediation,

if certain restrictions are necessary during the dredging activity to prevent/minimize further impact, if sediments can be disposed of in the open lake, and if sediments are suitable for upland beneficial reuse. All dredging and disposal projects are reviewed by the Ohio EPA, under the authority of Clean Water Act Section 401, to ensure protection of water quality. The Great Lakes Dredging Manual and Inland Testing Manual, prepared by U.S.EPA and the Corps of Engineers, address testing for dredged sediments that are proposed for disposal in waters of the U.S. The manuals present a tiered approach that looks at bulk sediment concentrations via elutriate analysis, bioassays (toxicity) and bioaccumulation. Ohio EPA is currently developing guidance on evaluating sediment contaminant results that will assist in further defining when this use is impaired or not. This method also utilizes a tiered approach. It is likely that, when actual sediment remediation dredging is implemented, final sediment targets may be based on maximum contaminant concentrations allowable, a 95% Upper Confidence Limit (UCL), a surface weighted concentration (SWAC), or an arithmetic or geometric mean. Final sediment targets may vary for each AOC depending on the contaminants present, the characteristics of the watershed (i.e. sediment load from upstream), the uses associated with that section of the AOC, and the contaminants or program that is guiding the remediation.

It is difficult to establish standards for sediment because the concentrations and availability of contaminants vary based on sediment particle size (i.e., sand content vs. silt content), the amount of total organic carbon in the sediment, the bioavailability of different forms of a contaminant, environmental physical and chemical conditions, and the contaminant pathways that may exist. As a general guidance, sediments that are greater than 60 percent sand (.063 mm grain size) and have less than 5g/kg of total organic carbon will probably not contain contaminants at levels of concern. The main sediment contaminants of concern in Ohio AOCs are metals, PCBs and PAHs.

Tables summarizing background/benchmark concentrations for Lake Erie and tributaries in the Lake Erie watershed are provided in Appendix Table D-1. Background, threshold and probable effect levels developed by U.S.EPA and Environment Canada are provided in Appendix Table D-2. Preliminary guidelines for upland reuse of dredged sediment are in Table D-3. Each of the RAP groups will need to work with the references available and the agencies involved to determine the appropriate sediment target levels for their AOC.

\*In certain cases, in-water disposal may be restricted due to the sheer volume of sediment to be discharged. This would be applicable to the open lake disposal of sediments in the western basin that are dredged from the Toledo Harbor lake approach channel.

## References

Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines, Winnipeg, Manitoba.

Ingersoll, C., P. Haverland, E. Brunson, T. Canfield, F. Dwyer, C. Henke, N. Kemble, D. Mount and R. Fox. 1996. Calculation and evaluation of sediment effect concentrations for the amphipod *Hyalella azteca* and the midge *Chironomus riparius*. J. Great Lakes Research. 22(3):602-623.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at: [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Lake Erie Lakewide Management Plan (LaMP) and associated reports. 2004. Available at: [www.epa.gov/glnpo/lakeerie/](http://www.epa.gov/glnpo/lakeerie/).

MacDonald, D., C. Ingersoll and T. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Archives of Environmental Contamination and Toxicology. 39:20-31.

Marvin, C., M. Charlton, E. Reiner, T. Kolic, K. MacPherson, G. Stern, E. Braekevelt, J. Estenik, L. Thiessen and S. Painter. 2002. Surficial sediment contamination in Lakes Erie and Ontario: A comparative analysis. J. Great Lakes Research 28(3):437-450.

Marvin, C., L. Grapentine and S. Painter. 2004. Application of a sediment quality index to the lower Laurentian Great Lakes. Environmental Monitoring and Assessment. Vol. 91(1):1-16.

Ohio EPA. 2001. Sediment sample guide and methodologies. Second Edition. Division of Surface Water. [www.epa.ohio.gov/portals/35/guidance/sedman2001.pdf](http://www.epa.ohio.gov/portals/35/guidance/sedman2001.pdf)

Ohio EPA. 2008. Sediment reference values. Division of Emergency and Remedial Response. Pg. 3-32. February 2003, revised April 2008. Ecological Risk Assessment Guidance [www.epa.ohio.gov/portals/30/rules/RR-031.pdf](http://www.epa.ohio.gov/portals/30/rules/RR-031.pdf)

Ohio EPA Section 401 Program. [www.epa.ohio.gov/dsw/401/index.aspx](http://www.epa.ohio.gov/dsw/401/index.aspx)

Ohio EPA. 2008. Guidance on evaluating sediment contaminant results. Draft August 2008. Division of Surface Water.

Painter, S., C. Marvin, F. Rosa, T. Reynoldson, M. Charlton, M. Fox, P. Lina Thiessen and J. Estenik. 2001. Sediment contamination in Lake Erie: A 25-year retrospective analysis. Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

Rheume, S., D. Button, D. Myers and D. Hubbell. 2001. Areal distribution and concentrations of contaminants of concern in surficial streambed and lakebed sediments, Lake Erie – Lake St. Clair drainages, 1990-97. U.S.G.S. Water Resources Investigations Report 00-4200.

Smith, S., D. MacDonald, K. Keenleyside, C. Ingersoll and L. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. J Great Lakes Res. 22(3):624-638.

U.S. EPA and U.S. Army Corps of Engineers. 1998. Great Lakes Dredged Material Testing and Evaluation Manual. (Available at: [www.epa.gov/glnpo/sediment/glitem/](http://www.epa.gov/glnpo/sediment/glitem/))

U.S. EPA and U.S. Army Corps of Engineers, 1998. Evaluation of dredged material proposed for discharge in waters of the U.S. (Inland Testing Manual). EPA-823-B-98-004. (Available at: [www.epa.gov/waterscience/itm/pdf/cover.pdf](http://www.epa.gov/waterscience/itm/pdf/cover.pdf))

U.S. EPA. 2004. Preliminary remediation goals for soil. U.S. EPA Region 9. <http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf>

Zarull, M., J. Hartig and L. Maynard. 1999. Ecological benefits of contaminated sediment remediation in the Great Lakes Basin. Sediment Priority Action Committee, Great Lakes Water Quality Board, International Joint Commission. (Available at: [www.ijc.org](http://www.ijc.org))

**This method of evaluation allows for subsequent assessment of the status of the beneficial use and follows the general US Policy Committee recommendations for delisting principles and criteria as listed below:**

- Allows for periodic review by respective State and Federal agencies in conjunction with the public and all stakeholders.
- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 8: Eutrophication or Undesirable Algae

### IJC Listing Guideline

An impairment will be listed when there are persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural (human-induced) eutrophication.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

1) Dissolved oxygen levels do not meet minimum criteria established in Ohio WQS for the stream segment of concern, and the cause is due to excessive nutrient loading or high BOD (biochemical oxygen demand) *and/or* 2) Nutrients entering the waters as a result of human activity create nuisance growths of aquatic weeds and/or algae (Ohio WQS, Chapter 3745-1-04(E) of the Ohio Administrative Code - *see Appendix A*).

### State of Ohio Delisting Target

- ✓ When waters meet the minimum dissolved oxygen criteria listed in the Ohio Water Quality Standards (WQS)
- **AND** -----
- ✓ No nuisance growths of algae, such as filamentous *Cladophora*, or blooms of blue-green algae exist. There are no nuisance growths of aquatic weeds that may be hindering recreational use or contact with the water body.

### State of Ohio Delisting Milestones

- Monitor change in dissolved oxygen concentrations and compare to Ohio WQS, tracking number and severity of violations.
- Monitor change in nutrient concentrations (phosphorus, nitrogen) and compare to Ohio WQS or guidelines for nutrients (currently under development or as listed in TMDLs).
- Track change in frequency, extent and time period over which nuisance growths of algae or aquatic weeds occur.
- Track change in the percentage of omnivorous fish species present. Greater than 40 percent of omnivorous fish is indicative of eutrophic conditions.
- Stream segment meets the biocriteria established for its use designation.
- ✓ Waters meet the dissolved oxygen and nutrient criteria/guidelines in the Ohio WQS and there are no nuisance growths of aquatic weeds or algal blooms.

## Rationale

Eutrophic waters can represent a natural stage in the aging of a water body. For example, as a lake fills in it becomes shallower, warmer and more susceptible to supporting excessive growths of aquatic vegetation and algae. However, in many cases, the eutrophication process is accelerated by human activities that cause increased nutrient and sediment loading.

Impacts in the water body could be low dissolved oxygen concentrations, elevated phosphorus and nitrogen concentrations, excessive vegetation, algal blooms, taste and odor problems in drinking water, and high turbidity. Eutrophication is considered an impairment if it is caused by human activity. Excessive phosphorus loading has been the primary cause of eutrophication in the waters of Lake Erie and its tributaries. Target total phosphorus concentrations have been established for each of the three basins in Lake Erie: western basin 15 ug/l; central and eastern basins 10 ug/l. These concentrations were determined using models to predict phosphorus levels that would prevent algal blooms, excessive *Cladophora* growth, and extensive areas of anoxia in the bottom waters of the central basin. Conditions in the tributaries are different than those in the lake proper, and these phosphorus levels would not apply. Ohio EPA is currently developing nutrient criteria for phosphorus, nitrogen, Chlorophyll *a* (a measure of primary productivity) and turbidity that may be applied to stream segments.

Eutrophication can be a localized problem in certain segments of streams that may be below sources of high levels of nutrients (either point or nonpoint), loadings of oxygen demanding substances or in areas of little circulation and low flow. In some areas, the natural stream channel has been dredged and deepened to accommodate shipping. If it is documented that this deepening is responsible for the failure to meet WQS, this use would not be considered impaired due to contaminant loading. However, should the opportunity arise to alter the stream morphology back to a more natural state, the RAP should encourage this option.

During years of stream sampling, Ohio EPA has documented a relationship between nutrient concentrations and the state of the biological community. Elevated nutrients may impact the biological community, even if nuisance growths of aquatic weeds and algae are not evident. The presence of certain populations of fishes may also be an indicator of eutrophication. Field surveys in the nearshore and lacustrine areas of the Ohio waters of Lake Erie suggest that a fish community population containing more than 40% omnivores is indicative of eutrophication.

## References

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1 of the Ohio Administrative Code.

Ohio EPA. 1999. Association between nutrients, habitat and the aquatic biota in Ohio rivers and streams. Ohio EPA Technical Bulletin MAS/1999-1-1 (available on line at: [www.epa.ohio.gov/dsw/document\\_index/docindx.aspx](http://www.epa.ohio.gov/dsw/document_index/docindx.aspx)).

Ohio EPA. 2000. Legal and technical basis for nutrient target values used in TMDL projects. ([www.epa.ohio.gov/dsw/guidance/guidance.aspx](http://www.epa.ohio.gov/dsw/guidance/guidance.aspx)).

Ohio EPA. 1999. Phosphorus in Lake Erie basin. ([www.epa.ohio.gov/dsw/policy/policy.aspx](http://www.epa.ohio.gov/dsw/policy/policy.aspx)).

Thoma, R.F and T. P. Simon. 2002. Correlation between nutrient stimulation and presence of omnivorous fish along the Lake Erie nearshore. Pages 187-199 *In* T.P. Simon [ED] Biological response signatures: Indicator patterns using aquatic communities. CRC Press, Boca Raton, FL.

**This method of evaluation allows for subsequent assessment of the status of the beneficial use and follows the general US Policy Committee recommendations for delisting principles and criteria as listed below:**

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- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 9: Restrictions on Drinking Water Consumption or Taste & Odor Problems

### IJC Listing Guideline

An impairment will be listed when treated drinking water supplies are impacted to the extent that:

1) Densities of disease-causing organisms, concentrations of hazardous or toxic chemicals, or radioactive substances exceed human health standards, objectives or guidelines; or 2) Taste and odor problems are present; or 3) Treatment needed to make raw water suitable for drinking is beyond the standard treatment (i.e. settling, coagulation, disinfection) used in comparable portions of the Great Lakes which are not degraded.

### State of Ohio Listing Guideline

Surface water sources (rivers, lakes and streams) are, by definition, open systems and can be subject to periodic adverse conditions. Occasional taste or odor complaints may not constitute a beneficial use impairment unless they are determined to be persistent.

This beneficial use shall be listed as impaired if any of the following apply:

1) Any chronic advisories or restrictions to drinking water consumption are imposed by the Ohio EPA, the Ohio Department of Health, or the community water system and are due to impacts to the source water quality caused by human activities in the AOC. *(By this definition, any water consumption advisories imposed due to water line breaks, equipment breakdowns, or operator error would not be considered an impairment.)* and/or 2) Additional treatment beyond "standard" is necessary to remove pathogens, hazardous or toxic chemicals, or radioactive substances, to make the raw water suitable for human consumption. This includes taste and odor, if the additional treatment is specifically necessary to control taste and odor problems. (Additional treatment as originally defined by the IJC may now be considered conventional for a variety of reasons. Supplemental treatment with activated carbon, required for removal of organics, shall now be considered "standard treatment" for water systems using surface water sources.) and/or 3) Chronic taste and/or odor complaints have been documented by the water system operator and are due to human activities within the AOC and not the result of treatment processes (i.e. chlorination.)

