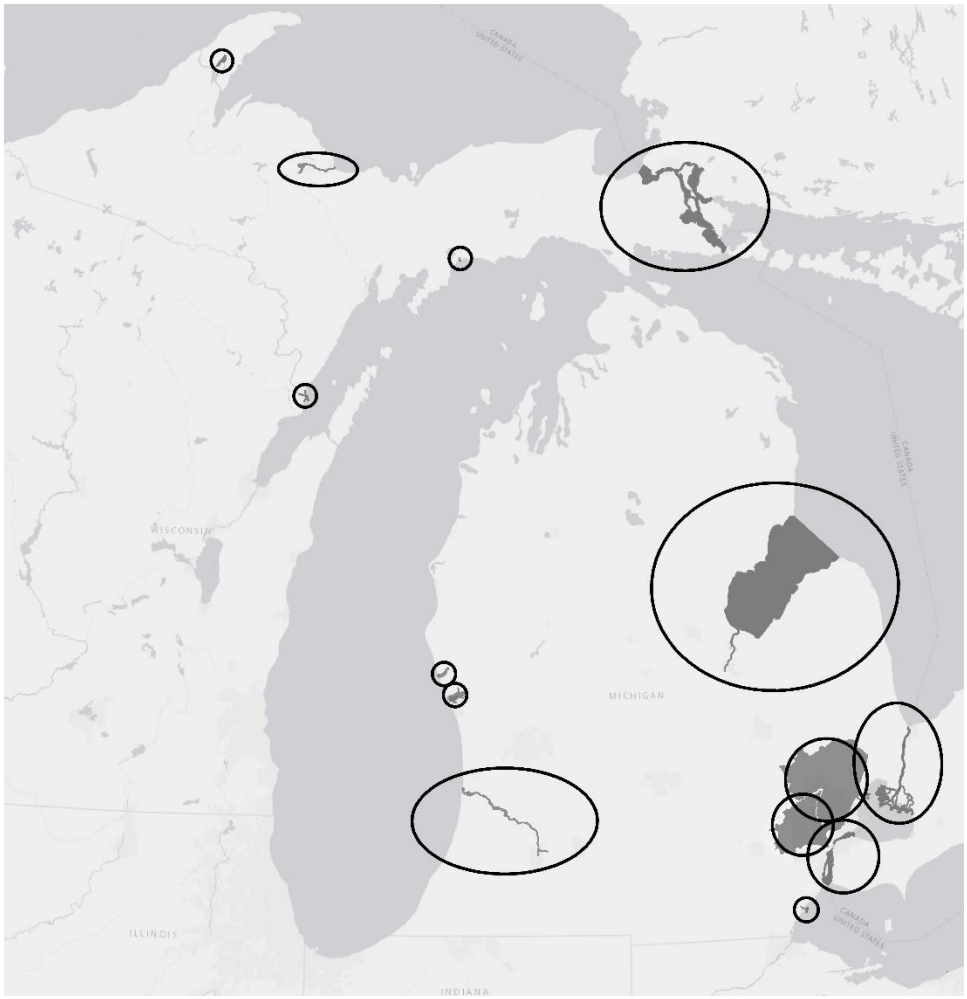
Guidance for Delisting Michigan's Great Lakes Areas of Concern



Michigan Department of Natural Resources
Office of the Great Lakes
P.O. Box 30028
Lansing, Michigan 48909-7528
www.michigan.gov/aocprogram

2018 Update

Guidance for Delisting Michigan's Great Lakes Areas of Concern

Acknowledgements

This document is the product of many individuals working toward a common purpose: to provide a useful tool for guidance in delisting Michigan's Areas of Concern (AOCs). Technical staff in the Michigan Department of Environmental Quality (MDEQ), the Michigan Department of Natural Resources (MDNR), Michigan Department of Health and Human Services (MDHHS), U.S. Environmental Protection Agency (U.S. EPA) Great Lakes National Program Office, the U.S. Fish and Wildlife Service, the Great Lakes Commission, the International Joint Commission (IJC), and other Great Lakes states' agencies contributed valuable input. In addition to agency staff, the Statewide Public Advisory Council for Michigan's Areas of Concern program, and members of individual Public Advisory Councils (PACs) gave freely of their time and provided a critical public perspective on the document.

Compiled January, 2006 by:
Shanna Draheim, Water Bureau
Roger Eberhardt, Office of the Great Lakes

Updated August, 2008 by:
Julie Sims, Water Bureau

Updated May, 2015 by:
Roger Eberhardt, Office of the Great Lakes

Updated 2018.

Jon W. Allan, Director, Office of the Great Lakes

Keith Creagh, Director, Michigan Department of Natural Resources

Rick Snyder, Governor, State of Michigan

Organizational Note:
At the inception of the AOC program in the 1980's, Michigan's lead agency for AOCs was the MDNR. In 1995, the MDEQ was created, and the AOC program was housed in what later became the Water Bureau. In 2010, the AOC program moved to the Office of the Great Lakes (OGL). At the end of 2017, the OGL moved to the MDNR. These restructurings explain the apparently inconsistent agency references in this document. Our intent is to remain true to the structure in place at the time of each reference.

How to reference this document:
Michigan Department of Natural Resources. 2018. Guidance for Delisting Michigan's Great Lakes Areas of Concern.

Guidance for Delisting Michigan's Great Lakes Areas of Concern

Table of Contents

INTRODUCTION **3**

BACKGROUND 3
FIGURE 1: MICHIGAN'S ORIGINAL GREAT LAKES AREAS OF CONCERN* 4
PURPOSE 4
HOW TO USE THIS DOCUMENT 5
DISCLAIMER 5
TABLE 1: ORIGINAL MICHIGAN AOC/BUI MATRIX-2006 6

TRACKING RESTORATION OF BENEFICIAL USE IMPAIRMENTS **7**

REMOVAL OF BENEFICIAL USE IMPAIRMENTS **8**

DELISTING AREAS OF CONCERN **9**

SPECIAL CONSIDERATIONS **10**

CRITERIA FOR RESTORATION OF BENEFICIAL USE IMPAIRMENTS **12**

RESTRICTIONS ON FISH AND WILDLIFE CONSUMPTION 13
TAINTING OF FISH AND WILDLIFE FLAVOR 17
FISH TUMORS OR OTHER DEFORMITIES 19
BIRD OR ANIMAL DEFORMITIES OR REPRODUCTIVE PROBLEMS 21
DEGRADATION OF BENTHOS 25
RESTRICTIONS ON DREDGING ACTIVITIES 28
EUTROPHICATION OR UNDESIRABLE ALGAE 30
RESTRICTIONS ON DRINKING WATER CONSUMPTION OR TASTE AND ODOR PROBLEMS 33
BEACH CLOSINGS 35
DEGRADATION OF AESTHETICS 38
ADDED COST TO AGRICULTURE OR INDUSTRY 41
DEGRADATION OF PHYTOPLANKTON OR ZOOPLANKTON POPULATIONS 43
LOSS OF FISH AND WILDLIFE HABITAT 45
DEGRADATION OF FISH AND WILDLIFE POPULATIONS 45

APPENDIX 1: FIVE YEAR BASIN CYCLE MONITORING **50**

GLOSSARY/ACRONYMS **60**

THE FUTURE **63**

MDNR AOC PROGRAM CONTACT **63**

Introduction

Background

In 1987, amendments to the Great Lakes Water Quality Agreement (GLWQA) were adopted by the federal governments of the U.S. and Canada. Annex 2 of the amendments listed fourteen different beneficial use impairments (BUIs) which are caused by a detrimental change in the chemical, physical, or biological integrity of the Great Lakes system. It directed the two countries to identify AOCs that did not meet the objectives of the GLWQA. Remedial Action Plans (RAPs) addressing the BUIs were to be prepared for all AOCs. The BUIs provided a tool for describing effects of the contamination, and a means for focusing remedial actions. The AOC program was re-affirmed in Annex 1 of the 2012 Protocol Amending the GLWQA.

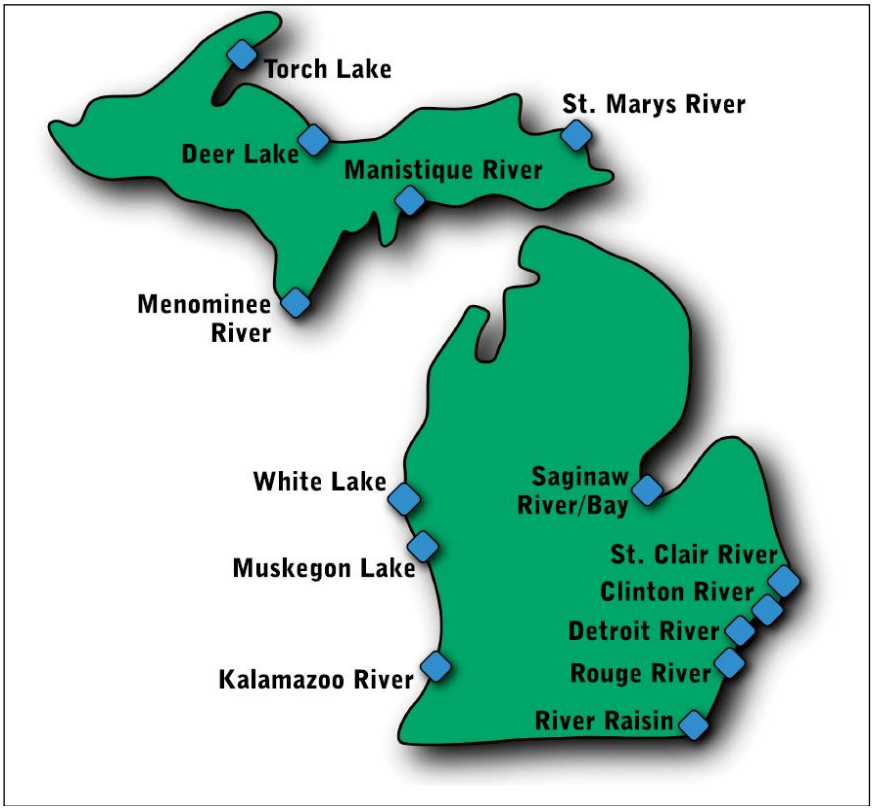
The scope of the AOC program is based on the concept that each area has had at least one BUI that is an extraordinary problem; one that sets the area apart from other sites with lesser contamination in the state that are not an AOC.

There are fourteen AOCs in Michigan, with an original total of 111 BUIs (see Table 1). Ten of the AOCs are completely within Michigan's borders (Kalamazoo River, Muskegon Lake, White Lake, Manistique River, Deer Lake, Torch Lake, Saginaw River/Bay, River Raisin, Rouge River, and Clinton River). Three (the Detroit, St. Clair and St. Marys Rivers) are along the U.S. and Canadian border, and one AOC, Menominee River, is shared with Wisconsin. In the latter four AOCs, responsibility for restoring BUIs is shared among jurisdictions (see Figure 1). The current list of BUIs can be found at www.michigan.gov/aocprogram.

Public involvement is a key component of the AOC program in Michigan. Each AOC has had significant input from a PAC and the program has a Statewide Public Advisory Council consisting of members of individual councils. All are integral to the program.

There are major differences in geographic scope and contamination in Michigan's AOCs. For example, the Manistique River AOC consists of only the last 1.7 miles of river in Manistique (pop. 2,918) and the BUIs are primarily caused by one pollutant - PCBs. On the other end of the scale, the Detroit River AOC is a 32-mile-long international connecting channel in Detroit (pop. 677,116), with 11 BUIs caused by numerous sources of industrial, municipal, and agricultural pollutants on both sides of the border.

Figure 1: Michigan's Original Great Lakes Areas of Concern*



*White Lake and Deer Lake were delisted in 2014.

Purpose

When AOCs were originally designated in the late 1980s, no specific, quantitative criteria for listing or delisting these areas were developed. The IJC issued general listing and delisting criteria in 1991 (IJC, 1991), and the U.S. Policy Committee (USPC) issued general guidance on the process for AOC delisting in 2001 (USPC, 2001). These efforts, however, were not specific enough for use in determining restoration of individual BUIs by either the state of Michigan or the U.S. federal government.

In order to direct restoration efforts and develop benchmarks for measuring their success, several AOCs in Michigan began to develop their own individual restoration targets. As they proceeded in developing restoration targets and plans for delisting, the State received many requests from PACs for information regarding what criteria would be applied, what approaches are acceptable, and how the delisting process will work when an AOC has restored all its BUIs.

In response, the State developed this *Guidance for Delisting Michigan's Great Lakes Areas of Concern*. The purpose of this document is to: 1) provide guidance to AOC communities about the State's process for delisting AOCs; and 2) identify specific quantitative or qualitative criteria which the State will use to determine when BUIs have been restored.

How to Use this Document

The first sections of the document outline the process the State will use to track restoration progress, remove BUIs, and ultimately delist AOCs. These sections identify the key steps and principles for evaluating the status of AOC impairment listings, the process for formally removing BUIs for each AOC, and the steps for working with PACs and the U.S. EPA to request and document that an AOC is ready for delisting.

The main part of the document is the statewide Criteria for Restoration of Beneficial Use Impairments for Michigan's Great Lakes Areas of Concern. The criteria offer Michigan's position on what constitutes restoration of the BUIs, and any BUI that meets these criteria will be considered restored by the State. Assessment of each BUI is integrated with the criteria.

