



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
OFFICE OF THE GREAT LAKES
LANSING



PATRICIA BIRKHOLZ
DIRECTOR

July 18, 2011

Mr. David Cowgill, Acting Director
Great Lakes National Program Office
United States Environmental Protection Agency
77 West Jackson Boulevard
Mail Code G-17J
Chicago, Illinois 60604-3507

Dear Mr. Cowgill:

The Michigan Department of Environmental Quality (MDEQ) Office of the Great Lakes (OGL) is pleased to submit the enclosed Stage 2 Remedial Action Plan for the White Lake Area of Concern, prepared in consultation with the White Lake Public Advisory Council and U.S. Environmental Protection Agency (U.S. EPA) staff.

The document includes all the known management actions necessary to delist the White Lake Area of Concern. These actions are anticipated to be completed by September, 2012. The MDEQ is committed to working with its partners to implement all management actions listed in the tracking matrix on page 13 of the document by that date.

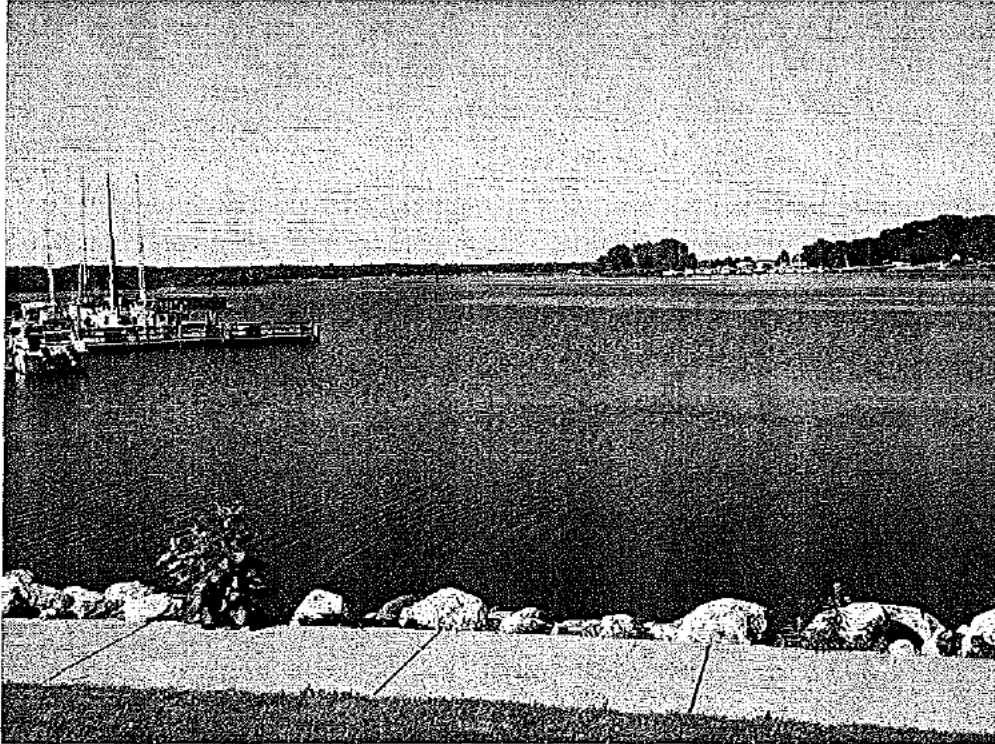
If you have questions or concerns, please contact Mr. John Riley, OGL, at 517-335-4122 or rileyj2@michigan.gov, or you may contact me.

Sincerely,

Patricia Birkholz
Director
517-335-4056

cc: Mr. Jeff Auch, Muskegon Conservation District
Mr. John Perrecone, U.S. EPA Great Lakes National Program Office
Mr. Frank Ruswick, OGL
Mr. Roger Eberhardt, OGL
Mr. Richard Hobrla, OGL
Mr. John Riley, OGL

Stage 2 Remedial Action Plan White Lake Area of Concern



Office of the Great Lakes
Great Lakes Management Unit
Michigan Department of Environmental Quality

July 18, 2011

Compiled by:

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Acknowledgements

The efforts to restore the White Lake Area of Concern are the work of many dedicated and caring individuals over more than 2 decades. The summary information presented here only touches the surface of the good work carried out by those who live in the White Lake Area of Concern and those who staff the federal and state agencies involved.