*Note: For an impairment of water quality due to human impacts from outside the AOC, this Beneficial Use may be listed as "Impaired - Not Due to Local Sources." Responsibility for addressing the source of the impacts would fall to appropriate environmental agencies or programs. Formalizing follow-up activities with specific documentation (i.e. Memoranda of Understanding) may be necessary.*

| <p style="text-align: center;"><b>State of Ohio</b><br/><b><u>Delisting Target</u></b></p>   | <p style="text-align: center;"><b>State of Ohio</b><br/><b><u>Delisting Milestones</u></b></p>  |
|--|---|
| <p>✓ No consumption advisories or taste or odor complaints on the finished water, due to degradation of raw water quality caused by human activities within the AOC, for any community water system using "standard or conventional" treatment and drawing water from the AOC.</p> | <p>➤ Track change in the number and cause of advisories due to a degradation of raw water quality resulting from human activities within the AOC</p> <p>➤ Track change in the number of water systems with advisories</p> <p>➤ Track change in the number of days with advisories</p> <p>✓ No consumption advisories due to a degradation of raw water quality caused by human activities within the AOC.</p> <p style="text-align: center;"><b>AND</b></p> <p>➤ Track change in the number of complaints of taste or odor problems due to a degradation of raw water quality</p> <p>➤ Track change in the number of systems with complaints of taste or odor</p> <p>➤ Track change in the length of time taste or odor problems exist</p> <p>✓ No reported taste or odor problems due to a degradation of raw water quality caused by human activities within the AOC.</p> |

### **Rationale**

According to the IJC Listing Guidelines, an impairment for this beneficial use takes into account human health issues related to treated drinking water as well as the aesthetics (taste/odor) of the treated drinking water. Drinking water that is completely safe for human consumption may not be palatable for drinking because of taste or odor. Also of concern to the IJC is the use of treatment techniques beyond what is considered standard (settling, coagulation, disinfection). It is extremely important to note:

- All water systems getting their water from a surface water source must include the filtration of that surface water. Filtration may not be considered standard by the original IJC guidelines, but is required treatment even for systems utilizing a pristine stream as the raw water source (OAC 3745-81-73). Sometimes that filtration may include a layer of activated carbon.
- The Disinfection By-Products Rule of the Safe Drinking Water Act requires a percentage removal of organics before chlorination in order to prevent the production of potentially harmful chlorinated organic by-products, such as trihalomethanes (THM). Organic removal utilizes a supplemental treatment of granular activated carbon filtration or powdered activated carbon addition, then filtration. The removal of organics by either of these methods, although not considered standard treatment by the IJC, is, by law, now considered to be conventional treatment.

- The use of activated carbon for a reduction of organics is also effective in the removal of taste and odor problems. It may be considered conventional treatment.
- Although odor is included as a Secondary Maximum Contaminant Level parameter, virtually no water system in the Ohio Lake Erie basin is currently conducting threshold odor number monitoring.
- In most cases, filtration with activated carbon treatment is now or will soon be utilized by community water systems for organic by-products control.
- If a water system draws its water from one particular site on a stream or river, the watershed upstream of that location may be designated "impaired."

All Community Public Water Systems in Ohio are regulated by the Ohio EPA, according to the Safe Drinking Water Act, and must submit regular reports of treated water quality to the Ohio EPA. For contaminants of concern to human health, this assessment of the beneficial use impairment shall rely on an Ohio EPA and/or a community water system issuance of a restriction or advisory. Consideration must be given to:

- The severity/duration of the restriction or advisory
- The ultimate cause of the restriction or advisory. (*To be a drinking water beneficial use impairment, the restriction or advisory must have been issued because of a raw water quality problem.*)

Odor is not routinely monitored by any Community Public Water System in the Ohio Lake Erie basin. Although some secondary contaminants that could affect taste are monitored, the taste of water is perceived differently by each person. For these reasons, taste and odor problems are now tracked by the water system only by the number of citizen complaints. For taste and odor problems, this assessment shall rely upon:

- The number of taste and odor complaints received by the Community Water System
- The cause and duration of those taste and odor problems

*Note: Ohio EPA Division of Drinking and Ground Water is currently developing public drinking water assessment methodology. It will include assessment of both raw and finished water with the core water quality indicators of nitrate, pesticides, contaminants with primary MCLs and cryptosporidium. When their methodology is complete, the RAP delisting target will be revised to reflect this methodology.*

## References

Hartig, J., D. Rathke, D. Williams. 1990. How Clean is Clean in the Great Lakes Areas Of Concern? - Report from the 1988 IAGLR Symposium. J. Great Lakes Res. 16(1):169-179.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Ohio Administrative Code 3745-81-73 (Requires water systems that use a surface water source to provide conventional filtration, direct filtration, slow sand filtration or other filtration technology.)

Restoring United States Areas of Concern: Delisting Principles and Guidelines. Adopted by the United States Policy Committee Dec. 6, 2001

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- Allows for periodic review by respective State and Federal agencies in conjunction with the public and all stakeholders.
- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## [BUI 10: Beach Closings \(Recreational Contact\)](#)

### [IJC Listing Guideline](#)

An impairment will be listed when waters, which are commonly used for total-body contact or partial-body contact recreation, exceed standards, objectives, or guidelines for such use.

### [State of Ohio Listing Guideline](#)

Using the recreational use designations listed in the Ohio WQS for the water body segments being assessed, this beneficial use shall be listed as impaired if the following criteria are exceeded during the recreational season from May 1 to October 15:

#### [Total Body Contact:](#)

For Bathing Waters - *E. coli* content exceeds 235 per 100 ml. in more than 10% of the samples taken during a 30-day period.

For Primary Contact - Geometric mean *E. coli* content, based on not less than five samples within a 30-day period, exceeds 126 per 100 ml.; or *E. coli* content exceeds 298 per 100 ml. in more than 10% of the samples taken during any 30-day period; or geometric mean fecal coliform content, based on not less than five samples in a 30-day period exceeds 1000 per 100 ml; or fecal coliform content exceeds 2000 per 100 ml in more than 10% of the samples taken in any 30-day period.

#### [Partial Body Contact:](#)

Secondary Contact - *E. coli* exceeds 576 per 100 ml. in more than 10% of the samples taken during any 30-day period; or fecal coliform exceeds 5000 per 100 ml in more than 10% of the samples taken in any 30-day period.

#### [Chemical Contaminant Contact:](#)

A state or local government agency has issued a warning to avoid contact with the water due to the presence of a chemical of concern, such as PCB or PAH.

### State of Ohio Delisting Target

- ✓ For bathing waters (primarily Lake Erie beaches), no more than 10 posted advisory days, due to high bacteria levels, per year for five consecutive years.  
————— **OR** —————
- ✓ For primary contact recreation, for stream segments designated as such in the Ohio WQS, the 75<sup>th</sup> percentile of all samples collected in one year does not exceed 1000 per 100 ml fecal coliform or the 90<sup>th</sup> percentile does not exceed 2000 per 100ml fecal coliform. or For *E.coli*, the 75<sup>th</sup> percentile does not exceed 126 per 100ml or the 90<sup>th</sup> percentile does not exceed 298 per 100ml. This standard must be met for five consecutive years.  
————— **OR** —————
- ✓ For secondary contact recreation, for streams designated as such in the Ohio WQS, the 90<sup>th</sup> percentile of samples collected over a five year period does not exceed 5000 per 100ml fecal coliform or 576 per 100ml *E. coli*.  
————— **AND** —————
- ✓ No local or state contact advisories related to the presence of a chemical contaminant exist.

### State of Ohio Delisting Milestones

#### For Bathing Waters:

- Track number of advisories posted
- Track number of days of advisories
- Track number of days Ohio WQS for *E. coli* are exceeded.
- ✓ 10 or less posted beach advisories each year for five consecutive years.

————— **OR** —————

#### For Primary Contact Recreation:

- Track *E. coli* or fecal coliform content in area streams as measured by Ohio EPA, or others, in routine monitoring surveys.
- ✓ Exceedences of bacteria standards within acceptable levels at 75<sup>th</sup> and 90<sup>th</sup> percentiles.

————— **OR** —————

#### For Secondary Contact Recreation:

- Track *E. coli* or fecal coliform content in area streams as measured by Ohio EPA, or others, in routine monitoring surveys.
- ✓ 90<sup>th</sup> percentile does not exceed 5000 fecal coliform or 576 *E. coli*.

————— **AND** —————

#### For Chemical Contaminant Contact:

- Track decreases in contaminant of concern in the affected area.
- ✓ Local or state contact advisories due to chemical contaminants are lifted.

### Rationale

The BUI title of "beach closings" severely limits its use when applied to the Areas of Concern. Many of the AOCs do not actually have beaches, but they do have areas where people recreate. Therefore, it is much more accurate and protective of human health to expand the assessment for this BUI to more than just beach areas. Based on the IJC listing guidance, it does appear that the original intention of this BUI was to look at bacteria content in recreational waters, not just beach closings. Ohio water quality standards include criteria for bathing beaches, primary contact recreation and secondary contact recreation. These are the main criteria used to determine whether or not this use is impaired. The Ohio Department of Health, the state agency responsible for monitoring and tracking beach water quality, maintains a web site at <http://www.odh.ohio.gov/odhPrograms/eh/bbeach/beachmon.aspx> that lists seasonal bacteria

counts and postings at all public beaches along Lake Erie and at inland lakes that are monitored. The recreational season is defined as May 1 to October 15.

Total body contact includes bathing waters and waters designated as primary contact recreation. Bathing waters are those that, during the recreational season, are suitable for swimming and where a lifeguard and/or bathhouse facilities are present. Primary contact recreation includes those waters that, during the recreational season, are suitable for full-body contact recreation, such as, but not limited to, swimming, kayaking, and scuba diving with minimal threat to public health due to water quality.

Waters designated as secondary contact are those waters that, during the recreational season, are suitable for partial body contact such as, but not limited to, wading with minimal threat to public health due to water quality.

The Ohio 2004 Integrated Report provides some protocol for assessment of recreational use which is used in this delisting target guidance. *E. coli* is routinely monitored for bathing waters. Considerably less data on *E. coli* is available for the stream segments designated as primary or secondary contact recreation, so fecal coliform criteria are used for assessment of those streams.

In several Ohio AOCs, contact advisories have been posted by the Ohio Department of Health (ODH) due to the presence of PCBs or PAHs. For the Ottawa River (Maumee AOC), ODH has posted a contact advisory for a segment of the stream due to the presence of high levels of PCBs. A contact advisory due to PAHs, posted in 1983 in the lower Black River, was lifted in 2004.

## References

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004. Lake Erie LaMP Work Group. (Available on-line at: [www.epa.gov/glnpo/lakeerie](http://www.epa.gov/glnpo/lakeerie)).

Ohio Department of Health. Beach Monitoring Results. [www.odh.state.oh.us/ODHPrograms/beach/sample.htm](http://www.odh.state.oh.us/ODHPrograms/beach/sample.htm)

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-07 of the Ohio Administrative Code (Available on line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Ohio EPA. 2004. Ohio 2004 Integrated Water Quality Monitoring and Assessment Report. Ohio EPA, Division of Surface Water (Available on line at: [www.epa.ohio.gov/dsw/tmdl/2004IntReport/2004OhioIntegratedReport.aspx](http://www.epa.ohio.gov/dsw/tmdl/2004IntReport/2004OhioIntegratedReport.aspx))

Ohio EPA. 2008. Ohio 2008 Integrated Report. Section F. Evaluating Beneficial Use: Recreation. Ohio EPA, Division of Surface Water. Available on line at: [www.epa.ohio.gov/dsw/tmdl/2008IntReport/2008OhioIntegratedReport.aspx](http://www.epa.ohio.gov/dsw/tmdl/2008IntReport/2008OhioIntegratedReport.aspx)

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee December 2001.

USEPA. 2002. Great Lakes Strategy 2002: A Plan for the New Millennium.

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- Consistent with applicable State and Federal standards, regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement.
- Based upon measurable indicators.
- Allows demonstration the impairment is not solely of local geographic extent but typical of lakewide, areawide or regionwide conditions.
- Allows demonstration that the impairment is due to natural rather than human causes.
- Allows for a listing of "Impaired - Not Due To Local Sources" for impairments caused by sources outside the Area of Concern.

## BUI 11: Degradation of Aesthetics

### IJC Listing Guideline

When any substance in water produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

Any of the five "free froms" (A, B, C, E, and F) designated in the Ohio Administrative Code section 3745-1-04 are not being met to the extent practical and possible.

### State of Ohio Delisting Target

- ✓ The general surface water quality shall meet the criteria outlined in Ohio Administrative Code Section 3745-1-04 to the extent practical and possible. This section is summarized as:
  - (A) Free from suspended solids or other substances that enter the waters as a result of human activity and that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life;
  - (B) Free from floating debris, oil, scum and other floating materials entering the waters as a result of human activity in amounts sufficient to be unsightly or cause degradation;
  - (C) Free from materials entering the waters as a result of human activity producing color, odor or other conditions in such a degree as to create a nuisance;
  - (E) Free from nutrients entering the waters as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae;\*
  - (F) Free from public health nuisances associated with raw or poorly treated sewage.

*\*Note: For more detail see BUI 8:  
Eutrophication or Undesirable Algae*

### State of Ohio Delisting Milestones

- Monitor change in problem stream segments or individual stream locations within the AOC
- Track implementation of source reduction and/or elimination projects
- Monitor change in problem areas for reoccurrence
- Monitor the AOC for new problem locations
- ✓ All five "free froms" in the Ohio Administrative Code 3745-1-04 are being met.