Disclaimer

The GLWQA is a non-regulatory agreement between the U.S. and Canada, and criteria developed under its auspices are non-regulatory in nature. The criteria in this document may not be used separately in enforcement or regulatory actions under any state or federal law. The restoration criteria are consistent with state and federal regulatory authority, and regulatory actions may be used to achieve restoration in AOCs where specific authority exists in state or federal law. Standards and formal guidelines in state and federal law are referenced wherever applicable in the criteria. Further, the AOC BUI assessment criteria in this Guidance are not to be used to set state or federal regulatory standards.

Table 1: Original Michigan AOC/BUI Matrix-2006

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Clinton River	X				X	X	X		X	X			X	X	8
Deer Lake	X			X			X								3
Detroit River	X	X	X	X	X	X		X	X	X			X	X	11
Kalamazoo River	X			X	X	X			X	X			X	X	8
Manistique River	X				X	X			X					X	5
Menominee River	X				X	X			X				X	X	6
Muskegon Lake	X				X	X	X	X	X	X			X	X	9
River Raisin	X			X	X	X	X		X	X			X	X	9
Rouge River	X		X		X	X	X		X	X			X	X	9
Saginaw Bay/River	X	X		X	X	X	X	X	X	X		X	X	X	12
St. Clair River	X	X		X	X	X		X	X	X	X			X	10
St. Marys River	X		X	X	X	X	X		X	X			X	X	10
Torch Lake	X		X		X										3
White Lake	X				X	X	X	X		X			X	X	8

Table 1 is the official list of BUIs in the RAPs and RAP updates for which remedial actions have been or will be developed. The numbered columns below with BUI labels corresponds to the first numbered row of the table. The current list of BUIs remaining in Michigan can be found on the Michigan AOC Program website at www.michigan.gov/aocprogram.

1. Restrictions on fish and wildlife consumption
2. Tainting of fish and wildlife flavor
3. Fish tumors or other deformities
4. Bird or animal deformities or reproductive problems
5. Degradation of benthos
6. Restrictions on dredging activities
7. Eutrophication or undesirable algae
8. Restrictions on drinking water consumption or taste and odor problems
9. Beach closings
10. Degradation of aesthetics
11. Added costs to agriculture or industry
12. Degradation of phyto- or zooplankton populations
13. Degradation of fish and wildlife populations
14. Loss of fish and wildlife habitat

Tracking Restoration of Beneficial Use Impairments

This section describes actions and policy for applying restoration criteria to the BUIs in AOCs and documenting progress toward removal. The State is committed to a partnership with the PACs and the U.S. EPA in this effort.

a) Restoration criteria are applied when BUIs identified for each AOC are ready for assessment. State AOC staff conduct periodic qualitative reviews of the status of each AOC's BUIs as reported in RAP updates to gauge readiness.

b) The State's restoration criteria are applied to all BUIs except where locally developed criteria are approved. The PACs have the ability to establish restoration criteria that are functionally equivalent to the statewide criteria. Any locally developed criteria must be submitted to the Office of the Great Lakes for approval. The PACs are expected to demonstrate how any locally developed criteria are equivalent to the statewide criteria. Approval is based on meeting or exceeding the State's criteria.

c) State assessments required for each BUI are integrated into the criteria.

d) Local targets that require assessment beyond what is required for the statewide criteria (e.g., more frequent, different parameters, etc.) are the responsibility of the local PAC, including reporting results to the OGL. The State assists as resources allow.

e) The OGL maintains the official delisting file for each AOC with all finalized BUI restoration/removal records, finalized memos/letters, RAPs, and finalized RAP updates. These files are maintained in the OGL offices and are available to the public.

Removal of Beneficial Use Impairments

This section describes the actions and policies for removing a BUI and documenting these activities in MDNR's AOC files. The BUIs can be removed individually, in groups, or all at the same time. The MDNR is committed to a partnership with the local PACs and U.S. EPA in this effort. In official correspondence, the Director of Michigan's Office of the Great Lakes may represent the State of Michigan.

a) When the OGL AOC coordinator, in consultation with the PAC, determines a BUI is ready for final review of restoration according to the applicable criteria, a team of relevant MDEQ, MDNR, MDHHS, and federal agency staff (as applicable) is convened to review the documentation and determine whether to support removal of the BUI.

b) If the technical team supports removal of the BUI, a public meeting is held in the AOC if requested. A formal public comment period is established and comments supporting or opposing the BUI removal are solicited. When the public review is completed, the OGL AOC Coordinator reviews the public comments and requests a letter of support from the PAC for the removal of the BUI, if appropriate.

c) If supported by the technical and public review of the BUI removal recommendation, a letter is sent from the Director of the Office of the Great Lakes to the U.S. EPA to document removal of the BUI(s). The letter requests concurrence with the removal from the U.S. EPA. The letters from MDNR-OGL, the PAC and U.S. EPA are part of the permanent AOC file.

d) Once documented as removed, there is no further assessment of the BUI required to delist an AOC. While BUIs which have been removed are not re-assessed as part of the AOC program, waters of the state continue to be monitored as part of MDEQ's regular 5-year Basin Cycle Monitoring and other state monitoring programs.

e) After removal of a BUI, if additional contamination is found in an AOC during routine or other program monitoring, it is addressed on a case-by-case basis by the MDNR under existing state programs. This is not a cause for delaying delisting unless the contamination is indicative that the source of the original BUI was not resolved.

f) All local, state, and federal partners cooperate on publicizing the BUI restoration, as appropriate.

Delisting Areas of Concern

This section outlines actions normally used in Michigan to delist an AOC. These actions occur when all beneficial uses have been restored (all BUIs removed), so they are informational in nature and provide an opportunity for all partners in the AOC program to highlight and celebrate the significant achievement of an AOC delisting. In all official correspondence, the Director of Michigan's Office of the Great Lakes may represent the State of Michigan.

a) When all BUIs in an AOC have been removed, a draft final RAP report is prepared by the OGL in consultation with the PAC, the MDNR, the MDEQ, the U.S. EPA, and the other agencies as appropriate.

b) The OGL and the U.S EPA, in consultation with the PAC, hold a public meeting to formally present the draft final RAP report to the public and stakeholders for review and comment. A public comment period is established for a minimum of 30 days and the public meeting is held within the comment period.

c) Taking state agency, U.S. EPA, PAC, and public comments into account, the OGL prepares and transmits to the U.S. EPA a recommendation to delist the AOC, accompanied by a final RAP report. A summary of public comments and agency responses is also produced.

d) The U.S. EPA coordinates any additional federal, Canadian or IJC review, obtaining approvals as appropriate.

e) U.S. EPA confirms the AOC delisting to the OGL, with copy to the IJC.

f) Local, state, and federal partners collaborate on publicizing and celebrating delisting of the AOC. This step may occur any time after Step d. above.

Special Considerations

This section addresses a few special cases related to shared jurisdictions, use of special designations, source control, and dispute resolution for the processes outlined above. In all official actions in this section, the Director of Michigan's Office of the Great Lakes may represent the State of Michigan.

a) The 4-Agency Letter of Commitment (see Glossary) processes for delisting and dispute resolution apply to the binational AOCs. Binational restoration targets for these AOCs must be at least functionally equivalent to Michigan's statewide restoration criteria.

b) Michigan shares jurisdiction for the Menominee River AOC with Wisconsin. If the PAC chooses to develop common set of restoration targets for the AOC, the targets must be at least functionally equivalent to Michigan's statewide restoration criteria. Michigan's process for removal of BUIs and delisting AOCs applies to the Michigan portion of this AOC unless shared criteria are developed.

c) The restoration and removal process for BUIs and the delisting process for AOCs are supported by the MDNR only for an entire AOC and an entire BUI, not sub-watersheds or portions of BUIs. Progress is shown by removal of BUIs.

d) In some circumstances, monitoring may indicate that full restoration of a BUI has not occurred (i.e., does not meet the criteria), even when all remedial actions to address the problem and control sources of pollutants in the AOC have been completed. This could be due to several factors, including: 1) sources of contaminants are external to the AOC watershed; or 2) the resources affected are still recovering from historical (pre-remediation) effects of contamination or habitat loss.

   In the first instance, when assessment of a BUI indicates that it does not meet the statewide restoration criteria, and there is indication that it may be due to external pollutant sources, the State will undertake further investigation of potential contaminant sources to rule out the possibility of an ongoing source within the AOC watershed. If the existence of an impairment is determined to be due to contaminants originating only from sources outside the AOC watershed, it will not preclude removal of a BUI and delisting of an AOC.

   In the second instance, the OGL will consider the time of recovery for some resources when evaluating restoration success. For some BUIs, the affected resource may take many years to recover after remedial actions are complete. Full restoration of the impairment may not be required in all cases prior to delisting, if the OGL determines the resource is showing consistent improvement after all necessary remedial actions have been completed. Annex 1 of the 2012 GLWQA Amendments provides for use of the AOC in Recovery

designation as an option, if determined by the MDNR to be appropriate for an AOC that requires extended recovery time after all management actions are complete.

e) The OGL may consider removal of a BUI on a case by case basis for AOCs with special circumstances

f) In some circumstances, especially those of a lakewide nature, a BUI may be found to be beyond the scope of the AOC program's ability to address it. In those circumstances, consideration may be given to addressing the BUI using the LAMP Partnerships under Annex 2 of the GLWQA.

g) The AOC boundaries are those shown on the web sites of the AOC program at: https://www.epa.gov/great-lakes-aocs. Any subsequent change to the boundaries must be documented and approved by letters from the OGL, in consultation with the PAC, to the U.S. EPA.

h) Technical or procedural issues regarding either removal of a BUI or delisting of an AOC are resolved by technical staff of the State of Michigan, U.S. EPA, and PAC. Unresolved technical issues may be elevated to a panel consisting of the Director of the OGL, the Director of U.S. EPA's Great Lakes National Program Office, and the PAC chair or designee.

Criteria for Restoration of Beneficial Use Impairments

The following pages contain the specific restoration criteria for each of the 14 BUIs identified in Annex 2 of the 1987 Amendments to the GLWQA. The criteria for each BUI include 4 main components:

1. *Significance in Michigan's Areas of Concern:* The number of AOCs affected by the impairment and other relevant considerations regarding scope.

2. *Restoration Criteria and Assessment:* The specific, measurable goals for guiding restoration, and the monitoring and assessment requirements for demonstrating restoration success.

3. *Rationale:* Relevant rationale for why the specific criteria were selected for Michigan's AOCs.

4. *State of Michigan Programs and Authorities for Evaluating Restoration*: A brief overview of the existing state programs and methodologies that will be used by the OGL to assess whether the restoration criteria have been met.

The criteria are Michigan's position on what constitutes restoration of the BUIs, and any AOC that meets these criteria will be considered restored by the State. Local PACs may offer alternate criteria that will be reviewed by the State and may be approved if functionally equivalent to, or more stringent than Michigan's criteria.

A fundamental assumption of the statewide restoration criteria is that sources of pollutants <u>within</u> the AOC watershed which cause any of the BUIs must be controlled before a BUI can be removed and an AOC delisted. Assessment of this step is determined by results from site-specific monitoring of remedial actions or other monitoring in the AOC. If a beneficial use is impaired only due to contaminants originating from sources outside the AOC watershed, it will not preclude removal of BUI and delisting of an AOC.

Restrictions on Fish and Wildlife Consumption

Significance in Michigan's Areas of Concern

Fish and wildlife consumption advisories in Michigan are determined by the Michigan Department of Health and Human Services (MDHHS), based on levels of contaminant concentrations in fish or wildlife tissue. Currently, all of Michigan's 14 AOCs have consumption advisories for specific contaminants in certain species of fish, though originally only 12 AOCs had these advisories rise to the level of a BUI. The Saginaw River floodplain and connected areas have advisories for wildlife consumption, due to dioxin contamination: http://www.michigan.gov/documents/mdch/Eat_Safe_Wild_Game_277942_7.pdf. Fish consumption advisories range from no human consumption to restrictions on consumption for specific amounts of fish for certain human populations.

Almost all fish consumption advisories are based on levels of polychlorinated biphenyls (PCBs) or mercury which exceed MDHHS guidelines. Excessive levels of dioxin result in fish consumption advisories in the Saginaw River/Bay AOC and in the Detroit River AOC. Other non-AOC locations in Michigan also have various consumption advisories for these contaminants. There is a statewide consumption advisory for certain fish in all inland lakes due to mercury contamination.

Michigan Restoration Criteria and Assessment

The restoration criteria for this BUI use a tiered approach for evaluating restoration success. This BUI will be considered restored when:

1. The fish consumption advisories in the AOC are the same or less restrictive than the associated Great Lake or appropriate control site.

OR, if the advisory in the AOC is more stringent than the associated Great Lake or control site:

2. A comparison study of fish tissue contaminant levels demonstrates that there is no statistically significant difference in fish tissue concentrations of contaminants causing fish consumption advisories in the AOC compared to a control site.

OR, if a comparison study is not feasible because of the lack of a suitable control site:

3. Analysis of trend data (if available) for fish with consumption advisories shows similar trends to other appropriate Great Lakes trend sites.

- When comparison studies (per #2 above) are used to demonstrate restoration of a BUI, the studies will:

Be designed to control variables known to influence contaminant concentrations such as species, size, age, sample type, lipids and other relevant variables from the examples in the MDEQ's Fish Contaminant Monitoring Program (FCMP).

- Include a control site which is agreed to by the OGL, in consultation with the PAC. It will be chosen based on physical, chemical, and biological similarity to the AOC and the two sites must be within the same U.S. EPA Level III Ecoregions for the Conterminous U.S. (see references). When a single control site cannot be found, sites may be pooled for comparisons. Where mercury concentrations in fish tissue cause waterbody specific advisories in lakes, the comparison may be made to the concentrations causing the general inland lake advisory.