Of special note is the work of the members of the White Lake Public Advisory Council, who have worked tirelessly to restore the place they call home.

It is a privilege to work with my colleagues in the Departments of Environmental Quality and Natural Resources and with our counterparts in U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service, among others.

White Lake Area of Concern Stage 2 Remedial Action Plan

Purpose of the Stage 2 Remedial Action Plan

A Michigan Department of Environmental Quality (DEQ) Stage 2 Remedial Action Plan (RAP) for each Area of Concern (AOC) is the primary tool for documenting and communicating restoration progress. The AOC-specific Stage 2 RAPs are meant to be brief, user-friendly documents that identify actions needed to restore Beneficial Use Impairments (BUIs) in each AOC. The Stage 2 RAPs are prepared by the DEQ in consultation with the respective AOC Public Advisory Council (PAC) and the U.S. Environmental Protection Agency (USEPA), Great Lakes National Program Office.

Identifying specific actions necessary to remove a BUI is one component of the DEQ's process for tracking AOC restoration, removing BUIs, and ultimately delisting AOCs. These processes and relevant restoration criteria are described in more detail in the DEQ's *Guidance for Delisting Michigan's Great Lakes Areas of Concern (Guidance)* (DEQ, 2008). Comprehensive background information on the AOC is provided in previous RAP documents, which are listed in the Reference section of this publication.

Disclaimer

The Great Lakes Water Quality Agreement (GLWQA) is a non-regulatory agreement between the U.S. and Canada, and criteria developed under its auspices are non-regulatory in nature. The actions identified in this document as needed to achieve BUI restoration criteria are not subject to enforcement or regulatory actions by virtue of being listed in this document.

The actions identified in this Stage 2 RAP do not constitute a list of pre-approved projects, nor is it a list of projects simply related to BUIs or generally to improve the environment. Actions identified in this document are directly related to removing a BUI and are needed to delist the AOC.

Introduction

In 1987, amendments to the GLWQA were adopted by the federal governments of the U.S. and Canada. Annex 2 of the amendments listed 14 BUIs which are caused by a detrimental change in the chemical, physical, or biological integrity of the Great Lakes system (International Joint Commission, 1987). The Annex directed the two countries to identify AOCs that did not meet the objectives of the GLWQA. The RAPs addressing the BUIs were to be prepared for all 43 AOCs identified, including the White Lake AOC. The BUIs provided a tool for describing effects of the contamination, and a means for focusing remedial actions.

The White Lake AOC is located in West Michigan, along the eastern shore of Lake Michigan, in Muskegon County (Figure 1). The 1987 Remedial Action Plan for the White Lake Area of Concern was written by the Department of Natural Resources (DNR, 1987). It described problems known at the time and identified actions and studies needed to further define and remediate those problems. However, the RAP was written before the 1987 amendments to the GLWQA that outlined new guidelines for RAPs were published. The guidelines included identifying which of 14 potential beneficial use impairments existed in the AOC. Eight years later, the 1995 RAP update reflected those requirements and identified eight BUIs in the Area of Concern. These included: restrictions on fish and wildlife consumption, degradation of fish & wildlife populations, degradation of benthos, restrictions on dredging activities, eutrophication or