## Rationale

The Degradation of Aesthetics Beneficial Use Impairment (BUI) is subjective as compared to most of the other beneficial use impairments. Ohio's Delisting Target for this BUI utilizes existing Ohio Law for water quality standards as they apply to all surface waters of the state, including mixing zones. If any of the five "free froms" listed above are persistent then the beneficial use has not been restored. Any single occurrence due to such instances as an accident, line break, or equipment breakdown, would not be considered an impairment. The sixth "free from", which is item D in OAC Section 3745-1-04, was not included for aesthetics assessment as it is related to the presence of substances that are toxic or harmful to human, animal or aquatic life, as opposed to causing a visual or malodorous nuisance.

## References

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. (Available at [www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-04 of the Ohio Administrative Code (Available on-line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Restoring United States Areas of Concern: Delisting Principles and Guidelines. Adopted by the United States Policy Committee Dec. 6, 2001

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## BUI 12: Added Costs to Agriculture or Industry

### IJC Listing Guideline

An impairment will be listed when there are additional costs required to treat the water prior to use for agricultural purposes (i.e. including but not limited to, livestock watering, irrigation and crop-spraying) or industrial purposes (i.e. intended for commercial or industrial applications and non-contact food processing).

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

- 1) Additional costs are incurred by the user to treat the water from the AOC prior to use for agricultural purposes (i.e. including but not limited to, livestock watering, irrigation and crop-spraying) and the additional treatment is due to persistent water quality problems resulting from human activities within the boundaries of the AOC. ***and/or***
- 2) Additional costs are incurred by the user to treat the water from the AOC for industrial purposes (i.e. intended for commercial or industrial applications and non-contact food processing) and the need for the additional treatment is due to persistent water quality problems resulting from human activities occurring within the boundaries of the AOC.

### State of Ohio Delisting Target

- ✓ No additional costs (due to human activities within the AOC) are necessary to treat water from the AOC prior to agricultural, commercial or industrial use.

### State of Ohio Delisting Milestones

- Document number of users of water from the AOC for agricultural use
- Track change in number of agricultural users that must treat the water and note reasons for that treatment
- Track change in total costs of treatment for agricultural users
- ✓ No additional costs necessary to agricultural users
- **AND/OR** —————
- Document the number of withdrawals of water from the AOC for industrial/commercial use
- Track change in number of commercial/industrial users that must treat the water and note reasons for that treatment
- Track change in total costs of treatment for those users
- ✓ No additional costs necessary to commercial/industrial users

## Rationale

The potential uses of water for agricultural, commercial and industrial purposes can cover a wide range of possibilities and, therefore, a wide range of treatment options, and finally a wide range of treatment costs. Additional treatment must be due to persistent water quality problems and due to human related activities within the AOC. Only one of Ohio's RAPs has identified this beneficial use as impaired in their AOC. It applies to the Ottawa River in the Maumee AOC. If impairment is suspected, complete a more detailed investigation using the following:

### *Suggested Approach to Assess Impairment Status*

1. Set up a RAP subcommittee to evaluate all known users of water from the AOC for agricultural or industrial purposes.
2. Develop and conduct a survey to evaluate if treatment is necessary, why, and the costs of treatment.
3. Determine if either use is impaired.

The sub-committee, in reviewing the survey, will be able to decide if the treatment is necessary due to degraded water quality from human activities within the Area of Concern. As suggested by the US Policy Committee, a degradation of water quality (for agricultural and industrial/commercial use) from outside the AOC "should not impinge on the ability to delist an AOC." In these instances, a listing of "Impaired-Not Due to Local Sources" could be used. Using this survey and review method, new users of water can be added and surveyed and through periodic follow-up surveys the sub-committee can show the progress in addressing this beneficial use impairment by both the number of users needing treatment and the total costs of treatment throughout the Area of Concern.

## References

Hartig, J., D. Rathke and D. Williams. 1990. How Clean is Clean in the Great Lakes Areas Of Concern? - Report from the 1988 IAGLR Symposium, J. Great Lakes Res. 16(1):169-179.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes Areas of Concern. Focus on IJC Activities, Volume 16, Issue 1. ISSN 0832-6673. ([www.ijc.org/focus/listdelist](http://www.ijc.org/focus/listdelist)).

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## BUI 13: Degradation of Phytoplankton and Zooplankton Populations

(Note discussion in the Rationale)

### IJC Listing Guideline

An impairment will be listed when phytoplankton and zooplankton community structure significantly diverges from un-impacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when relevant, field-validated, phytoplankton or zooplankton bioassays (e.g. *Ceriodaphnia*, algal fractionation bioassays) with appropriate quality assurance/quality controls confirm toxicity in ambient waters.

### State of Ohio Listing Guideline

Ohio EPA considers this BUI to be related to bays or lakes rather than streams and considers it not applicable to Ohio AOCs.

### Rationale

Plankton are small organisms, both plants (phyto) and animals (zoo), that live in the water column. They possess limited or no ability to swim against currents, but move with the water. Phytoplankton forms the base of the pelagic food web. Much of the energy captured by phytoplankton is consumed by zooplankton that, in turn, are eaten by larger organisms such as larger zooplankton, benthos and fish. The beneficial use of plankton communities is the conversion of solar energy to chemical energy (biomass), the incorporation of nutrients into biomass and the conveyance of these materials to normal, diverse fish and wildlife communities, and ultimately to human populations. In order to function most efficiently in this role, the plankton community must be balanced and adaptive to change. An impairment would be a decrease in the ability of the plankton communities to perform these functions due to stress caused by such activities as increased sediment runoff, high nutrient or contaminant loads, changes in hydrology and increased water temperatures.

Plankton has historically been used as an indicator in lakes rather than streams. There is considerable historical and current plankton data on the open waters of Lake Erie, but this information does not extend into the tributaries included in the boundaries of the AOCs. Ohio EPA does not have water quality standards or biological criteria that address plankton community structure. Due to a long history of urban and industrial development along Ohio's Lake Erie shoreline, there are no *un-impacted* control sites to use for baseline assessments. Ohio EPA biological surveys have not included plankton so there is no historical population data against which to compare recent data if it were to be collected. Many of the point source dischargers are required to conduct toxicity tests using *Ceriodaphnia* bioassays as part of their permit applications or the monitoring conditions in their permits. This information may provide some basis for determining the toxicity of the waters of the AOC to zooplankton. A healthy

diverse fish community would likely contain planktivores (fish that eat plankton) and may also suggest that a diverse plankton community exists. Some work has been done on periphyton communities in the AOCs and that information may also be used as surrogate for the status of the plankton populations (Sgro and Johansen 1995, 1998).

Since no plankton assessments have been done in Ohio's AOCs, and there is no methodology established for conducting one, for the time being we propose to continue to list the status of this BUI as "Not Applicable." As an AOC approaches delisting, monitoring to verify the presence of plankton species known to be representative of clean waters, or bioassays using ambient water to verify no toxicity to plankton species may be done if there appears to be an unknown reason as to why the other BUIs have not been restored. Otherwise, it will be assumed that waters achieving the target biological indices for fish and macroinvertebrates are also supporting a healthy plankton community. The presence of nuisance plankton populations, such as blue-green algal blooms, is assessed under the eutrophication and aesthetics BUIs.

Individual RAPs are free to investigate ways to monitor and assess plankton and set their own targets.

## References

IJC. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

IJC. 1991. Commission approves list/delist criteria for Great Lakes areas of concern. Focus on International Joint Commission. Volume 16, Issue 1, ISSN 0832-6673 March/April 1991. (Available on line at: [www.ijc.org/focus/listdelist/](http://www.ijc.org/focus/listdelist/)).

Johannsson, O. and E.S. Millard. 1998. Impairment assessment of beneficial uses: Degradation of phytoplankton and zooplankton populations. Lake Erie LaMP Tech, Rept. No. 13. (Available online at: [www.epa.gov/glnpo/lakeerie/buia/reports.html](http://www.epa.gov/glnpo/lakeerie/buia/reports.html))

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-07 of the Ohio Administrative Code (Available on line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

Sgro, G. and J. Johansen. 1995. Ecology and assessment of the algae of four Lake Erie estuaries. Prepared under a grant from the Ohio Lake Erie Protection Fund.

Sgro, G. and J. Johansen. 1998. Algal periphyton bioassessment methods for Lake Erie estuaries. Prepared under a grant from the Ohio Lake Erie Protection Fund.

USEPA. 2002. Great Lakes Strategy 2002: A Plan for the New Millennium.

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## BUI 14: Loss of Fish and Wildlife Habitat

### IJC Listing Guideline

An impairment will be listed when fish and wildlife management goals have not been met as a result of loss of fish and wildlife habitat due to a perturbation in the physical, chemical or biological integrity of the Boundary Waters, including wetlands.

### State of Ohio Listing Guideline

This beneficial use shall be listed as impaired if:

#### Fish Habitat:

1) Habitat quality, as applicable and measured by the Qualitative Habitat Evaluation Index (QHEI), averages below a score of 60 throughout the free-flowing stream stretches of the AOC; 2) An assessment of the nearshore, harbor or lacustuary areas using the Lake Erie QHEI methodology indicates impairment; or 3) Ohio Aquatic Life WQS are not being met **or** 1) Fish management officials identify loss of or poor quality habitat as cause for non-attainment with fishery goals.

#### Wildlife Habitat:

1) Wildlife management officials identify loss of or poor quality habitat as cause for non-attainment with wildlife goals.

### State of Ohio Delisting Target

#### Fish Habitat:

- ✓ For mainstem and tributaries, habitat quality shall average a QHEI score of 60 or better throughout the free-flowing stream stretches of the AOC
  - ✓ For nearshore, harbor or lacustuary areas, Lake Erie QHEI results do not indicate an impairment, **and** Ohio Aquatic Life Water Quality Standards are met
- OR**
- ✓ Fish and Wildlife officials do not identify loss of or poor quality habitat as cause for non-attainment with fishery goals.

### State of Ohio Delisting Milestones

#### Fish Habitat:

- Track changes in QHEI scores
- Track watershed survey results (Technical Support Documents, TMDLs, Ohio Integrated Water Quality Monitoring and Assessment Report, etc.) for compliance with State Aquatic Life Water Quality Standards
- Conduct a habitat assessment of the nearshore and lacustuary areas using the Lake Erie QHEI methodology
- ✓ Habitat is sufficient to support achievement of the biocriteria associated with State Aquatic Life Water Quality Standards in the free-flowing stream segments of the AOC, to support achievement of biological indice guidance for the lacustuary and nearshore segments of the AOC, and to meet fishery goals set by fish and wildlife officials.

**State of Ohio**  
**Delisting Target**

**Wildlife Habitat:**

- ✓ Forested buffers exist on 50% of residential tributaries and 25% of urban tributaries ***and***
- ✓ For headwater streams, HHEI habitat quality shall average a score of 30 for warm water streams and 70 for cold water streams  
\_\_\_\_\_ **OR** \_\_\_\_\_
- ✓ For headwater streams and wetlands, State Aquatic Life Water Quality Standards are met  
\_\_\_\_\_ **OR** \_\_\_\_\_
- ✓ Wildlife officials do not identify loss of or poor quality habitat as cause for non-attainment with wildlife goals.

**State of Ohio**  
**Delisting Milestones**

**Wildlife Habitat:**

- Buffers, conservation easements, riparian setback ordinances or other protective mechanisms are in place on more than 80% of the streams and tributaries
- Over 10% of major watershed and over 6% of sub-watershed is high quality wetland habitat
- Over 75% of the stream length is naturally vegetated
- Less than 15% of the watershed is impervious
- Over 30% of the watershed is in forest cover
- Track HHEI scores
- Track percentage of forested riparian buffers along streams in residential and urban areas
- Track wildlife management goal attainment
- ✓ Habitat is sufficient to support wildlife goals for the AOC.

**Rationale**

The IJC listing guideline is in two parts. An AOC must determine there is no loss of habitat for both fish and wildlife due to disproportionate or undue alterations in the chemical, physical or biological components of the waters of the AOC. The development of the greater Lake Erie basin will cause some habitat areas to suffer, but the state strives to limit those impacts or allow for a mitigation of those impacts. A moratorium on future development or returning developed lands to a pristine state is not, nor can it be, the goal in restoring this beneficial use impairment. The primary goal is reasonable protection in place for existing un-impacted habitat areas, followed by restoration or rehabilitation of degraded habitat areas. According to *“Restoring United States Areas of Concern: Delisting Principles and Guidelines,”* the beneficial use restoration process must include a maintenance plan to reduce the risk of future degradation. Adjacent land use practices have considerable impact on water quality and habitat. Development pressures will continue and reasonable assurances that future degradation of certain areas may not be practical. However, developmental impacts to the quantity and quality of habitats can be lessened or mitigated. The Ohio Lake Erie Balanced Growth Program, which is now being initiated statewide, may be a potential program to partner with to preserve or restore this beneficial use.

### **Fish Habitat Assessment:**

The Ohio EPA has a long history of assessing aquatic biological communities, including habitat, during their routine environmental surveys. Two main components of aquatic health assessment in regard to habitat are the QHEI for streams and the Lake Erie nearshore, and HHEI for headwater streams. The HHEI evaluates the habitat potential in watersheds less than or equal to 1 mi<sup>2</sup>. State numeric values have been set for fish communities according to size and type of the water resource. From the State's perspective, if aquatic life use designations in the Ohio WQS for the AOC water bodies are being met, then habitat will not be considered impaired. A methodology to conduct a QHEI along the Lake Erie shoreline and in the lacustrine areas has been developed, but no scoring system has yet been defined. The Lake Erie QHEI can, nonetheless, be used as an indicator of whether these areas are potentially degraded.