- Use fish samples collected from the AOC and control site within the same time frame (ideally one year).

- Evaluate contaminant levels in the same species of fish from the AOC and the control site to avoid problems with cross-species comparisons. In addition, fish used for comparison studies should be the same species as the consumption advisory.

If there is no statistically significant difference (alpha = 0.05) in fish tissue concentrations of contaminants causing advisories in the AOC compared to a control site, then the BUI has been restored. If there is a significant difference between the AOC and the control site in the comparison study, then an impairment still exists.

If a comparison study is not practical for the AOC due to the lack of an appropriate control site, then trend monitoring data (if available) can be used to determine restoration success (as per approach #3 above). This is likely to be the approach used to evaluate this BUI in the connecting channel AOCs, where there are not appropriate control sites for a comparison study, and where MDEQ has substantial trend monitoring data. If MDEQ trend analysis of fish with consumption advisories shows similar trends to other appropriate OGL-approved Great Lakes trend sites, this BUI will be considered restored. If trend analysis does not show similarity to other appropriate Great Lakes trends sites, then an impairment exists.

The Saginaw River and Bay AOC has an advisory for wildlife consumption. The process for assessing restoration of the wildlife restriction will be similar to the process outlined above for fish consumption.

Rationale

Practical Application in Michigan

Restoration of the fish consumption advisory BUI is based on comparison of fish consumption advisories and tissue concentrations in the AOC with the associated Great Lake or other appropriate control site, not whether fish advisories exist in the AOCs or control site.

Comparison of advisories or tissue concentrations to a control site is used because some fish consumption advisories are issued statewide or are due to sources outside an AOC. Because the existence of an advisory may not be due to contaminant sources in an AOC, it should not preclude removal of this BUI. A more stringent advisory in the AOC than the associated Great Lake is an indication that there may be an ongoing contaminant issue within the AOC. In this case, additional source assessment may be conducted to determine whether there are sources of contamination within the AOC (e.g., caged fish studies).

1991 IJC General Delisting Guideline

When contaminant levels in fish and wildlife populations do not exceed current standards, objectives or guidelines, and no public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must not be due to contaminant input from the watershed.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above takes the general guideline and applies specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation plan according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and the "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds are sampled at selected sites defined by the National Pollutant Discharge Elimination System (NPDES) permitting program for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for basin rotation maps). One element of the State's monitoring strategy is the enhanced and improved FCMP.

The specific objectives of the FCMP are to:

1. Determine whether fish from the waters of the state are safe for human consumption.

2. Measure whole fish contaminant concentrations in the waters of the state.

3. Assess whether contaminant levels in fish are changing with time.

4. Assist in the identification of waters that may exceed standards and target additional monitoring activities.

5. Evaluate the overall effectiveness of MDEQ programs in reducing contaminant levels in fish.

6. Identify waters of the state that are high quality.

7. Determine if new chemicals are bio-accumulating in fish from Michigan waters.

The FCMP element consists of several components that, in combination, provide data necessary to achieve these objectives. These include:

- Edible fish portion monitoring to support the establishment or delisting of fish consumption advisories;
- Native whole fish trend monitoring;
- Periodic evaluations to expand and improve the State's fish trend monitoring network; and
- Caged fish monitoring for source/problem identification.

Fish contaminant data are used to determine whether fish from waters of the state are safe for human and wildlife consumption, and as a surrogate measure of bioaccumulative contaminants in surface water. Fish tissues are analyzed for bioaccumulative contaminants of concern. These include mercury, PCBs, chlorinated pesticides (e.g., DDT/DDE/DDD), dioxins, and furans. More recently, some fish tissues have been analyzed for polybrominated biphenyl ethers (PBDEs) and perfluorooctane sulfonate (PFOS). Data are reviewed each year to determine whether there are additional new parameters of concern for which the fish should be analyzed.

Fish contaminant studies needed for the assessment of this BUI restoration will be arranged by MDEQ as part of the Michigan FCMP. Timing and study design will be determined by the MDEQ based on available resources.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the MDEQ for review. If the MDEQ determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

Tainting of Fish and Wildlife Flavor

Significance in Michigan's Areas of Concern

Three of Michigan's AOCs have been listed as either impaired or unknown for fish and wildlife tainting – Detroit River, Saginaw River/Bay, and St. Clair River. The impairment in all of these AOCs was due to fish, not wildlife, tainting.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when:

- No more than three reports of fish tainting have been made to the MDNR or MDEQ for a period of three years.

OR, if there have been reports of tainting:

- A one-time analysis of representative fish species in an AOC in accordance with MDEQ Surface Water Assessment Section (SWAS) Procedure #WRD-SWAS-006 for conducting taste and odor studies indicates that there is no tainting of fish flavor.

Rationale

Practical Application in Michigan

Throughout Michigan, including the AOCs identified above, there have been historical taste and odor complaints related to fish. Tainting has been associated with water quality contaminants such as oils, grease, metals, phenols, PCBs, and wastewater, as well as algae over-abundance from high levels of nutrients.

The SWAS Procedure lays out a specific methodology for evaluating fish tainting in compliance with Rule 55 of the Michigan Water Quality Standards (WQS). Rule 55 states that "waters of the state shall contain no taste-producing or odor-producing substances in concentrations which impair or may impair their use for a public, industrial, or agricultural water supply source, or which impair the palatability of fish …". This BUI restoration criterion is consistent with Rule 55 of the state WQS and SWAS Procedure #WRD-SWAS-006.

The State has no formal methodology for evaluating wildlife tainting, but none has been reported. The only means of tracking wildlife tainting is through calls or complaints to the MDNR or MDEQ.

1991 IJC General Delisting Guideline

When survey results confirm no tainting of fish or wildlife flavor.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

If a taste and odor study is necessary in an AOC, the OGL and MDEQ will work with the PAC to develop a tainting study according to Procedure #WRD-SWAS-006. After the assessment is completed, the OGL will evaluate whether the data indicate that the restoration criteria for this BUI has been met.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

Fish Tumors or Other Deformities

Significance in Michigan's Areas of Concern

Four of Michigan's AOCs have been identified as impaired for fish tumors, including: Detroit River, Rouge River, Torch Lake, and St. Marys River.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when:

- No reports of fish tumors or deformities due to chemical contaminants which have been verified through observation and analysis by the MDNR or MDEQ for a period of five years.

OR, in cases where any tumors have been reported:

- A comparison study of resident benthic fish (e.g., brown bullhead) of comparable age and at maturity (three years), or of fish species which have historically been associated with this BUI, in the AOC and a non-impacted control site indicates that there is no statistically significant difference (with a 95% confidence interval) in the incidence of liver tumors or deformities.

Rationale

Practical Application in Michigan

Comparing tumor and deformity rates in resident benthic fish species, or historically impacted species, between an AOC and an un-impacted control site allows for the determination of whether this impairment is caused by local contaminant sources within an AOC or is a lakewide problem. Brown bullhead is a particularly good indicator species because it is pollution tolerant and primarily a resident fish. However, it is habitat limited in both the Detroit and Rouge River AOCs, so other benthic species may need to be used in some AOCs to evaluate tumor or deformity prevalence.

Research is ongoing to develop background rates for tumor and deformity incidence in the Great Lakes, as well standardized histology and monitoring methods. The OGL will incorporate the results of these research efforts, as available and applicable, into the assessment of whether this restoration criterion has been met in Michigan AOCs.

The OGL will consider restoration of this BUI on a case-by-case basis for AOCs with circumstances that do not fit exactly into the evaluation steps outlined above.

1991 IJC General Delisting Guideline

When the incidence rates of fish tumors or other deformities do not exceed rates at un-impacted control sites and when survey data confirm the absence of neoplastic or preneoplastic liver tumors in bullheads or suckers.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities

State of Michigan Programs/Authorities for Evaluating Restoration

The MDNR will coordinate with the MDEQ to determine whether there have been any reports of fish tumors or deformities due to chemical contaminants which have been verified through observation and analysis by the appropriate agency in the previous five years.

If a study of fish tumors and deformities is necessary, the OGL will work with the MDEQ and MDNR to develop a study comparing fish tumors in the AOC to an appropriate control site or reference conditions. Once the assessment is complete, the OGL will evaluate whether the data indicate that the restoration criteria for this BUI has been met.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

Bird or Animal Deformities or Reproductive Problems

Significance in Michigan's Areas of Concern

Seven of Michigan's AOCs have been listed as either impaired or unknown status for bird and animal deformities (e.g., crossed bills) or reproductive problems (e.g., egg shell thinning), including: River Raisin, St. Clair River, Detroit River, Saginaw River/Bay, St. Marys River, Deer Lake, and Kalamazoo River.

In Saginaw River/Bay, Deer Lake, and Kalamazoo River, past studies have indicated elevated toxic chemical concentrations (e.g., mercury or PCBs) and/or some deformities in birds and other animals. In the other AOCs which list this BUI, the status is either unknown or inconclusive. In most cases, studies on bird and animal deformities have not been done. The species historically impacted are fish eating birds or animals such as bald eagles, herring gulls, common terns, mink, or otter. The contaminants associated with these impacts are primarily the persistent bioaccumulative toxics: PCBs, dioxins, DDT, and mercury.

Michigan Restoration Criteria and Assessment

Restoration of this BUI will be demonstrated using two approaches, depending on availability of data in an AOC. The first approach evaluates restoration based on field assessment of birds and/or other wildlife in those AOCs where MDNR, MDEQ, or other State-approved bird and wildlife data are available.

The second approach will be applied in those AOCs where bird and other wildlife data are not available and uses levels of contaminants in fish tissue known to cause reproductive or developmental problems as an indicator of the likelihood that deformities or reproductive problems may exist in the AOC.

<u>Approach 1 – Observational Data and Direct Measurements of Birds and Other Wildlife</u>

- Evaluate observational data of bird and other animal deformities for a minimum of two successive monitoring cycles in species identified in the RAP as exhibiting these problems. If deformity or reproductive problem rates are not statistically different than inland background levels (at a 95% confidence interval), or no reproductive or deformity problems are identified during the two successive monitoring cycles, then the BUI is restored. If the rates are statistically different, it may indicate a source from either within or from outside the AOC. Therefore, if the rates are statistically different or the amount of data is insufficient for analysis, then:

- Evaluate tissue contaminant levels in egg, young, and/or adult wildlife. If contaminant levels are lower than the Lowest Observable Effect Level (LOEL) for that species or are not statistically different than inland control

populations (at a 95% confidence interval), then the BUI is restored.

Data for a comparison study must come from a control site which is agreed to by the MDEQ, in consultation with MDNR. It will be chosen based on physical, chemical, and biological similarity to the AOC and the two sites must be within the same U.S. EPA Level III Ecoregions for the Conterminous U.S. (see references).

Where direct observation of wildlife and wildlife tissue data is not available, the following approach will be used:

Approach 2: Fish Tissue Contaminant Levels as an Indicator of Deformities or Reproductive Problems

- If fish tissue concentrations of PCBs, dioxins, DDT, or mercury (as determined in the RAP) contaminants of concern in the AOC are at or lower than the LOEL known to cause reproductive or developmental problems in fish-eating birds and mammals the use impairment is restored.

OR

- If fish tissue concentrations of PCBs, dioxins, DDT, or mercury in the AOC are not statistically different than the associated Great Lake (at 95% confidence interval), then the BUI is restored. In the connecting channel AOCs, either the upstream or downstream Great Lake may be used for comparison.

Fish of a size and species to be prey for the wildlife species under consideration must be used for the tissue data.

Rationale

Practical Application in Michigan

Bird and other animal deformities and reproductive problems have a particular challenge related to criteria for restoration:

- Most of the species involved are only part year residents in an AOC or have a home range that may include locations outside an AOC. This makes it difficult to attribute deformities or reproductive problems to a specific location. The two approaches of the criteria address this.
- There is also a wide variation in how this use impairment was originally determined in Michigan's AOCs. Some AOCs had empirical data and some had anecdotal information.
- Many fish-eating birds and animals such as eagles are long-lived birds. Long after remedial actions have occurred and a site is restored, it is possible for reproductive effects to remain apparent.

- It is very difficult to determine actual prevalence of deformities and reproductive problems. Fox and Bowerman (2005), provide examples of this last point and detail issues with assessments of this BUI.
- In some AOCs with this BUI, the species monitored under MDEQ's wildlife monitoring program do not reside there, so no direct wildlife data are available.

Given the above practical considerations, the statewide criteria for this BUI uses two approaches – one for AOCs where wildlife data are available, and a second approach where direct wildlife information is not available. In the latter case, contaminant levels in fish tissues are used as an indicator of potential deformities or reproductive problems in the fish-eating species which have historically been impacted by contaminants (e.g., eagles, herring gulls, mink, and otter). Even in the absence of direct wildlife data, if contaminant levels in fish tissue are high, it indicates that the possibility for deformities or reproductive problems in fish-eating wildlife may be higher.

The contaminants of concern are PCBs, dioxins, DDT, and mercury and each AOC with this BUI may have one or more contaminants present. Assessment in each AOC will be based on the relevant contaminant(s).

1991 IJC General Delisting Guideline

When the incidence rates of deformities or reproductive problems in sentinel wildlife species do not exceed background levels in inland control populations.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation plan according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds is sampled at selected sites defined by the NPDES permitting program for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for maps of the basin rotations). One element of the strategy is wildlife contaminant monitoring.

Wildlife play an important role in monitoring water quality and ecosystem health and can be used to monitor for spatial and temporal trends in contaminant concentrations. Specific life stages may be sampled to provide discrete time units

for determination of temporal trends. Specific geographic regions or watersheds may be targeted for the determination of spatial trends.