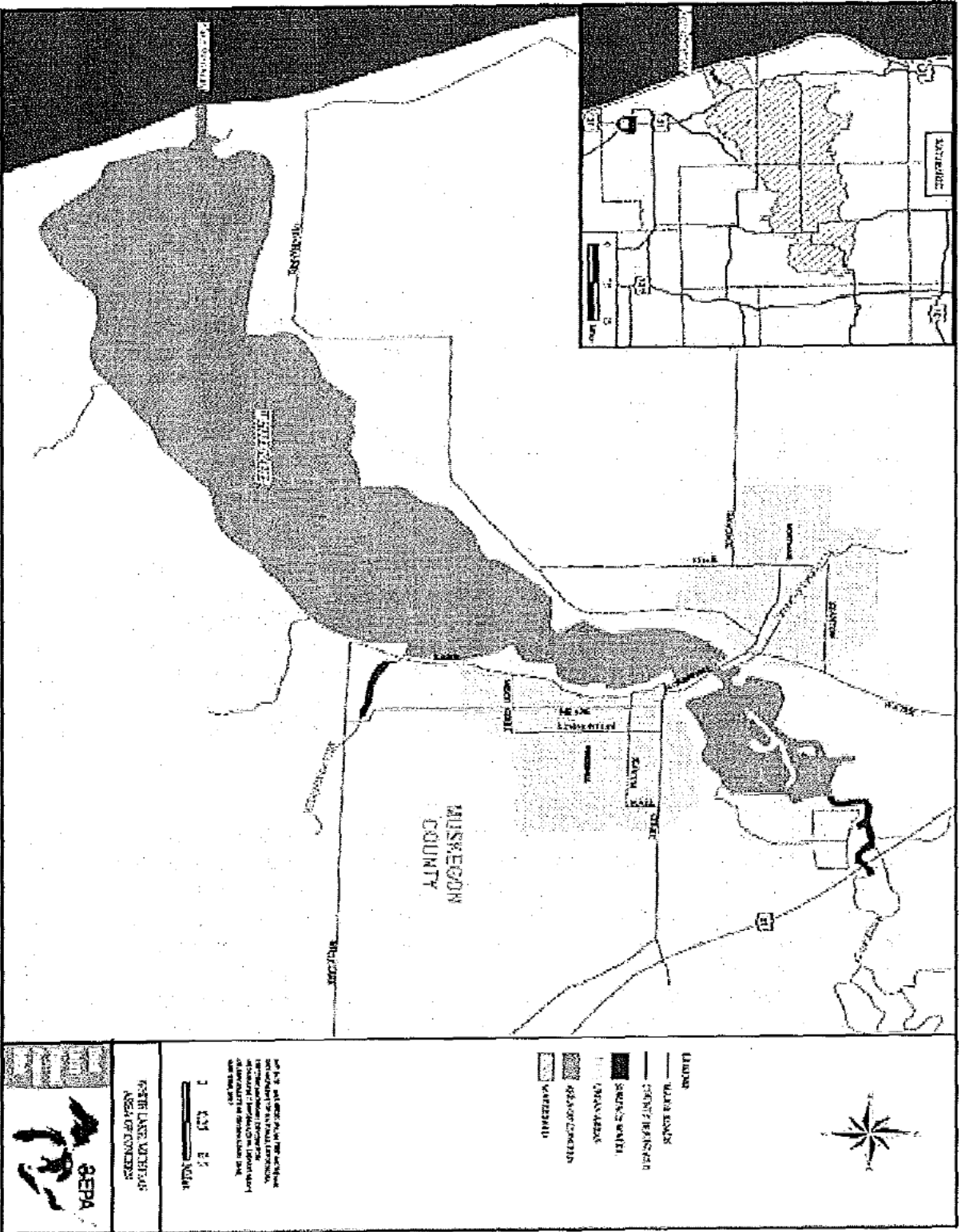
undesirable algae, restrictions on drinking water consumption, degradation of aesthetics, and loss of fish & wildlife habitat (DEQ, 1995).

In 2008, the White Lake PAC voted to adopt the restoration criteria for the non-fish and wildlife habitat-related BUIs included in the *Guidance* to evaluate the status of the AOC BUIs. On May 28, 2009, the DEQ approved the AOC-specific restoration criteria developed for the habitat-related BUIs (i.e., the Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat). Table 1 is a summary of the status of BUI assessments and removals from the White Lake AOC.

Table 1. White Lake BUI Status.

Beneficial Use Impairment	Beneficial Use Remains Impaired	Assessment in 2011	BUI Removed
Restrictions on fish and wildlife consumption	X	X	
Restrictions on drinking water consumption or taste & odor problems	X	X	
Degradation of benthos	X	X	
Restrictions on dredging activities	X	X	
Eutrophication or undesirable algae	X	X	
Degradation of aesthetics	X	X	
Degradation of fish and wildlife populations	X	X	
Loss of fish and wildlife habitat	X		

Figure 1. The White Lake Area of Concern.



1) Restrictions on Fish and Wildlife Consumption

Significance in the White Lake Area of Concern

According to the 1987 RAP, contamination due to non-point source runoff and the discharge of municipal and industrial wastes resulted in elevated polychlorinated biphenyls (PCBs) and chlordane levels found in carp. Chlordane was discontinued for use as a pesticide in 1980 and no source of the compound was found in White Lake, so it is no longer a part of ongoing monitoring.