### **Wildlife Habitat Assessment:**

While aquatic habitat assessment methodologies have been a proven tool in monitoring aquatic habitat potential, little data is available on terrestrial or amphibian habitat evaluations associated with the water resource. For this reason, indirect assessment through the use of land cover, riparian and aquatic vegetation, acres of wetland, wetland quality and total suspended sediment in the stream are utilized. Individual RAP organizations are tasked with restoring the beneficial uses in distinctly different areas with differing land use, location and size. Each RAP organization should utilize any or all of this indirect assessment approach to address wildlife habitat concerns for their particular AOC.

Since it is commonly agreed healthy riparian borders protect and enhance both the aquatic and terrestrial habitats, the presence of these riparian areas are of vital importance to habitat evaluations. These borders also function as migratory pathways for animals traversing the area, especially into the more traditionally forested habitat areas. In addition, wetlands serve as both aquatic and terrestrial habitats and a certain amount of acreage is desirable. Higher quality wetlands are also desirable as measured by the Ohio Rapid Assessment Method and as compared to Ohio wetland standards. Aquatic habitats in streams too small for fish are evaluated using the headwater habitat evaluation index (HHEI). Smaller watersheds may not be of sufficient size or depth to accommodate fish, so the HHEI was developed for this smaller systems and this index determines the habitat potential for other aquatic organisms, such as salamanders. State numeric values have been set according to type of headwater resource.

Most wildlife population goals set by wildlife managers are based on areas much larger than the AOC boundaries. Each RAP will have to establish a vision of the aquatic and associated terrestrial habitat that can be achieved in their AOC based on original habitat, amount and type of habitat that has been irreplaceably lost, how their AOC may fit into the larger regional picture for such things as importance as a migratory corridor or important bird area, and what can reasonably be protected or restored. Wetland acreage lost in Ohio and the percent of Ohio Lake Erie shoreline that has been altered are extensive. Protection of what remains should be a high priority. The suggested percentages listed in the milestones are based on work done to guide the Canadian AOCs in setting targets for habitat rehabilitation (Environment Canada et. al. 1998). The goals for establishing forested buffers on residential and urban streams are from the Ohio Lake Erie Protection and Restoration Plan (Ohio Lake Erie Commission 2000).

## References

Environment Canada. 1998. How Much Habitat is Enough? Great Lakes Fact Sheet, Catalog Number 40-222/8-1998E.

Environment Canada, Ontario Ministry of Natural Resources and Ontario Ministry of Environment. 1998. A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern. Canada-Ontario Remedial Action Plan Steering Committee.

International Joint Commission. 1988. Revised Great Lakes Water Quality Agreement of 1978, as amended by Protocol signed November 18, 1987. Consolidated by the International Joint Commission, United States and Canada.

Lake Erie Lakewide Management Plan (LaMP) 2000, 2002, 2004, 2006, 2008. Lake Erie LaMP Work Group. (Available on line at: [www.epa.gov/glnpo/lakeerie/](http://www.epa.gov/glnpo/lakeerie/) )

Mack, John. 2001. Ohio Rapid Assessment Method for Wetlands, Manual for Using Version 5.0. Ohio EPA Technical Bulletin Wetland/2001-1-1. Ohio Environmental Protection Agency, Division of Surface Water, 401 Wetland Ecology Unit, Columbus, OH. (Available on-line at: [www.epa.ohio.gov/dsw/401/index.aspx](http://www.epa.ohio.gov/dsw/401/index.aspx))

Mack, John. 2004. Integrated Wetland Assessment Program. Part 4: Vegetation Index of Biotic Integrity (VIBI) and Tiered Aquatic Life Uses (TALUs) for Ohio Wetlands. Ohio EPA Technical Report WET/2004-4. Ohio Environmental Protection Agency, Division of Surface Water, Wetlands Ecology Group, Columbus, OH. (Available on-line at [www.epa.ohio.gov/dsw/401/index.aspx](http://www.epa.ohio.gov/dsw/401/index.aspx)).

Ohio EPA. Ohio Water Quality Standards. Chapter 3745-1-07 of the Ohio Administrative Code (Available on-line at: [www.epa.ohio.gov/dsw/rules/3745\\_1.aspx](http://www.epa.ohio.gov/dsw/rules/3745_1.aspx))

Ohio EPA. 2002. Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams. Division of Surface Water. ([www.epa.ohio.gov/dsw/wqs/headwaters/index.aspx](http://www.epa.ohio.gov/dsw/wqs/headwaters/index.aspx))

Ohio EPA. 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application, November 6, 1989. Division of Surface Water.

Ohio Lake Erie Commission. 2000. Lake Erie Protection and Restoration Plan. (Available on-line at: [www.lakeerie.ohio.gov](http://www.lakeerie.ohio.gov) )

Ohio Lake Erie Commission Balanced Growth Program. Information available on-line at: [www.lakeerie.ohio.gov](http://www.lakeerie.ohio.gov)

Restoring United States Great Lakes Areas of Concern: Delisting Principles and Guidelines. Adopted by the U.S. Policy Committee, December 2001.

Thoma, Roger. 2004. Methods of Assessing Habitat in Lake Erie Shoreline Waters Using the Qualitative Habitat Evaluation Index (QHEI) Approach. Ohio Environmental Protection Agency, Division of Surface Water, 401 Section, Columbus, Ohio.

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## Appendix A

### Ohio Water Quality Standards: Ohio Administrative Code 3745-1

Water quality standards contain two distinct elements: designated uses and numerical or narrative criteria designed to protect and measure attainment of the uses. Rules 3745-1-01 to 3745-1-07 of the Ohio Water Quality Standards apply to all surface waters of the State of Ohio. Rules 3745-1-08 to 3745-1-30 define the use designations applicable to the river and stream segments around the state. Additional chemical-specific criteria applicable within the Lake Erie drainage basin are contained in rules 3745-1-31 and 3745-1-33. The water quality criteria applicable to a specific water body are determined by identifying the use designations assigned to that water body in Rules 3745-1-08 to 3745-1-30, then referring to Rule 3745-1-07 and 3745-1-33 for criteria protective of those use designations. The following are excerpts from OAC 3745-1.

#### OAC 3745-1-01 Purpose and Applicability

(A) It is the purpose of these water quality standards, Chapter 3745-1 of the Administrative Code, to establish minimum water quality requirements for all surface waters of the state, thereby protecting public health and welfare; and to enhance, improve and maintain water quality as provided under the laws of the state of Ohio, section 6111.041 of the Revised Code, the federal Clean Water Act, 33 U.S.C. section 1251 et seq., and rules adopted thereunder.

(B) Whenever two or more use designations apply to the same surface water, the more stringent criteria of each use designation will apply.

(C) These water quality standards will apply to all surface waters of the state except as provided in paragraph (D), (E), or (F) of this rule. Compliance schedules may be granted pursuant to rule 3745-33-05 of the Administrative Code.

(D) These water quality standards will not apply to water bodies when the flow is less than the critical low-flow values determined in rule 3745-2-05 of the Administrative Code.

(E) The following exceptions will apply only to the specific water quality criteria involved in each case for a reasonable period of time as determined by the director.

(1) Whenever chemicals are applied for control of aquatic plants or animals, notice must be given to the director before chemicals are applied. The director, upon receiving such notice, may order that chemicals not be applied if he concludes that the proposed application would pose an unreasonable danger to human or aquatic life.

(2) Whenever dredging or construction activities occur on or near water bodies or during the period of time when the aftereffects of dredging or construction activities degrade water quality and such activities have been authorized by the US Army Corps of Engineers and/or by a 401 water quality certification or an isolated wetland permit issued by the Ohio Environmental Protection Agency.

(3) Whenever coal remining permits are issued pursuant to section 301(p) of the act. This exception applies to pH, iron and manganese for the duration of the remining activity. This exception applies only if: there is a demonstrated potential for improved water quality from

the remaining operation; and no degradation of existing in stream conditions occurs.

(F) Temporary variances. The director may grant temporary variances from compliance with water quality criteria applicable by this chapter pursuant to rule 3745-33-07 of the Ohio Administrative Code.

**3745-1-04 Criteria applicable to all waters *(this section is included in its entirety)***

The following general water quality criteria shall apply to all surface waters of the state including mixing zones. To every extent practical and possible as determined by the director, these waters shall be:

(A) Free from suspended solids or other substances that enter the waters as a result of human activity and that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life;

(B) Free from floating debris, oil, scum and other floating materials entering the waters as a result of human activity in amounts sufficient to be unsightly or cause degradation;

(C) Free from materials entering the waters as a result of human activity producing color, odor or other conditions in such a degree as to create a nuisance;

(D) Free from substances entering the waters as a result of human activity in concentrations that are toxic or harmful to human, animal or aquatic life and/or are rapidly lethal in the mixing zone;

(E) Free from nutrients entering the waters as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae;

(F) Free from public health nuisances associated with raw or poorly treated sewage. A public health nuisance shall be deemed to exist when the conditions set forth in paragraph (F) (1) of this rule are demonstrated.

(1) An inspection conducted by, or under the supervision of, Ohio EPA or a sanitarian registered under Chapter 4736 of the Revised Code documents odor, color and/or other visual manifestations of raw or poorly treated sewage; and

(a) Water samples exceed five thousand fecal coliform counts per one hundred milliliters (either MPN or MF) in two or more samples when five or fewer samples are collected, or in more than twenty per cent of the samples when more than five samples are taken; or

(b) Water samples exceed five hundred seventy-six E. coli counts per one hundred milliliters in two or more samples when five or fewer samples are collected, or in more than twenty per cent of the samples when more than five samples are taken.

(2) Paragraph (F)(1) of this rule may be used by the appropriate authorities to document the existence of unsanitary conditions as described in section 6117.34 of the Revised Code, but does not preclude the use of other evidence of unsanitary conditions for the purposes described in section 6117.34 of the Revised Code.

(G) For the purposes of applying paragraph (F) of this rule the collection of water samples shall adhere to the following specifications:

- (1) The samples shall be collected when flow is representative of steady state dry weather conditions, i.e., base flow or delayed flow, and
- (2) The samples shall be collected at least two hours apart, and
- (3) The samples shall be collected over a time period not to exceed thirty days.

(H) Nothing in paragraph (F) or (G) of this rule shall limit or otherwise change the applicability of paragraphs (A) to (E) of this rule.

### 3745-1-07 Water use designations and statewide criteria

*(this section is NOT included in its entirety)*

(A) Water quality standards contain two distinct elements: designated uses; and numerical or narrative criteria designed to protect and measure attainment of the uses.

- (1) Each water body in the state is assigned one or more aquatic life habitat use designations. Each water body may be assigned one or more water supply use designations and/or one recreational use designation. These use designations are defined in paragraph (B) of this rule. Water bodies are assigned use designations in rules 3745-1-08 to 3745-1-32 of the Administrative Code. In addition, a water body may be assigned designations as described in the antidegradation rule (rule 3745-1-05 of the Administrative Code).

(A)(6) Biological criteria presented in Table 7-15 of this rule provide a direct measure of attainment of the warmwater habitat, exceptional warmwater habitat and modified warmwater habitat aquatic life uses. Biological criteria and the exceptions to chemical-specific or whole-effluent criteria allowed by this paragraph do not apply to any other use designations.

(B) Use designations are defined as follows:

(1) Aquatic life habitat

- (a) “Warmwater” – these are waters capable of supporting and maintaining a balanced, integrated, adaptive community of warmwater aquatic organisms having a species composition, diversity, and functional organization comparable to the twenty-fifth percentile of the identified reference sites within each of the following ecoregions: the interior plateau ecoregion; the Erie/Ontario lake plains ecoregion; the western Allegheny plateau ecoregion; and the eastern corn belt plains ecoregion. For the Huron/Erie lake plains ecoregion, the comparable species composition, diversity and functional organization are based upon the ninetieth percentile of all sites within the ecoregion. For all ecoregions, the attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as defined in “Biological Criteria for the Protection of Aquatic Life: Volume II, Users Manual for Biological Field Assessment of Ohio Surface Waters,” as cited in paragraph (B) of rule 3745-1-03 of the Administrative Code. In addition to those water body segments designated in rules 3745-1-08 to 3745-1-32 of the Administrative Code, all upground storage reservoirs are designated warmwater habitats. Attainment of this use designation (except for upground storage reservoirs) is based on the criteria in table 7-15 of this rule. A temporary variance to the criteria associated with this use

designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

(b) “Limited warmwater” – these are waters that were temporarily designated in the 1978 water quality standards as not meeting specific warmwater habitat criteria. Criteria for the support of this use designation are the same as the criteria for the support of the use designation warmwater habitat. However, individual criteria are varied on a case-by-case basis and supersede the criteria for warmwater habitat where applicable. Any exceptions from warmwater habitat criteria apply only to specific criteria during specified time periods and/or flow conditions. The adjusted criteria and conditions for specified stream segments are denoted as comments in rules 3745-1-08 to 3745-1-30 of the Administrative Code. Stream segments currently designated limited warmwater habitats will undergo use attainability analyses and will be redesignated other aquatic life habitats. No additional stream segments will be designated limited warmwater habitats.