The specific objectives of the wildlife contaminant monitoring are to:

1. Determine contaminant levels in wildlife that may be exposed to contaminants from surface waters of the state.

2. Assess whether contaminant levels in fish are changing with time.

3. Evaluate the overall effectiveness of MDEQ programs in protecting wildlife from toxic contaminants.

4. Determine whether new chemicals are bioaccumulating in wildlife.

The wildlife contaminant monitoring element currently consists of two components that, in combination, provide data necessary to achieve these objectives. These components include bald eagle and herring gull egg monitoring. The bald eagle project began in 1999 and has continued each year since then. Sample collection and analysis of herring gull eggs began in 2002. Wildlife are analyzed for bioaccumulative contaminants of concern, including mercury, PCBs, and chlorinated pesticides (e.g., DDT/DDE/DDD). Data are reviewed each year to determine whether there are additional new parameters of concern for which wildlife should be analyzed.

Another element of the State's monitoring strategy applicable to this BUI is enhanced and improved FCMP. Fish contaminant data are used to determine whether fish from waters of the state are safe for human and wildlife consumption, and as a surrogate measure of bioaccumulative contaminants in surface water. Fish tissues are analyzed for bioaccumulative contaminants of concern. These include mercury, PCBs, chlorinated pesticides (e.g., DDT/DDE/DDD), dioxins, and furans. More recently, some fish tissues have been analyzed for polybrominated biphenyl ethers (PBDEs) and perfluorooctane sulfonate (PFOS).

Fish contaminant studies needed for the assessment of this BUI restoration will be arranged by MDEQ as part of the Michigan FCMP. Timing and study design will be determined by the MDEQ based on available resources.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

Degradation of Benthos

Significance in Michigan's Areas of Concern

Thirteen AOCs in Michigan have identified Degradation of Benthos as a BUI (all except Deer Lake). This impairment usually results from the biologically-based effects of sediment contamination and is closely related to the restrictions on dredging impairment. This impairment deals with only the surficial layer of sediments where organisms live.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when:

- An assessment of benthic community, using either MDEQ's SWAS Procedure #51 for wadeable streams or MDEQ's Procedure #22 for non-wadeable rivers yields a score for the benthic metrics which meets the standards for aquatic life in any two successive monitoring cycles (as defined in the two procedures).

  OR, in cases where MDEQ procedures are not applicable and benthic degradation is caused by contaminated sediments, this BUI will be considered restored when:

- All remedial actions for known contaminated sediment sites with degraded benthos are completed (except for minor repairs required during operation and maintenance) and monitored according to the approved plan for the site. Remedial actions and monitoring are conducted under authority of state and federal programs, such as the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund), Resource Conservation and Recovery Act, Great Lakes Legacy Act, or Part 201 of Michigan's National Resource and Environmental Protection Act (NREPA) of 1994.

Rationale

Practical Application in Michigan

The AOC program addresses the worst contaminated sites in the Great Lakes. Those AOCs that have degradation of benthos from sediment contamination have specific sites that are being remediated with regulatory programs. Once these specific sites have been remediated, the benthos in the AOC will no longer be among the worst in the Great Lakes so the use impairment can be considered restored. The reason for identifying degradation of benthos varies across Michigan's AOCs. Benthos in some AOCs is degraded due to non-contaminated

sediment deposition, or hydrologic changes in the waterbody. In other AOCs, benthos are degraded due to the effects of contaminated sediments.

The restoration criteria for Degradation of Benthos allows for two different approaches for evaluating restoration success. The first approach employs MDEQ procedures for evaluating benthic community structure in wadeable and non-wadeable streams. Rapid, qualitative biological assessments of wadeable streams and rivers are conducted using SWAS Procedure #51, which compares fish and benthic invertebrate communities at a site to the communities that are expected at an unimpacted, or reference site. This is a key tool used by MDEQ to determine whether waterbodies are attaining Michigan WQS. However, this procedure cannot be used on non-wadeable rivers. Procedure #22 is a procedure for assessing aquatic communities in non-wadable rivers that the State implemented beginning in 2013. If these procedures are applicable to an AOC, data collected under the monitoring program will be used to evaluate whether benthos has been restored according to the criteria. Where biological assessments are not applicable, the second approach will be used to determine removal of this BUI.

The second approach focuses on benthic degradation from chemical contamination. Contaminated sediments are the primary cause for benthic impairments in AOCs. Sediment remediation and assessment will be accomplished through established programs such as federal Superfund, Resource Conservation and Recovery Act, Great Lakes Legacy Act, and Michigan's NREPA Part 201. Criteria are site specific and are usually based on sediment chemistry or sediment toxicity. In addition to dredging contaminated sediments for remediation, regulatory programs sometimes adopt natural attenuation as the method for addressing contaminated sediments. In both cases, when the final remedial measures are completed, and monitored according to site plans, the BUI will be considered restored. Removal of the BUI will not be contingent on full recovery of the benthic community, which may take many years or even decades.

1991 IJC General Delisting Guideline

When the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan conducts remedial actions on contaminated sediments under NREPA Part 201 and other state regulatory authority. The State also cooperates with federal programs that remediate contaminated sediments and restore benthos, such as the U.S. Superfund, the Resource Conservation and Recovery Act, and the Great Lakes Legacy Act programs. In addition, the State has a permit program for dredging and filling of lakes, streams, and wetlands. Through these programs, biologically based effects of contamination could be determined as part of any assessment. Remediation which addresses biological effects occurs on a site-specific basis.

The MDEQ has benthic data from wadeable stream surveys (SWAS Procedure #51) gathered as part of the 5-year rotating basin monitoring in the state. In addition, the State monitors for benthos in non-wadeable streams as part of the 5-year basin monitoring program using SWAS Procedure #22. Data from these surveys, as well as other relevant state monitoring data (e.g. MDNR surveys or special studies by MDEQ for lake systems) will be used as applicable for monitoring and assessing restoration of this impairment.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

Restrictions on Dredging Activities

Significance in Michigan's Areas of Concern

Originally, twelve AOCs in Michigan identified restrictions on dredging as impaired or potentially impaired (all except Deer Lake and Torch Lake). This BUI addresses the requirement for special handling or disposal of commercial or recreational navigation channel dredge spoils due to chemical contamination of sediments. This BUI was originally identified for some AOCs based on the existence of contaminated sediments, not on whether there were actual restrictions on dredging in the AOC.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when:

- During the most recent routine dredging in the U.S. Army Corps of Engineers (COE) designated navigational channel, use of a confined disposal facility or TSCA-level landfill for dredge spoils was not required due to chemical contamination.

Rationale

Practical Application in Michigan

Dredging sediments in the Great Lakes and connected waterways requires state and federal approvals that regulate the extent of dredging, disposal of dredge spoils, and pre-dredge studies. Restrictions on dredging is defined as special handling for dredge spoils requiring use of a confined disposal facility or Toxic Substances Control Act level landfill due to chemical contamination. Open water disposal of any clean or contaminated dredge spoils in the Great Lakes or connected waterways is not routinely permitted in Michigan. As a result, use of disposal options (e.g., confined disposal facility) other than open water is not automatically a restriction on dredging. This restoration criterion applies only to the commercial and recreational navigational channels in the Great Lakes and connected waterways that are maintained by the COE.

1991 IJC General Delisting Guideline

When contaminants in sediments do not exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities

As part of existing planning and regulatory requirements, the MDEQ and the COE evaluate the environmental impacts associated with any proposed navigational dredging and disposal projects.

In assessing restoration of this BUI, the State, in consultation with the COE and the PAC, will conduct an evaluation of the most recent navigational dredging projects in an AOC to determine whether there have been restrictions on the dredging requiring confined disposal due to sediment contamination.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

All non-navigational channel dredging is evaluated under federal and state authorities and any special circumstances are addressed in the permit process, including contamination. These programs apply across the state, not just in AOCs, and as such are not included in the BUI.

Eutrophication or Undesirable Algae

Significance in Michigan's Areas of Concern

Originally, eight of Michigan's AOCs were listed as impaired due to eutrophication, including: River Raisin, Rouge River, Clinton River, Saginaw River/Bay, St. Marys River, Deer Lake, Muskegon Lake, and White Lake.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when:

- No waterbodies within the AOC are included on the list of non-attaining waters due to excessive algal growths from high nutrient loadings in the most recent Clean Water Act *Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report* (Integrated Report), which is submitted by the MDEQ to the U.S. EPA every two years.

OR, in cases where water bodies within the AOC are either on the non-attainment list or exhibit excessive algal growth from high nutrient loadings:

- This BUI will be considered restored when no persistent or high levels of nuisance algal growths or nuisance algal blooms occur for two consecutive monitoring cycles.

For the purposes of these criteria, the properties that cause AOC BUI impairment are unnatural or natural algal growths which are exacerbated by human activities. They must be persistent and high enough levels to be a nuisance. The assessments are not for determining whether water quality standards are being met under state or federal law.

Rationale

Practical Application in Michigan

The MDEQ regulates water pollution under the authority of Part 31 of the NREPA, P.A. 451 of 1994. The AOC restoration criteria are consistent with the state's WQS, and how the State identifies waters for inclusion on the Clean Water Act section 303(d) list, which is submitted to U.S. EPA every two years. If a waterbody exhibits growths of undesirable algae in quantities which interfere with a water body's "designated uses" as identified in rules R323.1060 and R323.1100 of the Michigan WQS (e.g., inhibits swimming due to the physical presence of algal mats and/or associated odor; inhibits the growth and production of warm water fisheries, and/or other indigenous aquatic life and wildlife), the waterbody is included on Michigan's Section 303(d) list.

In cases where waterbodies are on the non-attainment list or exhibit excessive nuisance algal growth, consideration may be given to assessment of the BUI using monitoring data. These assessments will be accomplished using protocol developed as described below.

In many locations in Michigan, eutrophication of a waterbody is a natural occurrence in certain seasons and circumstances. In some locations, natural eutrophication is augmented by watershed-wide agricultural practices that contribute non-point source nutrients to waterbodies. Neither situation is considered an issue to be addressed by the AOC program in Michigan.

In considering when eutrophication is an AOC issue, guidelines from non-regulatory actions may be used as supporting documentation, including nutrient targets under the GLWQA.

1991 IJC General Delisting Guideline

When there are no persistent water quality problems (e.g., dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication.

The IJC general delisting guideline is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation cycle according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds are sampled at selected sites for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for maps of the basin rotations). Two particularly relevant elements of the strategy are expanded and improved water chemistry monitoring and the lake monitoring program. One of the specific objectives of these programs is to determine whether nutrients are present in surface waters at levels capable of stimulating the growth of nuisance aquatic plants/algae/slimes.

Under the water chemistry monitoring program, water samples generally are analyzed for nutrients, conventional parameters (i.e., temperature, conductivity, suspended solids, pH, dissolved oxygen), total mercury, and trace metals (i.e., cadmium, chromium, copper, lead, nickel, zinc). A much smaller number of samples are analyzed for organic contaminants such as PCBs and base neutrals. Other parameters may be included as appropriate at specific locations, including

observations of nuisance algae in AOCs with this impairment. Nutrients and conventional parameters may also be monitored at sites where biological data are collected during routine watershed assessments. Data are reviewed each year to determine whether additional parameters should be added, removed, or analyzed at a greater or lesser frequency.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

Restrictions on Drinking Water Consumption or Taste and Odor Problems

Significance in Michigan's Areas of Concern

Originally, five of Michigan's AOCs were listed as impaired due to past restrictions on drinking water, including: White Lake, Saginaw River/Bay, Muskegon Lake, St. Clair River, and Detroit River.

For most AOCs, this BUI was designated due to the need for additional treatment of drinking water to meet human health standards and address taste or odor issues. In the St. Clair River, this BUI was originally designated due to closures of drinking water treatment plants to let plumes from chemical spills pass the intakes.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when monitoring data for two years indicates that public water supplies:

- meet the current and most stringent human health standards, objectives, or guidelines (at the point of distribution into the water system) for levels of disease-causing organisms, hazardous or toxic chemicals, or radioactive substances; and

- treatment needed to make raw water potable and palatable does not exceed standard methods in those supplies. In the event a public drinking water intake must be closed due to contamination of surface water, standard treatment methods are considered to have been exceeded.

Rationale

Practical Application in Michigan

For the purposes of restoring this impairment, standard treatment methods are those identified in the federal and Michigan Safe Drinking Water Acts. Standard treatment includes filtration, disinfection, coagulation/flocculation, sedimentation, iron removal (if necessary), well field management, new well location, and softening. Standards related to odor and taste are secondary Maximum Contaminant Levels and are not adopted by Michigan law. Taste and odor concerns are typically tracked by citizen complaints and are investigated at the local level by county health departments.

1991 IJC General Delisting Guideline

For treated drinking water supplies: 1) when densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health objectives, standards or guidelines; 2) when taste and odor problems are absent; and 3) when treatment needed to make raw water suitable for drinking does not exceed the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e., settling, coagulation, disinfection).

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities

State of Michigan Programs/Authorities for Evaluating Restoration

The U.S. EPA establishes and enforces drinking water standards nationwide. The state adopts and enforces those standards under the Michigan Safe Drinking Water Act (Act 399, 1976 as amended). The MDEQ carries out the community public water supply program directly, and contracts with local health departments to issue construction permits, oversee the monitoring, and carry out enforcement for non-community public water systems.

Under the Michigan Safe Drinking Water Act, public water suppliers in Michigan must submit regular reports of treated water quality to the MDEQ. The OGL will use these reports to evaluate whether this BUI has been restored.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately addresses the restoration criteria and meets quality assurance/quality control requirements, they may be used to demonstrate restoration success.