The Michigan Department of Community Health's (MDCH) 2010 Michigan Fish Advisory recommends that women who are or may become pregnant and children under the age of 15 do not eat carp from White Lake due to elevated concentrations of PCBs. All others are advised to eat no more than one meal of carp per week. The MDCH also recommends restrictions on the consumption of northern pike, smallmouth bass and walleye from White Lake due to elevated concentrations of PCBs and mercury. Details are in the Michigan Fish Advisory, A Family Guide to Eating Michigan Fish, available from the MDCH website at: <http://www.michigan.gov/mdch>.

Restoration Criteria

This BUI will be considered restored when contaminant levels in edible portion analyses of key fish species (largemouth bass and carp) are not significantly different from Pentwater Lake for two consecutive five year sampling periods. If a significant difference between fish contaminant levels in White Lake and Pentwater Lake is present at the end of the monitoring period, all available fish contaminant monitoring data for White Lake will be evaluated for a decreasing trend in concentration. In this situation, the BUI will be considered restored when edible portion analyses of key fish species in White Lake show a similar decreasing trend as other appropriate Great Lakes trend sites. (PAC Criteria, 2008)

Current Status and Actions to be Undertaken

This beneficial use is currently impaired. In 2006, researchers from Grand Valley State University's Annis Water Resources Institute collected and analyzed game fish for PCB congeners and mercury in White Lake and in Pentwater Lake as a reference system. No statistical difference in mercury and PCB congener levels was found in common carp and largemouth bass between fish from White Lake and Pentwater Lake. However, no distinct decreasing trend was found for PCBs and mercury in White Lake from the 1980s to 2006. Additional sampling in 2011 is scheduled to determine if contaminant levels have reached a steady state (Rediske, 2009) and to confirm statistical equivalence in mercury and PCBs between the two lakes. Further information is in the BUI Tracking Matrix on page 13.

2) Degradation of Benthos

Significance in the White Lake Area of Concern

Degradation of Benthos was listed as impaired because of sediment toxicity related to heavy metals and organic chemicals and impacts to species diversity from the discharge of municipal sewage and industrial waste.

Restoration Criteria

All remedial actions for known contaminated sediment sites with degraded benthos are complete and monitoring is proceeding according to the approved plan for each site. The known contaminated sediment sites with degraded benthos were Tannery Bay and the

Hooker/Occidental Outfall. In addition, average benthic macroinvertebrate populations in White Lake should reflect the following conditions:

Indicator	Target
Sediment Toxicity	Amphipod Survival >60%
<i>Hexagenia</i>	Present in river mouth littoral zone with an increasing trend over 3 years
Amphipods	Present in river mouth littoral zone with an increasing trend over 3 years
% Oligochaeta	< 75% or a decreasing trend
Chironomidae (#/m ²)	> 500 or an increasing trend
Diversity (SW)	1.5 or an increasing trend

Current Status and Actions to be Undertaken

Two of three years of monitoring are complete, and although the final round of sampling is scheduled to be conducted in October 2011, it appears that the data are trending toward meeting all the above criteria. Further information is in the BUI Tracking Matrix on page 13.

3) Restrictions on Dredging Activities

Significance in the White Lake Area of Concern

This BUI was identified in the 1995 RAP Update due to PAC concerns with contaminated sediments related to the historic discharge of municipal and industrial wastes. Previous sampling indicated areas of sediment contamination in White Lake. However, the most recent sediment testing data available for White Lake Harbor when the 1987 White Lake RAP document was written indicated the sediments were suitable for open water disposal and/or beach nourishment (DNR, 1987).

Restoration Criteria

This beneficial use will be considered restored when either there have been no restrictions on routine commercial or recreational navigation channel dredging by the US Army Corps of Engineers (USACE), based on the most recent dredging cycle; or, in cases where dredging restrictions exist, a comparison of sediment contaminant data from the commercial or recreational navigation channel (at the time of proposed dredging) in the AOC indicates that contaminant levels are not statistically different from other comparable, non-AOC commercial or recreational navigation channels.

Current Status and Actions to be Undertaken

In May 2008, a contractor for the USACE collected samples and analyzed sediments in the federally maintained navigation channel prior to dredging later that year. Analytical results indicated that sediments were suitable for use as beach nourishment material. Therefore, no restrictions were placed on the disposal of dredged materials. The DEQ will convene a technical committee in 2011 for a formal review and assessment. The committee will review the results of all supporting documentation to provide a decision on whether to support a recommendation to formally remove this BUI. Further information is in the BUI Tracking Matrix on page 13.