(c) “Exceptional warmwater” – these are waters capable of supporting and maintaining an exceptional or unusual community of warmwater aquatic organisms having a species composition, diversity, and functional organization comparable to the seventy-fifth percentile of the identified reference sites on a statewide basis. The attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as defined in “Biological Criteria for the Protection of Aquatic Life: Volume II, Users Manual for Biological Field Assessment of Ohio Surface Waters,” as cited in paragraph (B) of rule 3745-1-03 of the Administrative Code. In addition to those water body segments designated in rules 3745-1-08 to 3745-1-32 of the Administrative Code, all lakes and reservoirs, except upground storage reservoirs, are designated exceptional warmwater habitats. Attainment of this use designation (except for lakes and reservoirs) is based on the criteria in table 7-15 of this rule. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

(d) “Modified warmwater” – these are waters that have been the subject of a use attainability analysis and have been found to be incapable of supporting and maintaining a balanced, integrated, adaptive community of warmwater organisms due to irretrievable modifications of the physical habitat. Such modifications are of a long-lasting duration (i.e., twenty years or longer) and may include the following examples: extensive stream channel modification activities permitted under sections 401 and 404 of the act or Chapter 6131 of the Revised Code, extensive sedimentation resulting from abandoned mine land runoff, and extensive permanent impoundment of free-flowing water bodies. The attributes of species composition, diversity and functional organization will be measured using the index of biotic integrity, the modified index of well-being and the invertebrate community index as defined in “Biological Criteria for the Protection of Aquatic Life: Volume II, Users Manual for Biological Field Assessment of Ohio Surface Waters,” as cited in paragraph (B) of

rule 3745-1-03 of the Administrative Code. Attainment of this use designation is based on the criteria in table 7-15 of this rule. Each water body designated modified warmwater habitat will be listed in the appropriate use designation rule (rules 3745-1-08 to 3745-1-32 of the Administrative Code) and will be identified by ecoregion and type of physical habitat modification as listed in table 7-16 of this rule. The modified warmwater habitat designation can be applied only to those waters that do not attain the warmwater habitat biological criteria in table 7-15 of this rule because of irretrievable modifications of the physical habitat. All water body segments designated modified warmwater habitat will be reviewed on a triennial basis (or sooner) to determine whether the use designation should be changed. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

(e) “Seasonal salmonid” – these are rivers, streams and embayments capable of supporting the passage of salmonids from October to May and are water bodies large enough to support recreational fishing. This use will be in effect the months of October to May. Another aquatic life habitat use designation will be enforced the remainder of the year (June to September). A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

(f) “Coldwater” – these are waters that meet one or both of the characteristics described in paragraphs (B)(1)(f)(i) and (B)(1)(f)(ii) of this rule. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

(i) “Coldwater habitat, inland trout streams” – these are waters which support trout stocking and management under the auspices of the Ohio department of natural resources, division of wildlife, excluding waters in lake run stocking programs, lake or reservoir stocking programs, experimental or trial stocking programs, and put and take programs on waters without, or without the potential restoration of, natural coldwater attributes of temperature and flow. The director shall designate these waters in consultation with the director of the Ohio Department of Natural Resources.

(ii) “Coldwater habitat, native fauna” – these are waters capable of supporting populations of native coldwater fish and associated vertebrate and invertebrate organisms and plants on an annual basis. The director shall designate these waters based upon results of use attainability analyses.

(g) “Limited resource water” – these are waters that have been the subject of a use attainability analysis and have been found to lack the potential for any resemblance of any other aquatic life habitat as determined by the biological criteria in table 7-15 of this rule. The use attainability analysis must demonstrate that the extant fauna is substantially degraded and that the potential for recovery of the fauna to the level characteristic of any other aquatic life habitat is realistically precluded due to natural

background conditions or irretrievable human-induced conditions. All water body segments designated limited resource water will be reviewed on a triennial basis (or sooner) to determine whether the use designation should be changed. Limited resource waters are also termed nuisance prevention for some water bodies designated in rules 3745-1-08 to 3745-1-30 of the Administrative Code. A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of Rule 3745-1-01 of the Administrative Code. Waters designated limited resource water will be assigned one or more of the following causative factors. These causative factors will be listed as comments in rules 3745-1-08 to 3745-1-30 of the Administrative Code.

(i) "Acid mine drainage" - these are surface waters with sustained pH values below 4.1 s.u. or with intermittently acidic conditions combined with severe streambed siltation, and have a demonstrated biological performance below that of the modified warmwater habitat biological criteria.

(ii) "Small drainageway maintenance" - these are highly modified surface water drainageways (usually less than three square miles in drainage area) that do not possess the stream morphology and habitat characteristics necessary to support any other aquatic life habitat use. The potential for habitat improvements must be precluded due to regular stream channel maintenance required for drainage purposes.

(iii) Other specified conditions.

## Appendix B Ecoregional Biological Criteria

Attainment and non-attainment of aquatic life use is determined by using biological criteria as outlined in Ohio Administrative Code 3745-1-07. The aquatic life uses found in Ohio's Areas of Concern are:

### Warm Water Habitat (WWH)

This use designation defines the "typical" warmwater assemblage of aquatic organisms for Ohio rivers and streams; this use represents the principal restoration target for the majority of water resource management efforts in Ohio.

### Exceptional Warm Water Habitat (EWH)

This use designation is reserved for waters which support "unusual and exceptional" assemblages of aquatic organisms which are characterized by a high diversity of species, particularly those which are highly intolerant and/or rare, threatened, endangered, or special status (i.e. declining species); this use designation represents a protection goal for water resource management efforts dealing with Ohio's best water resources. Biological criteria for EWH apply uniformly across the state.

### Modified Warm Water Habitat (MWH)

This use applies to streams and rivers which have been subjected to extensive, maintained, and essentially permanent hydromodifications such that the biocriteria for the WWH use are not attainable and where the activities have been sanctioned and permitted by state and/or federal law; the representative aquatic assemblages are generally composed of species which are tolerant to low dissolved oxygen, silt, nutrient enrichment, and poor quality habitat. Biological criteria for MWH were derived from a separate set of habitat modified reference sites and are stratified across five ecoregions and three major modification types: channelization, run-of-river impoundments, and extensive sedimentation due to non-acidic mine drainage.

### Coldwater Habitat (CWH)

This use is intended for waters which support assemblages of cold water organisms and/or those which are stocked with salmonids with the intent of providing put-and-take fishery on a year round basis which is further sanctioned by the Ohio Department of Natural Resources (ODNR) Division of Wildlife; this use should not be confused with the Seasonal Salmonid Habitat (SSH) use which applies to the Lake Erie tributaries which support periodic "runs" of salmonids during the spring, summer, and/or fall. No specific biological criteria have been developed for the CWH use although the WWH biocriteria are viewed as attainable for CWH designated streams.

### Limited Resource Water Habitat (LRW)

This use applies to small streams (usually <3 sq. mi. drainage area) and other water courses which have been irretrievably altered to the extent that no appreciable assemblage of aquatic life can be supported. Such waterways generally include small streams in extensively urbanized areas, those which lie in watersheds with extensive drainage modifications, those which completely lack water on a recurring annual basis (i.e. true ephemeral streams), or other irretrievably altered waterways.

### Seasonal Salmonid Habitat (SSH)

This use applies to rivers, streams and embayments capable of supporting the passage of salmonids from October to May, and includes water bodies large enough to support recreational fishing. This use will be in effect the months of October to May. Another aquatic life habitat use designation will be enforced the remainder of the year (June to September). A temporary variance to the criteria associated with this use designation may be granted as described in paragraph (F) of rule 3745-1-01 of the Administrative Code.

The biological community performance measures that are used to determine attainment or non-attainment for each of these habitat types are the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb), both of which are based on fish community characteristics, and the Invertebrate Community Index (ICI) which is based on macroinvertebrate community characteristics. IBI and ICI are multi-metric indices patterned after an original IBI described by Karr (1981) and Fausch et al. (1984). The MIwb is a measure of the fish community abundance and diversity using numbers and weight information from a variety of Midwest Rivers (Gammon 1976, Gammon et al. 1981). The MIwb is a modification of the Index of Well-Being (IWB) and corrects the problem of relatively high scores at degraded sites. Thirteen highly pollution tolerant species, exotics and hybrids are eliminated from the numbers and biomass components of the IWB, but the tolerant and exotic species are included in the Shannon Index component of the MIwb calculations. The modification eliminates the undesired effect caused by high abundance (in both numbers and biomass) of tolerant species, but retains the influence in the Shannon indices.

Attainment of an aquatic life use is “full” if all three of the above indices meet the applicable criteria, “partial” if at least one of the indices does not attain and performance does not fall below the fair category, and “non” if all indices either fail to attain or any index indicates a poor or very poor performance.

The quality of the physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by Ohio EPA for streams and rivers in Ohio (Rankin 1989, Rankin 1995). Various attributes of the available habitat are scored based on the relative importance of each to the existence of viable, diverse aquatic faunas. Evaluations of the type and quality of substrate, amount of in-stream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to determine the QHEI score which generally ranges from 20 to 100 in Ohio.

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to only the habitat characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to localized disturbances yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided that water quality conditions are not limiting. QHEI scores from hundreds of segments throughout the state have indicated that values greater than 60 are generally conducive to existence of warmwater faunas. Scores greater than 75 frequently typify habitat conditions which have the ability to support exceptional warmwater faunas.

The following table includes the IBI, ICI, MIwb, and QHEI criteria scores that have been set as delisting targets. These scores are based on the aquatic life habitat use designation and the ecoregion for each stream. Ecoregions are classification of the landscape by region. They are large landscape areas defined by climate, physical characteristics of the landscape, and the plants and animals that are able to live there. Ecoregions contain many different physical settings and biological communities, which occur in predictable patterns (Land by the Lakes: Nearshore Terrestrial Ecosystems, Holland & Reid, 1997). Ohio's areas of concern are primarily included in two ecoregions: Huron-Erie Lake Plain (HELP) and Erie/Ontario Lake Plain (EOLP). Ohio's Areas of Concern and their relative location to each ecoregion can be seen in the map on the following page.

The river mouth areas of the streams present a transition zone between river habitat and lake habitat. For Lake Erie, these areas are typically drowned river mouths where lake and river waters mix, currents slow, and in many cases, have been artificially deepened for navigation. Ohio EPA refers to these areas as lacustuaries (a combination of the words lacustrine and estuary), rather than estuaries, as many people think of estuaries as sites where freshwater tributaries meet saltwater seas. The lacustuaries extend upstream approximately to the point where the river reaches lake level. Table B-2 lists the approximate boundaries of the lacustuaries for each of Ohio's AOCs. Because they represent a habitat different than both the river and the lake, Ohio EPA has developed separate sampling methods and biological indices for these areas. The draft indices for the lacustuary and nearshore areas are presented in Table B-3 and should be considered guidance only. Background scores for each AOC are available from Ohio EPA.

**Table B-1. Stream Evaluation Criteria by Ecoregion**

| Index Type – Site Type  | Erie/Ontario Lake Plain<br>(EOLP) |     |     | Huron-Erie Lake Plain<br>(HELP) |     |     |
|-------------------------|-----------------------------------|-----|-----|---------------------------------|-----|-----|
|                         | WWH                               | EWH | MWH | WWH                             | EWH | MWH |
| <b>IBI - Headwaters</b> | 40                                | 50  | 24  | 28                              | 50  | 20  |
| <b>IBI – Wading*</b>    | 38                                | 50  | 24  | 32                              | 50  | 20  |
| <b>IBI - Boat*</b>      | 40                                | 48  | 24  | 34                              | 48  | 20  |
| <b>MIwb – Wading</b>    | 7.9                               | 9.4 | 6.2 | 7.3                             | 9.4 | 5.6 |
| <b>MIwb – Boat</b>      | 8.7                               | 9.6 | 5.8 | 8.6                             | 9.6 | 5.7 |
| <b>ICI</b>              | 34                                | 46  | 22  | 34                              | 46  | 22  |
| <b>QHEI</b>             | 60                                | 75  | -   | 60                              | 75  | -   |

*\*Wading and boat refer to sampling methodology (i.e. wading in shallow water and use of a boat in deeper water)*

Table B-2. Delineation of Lake Erie Lacustuaries\*

| Stream          | Lacustuary Length (Miles) |
|-----------------|---------------------------|
| Ottawa River    | 6.8                       |
| Maumee River    | 14.8                      |
| Duck Creek      | 0.5                       |
| Otter Creek     | 2.5                       |
| Swan Creek      | 3.0                       |
| Crane Creek     | 2.9                       |
| Turtle Creek    | 4.2                       |
| Toussaint River | 7.9                       |
| Black River     | 6.8                       |
| Cuyahoga River  | 7.0                       |
| Ashtabula River | 2.5                       |