Beach Closings

Significance in Michigan's Areas of Concern

Originally, eleven of Michigan's AOCs were listed as impaired due to beach closings from bacterial contaminants, including: River Raisin, Detroit River, Rouge River, Clinton River, St. Clair River, Saginaw River/Bay, St. Marys River, Kalamazoo River, Menominee River, Muskegon Lake, and Manistique River.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when:

- No waterbodies within the AOC are included on the list of non-attaining waters due to human pathogens in the most recent Clean Water Act *Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report* (Integrated Report), which is submitted to U.S. EPA every two years.

OR, in cases where waterbodies within the AOC are on the list of non-attaining waters due to human pathogens:

- This BUI will be considered restored when human sources of pathogens regulated under the National Pollutant Discharge Elimination System (NPDES) are on schedule to be controlled through implementation of permit requirements.

Rationale

Practical Application in Michigan

These restoration criteria are based on Michigan's WQS for bacterial contamination. Rule 323.1062 of Michigan's WQS sets the maximum concentrations of *E. coli* that are acceptable for waters of the state to meet total- and partial-body contact recreation uses. The AOCs with a Beach Closing BUI have historically found persistent elevation of bacteria levels in their recreation waters, often due to the existence of sanitary sewer overflows and CSOs. This BUI does not address wide-spread, low level contamination from diffuse human sources of pathogens such as failing septic systems.

In accordance with Public Health Code (Act 368 of 1978), county health departments have the authority to monitor and evaluate public beaches to determine if the water is safe for bathing, swimming, or partial body contact recreation. While beach monitoring is a voluntary program, those county health departments that participate must monitor in accordance with Michigan's WQS. County health departments which monitor public beaches must submit their sampling data to the MDEQ, which tracks monitoring results and uses the data to

determine whether water bodies are identified as impaired in the *Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report to* the U.S. EPA on Clean Water Act compliance.

Point source discharges from combined sewer overflows can be a source of pathogens to AOC waters. Requirements to eliminate the discharges under NPDES permits are the primary source control tool available to restore the BUIs. When source control is assured under regulatory programs, this BUI is considered restored.

Sources of pathogens from failing on-site septic systems regulated under county health departments can be an issue state-wide and are not included in the AOC program.

1991 IJC General Delisting Guideline

When waters, commonly used for total-body contact or partial body-contact recreation, do not exceed standards, objectives, or guidelines for such use.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation cycle according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds are sampled at selected sites for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for maps of the basin rotations). One element of the strategy is improved support for public beach monitoring.

The specific objectives of the beach monitoring element are to:

1. Support county health departments in determining whether waters of the state are safe for total body contact recreation.

2. Evaluate the effectiveness of MDEQ programs in protecting waters of the state from bacteria/*E. coli* contamination.
3. Develop and maintain a database into which counties can enter their beach monitoring data, and which the public can access for the latest information.

The beach monitoring element consists of two components that, in combination, provide data necessary to achieve these objectives. These include annual grants awarded to local governments/county health departments each year to monitor public beaches through a grant application package, and development and maintenance of a statewide beach database, which is available on the MDEQ web site https://www.egle.state.mi.us/beach/. Counties enter data directly into the database.

The NPDES program is administered by the MDEQ Water Resources Division. It is applicable to discharges to waters of the state for the control of all forms of water pollution.

Degradation of Aesthetics

Significance in Michigan's Areas of Concern

Originally, ten of Michigan's AOCs were listed as impaired due to aesthetics, including: River Raisin, Detroit River, Rouge River, Clinton River, St. Clair River, Saginaw River/Bay, St. Marys River, Kalamazoo River, Muskegon Lake, and White Lake.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when monitoring data for two successive monitoring cycles indicates that water bodies in the AOC do not exhibit persistent, high levels of the following "unnatural physical properties" (as defined by Rule 323.1050 of the Michigan WQS) in quantities which interfere with the State's designated uses for surface waters:

- turbidity
- color
- foams
- settleable solids
- suspended solids
- oil films
- floating solids
- deposits

For the purposes of this criteria, these eight properties impair aesthetic values if they are unnatural – meaning those that are manmade (e.g., garbage, sewage), or natural properties which are exacerbated by human-induced activities (e.g., excessive algae growth from high nutrient loading). Persistent, high levels are those defined as long enough in duration, or elevated to the point of being injurious, to any designated use listed under Rule 323.1100 of the Michigan WQS.

Natural physical features which occur in normal ecological cycles (e.g., logjams/woody debris, rooted aquatic plants) are not considered impairments, and in fact serve a valuable role in providing fish and wildlife habitat.

Rationale

Practical Application in Michigan

Evaluation of aesthetic impairments can be subjective, with individuals having different perceptions about what constitutes a nuisance or impairment. The above criteria are focused solely on aesthetic impairments as they relate to water quality and are consistent with Rule 323.1050 of the Michigan WQS.

In evaluating whether any of the eight "unnatural physical properties" identified in the restoration criteria are causing an aesthetic impairment, the focus should be on whether it interferes with a waterbody's designated use (as identified in Rule 323.1100 of the Michigan WQS). The persistence, frequency, and magnitude of

the occurrence of these properties are a key part of the consideration regarding whether these problems are significant enough to warrant continued designation as an AOC.

1991 IJC General Delisting Guideline

When the waters are devoid of any substance which produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g., oil slick, surface scum).

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation cycle according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds are sampled at selected sites for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for maps of the basin rotations).

Selected water bodies are monitored for chemical and biological parameters including, nutrients, conventional parameters (i.e., temperature, conductivity, suspended solids, pH, dissolved oxygen), total mercury, and trace metals (i.e., cadmium, chromium, copper, lead, nickel, zinc), fish and benthic invertebrate communities. Other parameters may be included as appropriate at specific locations, including observations of "unnatural physical properties" in AOCs with this impairment. Data are reviewed each year to determine whether additional parameters should be added, removed, or analyzed at a greater or lesser frequency.

MDEQ developed a 2011 Statewide Aesthetics Assessment Workplan and Monitoring Protocol for AOCs with this BUI (MDEQ, 2011). That protocol was used to conduct the statewide assessment and can be used for any necessary further assessments of this BUI.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately

addresses the restoration criteria and meets quality assurance/quality control requirements, they may be used to demonstrate restoration success.

Added Cost to Agriculture or Industry

Significance in Michigan's Areas of Concern

Originally, only one of Michigan's AOCs, the St. Clair River, was listed as impaired due to added costs to agriculture and industry. The designation of this beneficial use impairment in the St. Clair River AOC is tied to costs associated with temporary shut-downs of intakes for drinking water treatment facilities in the U.S. and Canada, and for Akzo Salt in Port Huron, Michigan and some food processors in Wallaceburg, Ontario from pollutant spills into the river.

The 1995 Stage 2 RAP (Ontario Ministry of the Environment and Energy and MDNR, 1995) for the St. Clair River AOC included a locally-derived restoration target for the Added Costs to Agriculture and Industry which addressed costs associated with closures of drinking and industrial water intakes.

Michigan Restoration Criteria and Assessment

This BUI will be considered restored when the locally-derived restoration target for this BUI, approved by the 4-Agency Management Committee, which oversees shared U.S. and Canadian AOCs, is met. The current target for this BUI, as adopted in the 1995 Stage 2 RAP, is:

- No plant shutdowns attributable to water quality over a two-year period.
- No added costs for the disposal of contaminated sediments.

Rationale

Practical Application in Michigan

Because this BUI was originally designated only in the St. Clair River due to closures of water intakes for drinking water and industrial facilities, the statewide restoration criteria for this BUI is the same as the locally-derived and approved restoration target. If a new target for this BUI in the St. Clair River is adopted and approved by the 4-Agency Management Committee that oversees the connecting channel AOCs, the new target will become the State's restoration criteria for this BUI.

If any current or future AOC identifies Added Costs to Agriculture or Industry as a BUI, further restoration criteria will be developed by the State to specifically address the causes of impairment, or the State will evaluate locally-derived criteria for consistency with state authorities at that time.

1991 IJC General Delisting Guideline

When there are no 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) and industrial purposes (i.e., intended for commercial or industrial applications and noncontact food processing).

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

The State will work with the appropriate agencies and the St. Clair River Bi-national PAC to determine whether information provided by local water treatment plant and industrial facilities, which historically incurred additional costs due to water intake pipe closures, indicates that this BUI has been restored.

Degradation of Phytoplankton or Zooplankton Populations

Significance in Michigan's Areas of Concern

Originally, only one of Michigan's AOCs, Saginaw River/Bay, was listed as impaired due to the degradation of Phytoplankton and Zooplankton Populations. The BUI was originally designated because of hyper eutrophication and excessive growths of noxious phytoplankton (e.g., blue green algae) which historically caused restrictions on drinking water and recreation in the AOC.

Michigan Restoration Criteria and Assessment

In order to address the causes of degradation to phytoplankton and zooplankton in this AOC, this BUI will be considered restored when:

- The restoration criteria for the *Eutrophication or Undesirable Algae* BUI has been met in Saginaw River/Bay/River AOC.

Rationale

Practical Application in Michigan

Because this BUI was originally designated only in Saginaw River/Bay AOC due to hyper eutrophication, the statewide restoration criteria for this BUI is the same as the criteria for *Eutrophication or Undesirable Algae.*

If any current or future AOC identifies degradation of phyto- or zooplankton populations as a BUI, further restoration criteria will be developed by the State to specifically address the causes of impairment, or the State will evaluate locally-derived criteria for consistency with state water quality standards at the time.

1991 IJC General Delisting Guideline

When phytoplankton and zooplankton community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when phytoplankton and zooplankton bioassays confirm no significant toxicity in ambient waters.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Programs/Authorities for Evaluating Restoration

Michigan assesses water bodies throughout the state on a 5-year basin rotation cycle according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds are sampled at selected sites for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for maps of the basin rotations). Two particularly relevant elements of the strategy are expanded and improved water chemistry monitoring and the lake monitoring program. One of the specific objectives of these programs is to determine whether nutrients are present in surface waters at levels capable of stimulating the growth of nuisance aquatic plants/algae/slimes.

Under the water chemistry monitoring program, water samples generally are analyzed for nutrients, conventional parameters (i.e., temperature, conductivity, suspended solids, pH, dissolved oxygen), total mercury, and trace metals (i.e., cadmium, chromium, copper, lead, nickel, zinc). A much smaller number of samples are analyzed for organic contaminants such as PCBs and base neutrals. Other parameters may be included as appropriate at specific locations, including observations of nuisance algae in AOCs with this impairment. Nutrients and conventional parameters may also be monitored at sites where biological data are collected during routine watershed assessments. Data are reviewed each year to determine whether additional parameters should be added, removed, or analyzed at a greater or lesser frequency.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be submitted to the OGL for review. If the OGL determines that the data appropriately addresses the restoration criteria and meets quality assurance/quality control requirements, they may be used to demonstrate restoration success.

Loss of Fish and Wildlife Habitat
Degradation of Fish and Wildlife Populations

These two BUIs are being considered together in recognition of the integral relationship between them. For the purpose of assessing restoration, both of these BUIs will use the same criteria-setting process.

Significance in Michigan's Areas of Concern

Originally, twelve AOCs in Michigan identified Loss of Fish and Wildlife Habitat as a BUI in their RAPs (all except Deer Lake and Torch Lake). Nine AOCs in Michigan have identified Degradation of Fish and Wildlife Populations as a BUI including: Kalamazoo River, Muskegon Lake, White Lake, Menominee River, St. Marys River, Saginaw River/Bay, Clinton River, Rouge River, and River Raisin. Little quantitative information was available in the 1980s regarding habitat loss and population degradation, when impairments were first determined. Therefore, there is wide variability in these impairments among the AOCs due to both real variability in habitat and populations as well as variability in initial assessments.

Michigan Restoration Criteria and Assessment

Restoration of this BUI requires that a local aquatic habitat or population restoration plan be developed and implemented. The plan must contain at least the following components:

A. A short narrative on historical fish and wildlife habitat or population issues in the AOC, including how habitat or populations have been impaired by water quality.

B. Description of the impairment(s) and location for each aquatic habitat or population site, or for multiple sites where determined appropriate at the local level to address all habitat or population issues identified in the RAP and RAP updates.

C. A locally derived restoration target for each impacted habitat or population site. Sources of information for targets may include data from social science surveys, if appropriate. Habitat restoration targets may be based on restoration of fish and wildlife populations, if appropriate.

D. A list of all other ongoing habitat or population planning processes in the AOC, and a description of their relationship to the restoration projects proposed in the plan.

E. A scope of work for restoring each impacted aquatic habitat or population site. The scope of work should describe specific habitat or population restoration action(s) to be completed, including:

1. Timetable
2. Funding
3. Responsible entities
4. Indicators and monitoring
5. Evaluation process based on indicators
6. Public involvement

F. A component for reporting on habitat or population restoration implementation action(s) to the OGL.

Removal of this BUI will be based on achievement of full implementation of actions in the steps above, including monitoring conducted according to site plans and showing consistent improvement in quantity or quality of habitat or populations addressed in the criteria. Habitat values and populations need not be fully restored prior to delisting, as some may take many years to recover after actions are complete. Actions already implemented in AOCs may be reported and evaluated if the reports contain all the elements above. The final plans are part of the AOC program files maintained by OGL's AOC Coordinators.