4) Eutrophication or Undesirable Algae

Significance in the White Lake Area of Concern

At the time of AOC listing, Eutrophication or Undesirable Algae were not identified as an impairment. However, historical water quality degradation was mentioned in the 1987 RAP (DNR, 1987). This BUI was listed by the WLPAC in 1995 because of concerns related to historical non point source pollution in the White Lake watershed.

Restoration Criteria

The WLPAC developed local restoration criteria for removal of the Eutrophication and Undesirable Algae BUI that exceeds the State of Michigan *Guidance*. The DEQ approved the criteria as follows:

The Eutrophication and Undesirable Algae BUI will be considered restored when: (1) no waterbodies within the AOC are included on the list of impaired waters due to nutrients or excessive algal growths in the current Clean Water Act Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report and (2) the following average annual concentrations/values continue to meet criteria in White Lake after 5 years:

Indicator	Target	Reasoning
Surface Total Phosphorus Concentration	30 µg/l	DNR Recommendation for the 1987 RAP ¹
Chlorophyll a	10 µg/l	U.S. EPA ²
Secchi Disk depth	~ 2.0 m	Pentwater Lake as reference
Trophic Status Index	50-55	Pentwater Lake as reference

¹ A total phosphorus concentration of 30 µg/l (during spring and fall turnover) was recommended to maintain water quality at levels that will not produce nuisance algal blooms.

² A Chlorophyll a target of 10 µg/l (during the summer) was recommended to maintain water quality at levels that will not produce nuisance algal blooms.

Current Status and Actions to be Undertaken

Data collected in 2004, 2005 and 2006 by researchers at Grand Valley State University's Annis Water Resources Institute show that these targets are being met, so this beneficial use is likely no longer impaired. However, the criteria require a confirmational round of sampling in 2011.

The DEQ will convene a technical committee following analysis of the 2011 data. The technical committee will review the results of supporting documentation to decide whether to support a recommendation to formally remove this BUI. Further information is in the BUI Tracking Matrix on page 13.

5) Restrictions on Drinking Water Consumption or Taste and Odor Problems

Significance in the White Lake Area of Concern

This BUI was not originally identified in the 1987 RAP and was subsequently added by the WLPAC. According to the 2002 RAP update, this BUI was identified because of contaminated groundwater from industrial and chemical sources (WLPAC, 2002).

Restoration Criteria

In 2008, the White Lake PAC proposed restoration criteria specific to a number of contaminated groundwater sites in the White Lake area. The DEQ did not approve those criteria because they went beyond the scope of the AOC program. While there remains some disagreement between the DEQ and the PAC regarding how best to address the Drinking Water BUI, the state criteria as set forth in the *Guidance* remain in effect while discussions continue.

This beneficial use 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.

Current Status and Actions to be Undertaken

It is likely that this beneficial use is no longer impaired. The DEQ will convene a technical committee when this BUI is ready for formal review and assessment. The technical committee will review the results of completed remedial actions and supporting documentation to decide whether or not to support a recommendation to formally remove this BUI. Further information is in the BUI Tracking Matrix on page 13.

6) Degradation of Aesthetics

Significance in the White Lake Area of Concern

At the time of AOC listing, Aesthetics was identified as impaired due to surface scum from the tannery discharge and the dumping of hides in Tannery Bay. The closing of the Tannery and remediation of Tannery Bay sediment have improved the aesthetics of White Lake and its shoreline.

Restoration Criteria

The state criteria are in effect for restoring this beneficial use. The WLPAC has identified priority restoration sites for this BUI. The target is presented below:

This BUI will be considered restored when monitoring data for two successive monitoring cycles indicates that White Lake AOC does 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
- oil films
- floating solids
- foams
- settleable solids
- suspended solids
- deposits

Important public locations in White Lake where aesthetics are degraded include the Bush Creek/East Bay and Genesco (tannery) property where hides are present, shallow water areas with submerged debris, and the abandoned Whitehall and Montague dumps in the wetlands.

Current Status and Actions to be Undertaken

In 2011, White Lake will be assessed for aesthetic impairments as part of a statewide effort to assess all AOCs with the Aesthetics BUI. The DEQ will convene a technical committee when the status of this BUI is ready for a formal review. The technical committee will review the

results of the White Lake aesthetics assessment and other supporting documentation to decide whether to support a recommendation to formally remove this BUI. Further information is in the BUI Tracking Matrix on page 13.