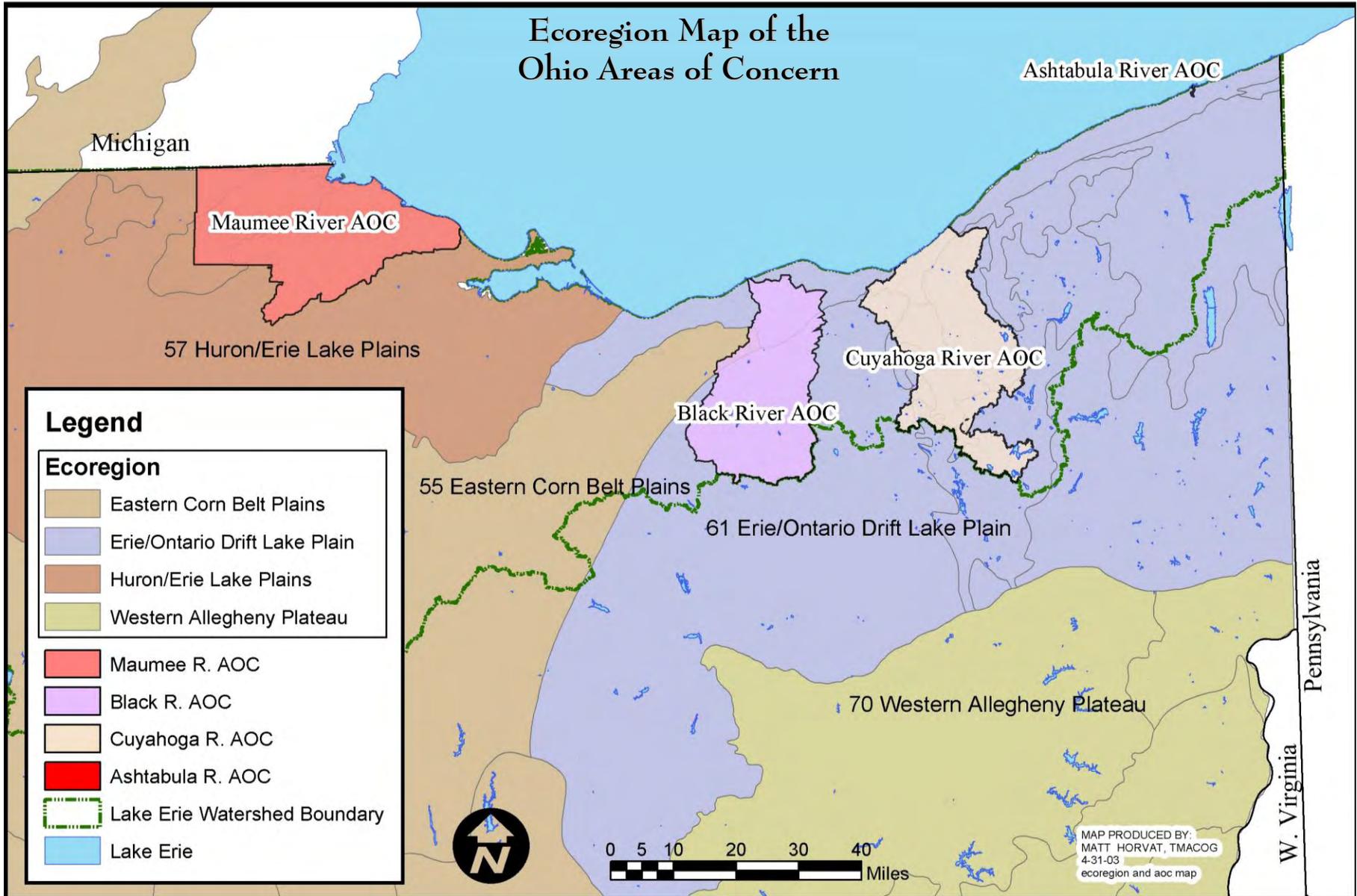
\*Lacustuary lengths are approximate and fluctuate with lake levels and wind direction. The lengths presented here are based on Ohio EPA field observations and the following Publication: Brant, R. and C.E. Herdendorf. 1972. Delineation of Great Lakes Estuaries. Proc. 15<sup>th</sup> Conf. Great Lakes Res. 1972:710-718. International Association Great Lakes Res.

Table B-3. Stream Evaluation Guidelines for Lake Erie Lacustuary and Nearshore Guidelines\*

|                           | IBI | MIwb | ICI |
|---------------------------|-----|------|-----|
| <b>Lacustuary</b>         | 42  | 8.6  | 42  |
| <b>Nearshore (rubble)</b> | 42  | 8.9  | N/A |
| <b>Nearshore (sand)</b>   | 31  | 7.2  | N/A |

\*Based on Thoma, 1999.

For the Lake Erie shoreline and lacustuary areas, a QHEI >55 is considered an acceptable target. Guidance on conducting QHEI's in this area and background data is available from Ohio EPA, Division of Surface Water.



## Appendix C HUCs and Ohio's Areas of Concern

An assessment unit provides a practicable way to summarize water quality data and to convey information about the inferred status of the waterway being evaluated. Comparisons between assessment units are useful in water quality management; therefore, some consistency between assessment units is desirable. Ohio EPA commonly uses the 11-digit hydrologic unit code (HUC). Ohio AOCs cover all or part of eighteen 11-digit HUCs. Information about most of these HUCs is available in Ohio EPA's Integrated Water Quality Monitoring and Assessment Report (2002).

### Ashtabula River Area of Concern

|          |     |   |
|----------|-----|---|
| 04110003 | 050 | Ashtabula River   |
| 04110003 | 040 | Lake Erie Tributaries (East of Grand River to West of Ashtabula Harbor)                   |
| 04120101 | 010 | Conneaut Creek; Lake Erie Tributaries (East of Ashtabula River to West of Conneaut Creek) |

### Cuyahoga River Area of Concern

|          |     |  |
|----------|-----|--|
| 04110002 | 020 | Cuyahoga River (downstream Black Brook to downstream Breakneck Creek)            |
| 04110002 | 030 | Cuyahoga River (downstream Breakneck Creek to downstream Little Cuyahoga River)  |
| 04110002 | 040 | Cuyahoga River (downstream Little Cuyahoga River to downstream Brandywine Creek) |
| 04110002 | 050 | Cuyahoga River (downstream Brandywine Creek to downstream Tinkers Creek)         |
| 04110002 | 060 | Cuyahoga River (downstream Tinkers Creek to mouth)                               |

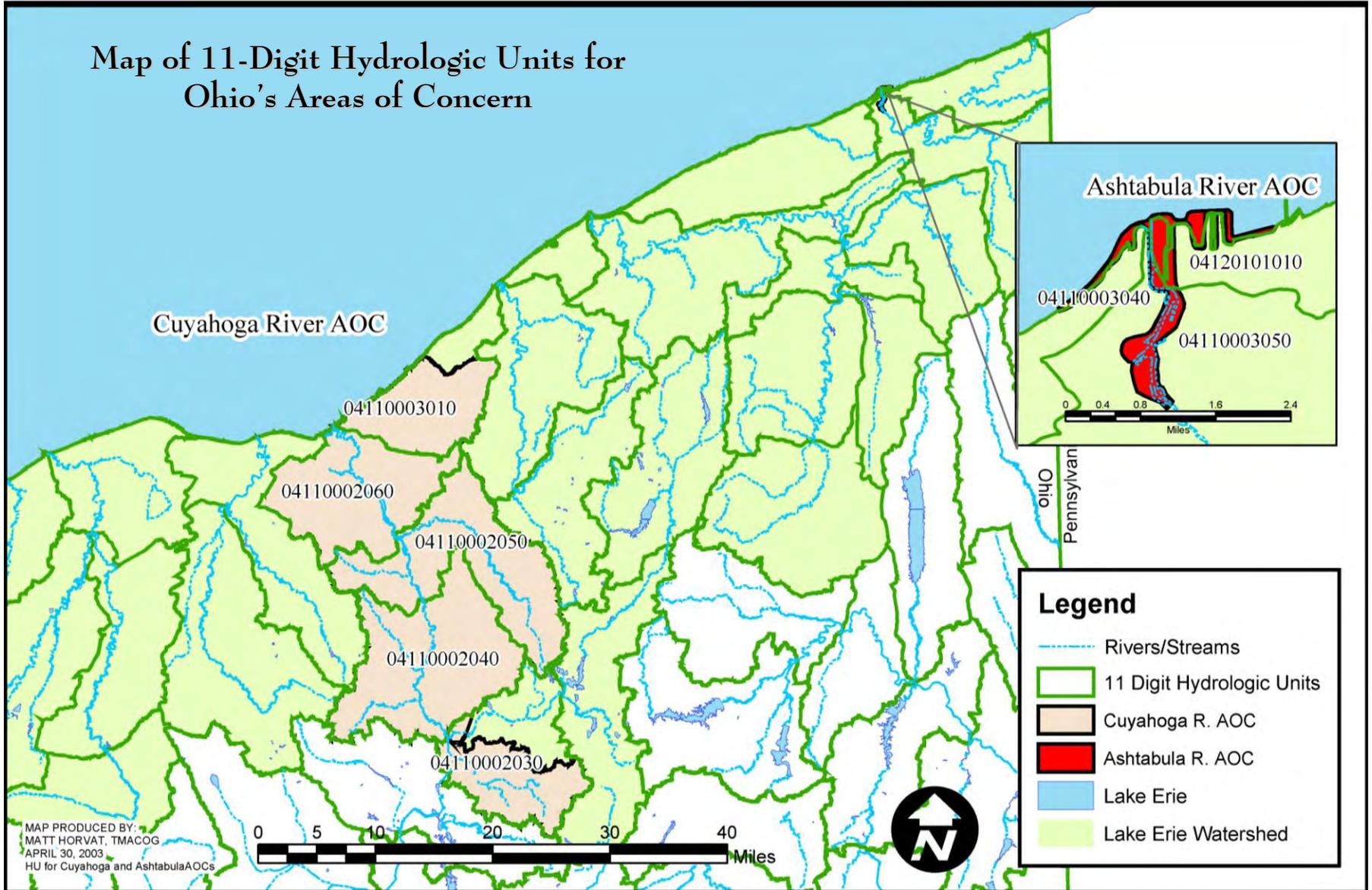
### Black River Area of Concern

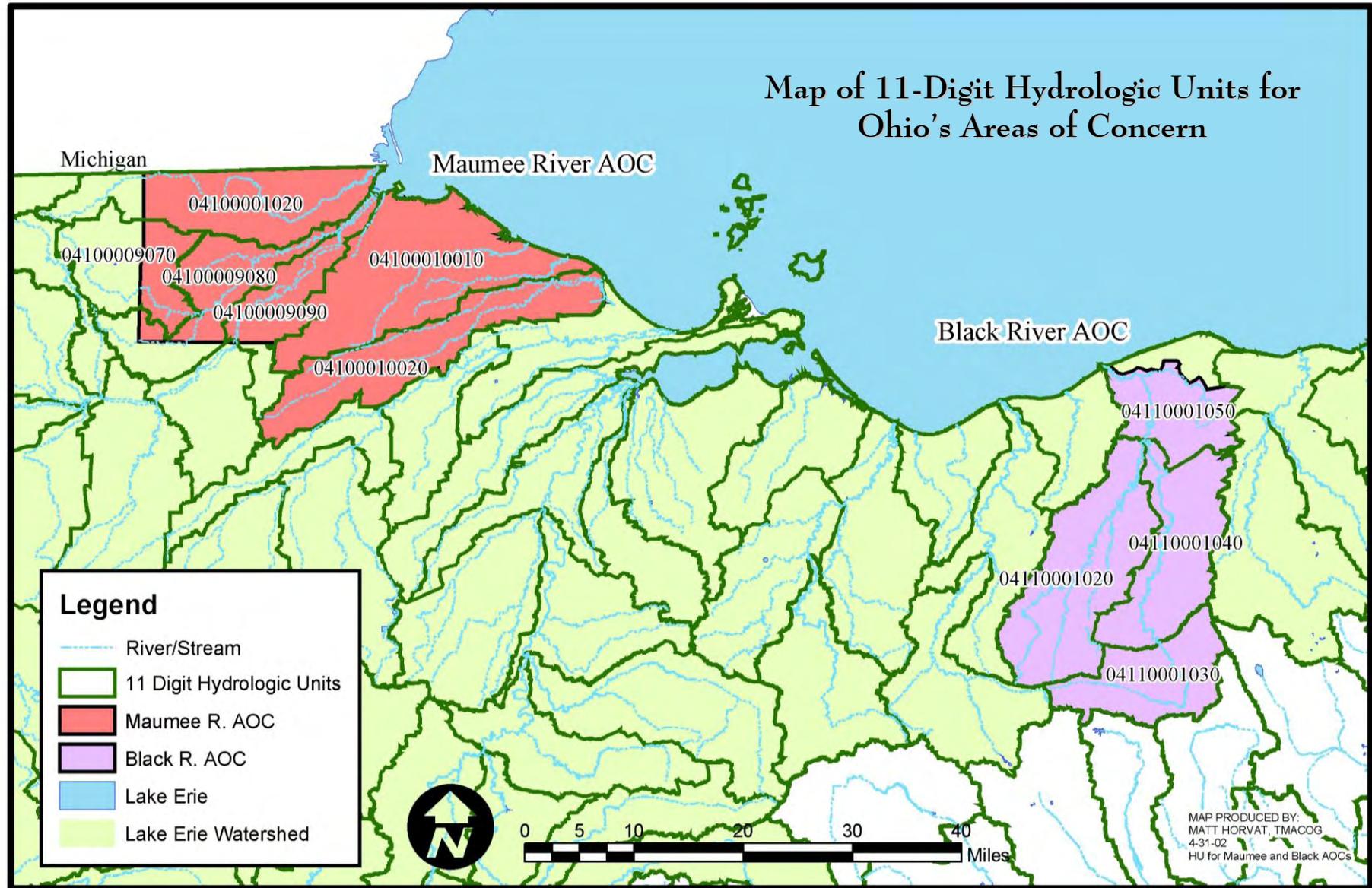
|          |     |  |
|----------|-----|--|
| 04110001 | 020 | West Branch of Black River   |
| 04110001 | 030 | East Branch Black River (headwaters to downstream Coon Creek)                  |
| 04110001 | 040 | East Branch Black River (downstream Coon Creek to mouth)                       |
| 04110001 | 050 | Black River; Lake Erie tributaries (East of Black R. to West of Porter Creek.) |

### Maumee River Area of Concern

|          |     |  |
|----------|-----|--|
| 04100001 | 020 | Ten Mile Creek; Ottawa River   |
| 04100009 | 070 | Swan Creek (headwaters to upstream Blue Creek)   |
| 04100009 | 080 | Swan Creek (upstream Blue Creek to mouth)  |
| 04100009 | 090 | Maumee River (downstream N. Granger Island to mouth);<br>excluding Maumee River mainstem |
| 04100010 | 010 | Lake Erie Tributaries (East of Maumee River to west of Toussaint River)                  |
| 04100010 | 020 | Toussaint Creek  |

# Map of 11-Digit Hydrologic Units for Ohio's Areas of Concern







## Appendix D Sediment Guidelines for Dredging and Disposal

While Ohio does not have standards for contaminated sediment, several reports are used to provide guidelines in determining when sediments are contaminated, if they are suitable for beach/shoreline nourishment and if they can be applied to an upland beneficial use. Table D-1 provides background or benchmark contaminant concentrations for Lake Erie and the tributaries in the Lake Erie watershed. Table D-2 provides threshold and probable effect concentrations/levels where one would expect to start seeing an impact. Table D-3 provides guidance on the quality of sediment needed to use dredged sediment for upland disposal/reuse.