Rationale

Practical Application in Michigan

While most Michigan AOCs have habitat impairments and/or populations degradation, none were designated as impaired primarily as a result of these. The AOCs vary widely in their levels of habitat or population degradation, historical habitat or population types, and current needs for habitat or population restoration. The extent of habitat or population restoration necessary in an AOC will be determined at the local level and documented in the RAP.

The habitat or population restoration plan will determine the type and extent of the restoration necessary to address habitat loss or population degradation issues identified in the RAPs. Individual, AOC-specific restoration plans and criteria will be developed and implemented through a federal/state/local partnership.

Sources of water quality contamination must be controlled before habitat or population restoration is conducted. In some circumstances, habitat degradation is actually contributing to water quality problems, rather than vice versa. In those instances, the workplan should discuss this issue and the remedial actions should be targeted accordingly.

1991 IJC General Delisting Guideline: Loss of Fish and Wildlife Habitat

When the amount and quality of physical, chemical, and biological habitat required to meet fish and wildlife management goals have been achieved and protected.

IJC Delisting Guideline: Degradation of Fish and Wildlife Populations:

When environmental conditions support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be expected from the amount and quality of suitable physical, chemical and biological habitat present. An effort must be made to ensure that fish and wildlife objectives for AOCs are consistent with Great Lakes ecosystem objectives and Great Lakes Fishery Commission fish community goals. Further, in the absence of community structure data, this use will be considered restored when fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.

The IJC general delisting guideline for the BUI is presented here for reference. The Practical Application in Michigan subsection above describes application of specific criteria for restoration based on existing Michigan programs and authorities.

State of Michigan Program and Authorities for Evaluating Restoration

Habitat or population restoration projects to address these use impairments will be implemented by a variety of programs at the federal, state, and local level, as determined in the restoration planning process. For the development of local habitat or population restoration plans and criteria, the OGL, in consultation with MDNR Fisheries and Wildlife Divisions, commits to partnering with local AOC groups to determine what those actions should be, and make available to the PACs the existing monitoring and reporting elements in state programs as applicable.

Michigan assesses water bodies throughout the state on a 5-year basin rotation plan according to the MDEQ's "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005). Each year, a set of targeted watersheds are sampled at selected sites for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years (see Appendix 1 for maps of the basin rotations). One element of the strategy is expanded and improved monitoring of biological integrity and physical habitat.

This element includes all monitoring conducted for fish and benthic invertebrate community structure, nuisance aquatic plants, algae, and slimes, and assessment of physical habitat. Because biological communities integrate the cumulative effects of multiple environmental stresses, this element is an important tool for evaluating water quality. The MDEQ's goal in conducting the watershed surveys is to assess 80% of the stream and river miles in Michigan over a five-year period.

The specific objectives of biological integrity and physical habitat monitoring are to:

1. Determine whether waters of the state are attaining standards for aquatic life.

2. Assess the biological integrity of the waters of the state.

3. Determine the extent to which sedimentation in surface waters is impacting indigenous aquatic life.

4. Determine whether the biological integrity of surface waters is changing with time.

5. Assess the effectiveness of best management practices and other restoration efforts in protecting and/or restoring biological integrity and physical habitat.

6. Evaluate the overall effectiveness of MDEQ programs in protecting the biological integrity of surface waters.

7. Identify waters that are high quality, as well as those that are not meeting standards.

8. Identify the waters of the state that are impacted by nuisance aquatic plants, algae, and bacterial slimes.

The biological integrity and physical habitat element consists of several components that, in combination, provide data necessary to achieve the following objectives:

- Rapid biological assessment of wadeable streams;
- Rapid assessment procedure for nonwadeable rivers; and
- Trend monitoring procedure for biological communities.

Rapid, qualitative biological assessments of wadeable streams and rivers are conducted using the SWAS Procedure #51, which compares fish and benthic invertebrate communities at a site to the communities that are expected at an un-impacted, or reference, site. This is a key tool used by the MDEQ to determine whether waterbodies are attaining Michigan WQS. However, this procedure cannot be used on nonwadeable rivers. The MDEQ has developed Procedure #22 for assessing aquatic communities in nonwadeable rivers.

The State will support efforts in all AOCs with this BUI to complete the items the checklist above. Support may be both direct, with partnership commitments from the MDEQ and MDNR to specific elements as appropriate, as well as indirect through grants to local AOC partners. Depending on available resources, support for local development of habitat or population restoration plans and criteria may be spread out among AOCs over multiple years.

Some local AOC communities also have programs for monitoring water quality and related parameters which may be applicable to this BUI. If an AOC chooses to use local monitoring data for the assessment of BUI restoration, the data can be

submitted to the OGL for review. If the OGL determines that the data appropriately address the restoration criteria and meet quality assurance and control requirements, they may be used to demonstrate restoration success.

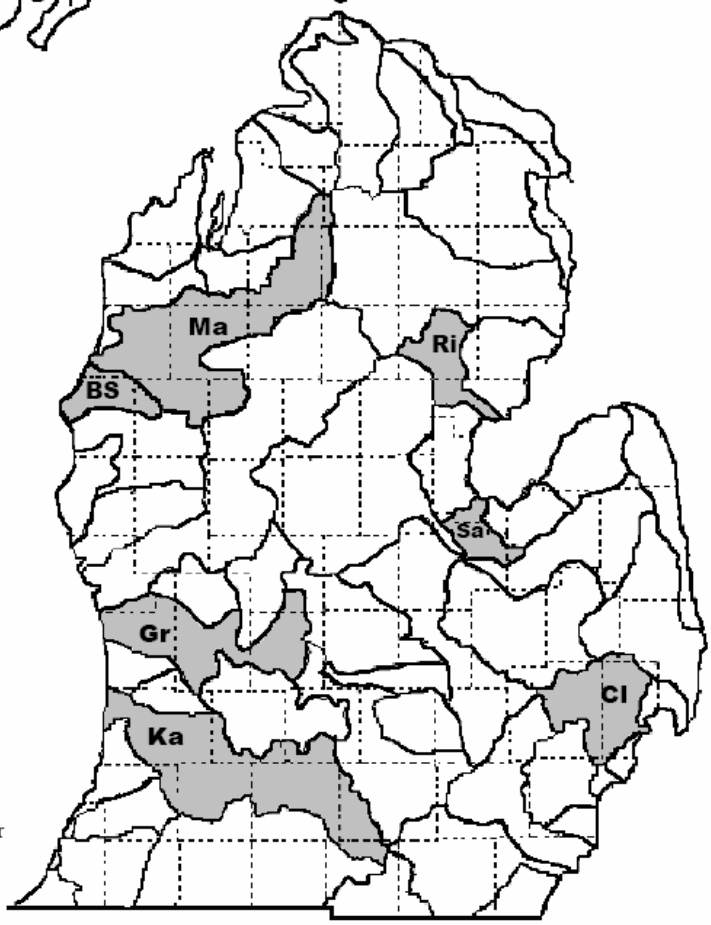
Appendix 1: Five Year Basin Cycle Monitoring

Monitoring and assessment of surface waters in Michigan is primarily the responsibility of the MDEQ Water Resources Division. In 1997, MDEQ developed the "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997). This strategy was updated in 2005 (Michigan Water Quality Monitoring Strategy Update, April 2005) to reflect current monitoring effort in the state, and to better incorporate U.S. EPA requirements for a comprehensive state monitoring program.

Under our "Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (MDEQ, 1997) and "Michigan Water Quality Strategy Update" (MDEQ, 2005), the MDEQ has divided the state into watershed basins to administer the NPDES and other water quality programs. Each year, a set of targeted watersheds are sampled at selected sites for conventional and toxic pollutants, and biological and physical habitat/morphology indicators. The set of watersheds sampled rotates each year, with each major watershed in the state revisited every five years. The following maps indicate which watersheds are sampled in each of the five-year cycles.

Assessment of AOCs for attainment of restoration criteria will normally be integrated into the five-year basin monitoring cycle. For Bird or Animal Deformities or Reproductive Problems, Degradation of Benthos, Eutrophication or Undesirable Algae, Degradation of Aesthetics, and Degradation of Phytoplankton or Zooplankton Populations BUIs, meeting the criteria in two successive monitoring cycles will indicate the BUI has been restored. Special considerations for one-time assessments may be made for an AOC on a case-by-case basis.

Monitoring Cycle Year – 2004, 2009, etc.



U.P. Watersheds

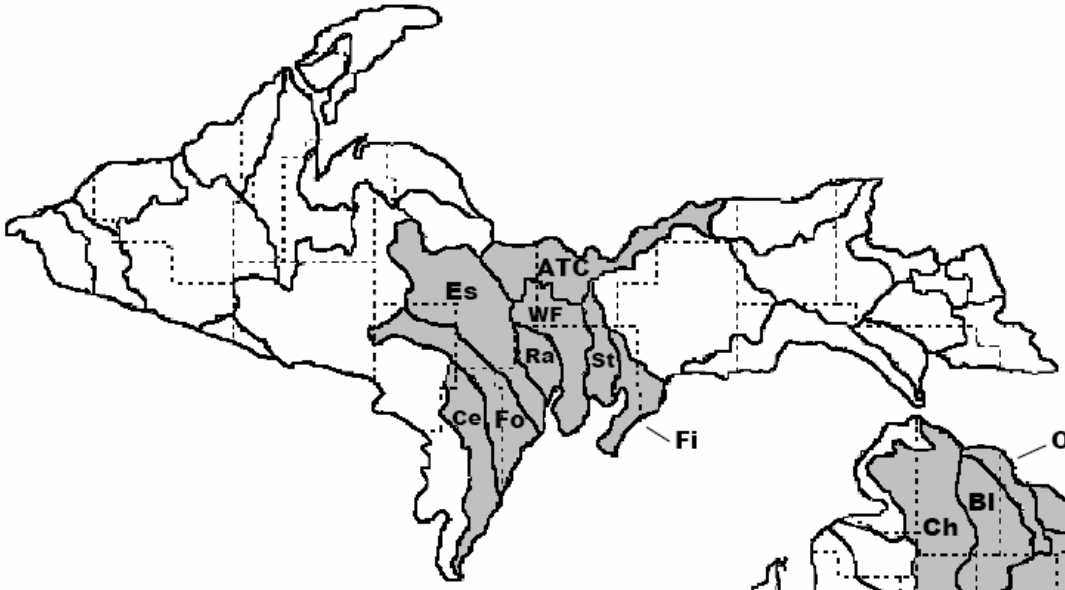
Ca – Carp River (Mackinac)
Ch – Charlotte & Upper St. Mary's (Chippewa)
Mi – Millecoquins (Mackinac: Lake Michigan Shoreline from Manistique to Lake Huron)
Msq – Manistique (Schoolcraft)
Mu – Munuscong and Lower St. Mary's (Chippewa)
Pe – Pendill's Creek (Chippewa)
Pi – Pine (Mackinac)
Ta – Tahquamenon (Chippewa)
2H – Two Hearted (Luce)
Wa – Waiska (Chippewa)

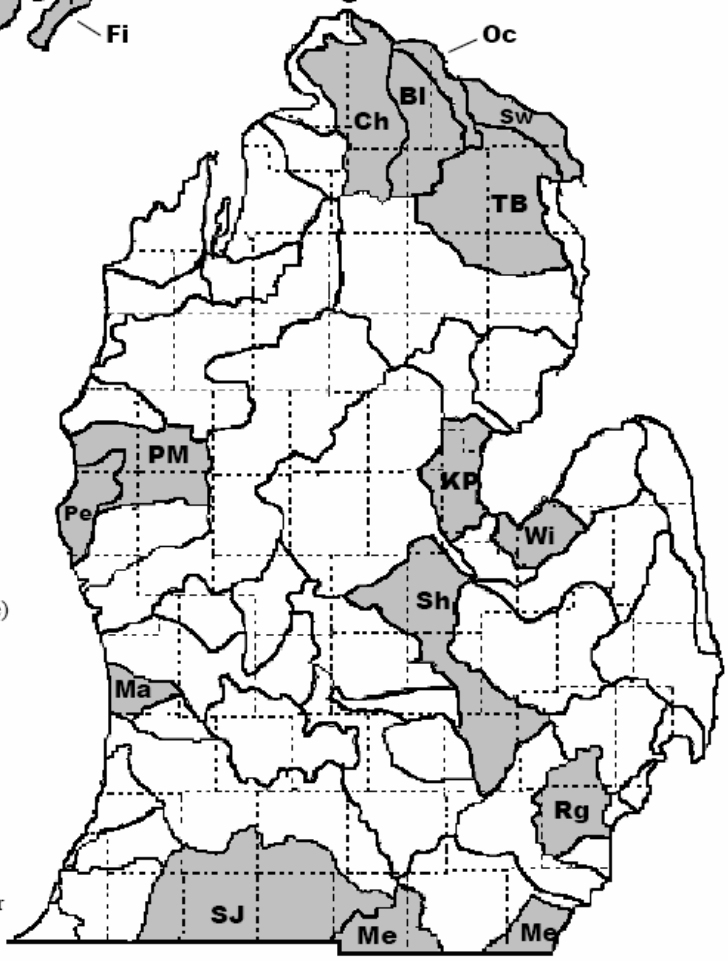
L.P. Watersheds

BS – Big Sable (Mason)
Cl – Clinton (Macomb)
Gr- Grand, Lower (Ottawa: Maple River to Lake Michigan)
Ka – Kalamazoo (Allegan)
Ma – Manistee (Manistee)
Ri – Rifle (Arenac)
Sa – Saginaw (Bay)

• Watersheds are identified by the name of the principal water body. The name in parentheses is the county where the most downstream segment of the principal water body is located.

Monitoring Cycle Year – 2005, 2010, etc.