7) Loss of Fish Habitat and Degradation of Populations

Based on the inextricable connection between habitat and populations, the White Lake PAC established local targets in 2008 for restoring the fish and wildlife BUIs, to be addressed as: Loss of Fish Habitat and Degradation of Populations, and Loss of Wildlife Habitat and Degradation of Populations (WLPAC, 2008). Therefore, they are dealt with in the same manner in this document. This is in contrast to, but not in conflict with the Great Lakes Water Quality Agreement's listing of these BUIs as: Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations.

Significance in the White Lake Area of Concern

According to the 1987 RAP, White Lake experienced increased degradation during the 1950s to the mid-1970s due to increased industrial and municipal discharges directly to and upstream of White Lake. The document specifically noted the loss of the white bass fishery, reduction of walleye, perch and northern pike populations. The loss of fish production was attributed to a loss of the benthic community.

The 1995 RAP update noted that oxygen levels in deep water remained depleted, making some areas inhabitable for some fish and the species they eat. The 1995 RAP went on to express concern regarding development destroying the lake's littoral zone, critical fish and wildlife habitat. It was also noted in 1995 that the introduction of exotic species, such as alewife, was thought to be contributing to the decline of certain species in White Lake.

Restoration Criteria

The restoration criteria for fish populations and habitat are to maintain an average Index of Biotic Integrity (IBI) score of 43 ± 4 for three consecutive years. This numerical target is based on the mean and standard deviation IBI score for White Lake during the past three years. On average, 68% of observations should be within one standard deviation of the mean, assuming the population is normally distributed. If the target is not achieved (i.e., average IBI score <39), then fish monitoring will continue for an additional 3 years to determine whether the numerical target is achieved.

Fish sampling will occur in other drowned river mouth lakes to provide an opportunity to determine whether temporal trends in IBI scores are specific to White Lake or associated with regional fluctuations in biotic and abiotic factors; especially Pentwater and Kalamazoo lakes. For instance, if regional fluctuations, not associated with human-induced disturbance, caused multiple drowned river mouth lakes to experience declines in IBI scores, then the numerical target for White Lake should be reassessed to determine its scientific validity (i.e., the numerical target may need to be shifted) (WLPAC, 2008).

Current Status and Actions to be Undertaken

This beneficial use may no longer be impaired. Current trends show that White Lake is meeting the IBI threshold in relationship to the reference system, Pentwater Lake. Two years of data already exist for 2009 and 2010. According to the locally developed targets, the criteria must be met over a three year period. Sampling in 2011 is expected to confirm the trend and every indication is that White Lake will meet the threshold.

After the data are gathered and analyzed, a technical committee will review the results of

remedial activities, monitoring data and other supporting documentation to decide whether to recommend formal removal of this BUI. Further current information is in the BUI Tracking Matrix on page 13.

8) *Loss of Wildlife Habitat and Degradation of Populations*

Significance in the White Lake Area of Concern

According to the 1987 RAP, White Lake experienced increased degradation during the 1950s to the mid-1970s due to increased industrial and municipal discharges directly to and upstream of White Lake. The 1995 RAP went on to express concern regarding development destroying the lake's littoral zone, critical fish and wildlife habitat.

Restoration Criteria

The restoration criteria for wildlife populations and habitats will be considered restored when all restoration, management, and monitoring activities are completed including:

1. Critical areas owned by the City of Montague and City of Whitehall are preserved through a charter designation or via a conservation easement.
2. Habitat areas (8.1 acres) owned by a mix of municipalities and private landowners are preserved through conservation easements and/or charter designations.
3. Private lands designated as critical habitat (37.5 acres) are protected through municipal planning processes.
4. Monitoring data for three successive monitoring cycles indicates that White Lake marsh habitats and populations do not significantly vary from other Great Lakes coastal marshes.
5. Initiate restoration and enhancement work on all "immediate", "high", and "intermediate" ranked sites as defined in the White Lake Shoreline Habitat Management Plan and delineated in the White Lake Shoreline Habitat Restoration Blueprint. Implement 50% of the restoration work delineated in the Blueprint including:
 - Soft shoreline engineering work (11.7 acres total)
 - Shoreline and littoral zone enhancement / re-establishment (25.6 acres total)
 - Removal of debris (5.6 acres total)
 - Conservation easement and shoreline protection workshops (2 sessions)
 - One-on-one landowners assistance (119 acres total)
 - Establishing shoreline buffers (17.9 acres total)