**Table D-1. Background/Benchmark concentrations of contaminants in sediments in the Lake Erie watershed.**

| Contaminant  | Background*   |               | Surficial 75 <sup>th</sup> Percentile Benchmark* |               | Sediment Reference Value **    |                              |
|--------------|---------------|---------------|--|---------------|--------------------------------|------------------------------|
|              | Western Basin | Central Basin | Western Basin                                    | Central Basin | Erie/Ontario Lake Plain (EOLP) | Huron-Erie Lake Plain (HELP) |
| Aluminum     | 1.66 (%)      | 1.81 (%)      | 1.66 (%)   | 1.85 (%)      | 29,000                         | 42,000                       |
| Arsenic      | 5.8           | 7.1           | 8.8  | 11.1          | 25                             | 11                           |
| Barium       |               |               |  |               | 190                            | 210                          |
| Cadmium      | <1            | <1            | 1.6  | 2.0           | 0.79                           | 0.96                         |
| Chromium     | 22.2          | 31            | 55.4   | 46.6          | 29                             | 51                           |
| Copper       | 15.1          | 35.1          | 46.8   | 49.2          | 32                             | 42                           |
| Iron         | 2.34 (%)      | 3.53 (%)      | 3.2 (%)  | 3.6 (%)       | 41,000                         | 44,000                       |
| Lead         | 13.2          | 22.7          | 57.1   | 59.8          | 47                             | 47                           |
| Manganese    | 519           | 573           | 650  | 872           | 1500                           | 1000                         |
| Magnesium    | -             | -             | -  | -             | 7100                           | 29,000                       |
| Mercury      | 0.034         | 0.049         | 0.65   | 0.25          | 0.12                           | 0.12                         |
| Nickel       | 27.6          | 45.9          | 50.1   | 51.7          | 33                             | 36                           |
| Nitrogen     | 1308          | 1782          | 2580   | 3198          | -                              | -                            |
| Phosphorus   | 466           | 523           | 779  | 936           | -                              | -                            |
| Total PCB*** | -             | -             | .177   | .111          | -                              | -                            |
| Zinc         | 63.5          | 105.8         | 209  | 237           | 160                            | 190                          |

\*Painter et.al. 2001    \*\*Ohio EPA 2003    \*\*\*Marvin et.al. 2002

- Background was determined by averaging concentrations from the 40 to 50 cm interval to the bottom of sediment cores and are generally representative of sediment concentrations in the lake prior to the advent of anthropogenic influences.
- All values are in ppm (mg/kg dry weight) unless otherwise noted.
- Benchmarks are surficial sediment concentrations falling within the 75<sup>th</sup> percentile.
- Sediment Reference Values are used as a screening tool to identify potential sediment contamination in lotic (flowing) waterbodies.

Table D-2. Selected guidelines for chemical concentrations in freshwater sediments that have been observed or predicted to be associated with adverse effects on aquatic biota. (concentrations are in mg/kg (ppm) dry weight)

| Contaminant            | U.S. EPA Great Lakes Sediment Effect Concentrations* |                                     | Environment Canada and Great Lakes Sediment Quality Assessment Values** |                             |
|------------------------|--|-------------------------------------|---|-----------------------------|
|                        | Threshold Effect Concentration (TEC)                 | Probable Effect Concentration (PEC) | Threshold Effect Level (TEL)  | Probable Effect Level (PEL) |
| <b>Organochlorines</b> |  |                                     |   |                             |
| Chlordane, total       | 0.00324  | 0.0176                              | 0.0045  | 0.0089                      |
| DDT, total             | 0.00528  | 0.5720                              | 0.007   | 4.45                        |
| Dieldrin               | 0.00190  | 0.0618                              | 0.00285   | 0.00667                     |
| Lindane                | 0.00237  | 0.0050                              | 0.00094   | 0.00138                     |
| PCBs, total            | 0.0598   | 0.676                               | 0.0341  | 0.277                       |
| <b>PAHs</b>            |  |                                     |   |                             |
| Anthracene             | 0.0572   | 0.845                               | -   | -                           |
| Benz[a]anthracene      | 0.1080   | 1.050                               | 0.0317  | 0.385                       |
| Benzo[a]pyrene         | 0.1500   | 1.450                               | 0.0319  | 0.782                       |
| Chrysene               | 0.1660   | 1.290                               | 0.0571  | 0.862                       |
| Phenanthrene           | 0.2040   | 1.170                               | 0.0419  | 0.515                       |
| PAH, total             | 1.6100   | 22.80                               | -   | -                           |
| <b>Metals</b>          |  |                                     |   |                             |
| Arsenic                | 9.79   | 33.0                                | 5.9   | 17.0                        |
| Cadmium                | 0.99   | 4.98                                | 0.596   | 3.53                        |
| Chromium               | 43.4   | 111.0                               | 37.3  | 90.0                        |
| Copper                 | 31.6   | 149.0                               | 35.7  | 197.0                       |
| Lead                   | 35.8   | 128.0                               | 35.0  | 91.3                        |
| Mercury                | 0.18   | 1.06                                | 0.174   | 0.486                       |
| Nickel                 | 22.7   |                                     |   |                             |
| Zinc                   | 121  | 459.0                               | 123.0   | 315.0                       |

\* MacDonald, D., C. Ingersoll and T. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

\*\* Canadian Council of Ministers of the Environment (1999)

Table D-3. Guidelines for Upland Reuse of Dredged Sediment.

| Parameter                   | Limit (mg/kg) | Limit (ug/kg) | Limit (ng/kg) | Volatile Organic | Semi-volatile Organic | Inorganic |
|-----------------------------|---------------|---------------|---------------|------------------|-----------------------|-----------|
| Acetone                     | 157           |               |               | X                |                       |           |
| Acrolein                    |               | 10            |               | X                |                       |           |
| Acrylonitrile               |               | 209           |               | X                |                       |           |
| Aldrin                      |               | 29            |               |                  | X                     |           |
| Aniline                     | 85            |               |               |                  | X                     |           |
| Antimony                    | 31            |               |               |                  |                       | X         |
| Aramite                     | 19            |               |               |                  | X                     |           |
| Arsenic                     | 41            |               |               |                  |                       | X         |
| Barium                      | 5,375         |               |               |                  |                       | X         |
| Benzene                     |               | 601           |               | X                |                       |           |
| Benzidine                   |               | 2             |               |                  | X                     |           |
| Benzyl alcohol              | 1,833         |               |               |                  | X                     |           |
| Beryllium                   | 154           |               |               |                  |                       | X         |
| Bis(2-chloroethyl)ether     |               | 211           |               |                  | X                     |           |
| Bis(2-chloroisopropyl)ether |               | 2,884         |               |                  | X                     |           |
| Bis(2-ethylhexyl)phthalate  | 35            |               |               |                  | X                     |           |
| Boron                       | 1,562         |               |               |                  |                       | X         |
| Bromobenzene                |               | 2,800         |               | X                |                       |           |
| Bromodichloromethane        |               | 824           |               | X                |                       |           |
| Bromoform                   | 62            |               |               | X                |                       |           |
| n-Butylbenzene              | 58            |               |               | X                |                       |           |
| sec-Butylbenzene            | 45            |               |               | X                |                       |           |
| tert-Butylbenzene           | 53            |               |               | X                |                       |           |
| Butyl benzyl phthalate      | 1,222         |               |               |                  | X                     |           |
| Cadmium                     | 39            |               |               |                  |                       | X         |
| Carbon disulfide            | 36            |               |               | X                |                       |           |
| Carbon tetrachloride        |               | 251           |               | X                |                       |           |
| Chlordane                   |               | 1,624         |               |                  | X                     |           |
| 4-Chloroaniline             | 24            |               |               |                  | X                     |           |
| Chlorobenzene               | 15            |               |               | X                |                       |           |
| Chlorobenzilate             |               | 1,801         |               |                  | X                     |           |
| Chloroform                  |               | 356           |               | X                |                       |           |
| beta-Chloronaphthalene      | 494           |               |               |                  | X                     |           |
| 2-Chlorophenol              |               | 6,300         |               |                  | X                     |           |
| o-Chlorotoluene             | 16            |               |               | X                |                       |           |
| Chromium VI                 | 30            |               |               |                  |                       | X         |
| Copper                      | 1,500         |               |               |                  |                       | X         |
| Cyanide (free)              | 122           |               |               |                  |                       | X         |
| DDD                         |               | 2,437         |               |                  | X                     |           |
| DDE                         |               | 1,720         |               |                  | X                     |           |
| DDT                         |               | 1,720         |               |                  | X                     |           |

| Parameter                    | Limit (mg/kg) | Limit (ug/kg) | Limit (ng/kg) | Volatile Organic | Semi-volatile Organic | Inorganic |
|------------------------------|---------------|---------------|---------------|------------------|-----------------------|-----------|
| Diallate                     |               | 7,973         |               |                  | X                     |           |
| Dibromochloromethane         |               | 1,109         |               | X                |                       |           |
| 1,2-Dibromo-3-chloropropane  |               | 454           |               | X                |                       |           |
| Dibutyl phthalate            | 611           |               |               |                  | X                     |           |
| 1,2-Dichlorobenzene          | 110           |               |               |                  | X                     |           |
| 1,3-Dichlorobenzene          |               | 1,600         |               |                  | X                     |           |
| 1,4-Dichlorobenzene          |               | 3,447         |               |                  | X                     |           |
| 3,3-Dichlorobenzidine        |               | 1,081         |               |                  | X                     |           |
| Dichlorodifluoromethane      |               | 9,400         |               | X                |                       |           |
| 1,1-Dichloroethane           | 51            |               |               | X                |                       |           |
| 1,2-Dichloroethane           |               | 278           |               | X                |                       |           |
| 1,1-Dichloroethylene         | 12            |               |               | X                |                       |           |
| 1,2-Dichloroethylene (cis)   |               | 4,300         |               | X                |                       |           |
| 1,2-Dichloroethylene (trans) |               | 6,900         |               | X                |                       |           |
| 2,4-Dichlorophenol           | 18            |               |               |                  | X                     |           |
| 1,2-Dichloropropane          |               | 342           |               | X                |                       |           |
| 1,3-Dichloropropene          |               | 777           |               | X                |                       |           |
| Dieldrin                     |               | 30            |               |                  | X                     |           |
| Diethyl phthalate            | 4,888         |               |               |                  | X                     |           |
| 2,4-Dimethylphenol           | 122           |               |               |                  | X                     |           |
| Dimethyl phthalate           | 61,000        |               |               |                  | X                     |           |
| 2,4-Dinitrophenol            | 12            |               |               |                  | X                     |           |
| 2,4-Dinitrotoluene           | 12            |               |               |                  | X                     |           |
| 2,6-Dinitrotoluene           |               | 6,100         |               |                  | X                     |           |
| Dinoseb                      |               | 6,100         |               |                  | X                     |           |
| di-n-Octyl phthalate         | 244           |               |               |                  | X                     |           |
| Dioxin (2,3,7,8-TCDD TEQ)    |               |               | 300           |                  | X                     |           |
| Diphenylamine                | 153           |               |               |                  | X                     |           |
| 1,2-Diphenylhydrazine        |               | 608           |               |                  | X                     |           |
| Disulfoton                   |               | 244           |               |                  | X                     |           |
| Endosulfan                   | 37            |               |               |                  | X                     |           |
| Endrin                       |               | 1,800         |               |                  | X                     |           |
| Ethylbenzene                 |               | 8,919         |               | X                |                       |           |
| Ethyl chloride               |               | 3,026         |               | X                |                       |           |
| Heptachlor                   |               | 108           |               |                  | X                     |           |
| Heptachlor epoxide           |               | 53            |               |                  | X                     |           |
| Hexachlorobenzene            |               | 304           |               |                  | X                     |           |
| Hexachlorobutadiene          |               | 6,236         |               | X                |                       |           |
| Lindane                      |               | 437           |               |                  | X                     |           |
| Hexachlorocyclopentadiene    | 37            |               |               |                  | X                     |           |
| Hexachloroethane             | 35            |               |               |                  | X                     |           |
| Isophorone                   | 512           |               |               |                  | X                     |           |
| Lead                         | 300           |               |               |                  |                       | X         |
| Mercury                      | 17            |               |               |                  |                       | X         |