U.P. Watersheds

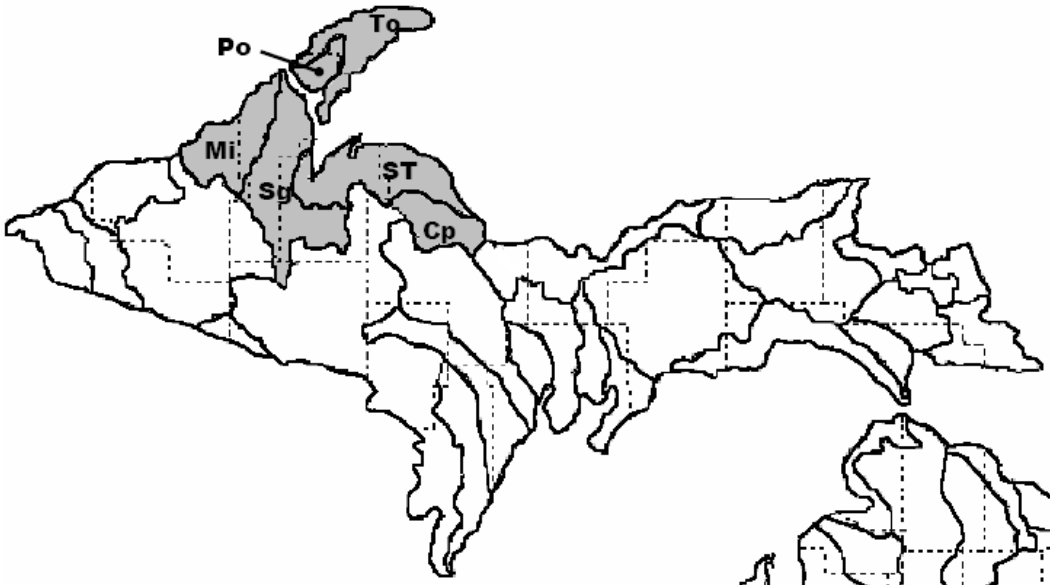
ATC – Au Train-Chocolay (Marquette-Alger)
Ce – Cedar (Menominee)
Es – Escanaba (Delta)
Fi – Fishdam (Delta)
Fo – Ford (Menominee)
Ra – Rapid (Delta)
St – Sturgeon (Delta)
Wf – Whitefish (Delta)

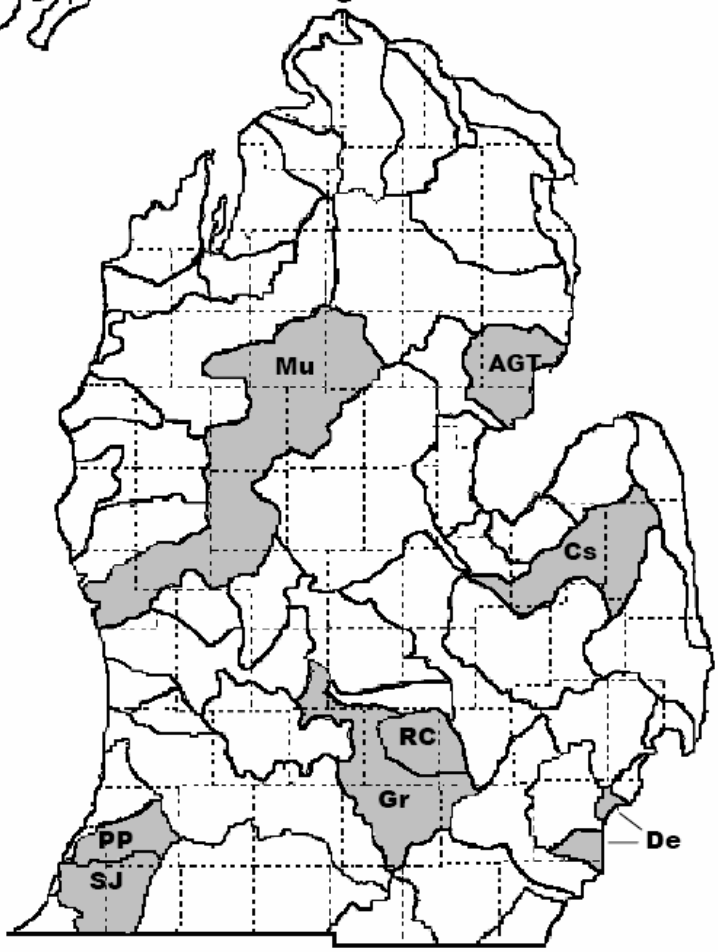
L.P. Watersheds

Bl – Black (Cheboygan)
Ch – Cheboygan (Cheboygan)
Kp – Kawkawlin-Pine (Bay-Arenac)
Ma – Macatawa (Ottawa)
Me – Maumee Tributaries (Hillsdale, Lenawee, Monroe)
Oc – Ocqueoc (Presque Isle)
Pe – Pentwater (Oceana)
PM – Pere Marquette (Mason)
Rg – Rouge (Wayne)
Sh – Shiawassee (Saginaw)
SJ – St. Joseph, Upper (St. Joseph)
Sw – Swan Creek (Presque Isle)
TB – Thunder Bay (Alpena)
Wi – Wiscoggin (Tuscola)

● Watersheds are identified by the name of the principal water body. The name in parentheses is the county where the most downstream segment of the principal water body is located.

Monitoring Cycle Year – 2006, 2011, etc.





U.P Watersheds

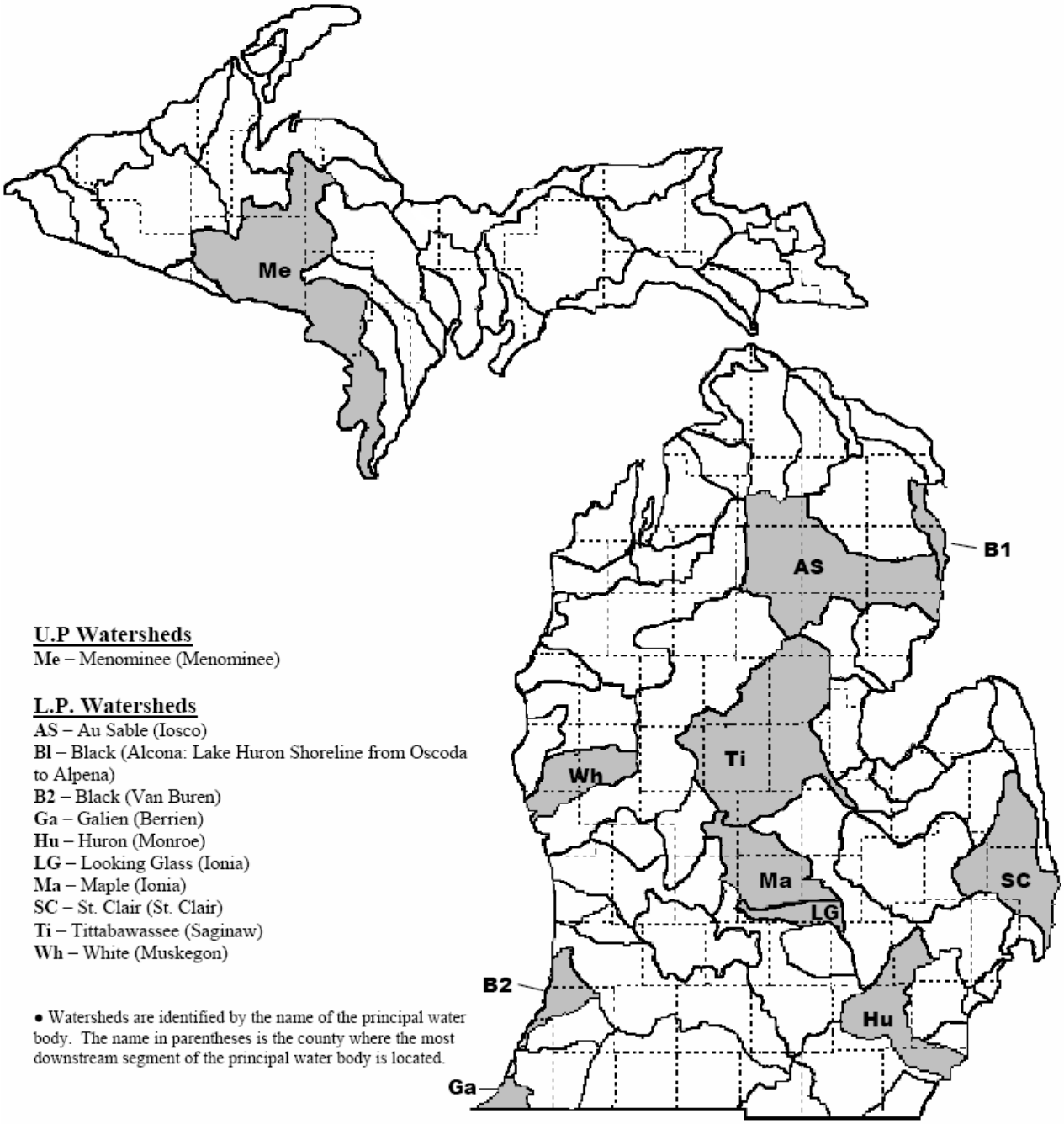
Cp – Carp (Marquette)
Mi – Misery (Ontonagon)
Po – Portage Lake (Houghton)
Sg – Sturgeon (Houghton)
ST – Salmon Trout (Marquette)
To – Tobacco (Keweenaw)

L.P. Watersheds

AGT – Au Gres/Tawas (Arenac-Iosco)
Cs – Cass (Saginaw)
De – Detroit (Wayne)
Gr – Grand, Upper (Ionia: Headwater to Maple R.)
Mu – Muskegon (Muskegon)
PP – Paw Paw (Berrien)
RC – Red Cedar (Ingham)
SJ – St. Joseph, Lower (Berrien)

• Watersheds are identified by the name of the principal water body. The name in parentheses is the county where the most downstream segment of the principal water body is located.

Monitoring Cycle Year – 2007, 2012, etc.



U.P Watersheds

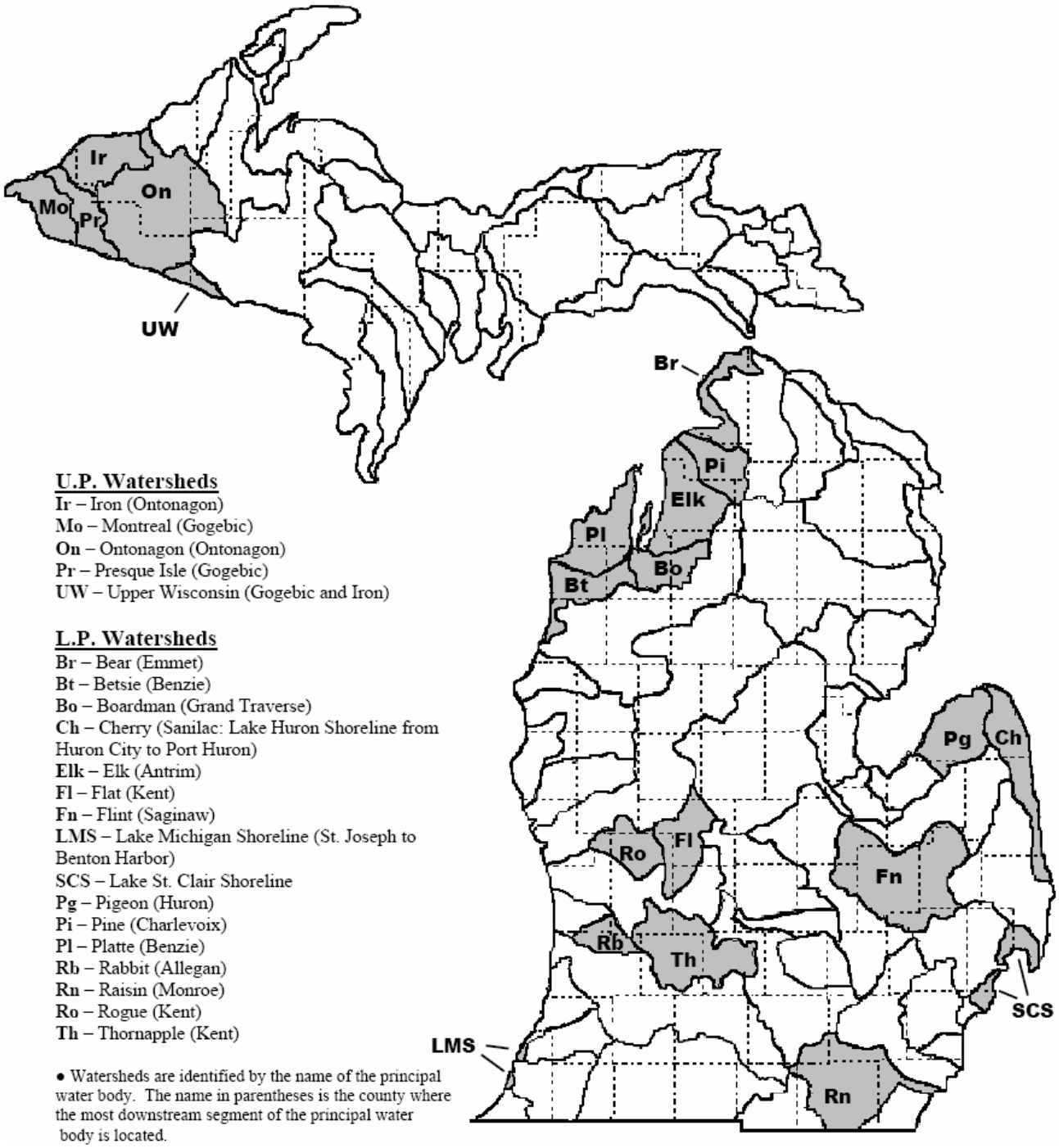
Me – Menominee (Menominee)

L.P. Watersheds

AS – Au Sable (Iosco)
Bl – Black (Alcona: Lake Huron Shoreline from Oscoda to Alpena)
B2 – Black (Van Buren)
Ga – Galien (Berrien)
Hu – Huron (Monroe)
LG – Looking Glass (Ionia)
Ma – Maple (Ionia)
SC – St. Clair (St. Clair)
Ti – Tittabawassee (Saginaw)
Wh – White (Muskegon)

• Watersheds are identified by the name of the principal water body. The name in parentheses is the county where the most downstream segment of the principal water body is located.