(WLPAC, 2008)

Current Status and Actions to be Undertaken

This beneficial use is currently impaired. In 2010, the Muskegon Conservation District won a 2.1 million dollar grant from the EPA, through the Great Lakes Restoration Initiative, to implement seven habitat restoration projects around White Lake. These projects were specifically designed to meet the restoration criteria listed above. The first project broke ground in June, 2011. All projects are scheduled for completion by September 2012. A technical committee will review the results of completed remedial actions and supporting documentation to decide whether to recommend formal removal of this BUI. Further information is in the BUI Tracking Matrix on page 13.

Actions to Delist: White Lake AOC BUI Tracking Matrix

The following BUI Tracking Matrix is intended as a simple way to track ongoing progress with the remedial activities identified as being necessary to remove each BUI, and subsequently to delist the AOC entirely. As progress is made, the matrix will be updated to reflect current conditions. Completed activities will remain in the matrix as it is updated, but updates will reflect completed status and completed BUI removals.

The matrix lists each BUI, indicates whether each BUI is scheduled for assessment in the current year, and lists the actions/tasks necessary to advance toward BUI removal. If a funding source has been identified, it is listed along with the targeted start and end dates for each action. Project leads are identified as appropriate, along with the targeted BUI removal date.

The matrix represents the AOC program's current best effort to assess activity in an AOC at the time the document was updated. The matrix does not necessarily commit the listed entities/individuals to any particular activity. Contracts, grant agreements, etc. are the documents governing commitments that have been or will be made.

The dates listed reflect the MDEQ's best estimate of project completion, given currently available information. Work does not always proceed as planned, and the MDEQ recognizes that unforeseen circumstances can arise at any time. The MDEQ is dedicated to facilitating the completion of each of the projects listed in the most timely manner possible.

White Lake AOC BUI Tracking Matrix

July 18, 2011

Area of Concern Name	Beneficial Use Impairment Name	Assessment in 2011? (Y/N)	Actions/Tasks Needed	Funding Source	Start Date	Targeted Completion Date	Project Lead	Targeted BUI Removal Date	Comments
White Lake	Restrictions on Fish and Wildlife Consumption	Yes	Fish Tissue Sampling by GVSU AWRI	GLRI State Capacity Monitoring Portion	July 2011	Jan. 2012	Riley, DEQ/Rediske, AWRI	May 2012	DEQ contracting with AWRI
White Lake	Degradation of Fish and Wildlife Populations	Yes	Conduct Index of Biotic Integrity monitoring. Implement 7 site habitat restoration project.	GLRI to MCD	May 2011	Sept. 2012	Auch, MCD/Ruetz, AWRI	Sept. 2012	Muskegon Conservation District managing several contracts to implement seven separate projects. AWRI will conduct IBI monitoring.
White Lake	Degradation of Benthos	Yes	Final year of monitoring	CMI to AWRI	July 2011	Sept. 2011	SWAS, DEQ/Rediske, AWRI	May 2012	Clean Michigan Initiative grant extended.
White Lake	Restrictions on Dredging Activities	Yes	Evaluate dredge spoils in federal navigational channel, prepare and submit Beneficial Use Impairment removal documents.	GLRI State capacity grant	July 2011	Sept. 2011	Riley, DEQ	Sept. 2011	
White Lake	Eutrophication or Undesirable Algae	Yes	Nutrient sampling	AWRI	Aug 2011	Oct. 2011	Rediske, AWRI	Jan. 2012	
White Lake	Restrictions on Drinking Water Consumption or Taste and Odor Problems	Yes	PAC will evaluate status of several sites and provide feedback to DEQ	GLRI PAC Support	May 2011	May 2012	Auch, MCD Riley, DEQ	July 2012	
White Lake	Degradation of Aesthetics	Yes	Analyze existing data and conduct assessment of Beneficial Use Impairment	GLRI state capacity grant	July 2011	May 2012	Riley, DEQ	June 2012	
White Lake	Loss of Fish and Wildlife Habitat	No	Implement 7 site habitat restoration project. Restore impacted sites and purchase conservation easements as identified in Restoration Plan	GLRI to MCD	July 2011	Sept. 2012	Auch, MCD	Sept. 2014	Muskegon Conservation District managing several contracts to implement seven separate projects

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