| Parameter                    | Limit (mg/kg) | Limit (ug/kg) | Limit (ng/kg) | Volatile Organic | Semi-volatile Organic | Inorganic |
|------------------------------|---------------|---------------|---------------|------------------|-----------------------|-----------|
| Methoxychlor                 | 31            |               |               |                  | X                     |           |
| Methylene bromide            |               | 6,700         |               | X                |                       |           |
| Methylene chloride           |               | 9,107         |               | X                |                       |           |
| Methyl ethyl ketone          | 733           |               |               | X                |                       |           |
| Methyl isobutyl ketone       | 79            |               |               | X                |                       |           |
| 2-Methylphenol               | 306           |               |               |                  | X                     |           |
| 3-Methylphenol               | 306           |               |               |                  | X                     |           |
| Methyl tertbutyl ether       | 62            |               |               | X                |                       |           |
| Mirex                        |               | 270           |               |                  | X                     |           |
| Molybdenum                   | 75            |               |               |                  |                       | X         |
| Nickel                       | 420           |               |               |                  |                       | X         |
| 2-Nitroaniline               |               | 175           |               |                  | X                     |           |
| Nitrobenzene                 |               | 2,000         |               |                  | X                     |           |
| N-Nitrosodimethylamine       |               | 10            |               |                  | X                     |           |
| N-Nitrosodiphenylamine       | 99            |               |               |                  | X                     |           |
| N-Nitroso di-n-propylamine   |               | 69            |               |                  | X                     |           |
| N-Nitroso-N-methylethylamine |               | 22            |               |                  | X                     |           |
| N-Nitrosopyrrolidine         |               | 232           |               |                  | X                     |           |
| Pentachlorophenol            |               | 2,979         |               |                  | X                     |           |
| Phenol                       | 3,666         |               |               |                  | X                     |           |
| Acenaphthene                 | 368           |               |               |                  | X                     |           |
| Anthracene                   | 2,190         |               |               |                  | X                     |           |
| Benz[a]anthracene            |               | 621           |               |                  | X                     |           |
| Benzo[b]fluoranthene         |               | 621           |               |                  | X                     |           |
| Benzo[k]fluoranthene         |               | 6,215         |               |                  | X                     |           |
| Benzo[a]pyrene               |               | 62            |               |                  | X                     |           |
| Chrysene                     | 62            |               |               |                  | X                     |           |
| Dibenz[ah]anthracene         |               | 62            |               |                  | X                     |           |
| Fluoranthene                 | 229           |               |               |                  | X                     |           |
| Fluorene                     | 275           |               |               |                  | X                     |           |
| Indeno[1,2,3-cd]pyrene       |               | 621           |               |                  | X                     |           |
| Naphthalene                  |               | 5,600         |               |                  | X                     |           |
| Pyrene                       | 232           |               |               |                  | X                     |           |
| Pronamide                    | 458           |               |               |                  | X                     |           |
| n-Propylbenzene              | 58            |               |               | X                |                       |           |
| Pyridine                     |               | 6,100         |               |                  | X                     |           |
| Selenium                     | 100           |               |               |                  |                       | X         |
| Silver                       | 39            |               |               |                  |                       | X         |
| Styrene                      | 440           |               |               | X                |                       |           |
| 1,1,1,2-Tetrachloroethane    |               | 3,187         |               | X                |                       |           |
| 1,1,2,2-Tetrachloroethane    |               | 408           |               | X                |                       |           |
| Tetrachloroethylene          |               | 1,505         |               | X                |                       |           |
| Tetrahydrofuran              |               | 9,361         |               | X                |                       |           |
| Thallium                     |               | 5,162         |               |                  |                       | X         |

| Parameter              | Limit (mg/kg) | Limit (ug/kg) | Limit (ng/kg) | Volatile Organic | Semi-volatile Organic | Inorganic |
|------------------------|---------------|---------------|---------------|------------------|-----------------------|-----------|
| Toluene                | 66            |               |               | X                |                       |           |
| Toxaphene              |               | 442           |               |                  | X                     |           |
| 1,2,4-Trichlorobenzene | 65            |               |               |                  | X                     |           |
| 1,1,1-Trichloroethane  | 200           |               |               | X                |                       |           |
| 1,1,2-Trichloroethane  |               | 729           |               | X                |                       |           |
| Trichloroethylene      |               | 53            |               | X                |                       |           |
| Trichlorofluoromethane | 39            |               |               | X                |                       |           |
| 2,4,5-Trichlorophenol  | 611           |               |               |                  | X                     |           |
| 2,4,6-Trichlorophenol  |               | 6,110         |               |                  | X                     |           |
| 1,2,3-Trichloropropane |               | 5             |               | X                |                       |           |
| 1,2,4-Trimethylbenzene |               | 5,200         |               | X                |                       |           |
| 1,3,5-Trimethylbenzene |               | 2,100         |               | X                |                       |           |
| Vinyl acetate          | 43            |               |               | X                |                       |           |
| Vinyl chloride         |               | 79            |               | X                |                       |           |
| Xylenes                | 28            |               |               | X                |                       |           |
| Zinc                   | 2,800         |               |               |                  |                       | X         |

- The parameters in this spreadsheet come from two sources: 1) parameters Pennsylvania monitored as part of the Bark Camp Mine Reclamation Laboratory project using dredged material from NY/NJ Harbor; and, 2) the Ohio EPA Pretreatment Program Priority Pollutant Scan list. The limits are from USEPA Region 9's Preliminary Remediation Goal Program (except arsenic and cadmium which are from the 40 CFR 503 sewage sludge regulations). The limits are multiple pathway risk-based limits for residential soil.

## Appendix E

### Sample Surveys to Support Suggested Approaches

Some of the delisting guidelines in this document suggest the formation of a RAP sub-group committee to gather information on the beneficial use. RAP sub-group formation, conducting public/stakeholder surveys, and survey assessment by the sub-group are suggested means of determining the status of certain beneficial uses in your Area of Concern.

For convenience, a few sample survey forms are included in this appendix. The cause and extent of particular beneficial use impairments might necessitate modifying these survey forms and the RAP sub-group is encouraged to modify these forms or produce new survey forms as necessary.

The RAP sub-group should keep in mind that any survey form used for the assessment of beneficial uses must:

- Allow for periodic review by the sub-group and respective state, federal and/or provincial agencies in conjunction with the public and stakeholders,
- Be consistent with applicable state and federal standards regulations, objectives, policies and guidelines, and the principles and objectives of the Great Lakes Water Quality Agreement,
- Be based on measurable indicators,
- Demonstrate the impairment is or is not solely due to local geographic extent, but typical of lakewide, areawide or regionwide conditions,
- Allow demonstration the impairment is due to human rather than natural causes,
- Allows for a listing of “Impaired - Not Due To Local Sources” for impairments caused by sources outside the Area of Concern.

**Beneficial Use Impairment Survey for the  
Assessment of Wildlife Populations,  
Tainting of Fish and Wildlife Flavor,  
and Bird and/or Animal Deformities**

Contact Name \_\_\_\_\_ Date \_\_\_\_\_  
Agency \_\_\_\_\_ Phone \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_

**Wildlife Populations**

1. Do you have any monitoring data on wildlife population health within the AOC?  
\_\_\_\_ NO \_\_\_\_ YES (please describe below)

| Species | Type of Study/Data |
|---------|--------------------|
| _____   | _____              |
| _____   | _____              |
| _____   | _____              |
| _____   | _____              |
| _____   | _____              |
| _____   | _____              |
| _____   | _____              |

2. Are you aware of any degraded wildlife populations within the AOC?  
\_\_\_\_ NO \_\_\_\_ YES (describe)

| Species | Reason |
|---------|--------|
| _____   | _____  |
| _____   | _____  |
| _____   | _____  |
| _____   | _____  |
| _____   | _____  |
| _____   | _____  |
| _____   | _____  |

3. Are there any current programs/projects to improve degraded populations?  
\_\_\_\_ NO \_\_\_\_ YES (describe what/where/when) \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Tainting of Fish or Wildlife Flavor

- 1. Are you aware of any reports of tainted fish or wildlife flavor within the AOC?  
 NO  YES (describe)

| Species | Problem |
|---------|---------|
|         |         |
|         |         |
|         |         |
|         |         |
|         |         |

- 2. Are there any programs in place to monitor for tainting of fish/wildlife flavor?  
 NO  YES (describe) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Bird or Animal Deformities

- 1. Are you aware of any problems of bird or animal deformities within the AOC?  
 NO  YES (describe)

| Species | Problem |
|---------|---------|
|         |         |
|         |         |
|         |         |
|         |         |
|         |         |
|         |         |

- 2. Are there any programs to monitor for bird or animal deformities in the AOC?  
 NO  YES (describe) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Further Assistance

- 1. Would you be willing to provide the RAP with wildlife data to aid in the assessment, improvement and protection of the AOC? \_\_\_\_\_

Suggested contacts - ODNR Division of Wildlife; County Wildlife Officers; local Audubon Society clubs; County, Municipal, State and National Park managers; Regional US Fish and Wildlife Offices.

## Ohio Lake Erie Watershed Remedial Action Plan Public Water System Source Water Survey

Your Public Water System has been identified as one that draws its source water from a Lake Erie Area of Concern. As part of the Remedial Action Plan process, we are attempting to determine the state of your source water and if your public water system suffers from an impairment, specifically a restriction on drinking the water or from taste or odor problems, that can be associated with that Area of Concern. Please take a few moments to fill out this questionnaire. Your participation is vital to our better understanding of the river system from which you draw your source water. Thank you.

Name of Public Water System \_\_\_\_\_ PWS ID \_\_\_\_\_  
Contact Name \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_  
Phone \_\_\_\_\_  
Fax \_\_\_\_\_  
E-mail \_\_\_\_\_

1. From what body of water do you draw your source water?
2. What contaminants have you found in your source water?
3. What is the most common contaminant to treat at your facility?
4. Are you able to adequately treat the source water to meet the needs (quantity and quality) of your consumers?
5. How often, and typically, at what times are the contaminants encountered during the calendar year?

6. Which encountered contaminant poses a significant threat for the effectiveness of treating water for drinking water purposes?

7. Are any encountered contaminants present in the source water to such an extent that you would consider the source to be impaired? (i.e. Do any of the encountered contaminants require additional treatment “beyond conventional measures?”)

8. Does your facility have additional treatment for the contaminant? If so, what is that additional treatment?

9. Have you had a history of taste or odor complaints?

10. Do the complaints usually come during certain times of the year?

11. What do you suspect as the cause of the complaints?

**THANK YOU FOR YOUR ASSISTANCE!**

## Appendix F Acronyms and Abbreviations

The acronyms and abbreviations below are commonly used in Ohio's RAP communities and are found throughout this document.

### A

AOC Area of Concern

### B

BMP Best Management Practice  
BOD Biochemical Oxygen Demand  
BUI Beneficial Use Impairment  
BUIA Beneficial Use Impairment Assessment

### C

CDF Confined Disposal Facility  
CSO Combined Sewer Overflow  
CWH Coldwater Habitat

### D

DDE DDT metabolite  
DDT Banned pesticide associated with bird and animal deformities and reproductive problems  
DELT Deformities, Eroded Fins, Lesions, and Tumors  
DNR Department of Natural Resources

### E

EIS Environmental Impact Study  
EOLP Erie-Ontario Lake Plain Ecoregion  
ESA Environmental Site Assessment  
EWH Exceptional Warmwater Habitat

### G

GIS Geographical Information System  
GLWQA Great Lakes Water Quality Agreement

### H

HELP Huron-Erie Lake Plain Ecoregion  
Hg Mercury  
HUC Hydrologic Unit Code

I

|     |                                |
|-----|--------------------------------|
| IBI | Index of Biotic Integrity      |
| ICI | Invertebrate Community Index   |
| IJC | International Joint Commission |

L

|      |  |
|------|--|
| LaMP | Lakewide Management Plan               |
| LOEC | Lowest Observable Effect Concentration |
| LRW  | Limited Resource Water                 |

M

|      |                              |
|------|------------------------------|
| Mg/l | milligrams per liter         |
| MGD  | Million Gallons/Day          |
| MIwb | Modified Index of Well Being |
| MWH  | Modified Warmwater Habitat   |

N

|       |   |
|-------|---|
| NOEC  | No Observable Effect Concentration              |
| NPDES | National Pollutant Discharge Elimination System |

O

|      |                                      |
|------|--------------------------------------|
| ODA  | Ohio Department of Agriculture       |
| ODNR | Ohio Department of Natural Resources |
| ODH  | Ohio Department of Health            |
| OEPA | Ohio Environmental Protection Agency |

P

|     |                                  |
|-----|----------------------------------|
| PAH | Polycyclic Aromatic Hydrocarbons |
| PCB | Polychlorinated Biphenyls        |
| PEL | Probable Effect Level            |

Q

|      |                                      |
|------|--------------------------------------|
| QHEI | Qualitative Habitat Evaluation Index |
|------|--------------------------------------|

R

|     |                      |
|-----|----------------------|
| RAP | Remedial Action Plan |
|-----|----------------------|

S

|      |                                      |
|------|--------------------------------------|
| SSO  | Sanitary Sewer Overflow              |
| SWCD | Soil and Water Conservation District |

T

TEL Threshold Effect Level  
TMDL Total Maximum Daily Load Limits

U

µg/kg micrograms per kilogram  
USACE United States Army Corps of Engineers  
USDA United States Department of Agriculture  
USEPA United States Environmental Protection Agency  
USFWS United States Fish and Wildlife Service  
USGS United States Geological Survey  
USPC United States Policy Committee

V

VAP Voluntary Action Program

W

WQ Water Quality  
WQS Water Quality Standards (Ohio Administrative Code 3745-1)  
WWH Warmwater Habitat  
WWTP Wastewater Treatment Plant