Monitoring Cycle Year – 2008, 2013, etc.



U.P. Watersheds

Ir – Iron (Ontonagon)
Mo – Montreal (Gogebic)
On – Ontonagon (Ontonagon)
Pr – Presque Isle (Gogebic)
UW – Upper Wisconsin (Gogebic and Iron)

L.P. Watersheds

Br – Bear (Emmet)
Bt – Betsie (Benzie)
Bo – Boardman (Grand Traverse)
Ch – Cherry (Sanilac: Lake Huron Shoreline from Huron City to Port Huron)
Elk – Elk (Antrim)
Fl – Flat (Kent)
Fn – Flint (Saginaw)
LMS – Lake Michigan Shoreline (St. Joseph to Benton Harbor)
SCS – Lake St. Clair Shoreline
Pg – Pigeon (Huron)
Pi – Pine (Charlevoix)
Pl – Platte (Benzie)
Rb – Rabbit (Allegan)
Rn – Raisin (Monroe)
Ro – Rogue (Kent)
Th – Thornapple (Kent)

• Watersheds are identified by the name of the principal water body. The name in parentheses is the county where the most downstream segment of the principal water body is located.

References

Baumann, P.C., I.R. Smith and C.D. Metcalf. 1996. Linkages between Chemical Contaminants and Tumors in Benthic Great Lakes Fish. *Journal of Great Lakes Research* 22(2): 131-152.

Canada and United States. 2012. Protocol Amending the Agreement Between Canada and the United States of America on Great Lakes Water Quality, 1978. Available at *(The link provided was broken and has been removed.)*

Chapman, Peter and Janette Anderson. 2005. A Decision-Making Framework for Sediment Contamination. *Integrated Environmental Assessment and Management* 1(3): 163-173.

Environment Canada. 1997. Contaminants in Herring Gull Eggs from the Great Lakes: 25 Years of Monitoring Levels and Effects. Great Lakes Fact Sheet, Catalogue No. 40-222/6-1997E.

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

----. 2003. Fish and Wildlife Health Effects in the Canadian Great Lakes Areas of Concern: Early Findings for Wildlife in Lower Great Lakes. Catalog Number CW66-223/2003E.

----. 2004. How Much Habitat is Enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern - Second Edition. Catalog Number CW66-164/2004E.

Fox, G.A. 2001. Wildlife as Sentinels of Human Health Effects in the Great Lakes-St. Lawrence Basin. *Environmental Health Perspectives Supplements* 109(S6).

Fox, G.A and W.W. Bowerman. 2005. Setting Delisting Goals for Wildlife Deformities and Reproduction at Great Lakes Areas of Concern. Report to the International Joint Commission.

Four Agency Letter of Commitment. April 17, 1998. Signed by Environment Canada, U.S. EPA, Michigan Department of Environmental Quality, and Ontario Ministry of the Environment.

Great Lakes Commission. Areas of Concern/Statewide Public Advisory Council website at: https://www.glc.org/work/SPAC.

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

----. 2003. “A Regional Workshop for Establishing Restoration Targets for Great Lakes Areas of Concern.” Workshop summary.

----. 2004. “Restoring Fish and Wildlife in Michigan’s Areas of Concern Workshop.” Workshop Summary.

International Joint Commission. Listing/Delisting Guidance web site: http://www.ijc.org/rel/focus/listdelist/lidemain.html

Lake Erie Lakewide Management Plan (LAMP) and associated reports. 2008. Available at: https://www.epa.gov/greatlakes/lake-erie-lamps

Lake Huron LAMP and associated reports. 2017. Available at: https://www.epa.gov/greatlakes/lake-huron-lamps

Lake Michigan LAMP and associated reports. 2008. Available at: https://www.epa.gov/greatlakes/lake-michigan-lamps

Lake Superior LAMP and associated reports. 2015. Available at: https://www.epa.gov/greatlakes/lake-superior-lamps

Michigan Department of Health and Human Services. Eat Safe Fish Guides. MDHHS web site: www.michigan.gov/mdhhs (then search: Michigan Fish Advisory).

Michigan Department of Environmental Quality. WQS. Available at: http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3728-350340--,00.html

----. January 1997. A Strategic Environmental Quality Monitoring Program for Michigan’s Surface Waters.

---. 2005. Michigan Water Quality Monitoring Strategy Update.

----. 2016. Water Quality and Pollution Control in Michigan 2016: Sections 303(d) and 305(b) Integrated Report. Available at: https://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3728-12711--,00.html

----. Drinking Water web site: https://www.michigan.gov/deq/0,1607,7-135-3313_3675---,00.html or go to www.michigan.gov/deq the click on Water then click on Drinking Water

----. Water Quality Monitoring web site: https://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686---,00.html or go to www.michigan.gov/deq then click on Water, then click on Water Quality Monitoring

Michigan Department of Natural Resources. Area of Concern Program web site at: www.michigan.gov/ogl, then click on Areas of Concern.

----. Remedial Action Plan documents request web site: www.michigan.gov/ogl then click on a specific AOC.

----. 2011 Statewide Aesthetics Assessment Workplan and Monitoring Protocol. Office of the Great Lakes, Michigan Department of Environmental Quality

Michigan Public Health Code web site: http://www.legislature.mi.gov/(S(bjhrewipbrh3gblpt1ddbmln))/mileg.aspx?page=getobject&objectname=mcl-act-368-of-1978&queryid=8222475&highlight

Michigan Safe Drinking Water Act web site: http://www.legislature.mi.gov/(S(x2zf3l53nnnyamz4jcjsglmg))/mileg.aspx?page=getobject&objectname=mcl-act-399-of-1976&queryid=8222529&highlight

Natural Resources and Environmental Protection Act of 1994 web site: http://www.legislature.mi.gov/(S(cfaguln3oolaajsmh0xlzm4t))/mileg.aspx?page=getobject&objectname=mcl-act-451-of-1994&queryid=8191308&highlight

NREPA, 1994. Part 201. Environmental Remediation. At: http://www.legislature.mi.gov/(S(3g0vhicnnrnnlgpffgtksty1))/mileg.aspx?page=getobject&objectname=mcl-451-1994-ii-7-201&highlight=

Ohio Environmental Protection Agency. 2005. Delisting Targets for Ohio Areas of Concern. Available at: http://www.epa.state.oh.us/

Ontario Ministry of the Environment and Energy and MDNR. 1995. The St. Clair River Area of Concern Water Use Goals, Remedial Measures, and Implementation Strategy.

Pennsylvania Department of Environmental Protection, U.S. Environmental Protection Agency, and Pennsylvania Sea Grant. January 2003. "Fish Tumors Related to Great Lakes Areas of Concern Conference Proceedings."

----. August 2003. "Second Fish Tumors Related to Great Lakes Areas of Concern Conference Proceedings."

Public Sector Consultants for the Partnership for the Saginaw Bay Watershed. 2002. Targeting Environmental Restoration in the Saginaw River/Bay Area of Concern.

Statewide Public Advisory Council. June 2003. Workshop -- Staying on Target: A Regional Workshop for Establishing Restoration Targets for Great Lakes Areas of Concern.

U. S. Environmental Protection Agency. Great Lakes National Program Office AOC web site: https://www.epa.gov/greatlakes

----. 2004. Pathway for Delisting Three Beneficial Use Impairments in Great Lakes Areas of Concern.

----. Level III Ecoregions of the Conterminous United States. Available at: https://www.epa.gov/eco-research/ecoregions

----. Joint Commitment on U.S. EPA/State Shared Water Goals.

----. Joint Commitment on U.S. EPA/State Shared Water Goals. Goal #3 on Swimming Waters.

---- and U.S. Army Corps of Engineers. 1998. Great Lakes Dredged Material Testing and Evaluation Manual.

U.S. Fish and Wildlife Service. Double-Crested Cormorants and Fisheries in the Great Lakes Basin Fact Sheet. Available at: https://www.fws.gov/migratorybirds/pdf/management/double-crested-cormorants/greatlakes_facts.pdf

Glossary/Acronyms

303(d) List: The list of water bodies in the state not meeting designated uses under Section 303 of the Clean Water Act

AOC: Great Lakes Area of Concern under Annex 2 of the Great Lakes Water Quality Agreement (as amended by protocol in 1987)

Assessment: Single event data collection to answer a specific question

BUI: Beneficial Use Impairment

Beneficial Use Impairment: One of 14 beneficial uses for water that can be designated as impaired in an Area of Concern under Annex 2 of the Great Lakes Water Quality Agreement (as amended by protocol in 1987)

CERCLA: federal Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)

COE: U.S. Army Corps of Engineers

DDT/DDE/DDD: dichlorodiphenyltrichloroethane and derivatives, a banned pesticide

Delisting: The process of restoration and subsequent removal of an AOC from the list of those in the Great Lakes

Designated Use: Specific uses for water named in the federal Clean Water Act

Dioxin/Furan: Chlorinated hydrocarbons that are by-products of certain activities

Ecoregion: Land units that differ significantly from one another in non-biological characteristics as well as in their related biological components. Two which will be used in considering control sites for BUI assessment are Forest Service and U.S. EPA Level III (see references)

FCMP: Fish Contaminant Monitoring Program of the MDEQ

4-Agency Letter of Commitment: Signed April 17, 1998 by Environment Canada, Ontario Ministry of the Environment, Michigan Department of Environmental Quality, and U.S. EPA. The letter committed the agencies to cooperate in the restoration of shared upper connecting channel AOCs and Lake St. Clair under the terms of the Great Lakes Water Quality Agreement. A 4-Agency Management Committee oversees implementation of the commitment.

GAP: Grant Application Package

GLNPO: Great Lakes National Program Office of U.S. EPA

GLWQA: The Great Lakes Water Quality Agreement of 1987 between the United States and Canada, as amended by protocol in 1987.

Guidance: Informal, non-regulatory narrative to guide the process of restoration

Guidelines: Formal, regulatory numbers for water quality based on standards

IJC: International Joint Commission established by the Boundary Waters Treaty between the United States and Canada in 1909

LAMP: Lakewide Action and Management Plan

LOEL: Lowest Observable Effect Level for a contaminant on an organism

MDHHS: Michigan Department of Health and Human Services

MDEQ: Michigan Department of Environmental Quality

MDNR: Michigan Department of Natural Resources

Monitoring: Long-term sampling for trend analysis of specific parameters

NPDES: National Pollution Discharge Elimination System under the federal Clean Water Act with permits administered by the state

NREPA: Michigan's Natural Resources and Environmental Protection Act of 1994

OGL: Office of the Great Lakes, part of the MDNR

PCB: Polychlorinated Biphenyls, oils formerly used in electrical equipment and carbonless paper, among other applications

Procedure #22: MDEQ Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers

Procedure #51: MDEQ Biological Monitoring/Assessment Protocol for Wadeable Streams

Procedure #WRD-SWAS-006: Fish Taste and Odor Studies

PAC: Public Advisory Council. Public advisory councils were established in the Areas of Concern to facilitate public involvement in cleanup efforts, provide

advice to state and federal agencies on issues of concern to local communities, and review and help write the Remedial Action Plans. They are intended to be a broad representation of stakeholders in each Area of Concern.

RAP: Remedial Action Plan for an Area of Concern

RCRA: federal Resource Conservation and Recovery Act

Restoration: Completion of actions such that the criteria for removal of a BUI have been met

Standards: Formal, regulatory numbers for water quality that are based on state statute

Superfund: Comprehensive Environmental Response, Compensation, and Liability Act

SWAS: Surface Water Assessment Section, Water Resources Division, MDEQ

Targets: Informal, non-regulatory guidance for restoration

TMDL: Total Maximum Daily Load; allocation among various sources of a pollutant to a waterbody such that a specified total is not exceeded

TSCA: Federal Toxic Substances Control Act

U.S. EPA: federal U.S. Environmental Protection Agency

USPC: U.S. Policy Committee, a forum of senior-level representatives from the Federal, State, and Tribal agencies responsible for environmental and natural resources management of the Great Lakes

WQS: Water Quality Standards under state and federal law

The Future

The Office of the Great Lakes is committed to protecting Michigan's environment and ensuring that all locations in the state of Michigan are protected and restored, whether they are or were AOCs. Delisting AOCs is just one step of a continuum in the process of restoring and protecting these areas in the Great Lakes. Reaching this point simply means that all BUIs have been addressed and that an area is no longer considered an AOC under the GLWQA. Public involvement in the AOC program is a critical component of this restoration and delisting process. A key component of future water quality protection efforts will be continued strong, local public involvement and partnerships with state and federal agencies.

MDNR AOC Program Contact

For further information on Michigan's Areas of Concern Program, contact:

Michigan Department of Natural Resources
Office of the Great Lakes
P.O. Box 30028
Lansing, MI 48909-7528
517-284-5052
www.michigan.gov/aocprogram